OMRON

Multi-function Compact Inverter

# M1 Series Ethernet Type

## EtherNet/IP™
## Modbus® TCP
## PROFINET® IO + PROFIdrive®

## User's Manual

**3G3M1-A□□□□-EMP (ver. 1.1)**




I697-E2-01

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# Introduction

Thank you for purchasing the Multi-function Compact Inverter 3G3M1 Series.

This User's Manual describes the installation/wiring of the 3G3M1 Series Inverter (From Ver. 1.1) and parameter setting method which is required for the operation, as well as troubleshooting and inspection methods.

## Intended Readers

This manual is intended for the following personnel.

Those who have knowledge of electrical systems (an electrical engineer or the equivalent) and also are qualified for one of the following:

- Personnel in charge of introducing the control equipment
- Personnel in charge of designing the control systems
- Personnel in charge of installing and maintaining the control equipment
- Personnel in charge of managing the control systems and facilities

## Notice

This manual contains information you need to know to correctly use the Multi-function Compact Inverter 3G3M1 Series.

Before using the inverter, read this manual and gain a full understanding of the information provided herein.

After you finished reading this manual, keep it in a convenient place so that it can be referenced at any time.

Make sure this manual is delivered to the end user.v

# Manual Configuration

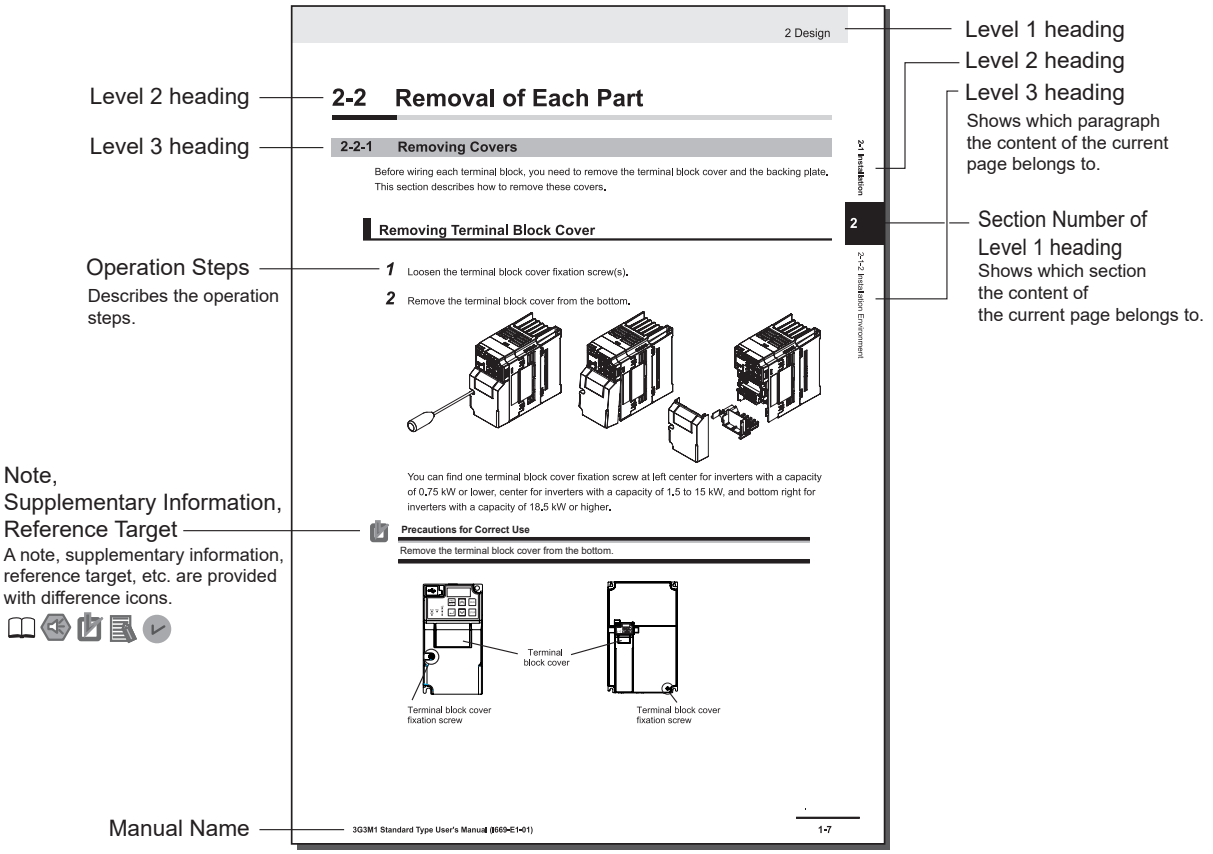
This manual is compiled section by section for user's convenience as follows.

| Section | | Overview |
|---|---|---|
| Section 1 | Overview | This section provides an overview of the 3G3M1 Series features, standard specifications, and external dimensions by inverter capacity.<br>It also shows the differences of this inverter from conventional inverters for those who use previous models. |
| Section 2 | Design | This section describes the installation environment and wiring methods. |
| Section 3 | Ethernet Communications | This section describes Ethernet communications specifications for the supported protocols |
| Section 4 | Drive Control and Test Run | This section describes the basic operation methods for the protocols using Omron or 3rd party PLCs |
| Section 5 | Parameter List | This section is a reference list with all the relevant information for all monitors and parameters of the M1 EMP. |
| Section 6 | Basic Settings | This section describes the basic functions of the inverter. |
| Section 7 | Motor and Control Functions | This section describes the vector control and applied functions characteristic of this inverter. |
| Section 8 | Other Functions | This section describes the details of more advanced functions not directly related with basic inverter and motor control. |
| Section 9 | Troubleshooting | This section describes how to analyze the cause and take countermeasures if the inverter fails, and provides troubleshooting for possible troubles. |
| Section 10 | Maintenance and Inspection | This section describes the maintenance and periodical inspection items. |
| Appendix | | This section provides a description of profiles and a list of objects for controlling the inverter, and provides information on error status codes, derating, capacitor life curve and inverter selection. |

# Manual Structure

## Page Structure and Symbol Icons

The following page structure and symbol icons are used in this manual.




Note: The above page is only a sample for illustrative purposes. It is not the actual content of the manual.

## Special Information

### Precautions for safe Use

Precautions on what to do and what not to do to ensure safe usage of the product.

### Precautions for Correct Use

Precautions on what to do and what not to do to ensure proper operation and performance.



**Additional Information**

Additional information to read as required.
This information is provided to increase understanding or make operation easier.



References are provided to more detailed or related information.

# Sections in this Manual


1 Overview

2 Design

3 Ethernet Communications

4 Drive Control and Test Run

5 Parameter List

6 Basic Settings

7 Motor and Control Functions

8 Other Functions

9 Troubleshooting

10 Maintenance and Inspection

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# Terms and Conditions Agreement

## Warranty, Limitations of Liability

### Warranties

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See https://www.omron.com/global/ or contact your OMRON representative for published informa-tion.

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# Application Considerations

## Suitability of Use

OMRON Companies shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in the Buyer's application or use of the Product. At Buyer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Product. This information by itself is not sufficient for a complete determination of the suitability of the Product in combination with the end product, machine, system, or other application or use. Buyer shall be solely responsible for determining appropriateness of the particular Product with respect to Buyer's application, product or system. Buyer shall take application responsibility in all cases.

NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY OR IN LARGE QUANTITIES WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT(S) IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

## Programmable Products

OMRON Companies shall not be responsible for the user's programming of a programmable Product, or any consequence thereof.

# Disclaimers

## Performance Data

Data presented in OMRON Company websites, catalogs and other materials is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the user must correlate it to actual application requirements. Actual per- formance is subject to the OMRON's Warranty and Limitations of Liability.

## Change in Specifications

Product specifications and accessories may be changed at any time based on improvements and oth- er reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications may be changed without any notice. When in doubt, special part numbers may be assigned to fix or estab- lish key specifications for your application. Please consult with your OMRON's representative at any time to confirm actual specifications of purchased Product.

## Errors and Omissions

Information presented by OMRON Companies has been checked and is believed to be accurate; how- ever, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

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OMRON SHALL NOT BE RESPONSIBLE AND/OR LIABLE FOR ANY LOSS, DAMAGE, OR EX- PENSES DIRECTLY OR INDIRECTLY RESULTING FROM THE INFECTION OF OMRON PROD- UCTS, ANY SOFTWARE INSTALLED THEREON OR ANY COMPUTER EQUIPMENT, COMPUTER PROGRAMS, NETWORKS, DATABASES OR OTHER PROPRIETARY MATERIAL CONNECTED THERETO BY DISTRIBUTED DENIAL OF SERVICE ATTACK, COMPUTER VIRUSES, OTHER TECHNOLOGICALLY HARMFUL MATERIAL AND/OR UNAUTHORIZED ACCESS.

It shall be the users sole responsibility to determine and use adequate measures and checkpoints to satisfy the users particular requirements for (i) antivirus protection, (ii) data input and output, (iii) main- taining a means for reconstruction of lost data, (iv) preventing OMRON Products and/or software instal- led thereon from being infected with computer viruses and (v) protecting OMRON Products from unau- thorized access.

# Safety Precautions

To ensure that the Multi-function Compact Inverter 3G3M1 Series is used safely and correctly, be sure to read this Safety Precautions section and the main text before using the product.
Learn all items you should know before use, regarding the equipment as well as required safety information and precautions.
Make an arrangement so that this manual also gets to the end user of this product.
After reading this manual, keep it in a convenient place so that it can be referenced at any time.

## Indications and Meanings of Safety Information

In this user's manual, the following precautions and signal words are used to provide information to ensure the safe use of the Multi-function Compact Inverter 3G3M1 Series.
The information provided here is vital to safety. Strictly observe the precautions provided.
The following notation is used.

## Meanings of Signal Words

| | |
|---|---|
| ⚠WARNING | Indicates an imminently hazardous situation which, if not avoided, is likely to result in serious injury or may result in death. Additionally there may be severe property damage. |
| ⚠CAUTION | Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage. |

## Explanation of Symbols

| | |
|---|---|
|  | ⃠ This symbol indicates a prohibited item (an item you must not do).<br>The specific instruction is indicated using an illustration or text inside or near ⃠.<br>The symbol shown to the left indicates “non-specific general prohibitions.” |
|  | ⃠ This symbol indicates a prohibited item (an item you must not do).<br>The specific instruction is indicated using an illustration or text inside or near ⃠.<br>The symbol shown to the left indicates “disassembly prohibited.” |
|  | △This symbol indicates caution and warning.<br>The specific instruction is indicated using an illustration or text inside or near△<br>The symbol shown to the left indicates "Caution against electric shock." |
|  | △This symbol indicates caution and warning.<br>The specific instruction is indicated using an illustration or text inside or near△<br>The symbol shown to the left indicates “Caution against fire.” |

| | |
|---|---|
|  | △This symbol indicates caution and warning.<br>The specific instruction is indicated using an illustration or text inside or near.△<br>The symbol shown to the left indicates “general caution.” |
|  | △This symbol indicates caution and warning.<br>The specific instruction is indicated inside △ as well as by using text.<br>The symbol shown to the left indicates “risk of hot surface.” |
|  | ● This symbol indicates a compulsory item (an item that must be done).<br>The specific instruction is indicated using an illustration or text inside or near.●<br>The symbol shown to the left indicates a “general compulsory item.” |
|  | ● This symbol indicates a compulsory item (an item that must be done).<br>The specific instruction is indicated inside ● as well as by using text.<br>The symbol shown to the left indicates “grounding required.” |

# ⚠ WARNING

| | |
|---|---|
| Be sure to ground the ground terminal of the inverter. (200-V class: type-D grounding, 400-V class: type-C grounding)<br>Not doing so may result in a serious injury due to an electric shock or fire. |  |
| Do not remove the surface cover during inverter power supply and for 10 minutes after power shut off.<br>Doing so may result in a serious injury due to an electric shock.<br>Switch various switches, change wiring and perform inspections at least 10 minutes after the power supply has been shut off; after confirming that the Operator is OFF and that a tester or similar tool has been used to confirm that the voltage between the main circuit terminals P(+) and N(-) has dropped to a safe voltage (25 VDC or less). |  |
| There is a risk of severe injury due to electric shock.<br>Wiring work must be carried out only by qualified personnel. Do not touch cables when the power supply is turned ON. Additionally, only designated personnel should perform maintenance or inspections, or replace parts. |  |
| There is a risk of severe injury due to electric shock.<br>After confirming that the power supply is OFF, wait at least 10 minutes and then perform wiring. |  |
| Do not operate the Operator or switches with wet hands. Also, remove metal objects (watches, rings, etc.) before starting work, and use insulating tools when using tools.<br>Not doing so may result in a serious injury due to an electric shock. |  |
| Do not touch the cooling fins, braking resistors and the motor, which become too hot during the power supply and for some time after the power shut off.<br>Doing so may result in a burn. |  |
| Inspection of the inverter must be conducted after the power supply was turned off.<br>Not doing so may result in a serious injury due to an electric shock.<br>The main power supply is not necessarily shut off even if the safety stop function is activated. |  |
| There is a risk of severe injury.<br>Do not enter the operating area during operation. |  |
| There is a risk of severe injury due to electric shock.<br>Do not perform maintenance while the power supply is ON. |  |

Although this product is manufactured under strict quality control, install equipment to ensure safety when used with applications in which serious accidents or property damage can be anticipated in the event of its failure.
Not doing so may result in accidents.



The Multi-function Compact Inverter (3G3M1 Series) is designed to drive a three-phase induction motor and synchronous motor. Do not use it for single-phase motors or for other purposes.
Doing so may result in fire or accident.



Install the inverter on a non-flammable material such as metallic wall. Also, do not place flammable object nearby.
Doing so may result in fire.



Be sure to perform wiring after installing the inverter unit. Also, tighten terminals with specified torque.
Not doing so may result in injury, electric shock or fire.



Ensure that the specifications of the input power of the product match the power supply to which the product is to be connected.
Not doing so may result in fire or accidents.



Be sure to use the wire of specified size. Not doing so may result in fire.



When wiring each inverter to the power supply, install a molded-case circuit breaker or earth leakage circuit breaker (with overcurrent protection function). Use recommended molded-case circuit breakers or earth leakage circuit breakers that do not exceed the recommended current capacity.
Not doing so may result in fire.



If no suitable equipment to detect leakage is installed in the upstream power supply line, in order to avoid the entire power supply system's shutdown due to operation of devices such as earth leakage circuit breaker as this is undesirable to operation, install an earth leakage circuit breaker individually to inverters to break the individual inverter power supply lines only.
Not doing so may result in fire.



When the capacity of the power transformer is 500 kVA or more and 10 times or more than the rated capacity of the inverter, ensure that a DC reactor is connected.
Not doing so may result in fire.



Never connect the power lines to the inverter output terminals U, V, or W.
Doing so may result in fire.



When connecting a braking resistor, do not connect it to any terminal other than terminals P(+) and DB.
Doing so may result in fire or accident.



Do not bundle multiple cables as one cable. Doing so may result in fire.



Do not connect a surge suppressor to the output lines of the inverter.
Doing so may result in fire.



In general, sheaths of the control signal wires do not use reinforced insulation, therefore if a control signal wire comes into direct contact with a live part of the main circuit, the insulation of the sheath might break down. In these cases, there is a danger of the control signal wire being exposed to high voltage from the main circuit, therefore ensure that the control signal wires will not come into contact with live parts of the main circuit.
Not doing so may result in electric shock or accidents.



| | |
|---|---|
| Even if the inverter has interrupted power to the motor, if the voltage is applied to the main circuit input terminals L1/R, L2/S and L3/T, voltage may be output to inverter output terminals U, V and W.<br>This may result in a serious injury due to an electric shock. |  |
| Even if the motor is stopped due to DC braking or pre-excitation, voltage is output to inverter output terminals U, V and W.<br>This may result in a serious injury due to an electric shock. |  |
| Starting auto-tuning involves motor rotation. Sufficiently check that motor rotation carries with it no danger beforehand.<br>Not doing so may result in injury or accidents. |  |
| The inverter may operate with acceleration/deceleration time or speed different from as set due to stall prevention function. Design the machine so that safety is ensured even in such cases.<br>Not doing so may result in accidents. |  |
| The inverter can easily have high-speed operation set. When changing the speed setting, carefully check the specifications of motors or machine beforehand.<br>Additionally, set the parameters only after fully understanding the User's Manual. If the user recklessly changes the parameters and then operates the inverter, the motor may rotate at a torque or speed not permitted for the machine.<br>This may result in injury. |  |
| If you enable the "Restart mode after momentary power failure" (F014 = 3 or 4), then the inverter automatically restarts running the motor when the power is recovered. Design the machine so that safety is ensured even after such restarts.<br>Not doing so may result in injury or accidents. |  |
| If the motor stops as a result of a trip, the inverter may automatically restart and drive the motor depending on the parameter setting. Design the machine so that human safety and the safety of surroundings is ensured at the time of restarting.<br>Not doing so may result in accidents. |  |
| Remove any cause of the protective functions operating, then check the RUN command is OFF and cancel the alarm. Canceling the alarm when the RUN command is ON means that the inverter will supply power to the motor, which may start rotation thus posing a danger.<br>This may result in accidents. |  |
| When switching start methods or speed by external input, the motor may start suddenly or the speed may abruptly change.<br>This may result in injury or accidents. |  |
| Input terminals have functions such as run, stop and speed change. If the parameters are changed while signals are input to the input terminals, the motor operation may suddenly change. Ensure that you change parameters only after fully securing safety.<br>Not doing so may result in injury or accidents. |  |
| The branch circuit protection being open may indicate an interruption in the fault current. In order to reduce the danger of fire and electric shock, inspect energized parts and other controller components, and replace if damaged.<br>In the event of the overload relay current element burning out, the entire overload relay must be replaced.<br>Not doing so may result in a serious injury due to an electric shock or fire. |  |
| Output terminals (ROA, ROB) use relays, and may remain ON, OFF or undetermined when their lifetime is reached. For safety, equip the inverter with an external protective function.<br>Not doing so may result in fire or accidents. |  |
| Do not dismantle, repair or modify the product. Doing so may result in injury or electric shock. |  |

Always carry out the daily and periodic inspections described in the User's Manual. Use of the inverter for long periods of time without carrying out regular inspections could result in malfunction or damage of the inverter, and an accident or fire could occur.
This may result in fire or accident.



It is recommended that parts for periodic replacement be replaced in accordance with the standard replacement frequency indicated in the User's manual. Use of the inverter for long periods of time without replacement could result in malfunction or damage of the inverter, and an accident or fire could occur.
This may result in fire or accident.



It is recommended that periodic inspections be carried out every one to two years, however, they should be carried out more frequently depending on the usage conditions.
Not doing so may result in fire or accident.



Using STO safety function, periodical inspection must be performed at least once in three months, to maintain reliability of the safety function.
Not doing so may result in serious accident.
- See 8-6-5 and 8-6-4 for detail of inspection



When using a DC reactor, AC reactor, braking resistor or noise filter, etc., there is the possibility that a human body may touch the main circuit terminal block (live parts). In such cases, take measures such as installing the inverters in an location not easily accessible by humans.
Not doing so may result in a serious injury due to an electric shock.



There are conditions for compliance with the EU Low Voltage Directive and Machinery Directive. Strictly observe the conditions listed in the instruction manual or user's manual. Not doing so may result in a serious injury due to an electric shock or fire.



## Security Measures

**Anti-virus protection**
Install the latest commercial-quality antivirus software on the computer connected to the control system and maintain to keep the software up-to-date.



**Security measures to prevent unauthorized access**
Take the following measures to prevent unauthorized access to our products.
- Install physical controls so that only authorized personnel can access control systems and equipment.
- Reduce connections to control systems and equipment via networks to prevent access from untrusted devices.
- Install firewalls to shut down unused communications ports and limit communications hosts and isolate control systems and equipment from the IT network.
- Use a virtual private network (VPN) for remote access to control systems and equipment.
- Adopt multifactor authentication to devices with remote access to control systems and equipment.
- Set strong passwords and change them frequently.
- Scan virus to ensure safety of USB drives or other external storages before connecting them to control systems and equipment.



**Data input and output protection**
Validate backups and ranges to cope with unintentional modification of input/output data to control systems and equipment.
- Checking the scope of data
- Checking validity of backups and preparing data for restore in case of falsification and abnormalities
- Safety design, such as emergency shutdown and fail-soft operation in case of data tampering and abnormalities



**Data recovery**
Backup data and keep the data up-to-date periodically to prepare for data loss.



When using an intranet environment through a global address, connecting to an unauthorized terminal such as a SCADA, HMI or to an unauthorized server may result in network security issues such as spoofing and tampering.
You must take sufficient measures such as restricting access to the terminal, using a terminal equipped with a secure function, and locking the installation area by yourself.



When constructing an intranet, communication failure may occur due to cable disconnection or the influence of unauthorized network equipment.
Take adequate measures, such as restricting physical access to network devices, by means such as locking the installation area.



When using a device equipped with the SD Memory Card function, there is a security risk that a third party may acquire, alter, or replace the files and data in the removable media by removing the removable media or unmounting the removable media.
Please take sufficient measures, such as restricting physical access to the Controller or taking appropriate management measures for removable media, by means of locking the installation area, entrance management, etc., by yourself.



## ⚠ Caution

If connecting a commercially available braking resistor or regenerative braking unit, this may result in a moderate burn due to the heat generated in the braking resistor or regenerative braking unit.
In case of a braking resistor, install a thermal relay that monitors the temperature of the resistor. Configure a sequence that enables the inverter power to turn OFF when unusual over heating is detected in the braking resistor or regenerative braking unit.



The inverter has high voltage parts inside which, if short-circuited, might cause damage to itself or other property.
Place covers on the openings or take other precautions to make sure that no metal objects such as cutting bits or lead wire scraps go inside when installing and wiring.



Install a stop motion device to ensure safety. Not doing so might result in a minor injury.
(A holding brake is not a stop motion device designed to ensure safety.)



Be sure to confirm safety before conducting maintenance, inspection or parts replacement.



A breakdown of the built-in braking transistor could result in braking resistor heating or damage to the inverter's internal units. Shut off the main power of the inverter using Braking transistor broken signal (DBAL).



A breakdown of the built-in braking transistor or misconnection of the braking resistor could result in braking resistor heating or damage to the inverter's internal units.
If the inverter does not start up or continue being undervoltage (LU) after the main power of the inverter is turned ON, shut off the main power of the inverter.



When installing the product, use only the specified screws.
Not doing so may result in fire or accidents.



Do not install or operate an inverter with damaged external or internal components.
Doing so may result in injury, fire or accidents.



| | |
|---|---|
| Prevent lint, paper fibers, sawdust, dust, metallic chips, or other foreign materials from getting into the inverter or from accumulating on the cooling fin.<br>Not doing so may result in fire or accidents. |  |
| Support the inverter case or cooling fin instead of the surface cover during transportation.<br>Not doing so may result in injury due to the inverter dropping. |  |
| The inverter, motor and wiring generate electric noise. Be careful about malfunction of the nearby sensors and devices. Take noise control measures to prevent them from malfunctioning.<br>Not doing so may result in accidents. |  |
| The inverter has an overload protection function. Set the protection level using parameters. |  |
| The brake function of the inverter does not provide any holding mechanism. Provide a separate holding brake if necessary.<br>Not doing so may result in injury. |  |
| Comply with the local ordinance and regulations when disposing of the product.<br>Not doing so may result in injury. |  |
| UL and cUL compliance is subject to conditions. Strictly observe the conditions listed in the instruction manual or user's manual.<br>Not doing so may result in fire or accidents. |  |

# Precautions for Safe Use

## Installation and Storage

Do not store or use the product in the following places.

- Locations subject to direct sunlight.
- Locations subject to ambient temperature exceeding the specifications.
- Locations subject to relative humidity exceeding the specifications.
- Locations subject to condensation due to severe temperature fluctuations.
- Locations subject to corrosive or flammable gases.
- Locations subject to exposure to combustibles.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.

## Transportation, Installation, and Wiring

- Do not drop or apply strong impact on the product. Doing so may result in damaged parts or malfunction.
- Do not connect an AC power supply voltage to the control input/output terminals. Doing so may result in damage to the product. Also, check the voltage and current of the connected circuit and implement wiring correctly.
- Take sufficient shielding measures when using the product in the following locations. Not doing so may result in damage to the product.
  - Locations subject to static electricity or other forms of noise
  - Locations subject to strong magnetic fields
  - Locations close to power lines
- If there is noise or other effects, install a ferrite core. When installing a ferrite core, do not allow the shield sheath to be caught between the communications connector and the cable. Not doing so may cause insufficient noise reduction effect, resulting in the Inverter to malfunction.
- Fix the shield wire or use other means so that it is not subject to a heavy load. Shield wire breakage may occur due to the weight of the ferrite core.
- When carrying out wiring of communications line and configuring network settings, refer to applicable sections of the manual to ensure correct connection and configuration procedures.
- Install an appropriate stopping device to ensure safety. In particular, if configured to operate continuously even in the event of a communications error, the Inverter may not stop, resulting in equipment damage.
- Do not use a broken cable. If the ring is disconnected, the device may malfunction.

## Operation and Adjustment

- When checking a signal during the power supply and the voltage is erroneously applied to the control input terminals, the motor may start abruptly. Be sure to confirm safety before checking a signal.
- When changing parameters, do not turn OFF the inverter unit until saving is completed.
- Even when the inverter power is turned OFF, the counter-electromotive force occurs while the PM motor rotates, which may result in electric shock.

Do not remove the surface cover of the inverter until the PM motor stops.

- When the ring disconnection status occurs and then you reconnect an EtherNet communications cable, turn OFF the power supply to the EtherNet master and to the slaves. Connecting a faulty EtherNet communications cable while the devices are in operation may stop the entire EtherNet communications system.

## Maintenance and Inspection

- The capacitor service life is influenced by the ambient temperature. Refer to “Smoothing Capacitor Life Curve” described in the manual. When a capacitor reaches the end of its service life and does not work as the product, you need to replace the capacitor.
- When silent inverter operation mode is used (H413 parameter set to 1), inverter capacity is reduced to 1/3 of rated inverter power at high carrier values (F026=15 or 16kHz) in certain capacities (details in Silent Operation description section). Warranty may be void if thermal stress is diagnosed in repair analysis.
- If cooling fan control is enabled as "Control according to only internal temperature" by H006=2 (to reduce acoustic noise due to fan operation), inverter lifetime may be reduced because operation can temporary fall out of specs in heavy load or strong acceleration applications due to thermal inertias. Warranty may be void if thermal stress is diagnosed during repair analysis (as usual). There is no additional safety risk to persons as soon as installation and operation procedures are followed.

# Precautions for Correct Use

## Maintenance and Parts Replacement

- When a cooling fan reaches the end of its service life, replace it.
- When restore mode is active the integrity of the parameter set is not guaranteed during normal communications. Please make sure that restore mode is disabled (S098=0) or "166:RSTR" digital input setting is not closed in such normal operation. Removing 166:RSTR setting from wired digital inputs is recommended.
  Restore mode can also be used by customer purposes (e.g. send a full parameter list from customer PLC or controller program) without worrying about parameter send order). Please use with caution and double check that restored data is valid before machine operation.

## Product Disposal

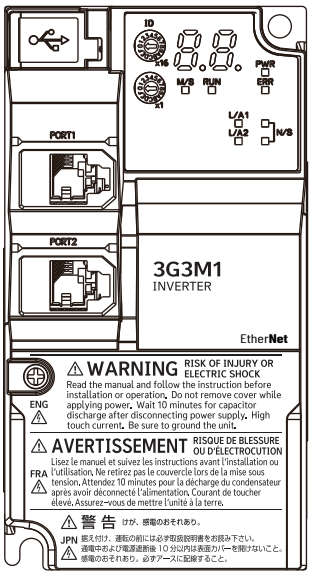
Comply with the local ordinance and regulations when disposing of the product.



This mark urges disposal in accordance with the WEEE Directive.

## Warning Label

- This product bears a warning label at the following location to provide handling warnings.
- Be sure to follow the instructions.
  The appearance differs depending on the capacity of the inverter.



## Warning Description



# Regulations and Standards

To export any part of this product that falls under the category of goods (or technologies) for which an export certificate or license is mandatory according to the Foreign Exchange and Foreign Trade Control Law of Japan, an export certificate or license (or service transaction approval) according to this law is required.

| Standard | | Applicable standard |
|---|---|---|
| CE UKCA | EMC | EN 61800-3:2004/A1:2012,<br>IEC 61800-3:2017 |
| | Functional safety | EN 61800-5-2:2017 STO SIL3,<br>EN/ISO 13849-1:2023, Cat.3 / PLe |
| | Electrical safety | EN 61800-5-1:2007,<br>EN 61800-5-1:2007/A1:2017,<br>EN 61800-5-1:2007/A11:2021 |
| UL | US | UL 61800-5-1, Edition 1, 2012 |
| | CA | CSA-C22.2 No.274, 2017 |
| Ecodesign regulation | | IEC 61800-9-2 (EU) 2019/1781 |

The customer must check the conditions that must be met for compliance with the environmental standards and regulations of their respective country.

1. Checking use of regulated chemical substances
   This product complies with regulated substances used in electrical parts based on the RoHS Directive.
   For details on the Certificate of Conformance and other regulations, contact the place of purchase.
2. Motor efficiency regulations
   This product is subject to energy efficiency regulations when it is used in motor systems that are driven by an inverter. For details on inverter efficiency with respect to motor output in accordance with EU efficiency regulations, refer to the following website. https://industrial.omron.eu/en/company-info/environmental/ecodesign-directive

# Items to Check after Unpacking

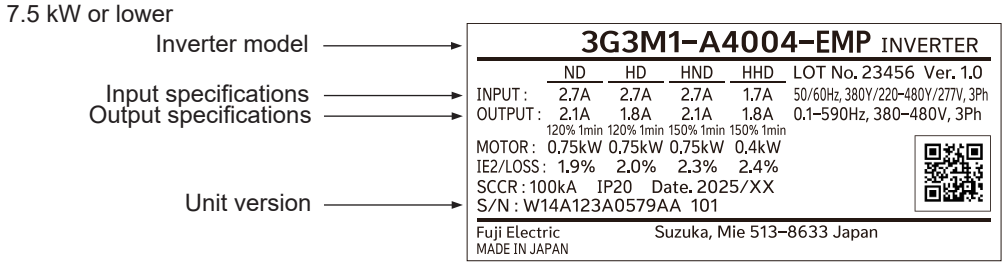
After unpacking, check the following items.

- Is this the model you ordered?
- Was there any damage sustained during shipment?

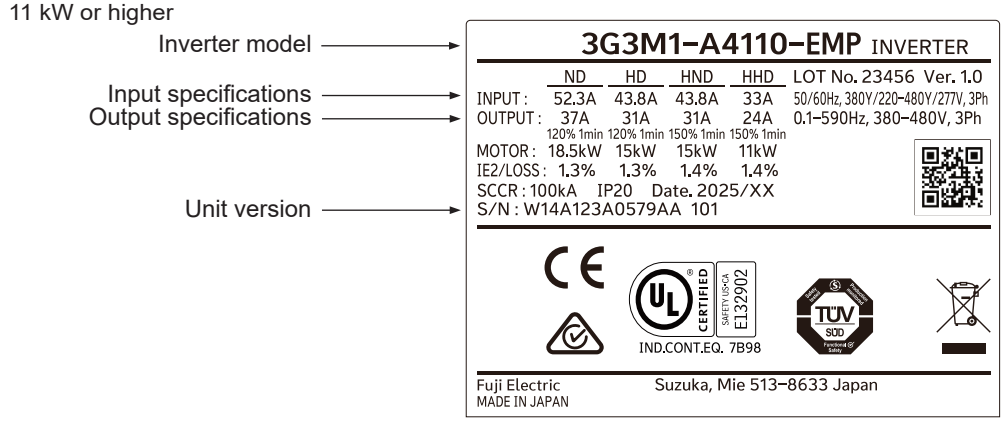
## Checking the Nameplate

The nameplate is affixed to the product.

7.5 kW or lower




11 kW or higher



## Checking the Model

3 G 3 M 1 - A 2 0 5 5 - E M P

Maximum applicable motor capacity (HHD rating)

| | |
|---|---|
| 002 | 0.2kW |
| 004 | 0.4kW |
| 007 | 0.75kW |
| 015 | 1.5kW |
| 022 | 2.2kW |
| 030 | 3.0kW |
| 037 | 3.7kW |
| 040 | 4.0kW |
| 055 | 5.5kW |
| 075 | 7.5kW |
| 110 | 11kW |
| 150 | 15kW |
| 185 | 18.5kW |
| 220 | 22kW |

Voltage class

| | |
|---|---|
| B | Single phase 200 VAC (200-V class) |
| 2 | Three-phase 200 VAC (200-V class) |
| 4 | Three-phase 400 VAC (400-V class) |

Enclosure rating

| | |
|---|---|
| A | Panel-mounting or closed wall-mounting models |

## Checking the Accessories

The instruction manual is the only accessory included in the Multi-function Compact Inverter (3G3M1 Series).

Mounting screws and other necessary parts must be provided by the user.

# Related Manuals

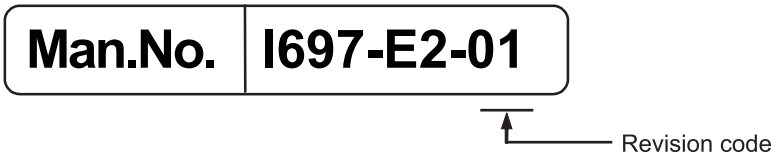
The following table summarizes the manuals relating to this manual. Read these manuals together with this manual.

| Name | Catalog No. | Model | Application | Description |
|---|---|---|---|---|
| Sysmac Studio Version 1 Operation Manual | W504 | SYSMAC-SE2□□□ | To learn about how to operate Sysmac Studio and its features. | Describes how to operate Sysmac Studio. |
| Sysmac Studio Version 1 Drive Functions Operation Manual | I589 | SYSMAC-SE2□□□ | To learn about how to set and adjust the inverter. | Describes how to operate Sysmac Studio. |

# Revision History

The manual revision code is an alphabet appended to the end of the catalog number found in the bottom right-hand corner of the front cover and in the bottom left-hand corner of the back cover.

Example




| Revision code | Revision date | Revised content |
|---|---|---|
| 01 | January 2026 | Original production |
| | | |

# 1

# Overview



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# 1-1 Overview of Functions

The Multi-function Compact Inverter 3G3M1 Series is mounted with diverse motor control methods for bringing out the performance of motors, advanced position control based on PG input, and SIL3/PLe-compatible STO as part of the standard specifications, and has been designed to expand the potential of supported applications.

## 1-1-1 Features of 3G3M1 Series Inverter

### Application Support

#### Diverse motor control

PM motors up to 128 poles and conventional induction motors are supported which allows a diverse range of motors to be driven.
Motor options for implementing on devices have been expanded. This allows the performance of motors selected in accordance with nine motor control methods to be fully demonstrated. In addition, an auto-tuning function enables optimum PM motor parameters to be set to ensure smooth motor startup.

#### Position Control

The inverter incorporates an encoder (PG) input function (ABZ phase, 1CH). Input of general encoder output as feedback position information enables position control of higher accuracy than that of previous models to be achieved. Position control suited to individual device applications, such as I/O input-based position control and Modbus communication-based commands from a host controller, is supported.

#### Safety Function

STO functions (SIL3/PLe) are achieved by hard-wiring. Safety inputs on two channels and EDM output are supported.

#### Conventional functions

Functions such as dual rating, multi-function I/O functions, analog I/O, relay output, PID functions, Modbus communication, torque control, and restart after momentary power failure are supported, and the inverter has been designed to achieve the same applications as on previous models.

### Sustainability

#### Improved device efficiency

Support for PM motors has been expanded. This has become all the more necessary as concern regarding energy savings has increased. Inverter efficiency has been improved, for example, by the removal of mechanisms such as speed reduction gears as a result of adopting a multi-pole motor and by drum motors with built-in conveyor, in addition to the support of high efficiency motors.

### Side-by-side installation

Side-by-side inverter installation (minimum clearance between inverters of 4 mm) is supported. This realizes the downsizing of control panels and the integration of devices into control panels, and helps reduce engineering costs.
Depending on the model, the reduction of the carrier frequency and the derating of the rated current are required. Refer to *2-1-2 Installation Environment* on page 2-2 for details.

## Usability

### Same look and feel operability

In the design of Sysmac Studio, attention has been paid to operability so that it has the same look and feel as in OMRON's drive products. This minimizes the need to familiarize yourself with new operations generally required with software tools, and helps improve the efficiency of development when designing and starting up new systems.

## 1-1-2 Classes of 3G3M1 Series Inverter

There are three voltage classes for 3G3M1 Series Inverters: 200-V class supporting single-phase 200 VAC and three-phase 200 VAC, and 400-V class supporting three-phase 400 VAC.
The maximum applicable motor capacity for this inverter is 0.1 to 22 kW for the heavy load mode and 0.2 to 30 kW for the light load mode.
All models comply as standard with the EC Directives and UL/cUL Standards.

| Rated voltage | Enclosure rating | Maximum applicable motor capacity | | Model |
|---|---|---|---|---|
| | | HHD: Heavy load | HND: Light load | |
| Three-phase 200 VAC | IP20 | 0.2 kW | 0.4 kW | 3G3M1-A2002-EMP |
| | | 0.4 kW | 0.75 kW | 3G3M1-A2004-EMP |
| | | 0.75 kW | 1.1 kW | 3G3M1-A2007-EMP |
| | | 1.5 kW | 2.2 kW | 3G3M1-A2015-EMP |
| | | 2.2 kW | 3.0 kW | 3G3M1-A2022-EMP |
| | | 3.7 kW | 5.5 kW | 3G3M1-A2037-EMP |
| | | 5.5 kW | 7.5 kW | 3G3M1-A2055-EMP |
| | | 7.5 kW | 11 kW | 3G3M1-A2075-EMP |
| | | 11 kW | 15 kW | 3G3M1-A2110-EMP |
| | | 15 kW | 18.5 kW | 3G3M1-A2150-EMP |
| | | 18.5 kW | 22 kW | 3G3M1-A2185-EMP |
| Three-phase 400 VAC | IP20 | 0.4 kW | 0.75 kW | 3G3M1-A4004-EMP |
| | | 0.75 kW | 1.1 kW | 3G3M1-A4007-EMP |
| | | 1.5 kW | 2.2 kW | 3G3M1-A4015-EMP |
| | | 2.2 kW | 3.0 kW | 3G3M1-A4022-EMP |
| | | 3.0 kW | 4.0 kW | 3G3M1-A4030-EMP |
| | | 4.0 kW | 5.5 kW | 3G3M1-A4040-EMP |
| | | 5.5 kW | 7.5 kW | 3G3M1-A4055-EMP |
| | | 7.5 kW | 11 kW | 3G3M1-A4075-EMP |
| | | 11 kW | 15 kW | 3G3M1-A4110-EMP |
| | | 15 kW | 18.5 kW | 3G3M1-A4150-EMP |
| | | 18.5 kW | 22 kW | 3G3M1-A4185-EMP |
| | | 22 kW | 30 kW | 3G3M1-A4220-EMP |
| Single-phase 200 VAC | IP20 | 0.2 kW | 0.4 kW | 3G3M1-AB002-EMP |
| | | 0.4 kW | 0.55 kW | 3G3M1-AB004-EMP |
| | | 0.75 kW | 1.1 kW | 3G3M1-AB007-EMP |
| | | 1.5 kW | 2.0 kW | 3G3M1-AB015-EMP |
| | | 2.2 kW | 2.7 kW | 3G3M1-AB022-EMP |
| | | 3.7 kW | - | 3G3M1-AB037-EMP |

## Checking the Model

3 G 3 M 1 - A 2 0 0 2 - E M P

Maximum applicable motor capacity (HHD rating)

| | |
|---|---|
| 002 | 0.2kW |
| 004 | 0.4kW |
| 007 | 0.75kW |
| 015 | 1.5kW |
| 022 | 2.2kW |
| 030 | 3.0kW |
| 037 | 3.7kW |
| 040 | 4.0kW |
| 055 | 5.5kW |
| 075 | 7.5kW |
| 110 | 11kW |
| 150 | 15kW |
| 185 | 18.5kW |
| 220 | 22kW |

Voltage class

| | |
|---|---|
| B | Single phase 200 VAC (200-V class) |
| 2 | Three-phase 200 VAC (200-V class) |
| 4 | Three-phase 400 VAC (400-V class) |

Enclosure rating

| | |
|---|---|
| A | Panel-mounting or closed wall-mounting models |

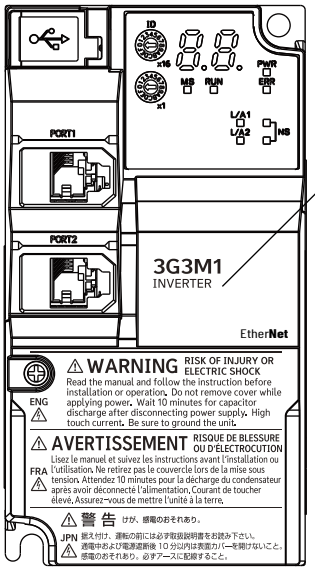
## 1-1-3 Compliance with International Standards

The 3G3M1 Series is compliant with the IEC international standard and so supports safety standards within Europe and other countries.

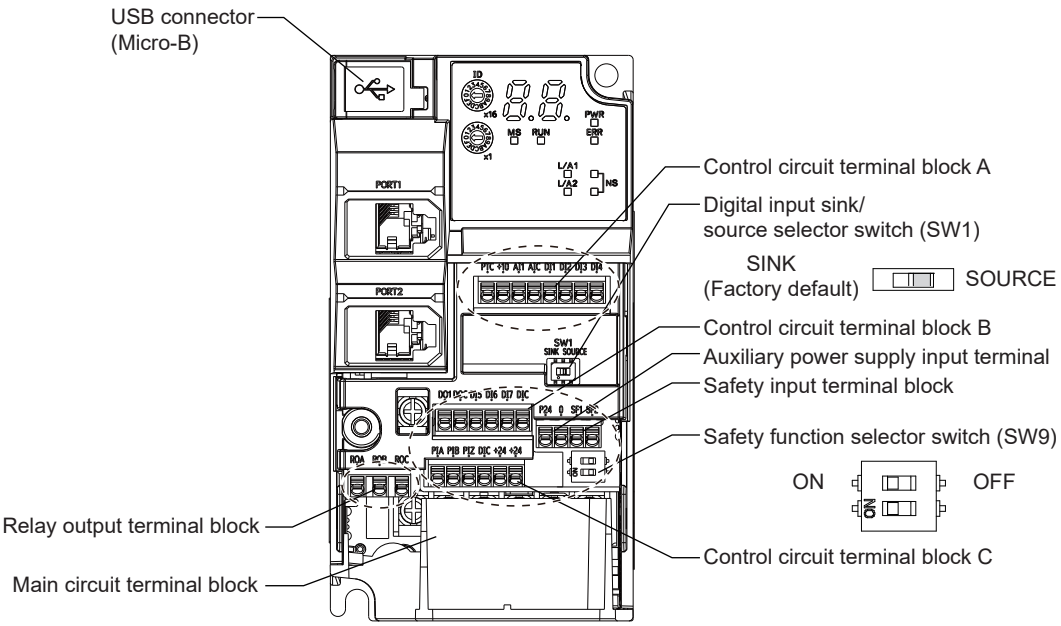
| Standard | | Applicable standard |
|---|---|---|
| CE UKCA | EMC | EN 61800-3:2004/A1:2012,<br>IEC 61800-3:2017 |
| | Functional safety | EN 61800-5-2:2017 STO SIL3,<br>EN/ISO 13849-1:2023, Cat.3 / PLe |
| | Electrical safety | EN 61800-5-1:2007,<br>EN 61800-5-1:2007/A1:2017,<br>EN 61800-5-1:2007/A11:2021 |
| UL | US | UL 61800-5-1, Edition 1, 2012 |
| | CA | CSA-C22.2 No.274, 2017 |
| Ecodesign regulation | | IEC 61800-9-2 (EU) 2019/1781 |

# 1-2 Appearance and Part Names

The following shows the front view when the product is unpacked.
(An example of 3G3M1-AB002/AB004/AB007/A2001/A2002/A2004/A2007-EMP)



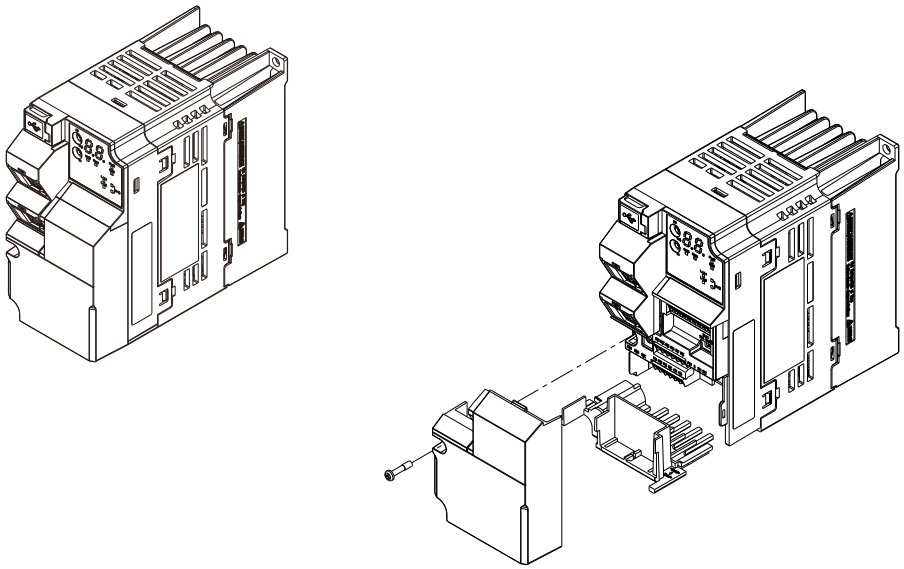

Open the terminal block cover to wire the main circuit terminal block and the control circuit terminal block.



The figures below show the components of each Inverter model.

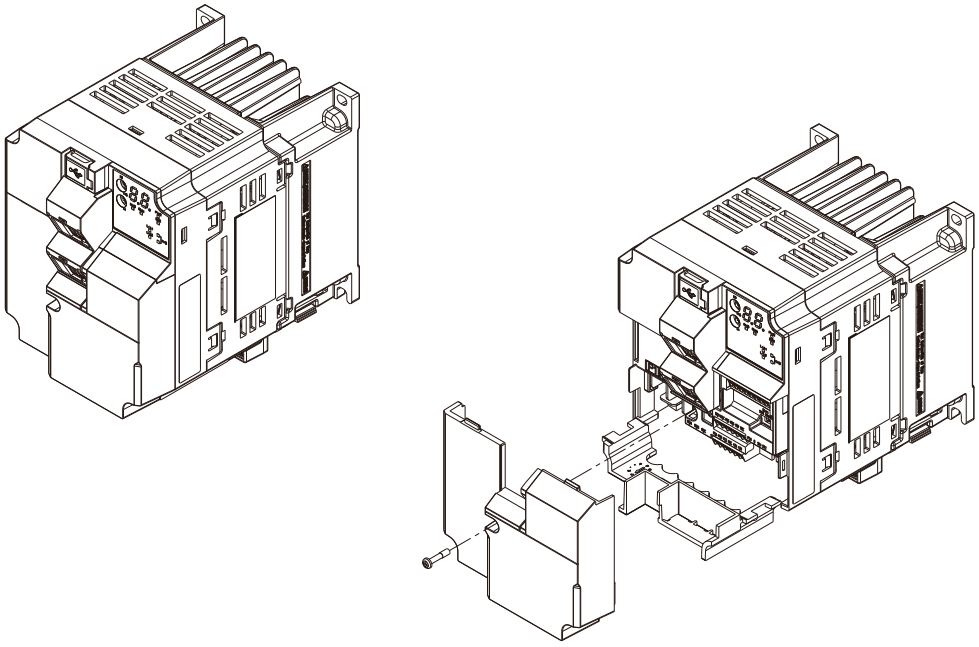
Single-phase 200 V, 0.1/0.2/0.4/0.75 kW

Three-phase 200 V, 0.1/0.2/0.4/0.75 kW



Single-phase 200 V, 1.5 kW Three-phase 200 V, 1.5/2.2 kW

Three-phase 400V, 0.4/0.75/1.5/2.2kW



(1) Cooling Fan Cover

(2) Cooling Fan

(3) Cooling Fin

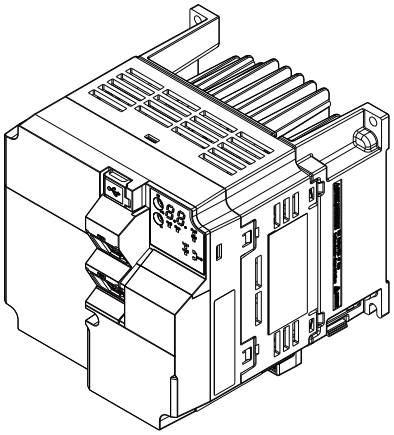
(4) Inverter Case

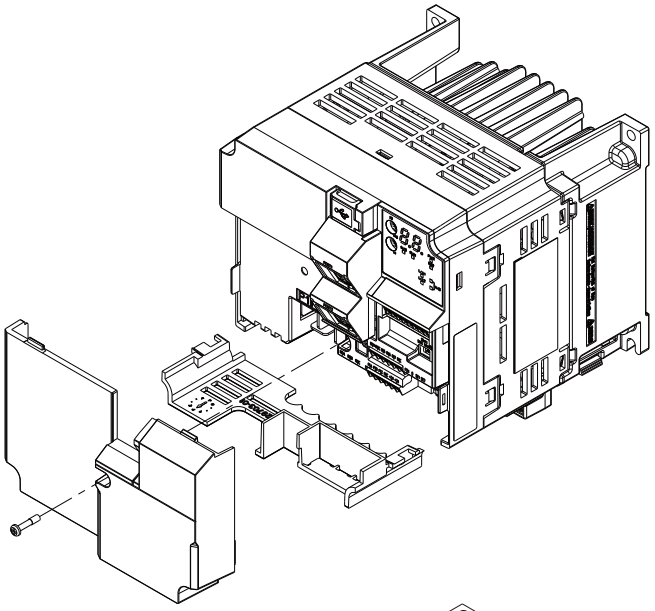
(5) Surface cover (Terminal block cover)

(6) Surface cover (Backing plate)

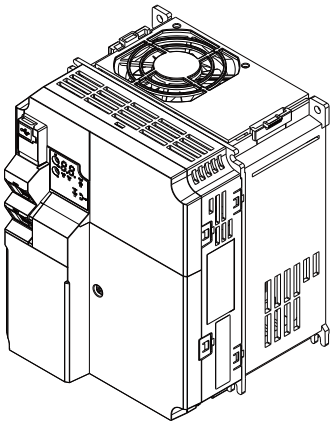
**Note** The single-phase 200-V, 1.5-kW and three-phase 200-V, 1.5-kW models have a cooling fan. The three-phase 400-V, 0.4/0.75/1.5 kW model, however, has no cooling fan.

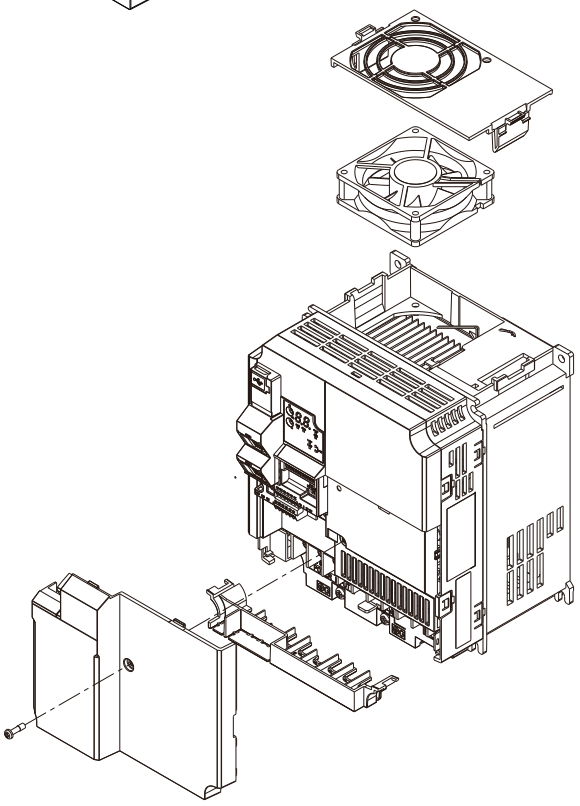
Single-phase 200 V, 2.2kW
Three-phase 200 V, 3.7 kW
Three-phase 400V, 3.0/4.0kW





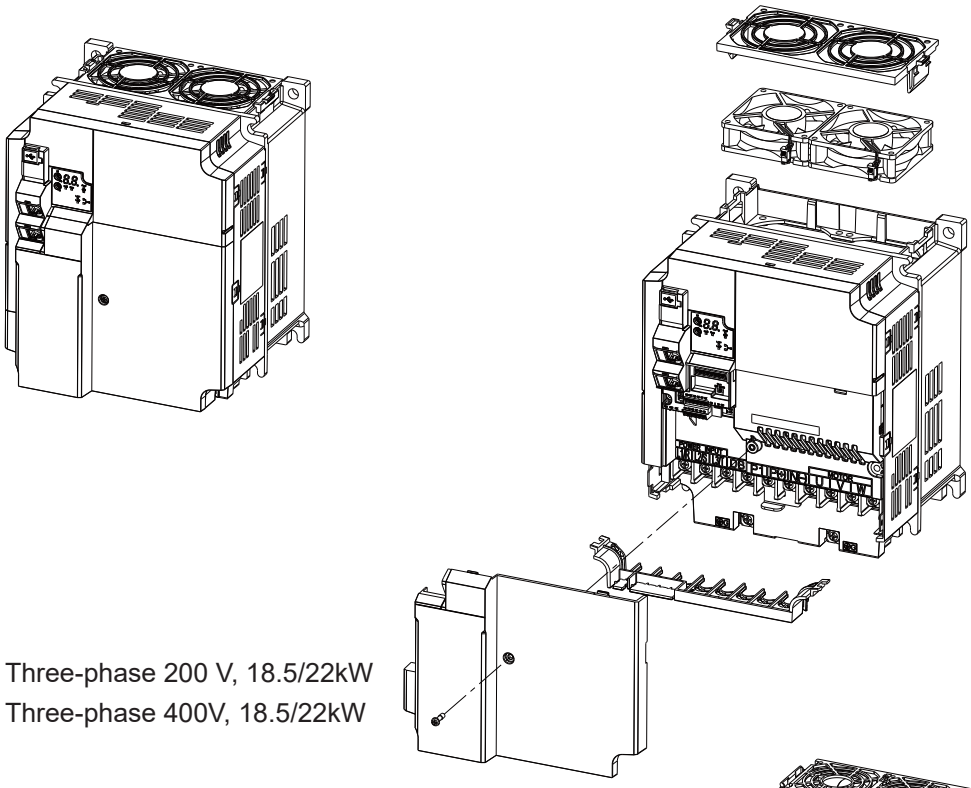
Single-phase 200 V, 3.7kW
Three-phase 200 V, 5.5/7.5kW
Three-phase 400V, 5.5/7.5kW



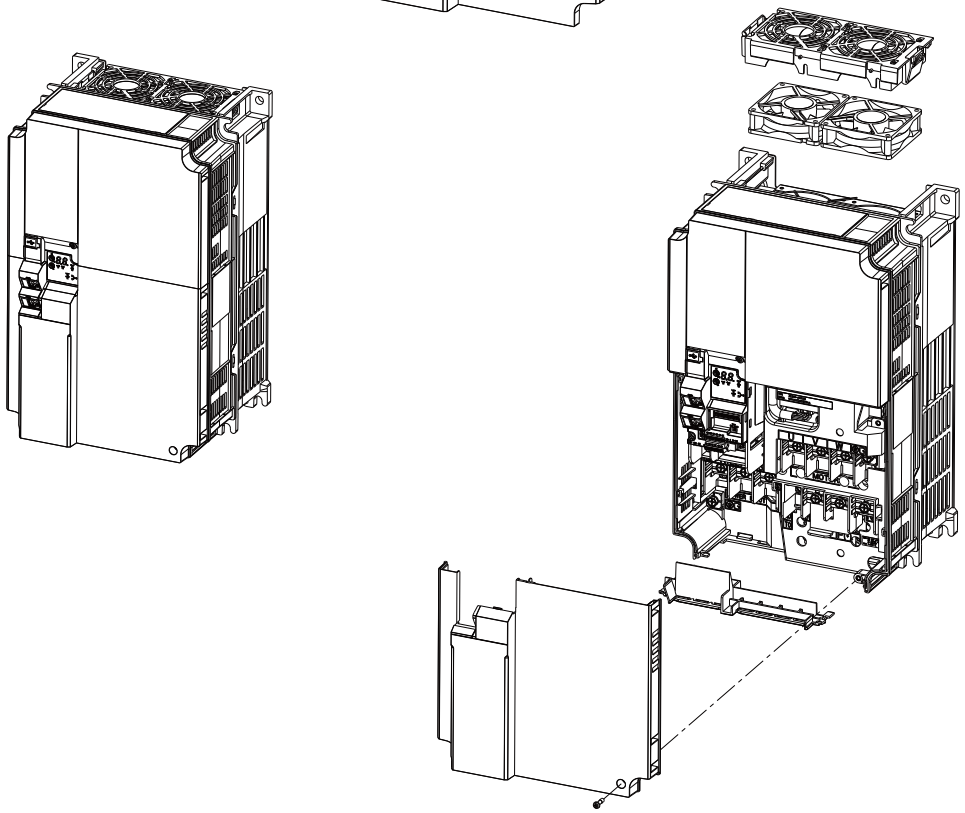


(1) Cooling Fan Cover
(2) Cooling Fan
(3) Cooling Fin
(4) Inverter Case
(5) Surface cover (Terminal block cover)
(6) Surface cover (Backing plate)

Three-phase 200 V, 11/15kW
Three-phase 400V, 11/15kW



Three-phase 200 V, 18.5/22kW
Three-phase 400V, 18.5/22kW



(1) Cooling Fan Cover
(2) Cooling Fan
(3) Cooling Fin
(4) Inverter Case
(5) Surface cover (Terminal block cover)
(6) Surface cover (Backing plate)

# 1-3 Specifications

## 1-3-1 Standard Specifications

### Three-phase 200-V Class

HHD: Heavy load, HND: Light load

| Item | | | Three-phase 200 V | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model (3G3M1-A2□□□-EMP) | | | | 002 | 004 | 007 | 015 | 022 | 037 | 055 | 075 | 110 | 150 | 185 |
| Maximum applicable motor capacity[*1] | kW | HHD | | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 |
| | | HND | | 0.4 | 0.75 | 1.1 | 2.2 | 3[*7] | 5.5[*7] | 7.5 | 11 | 15 | 18.5 | 22 |
| | HP | HHD | | 1/4 | 1/2 | 1 | 2 | 3 | 5 | 7 1/2 | 10 | 15 | 20 | 25 |
| | | HND | | 1/2 | 1 | 1 1/2 | 3 | 4 | 7 1/2 | 10 | 15 | 20 | 25 | 30 |
| Rated output capacity [kVA] [*2] | 200 V | HHD | | 0.6 | 1 | 1.7 | 2.8 | 3.8 | 6.1 | 8.7 | 11 | 16 | 21 | 26 |
| | | HND | | 0.7 | 1.2 | 2.1 | 3.3 | 4.2 | 6.8 | 10 | 14 | 19 | 24 | 30 |
| | 240 V | HHD | | 0.7 | 1.2 | 2.1 | 3.3 | 4.6 | 7.3 | 10 | 14 | 20 | 25 | 32 |
| | | HND | | 0.8 | 1.5 | 2.5 | 4.0 | 5.0 | 8.1 | 12 | 17 | 23 | 29 | 37 |
| Rated input voltage[*3] | | | Three-phase 200 to 240 V, 50/60 Hz | | | | | | | | | | | |
| Allowable voltage fluctuation | | | -15 % to +10 % | | | | | | | | | | | |
| Rated input current without DCR [A][*4] | | HHD | | 1.8 | 3.1 | 5.3 | 9.5 | 13.2 | 22.2 | 31.5 | 42.7 | 60.7 | 80 | 97 |
| | | HND | | 2.6 | 4.9 | 6.7 | 12.8 | 17.9 | 28.5 | 42.7 | 60.7 | 80 | 97 | 112 |
| Rated input current with DCR [A][*4] | | HHD | | 0.93 | 1.6 | 3 | 5.7 | 8.3 | 14 | 21.1 | 28.8 | 42.2 | 57.6 | 71 |
| | | HND | | 1.6 | 3 | 4.3 | 8.3 | 11.7 | 19.9 | 28.8 | 42.2 | 57.6 | 71 | 84.4 |
| Rated output voltage | | | Three-phase 200 to 240 V (with AVR) | | | | | | | | | | | |
| Rated output current [A][*5] | | HHD | | 1.6 | 3 | 5 | 8 | 11 | 17.5 | 25 | 33 | 47 | 60 | 76 |
| | | HND | | 2 | 3.5 | 6 | 9.6 | 12[*7] | 19.6[*7] | 30 | 40 | 56 | 69 | 88 |
| Braking torque [%][*6] | | HHD | 150 | | 100 | | 70 | 40 | | 20 | | | | |
| | | HND | 75 | | 53 | 68 | 48 | 29[*7] | 27[*7] | 15 | | | | |
| Braking resistor circuit | Regenerative braking | | Built-in braking resistor circuit (discharge resistor separately mounted) | | | | | | | | | | | |
| | Minimum connection resistance [Ω] | | 100 | | | | 40 | | 33 | 20 | 15 | 10 | 8.6 | 4 |
| | DCbus voltage level [VDC] | | 398 | | | | | | | | | | | 385 |

| Item | Three-phase 200 V | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Short circuit current rating [kA] | 100 | | | | | | | | | | | |
| Cooling method | Natural cooling | | | | Fan cooling | | | | | | | |
| Weight [kg] (Approximate) | | 0.5 | 0.7 | 0.9 | 1.4 | 1.4 | 1.7 | 3.8 | 3.9 | 5.3 | 5.4 | 11 |

*1. The maximum applicable motor capacity is given for a standard four-phase motor. When selecting an inverter, select not just by kW but also ensure that the inverter rated output current is greater than the motor rated current.
*2. In calculating the rated capacity, the rated output voltage is assumed to be 200 V or 240 V.
*3. A voltage higher than the power supply voltage cannot be output.
*4. When Carrier Frequency (F026) is set to the following or below, derating is required.
HHD mode...A2002 to A2037: 8 kHz, A2055 to A2185: 10 kHz
HND mode...A2002 to A2037: 4 kHz, A2055 to A2150: 10 kHz, A2185: 4 kHz
For derating, refer to A-1 Derating Table on page A-2.
*5. The following shows the calculated value when the power supply capacity is 500 kVA (10x the inverter capacity when the inverter capacity exceeds 50 kVA) and when a %X = 5% power supply is connected.
*6. The numeric value is the average braking torque per individual motor. (Varies according to motor efficiency)
*7. Allowable ambient temperature of 40°C or below of A2022 to A2037 in the HND mode.
The rated output current in the HND mode decreases by 1% for every temperature increase of 1°C when the ambient temperature is 40°C or more.

## Three-phase 400-V Class

HHD/HD: Heavy load, HND/ND: Light load

| Item | | | Three-phase 400 V | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model (3G3M1-A4□□□-EMP) | | | 004 | 007 | 015 | 022 | 030 | 040 | 055 | 075 | 110 | 150 | 185 | 220 |
| Maximum applicable motor capacity[*1] | kW | HD | 0.75 | 1.1 | 2.2 | 3 | 4 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 |
| | | ND | 0.75 | 1.5 | 2.2 | 3 | 4 | 5.5 | 11 | 15 | 18.5 | 22 | 30 | 37 |
| | | HHD | 0.4 | 0.75 | 1.5 | 2.2 | 3 | 4 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 |
| | | HND | 0.75 | 1.1 | 2.2 | 3[*7] | 4 | 5.5[*7] | 7.5 | 11 | 15 | 18.5 | 22 | 30 |
| | HP | HD | 1 | 1 1/2 | 3 | 4 | 5 | 7 1/2 | 10 | 15 | 20 | 25 | 30 | 40 |
| | | ND | 1 | 1 1/2 | 3 | 4 | 5 | 7 1/2 | 15 | 20 | 25 | 30 | 40 | 50 |
| | | HHD | 1/2 | 1 | 1 1/2 | 3 | 4 | 5 | 7 1/2 | 10 | 15 | 20 | 25 | 30 |
| | | HND | 1 | 1 1/2 | 3 | 4 | 5 | 7 1/2 | 10 | 15 | 20 | 25 | 30 | 40 |
| Rated output capacity [kVA][*2] | 380 V | HD | 1.2 | 2.2 | 3.3 | 4.1 | 5.8 | 7.3 | 12 | 15 | 20 | 25 | 30 | 39 |
| | | ND | 1.4 | 2.7 | 3.6 | 4.5 | 6.1 | 7.9 | 14 | 19 | 24 | 29 | 39 | 47 |
| | | HHD | 1.2 | 2.2 | 3.2 | 3.6 | 4.7 | 6.1 | 9.7 | 12 | 16 | 20 | 26 | 30 |
| | | HND | 1.4 | 2.7 | 3.6 | 4.5 | 5.8 | 7.3 | 12 | 15 | 20 | 25 | 30 | 39 |
| | 480 V | HD | 1.5 | 2.8 | 4.2 | 5.2 | 7.3 | 9.2 | 15 | 19 | 26 | 32 | 37 | 50 |
| | | ND | 1.7 | 3.4 | 4.6 | 5.7 | 7.6 | 10 | 18 | 24 | 31 | 37 | 49 | 60 |
| | | HHD | 1.5 | 2.8 | 4 | 4.6 | 6 | 7.6 | 12.3 | 15 | 20 | 26 | 32 | 37 |
| | | HND | 1.7 | 3.4 | 4.6 | 5.7 | 7.3 | 9.2 | 15 | 19 | 26 | 32 | 37 | 50 |
| Rated input voltage[*3] | | | Three-phase 380 to 480V, 50/60 Hz | | | | | | | | | | | |
| Allowable voltage fluctuation | | | -15 % to +10 % | | | | | | | | | | | |

| Item | | Three-phase 400 V | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated input current without DCR [A]*4 | HD | 2.7 | 3.9 | 7.3 | 11.3 | 14.2 | 16.8 | 23.2 | 33 | 43.8 | 52.3 | 60.6 | 77.9 |
| | ND | 2.7 | 4.8 | 7.3 | 11.3 | 14.2 | 16.8 | 33 | 43.8 | 52.3 | 60.6 | 77.9 | 94.3 |
| | HHD | 1.7 | 3.1 | 5.9 | 8.2 | 11.3 | 14.2 | 17.3 | 23.2 | 33 | 43.8 | 52.3 | 60.6 |
| | HND | 2.7 | 3.9 | 7.3 | 11.3 | 14.2 | 16.8 | 23.2 | 33 | 43.8 | 52.3 | 60.6 | 77.9 |
| Rated input current with DCR [A]*4 | HD | 2.7 | 3.9 | 7.3 | 11.3 | 14.2 | 16.8 | 23.2 | 33 | 43.8 | 52.3 | 60.6 | 77.9 |
| | ND | 2.7 | 4.8 | 7.3 | 11.3 | 14.2 | 16.8 | 33 | 43.8 | 52.3 | 60.6 | 77.9 | 94.3 |
| | HHD | 1.7 | 3.1 | 5.9 | 8.2 | 11.3 | 14.2 | 17.3 | 23.2 | 33 | 43.8 | 52.3 | 60.6 |
| | HND | 2.7 | 3.9 | 7.3 | 11.3 | 14.2 | 16.8 | 23.2 | 33 | 43.8 | 52.3 | 60.6 | 77.9 |
| Rated output voltage | | Three-phase 380 to 480V (with AVR) | | | | | | | | | | | |
| Rated output current [A]*5 | HD | 1.8 | 3.4 | 5 | 6.3 | 8.8 | 11.1 | 17.5 | 23 | 31 | 38 | 45 | 60 |
| | ND | 2.1 | 4.1 | 5.5 | 6.9 | 9.2 | 12 | 21.5 | 28.5 | 37 | 44 | 59 | 72 |
| | HHD | 1.8 | 3.4 | 4.8 | 5.5 | 7.2 | 9.2 | 14.8 | 18 | 24 | 31 | 39 | 45 |
| | HND | 2.1 | 4.1 | 5.5 | 6.9*7 | 8.8 | 11.1 *7 | 17.5 | 23 | 31 | 38 | 45 | 60 |
| Braking torque [%]*6 | HD | 53.3 | 68.2 | 47.7 | 29.3 | 29.3 | 26.9 | 15 | | | | | |
| | ND | 53.3 | 50.0 | 47.7 | 29.3 | 29.3 | 26.9 | 12 | | | | | |
| | HHD | 100 | | 70 | 40 | 40 | 40 | 20 | | | | | |
| | HND | 53 | 68 | 48 | 29*7 | 29 | 27*7 | 15 | | | | | |
| Braking resistor circuit | Regenerative braking | Built-in braking resistor circuit (discharge resistor separately mounted) | | | | | | | | | | | |
| | Minimum connection resistance [Ω] | 200 | | 160 | | 130 | | 80 | 60 | 40 | 34.4 | 16 | |
| | DCbus voltage level [VDC] | 796 | | | | | | | | | 770 | | |
| Short circuit current rating [kA] | | 100 | | | | | | | | | | | |
| Cooling method | | Natural cooling | | | Fan cooling | | | | | | | | |
| Weight [kg] (Approximate) | | 1.2 | 1.4 | 1.5 | 1.4 | 1.8 | 1.8 | 3.7 | 3.8 | 5.3 | 5.4 | 11 | 11 |

*1. The maximum applicable motor capacity is given for a standard four-phase motor. When selecting an inverter, select not just by kW but also ensure that the inverter rated output current is greater than the motor rated current.

*2. In calculating the rated capacity, the rated output voltage is assumed to be 380 V or 480 V.

*3. A voltage higher than the power supply voltage cannot be output.

*4. When Carrier Frequency (F026) is set to the following or below, derating is required.
HHD mode...A4004 to A4040: 8 kHz, A4055 to A4220: 10 kHz
HND mode...A4004 to A4040: 8 kHz, A4055 to A4185: 10 kHz, A4220: 6 kHz
HD and ND modes...All models: 4 kHz
For derating, refer to A-1 Derating Table on page A-2.

*5. The following shows the calculated value when the power supply capacity is 500 kVA (10x the inverter capacity when the inverter capacity exceeds 50 kVA) and when a %X = 5% power supply is connected.

*6. The numeric value is the average braking torque per individual motor. (Varies according to motor efficiency)

*7. Allowable ambient temperature of 40°C or below of A4022 to A4040 in the HND mode.
The rated output current of A4022 and A4040 in the HND mode decreases by 1% for every temperature increase of 1°C when the ambient temperature is 40°C or more.

## Single-phase 200-V Class

HHD: Heavy load, HND: Light load

| Item | | | Single-phase 200 V | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model (3G3M1-AB□□□-EMP) | | | | 002 | 004 | 007 | 015 | 022 | 037 |
| Maximum applicable motor capacity[*1] | kW | HHD | | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 |
| | | HND | | 0.4 | 0.55 | 1.1 | 2[*8] | 2.7[*9] | - |
| | HP | HHD | | 1/4 | 1/2 | 1 | 2 | 3 | 5 |
| | | HND | | 1/2 | 3/4 | 1 1/2 | 3 | 4 | - |
| Rated output capacity [kVA][*2] | 200 V | HHD | | 0.6 | 1 | 1.7 | 2.8 | 3.8 | 6.1 |
| | | HND | | 0.7 | 1.2 | 2.1 | 3.3 | 4.2 | - |
| | 240V | HHD | | 0.7 | 1.2 | 2.1 | 3.3 | 4.6 | 7.3 |
| | | HND | | 0.8 | 1.5 | 2.5 | 4 | 5 | - |
| Rated input voltage[*3] | | | Single-phase 200 to 240 V, 50/60 Hz | | | | | | |
| Allowable voltage fluctuation | | | -15 % to +10 % | | | | | | |
| Rated input current without DCR [A][*4] | | HHD | | 3.3 | 5.4 | 9.7 | 16.4 | 22 | 45.4 |
| | | HND | | 4.9 | 7.3 | 13.8 | 20.2 | 26 | - |
| Rated input current with DCR [A][*4] | | HHD | | 2 | 3.5 | 6.4 | 11.6 | 17.5 | 31.8 |
| | | HND | | 3.7 | 4.6 | 9.4 | 17.9 | 25 | - |
| Rated output voltage | | | Single-phase 200 to 240 V (with AVR) | | | | | | |
| Rated output current [A][*5] | | HHD | | 1.6 | 3 | 5 | 8 | 11 | 17.5 |
| | | HND | | 1.9 | 3.5[*7] | 6.0[*7] | 9.6[*7] | 12[*7] | - |
| Braking torque[*6] [%] | | HHD | | | 100 | | 70 | 40 | 40 |
| | | HND | | | 73 | 68 | 48 | 29 | - |
| Braking resistor circuit | Regenerative braking | | Built-in braking resistor circuit (discharge resistor separately mounted) | | | | | | |
| | Minimum connection resistance [Ω] | | 100 | | | | 40 | | |
| | DC bus voltage level [VDC] | | 398 | | | | | | |
| Short circuit current rating [kA] | | | 100 | | | | | | |
| Cooling method | | | Natural cooling | | | | Fan cooling | | |
| Weight [kg] | | | | Approx. 0.5 | Approx. 0.7 | Approx. 0.9 | Approx. 1.5 | Approx. 1.7 | Approx. 3.8 |

*1. The maximum applicable motor capacity is given for a standard four-phase motor. When selecting an inverter, select not just by kW but also ensure that the inverter rated output current is greater than the motor rated current.

*2. In calculating the rated capacity, the rated output voltage is assumed to be 200 V or 240 V.

*3. A voltage higher than the power supply voltage cannot be output.

*4. When Carrier Frequency (F026) is set to the following or below, derating is required.
HHD mode...AB002 to A2037: 8 kHz

HND mode...AB002 to A2022: 4 kHz
For derating, refer to A-1 Derating Table on page A-2.

*5. The following shows the calculated value when the power supply capacity is 500 kVA (10x the inverter capacity when the inverter capacity exceeds 50 kVA) and when a %X = 5% power supply is connected.
*6. The numeric value is the average braking torque per individual motor. (Varies according to motor efficiency)
*7. Allowable ambient temperature of 40°C or below of AB004, AB007, AB015 and AB022.
The rated output current in the HND mode decreases by 2% for every temperature increase of 1°C when the ambient temperature is 40°C or more.
*8. The maximum applicable motor capacity is 2.2 kW when the input voltage is 220 to 240 V.
*9. The maximum applicable motor capacity is 3.0 kW when the input voltage is 220 to 240 V.

## Common Specifications

| Item | Specifications |
|---|---|
| Enclosure rating*1 | Open type (IP20) |

| Item | | Specifications |
|---|---|---|
| Con-trol | Control Method | Phase-to-phase sinusoidal modulation PWM |
| | Output frequency range*2 | 5.00 to 590 Hz |
| | Frequency preci-sion | Digital command: ±0.01% of the maximum frequency, Analog command: ±0.2% of the maximum frequency (25±10°C) |
| | Frequency setting resolution | Digital setting: 0.01 Hz, Analog setting: Maximum frequency × 5/10,000 |
| | Overload current rating of inverter | Heavy load rating (HHD): 150%/60 s or 200%/0.5 s<br>Heavy load rating (HD): 150%/60 s<br>Light load rating (HND/ND): 120%/60 s |
| | Instantaneous overcurrent protec-tion | • Digital setting: 0.01 Hz (99.99 Hz max.), 0.1 Hz (100.0 to 590.0 Hz)<br>• Analog setting: Maximum frequency × 5/10,000<br>• Communication setting: 0.005% of the maximum output frequency or 0.01 Hz (fixed) |
| | Acceleration/ Deceleration time | 0.00 to 6000 s (line/curve arbitrary setting), 2nd acceleration/deceleration setting provided |
| | Carrier frequency change range | Three-phase 400-V class<br>• 3G3M1-A4004 to A4185-EMP<br>0.75 to 16 kHz (HHD/HND/HD) 0.75 to 10 kHz (ND)<br>• 3G3M1-A4220-EMP<br>0.75 to 16 kHz (HHD) 0.75 to 10 kHz (HND/HD) 0.75 to 6kHz (ND)<br><br>Three-phase 200-V class<br>• 3G3M1-A2002 to A2015-EMP, A2055 to A2185-EMP<br>0.75 to 16 kHz (HHD/HND)<br>• 3G3M1-A2022/A2037-EMP<br>0.75 to 16 kHz (HHD)<br>0.75 to 10 kHz (HND)<br><br>Single-phase 200-V class<br>• 3G3M1-AB002 to AB022-EMP<br>0.75 to 16 kHz (HHD)<br>0.75 to 10 kHz (HND)<br>• 3G3M1-AB037-EMP 0.75 to 16 kHz (HHD)<br><br>The carrier frequency automatically drops according to the ambient temperature and output current. (This function can be disabled.) |

| Item | | Specifications |
|---|---|---|
| Control | Starting torque | • 150% min. / Rated speed of 10%<br>V/f control (IM motor)<br>V/f control (slip compensation)<br>V/f control with speed sensor (IM motor)<br><br>• 200% min./0.5 Hz<br>Vector control without speed sensor (dynamic vector control) (IM motor)<br>V/f control with speed feedback (Automatic torque boost)<br>Sensorless vector control<br><br>• 200% min./0.0 Hz (0 Hz torque control) Vector<br>control with speed sensor (IM motor)<br>Vector control with speed and pole position sensor (PM motor)<br>(*) To obtain 200% starting torque at low speed, consider raising the capacity of the inverter to the next higher capacity.<br><br>• 200% min. / Rated speed of 10%<br>Vector control without speed and pole position sensor (PM motor)<br>(*) To obtain these starting torques at low speed, the capacity of the inverter and motor must be taken into consideration.<br><br>The maximum torque that can be used is limited when the current capacity matched to the mode is exceeded.<br>Current capacity of 200% in HHD mode, 150% in HD mode, and 120% in HND and ND modes |
| Protection function | | Overcurrent, Overvoltage, Undervoltage, Electronic thermal, Temperature error, Ground-fault current at power-on, Inrush current protection circuit, Overload limit, Incoming overvoltage, External trip, Memory error, CPU error, USP error, Communication error, Overvoltage suppression during deceleration, Power interruption protection, Forced Stop, etc. |
| Input signal | Frequency setting | External analog input signal: Variable resistor/0 to 10 VDC |
| | RUN/STOP command | External digital input signal (3-wire input available) |
| | Multi-function Input*3 | Seven points (DI1 to DI7, Functions can be selected from among 101) |
| | Analog input*4 | One point (voltage AI1 terminal: 10 bits/-10 to 10 VDC) |
| | Pulse input | One point (A, B, Z phases can be input, max. 32 kHz, 5 to 24 VDC) |
| Output signal | Multi-function output*3 | One point (DO1; Functions can be selected from among 92) |
| | Relay output*3 | One point (SPDT contact (ROA, ROB, ROC), Functions can be selected from among 92) |
| Communications | USB | USB 2.0, Micro-B connector |
| Other functions | | AVR function, V/f characteristics switching, Upper/Lower limit, Multi-step speed (16 steps), Starting frequency adjustment, Jogging operation, Carrier frequency adjustment, PID control, Frequency jump, Analog gain/bias adjustment, S-shape acceleration/deceleration, Electronic thermal characteristics/ level adjustment, Restart function, Torque boost function, Fault monitor, Frequency conversion display, USP function, 2nd control function, UP/DOWN, Overcurrent suppression function, etc. |

| Item | | Specifications |
|---|---|---|
| General specifications | Operating ambient temperature*5 | -10 to 50°C (Derating required) |
| | Storage ambient temperature | -25 to 70°C (Short-time temperature during shipment) |
| | Operating ambient humidity | 5% to 95% (with no condensation) |
| | Vibration resistance | Vibration Frequency / Specification<br>2 to less than 9Hz: 3mm (0.12inch) (Max. amplitude)<br>9 to less than 20Hz: 1G<br>20 to less than 55Hz 55 to less than 200Hz: 0.2G 0.1G |
| | Location | At a maximum altitude of 1,000 m, indoors (without corrosive gases or dust) |

*1. The enclosure rating complies with JISC0920.

*2. If you must use the motor at higher than 50/60 Hz, check the allowable maximum motor speed and other information with the motor manufacturer.

*3. In the HND/ND (light load) mode or PM motor mode compared with the HHD/HD (heavy load) mode, for some parameters, the default data and setting range also differ. For details, refer to *6-2-2 Load Mode Selection* on page 6-10.

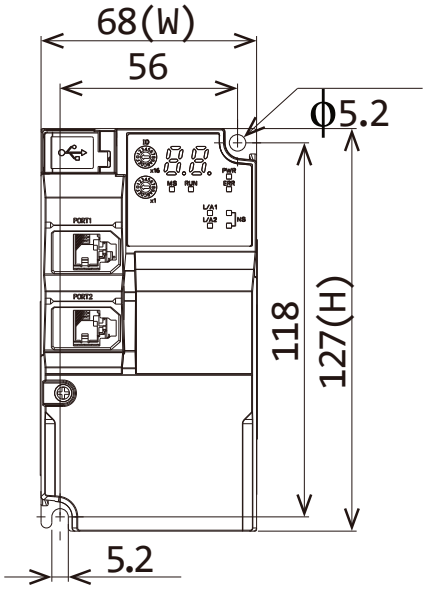
*4. By default, the maximum frequency is adjusted to 10 V for a voltage input of 0 to 10 VDC. If necessary, adjust the default parameter settings. For details, refer to *8-3-2 Analog Input Adjustment Function* on page 8-35.

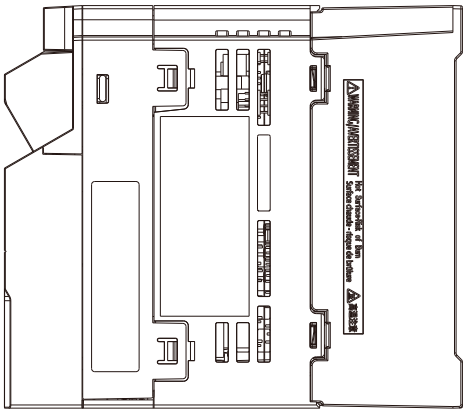
*5. Derating of the rated output current of the inverter may be required depending on the heavy/light load mode selection, operating ambient temperature, side-by-side installation, and carrier frequency settings. Use the inverter in an appropriate environment according to *A-7 Derating Table* on page A-276.

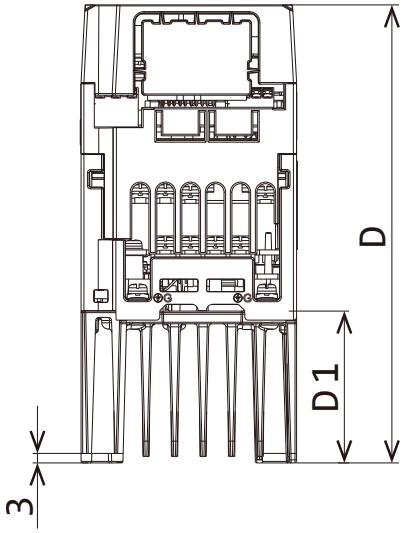
## 1-3-2 EtherNet Communication Specifications

| Item | Specifications |
|---|---|
| Physical layer | 100BASE-TX (IEEE802.3) |
| Connector | RJ45 × 2 (shielded type) |
| | PORT1: EtherNet Port 1 PORT2: EtherNet Port 2 |
| Communications media | Category 5 or higher (cable with double, aluminum tape and braided shielding) is recommended. |
| Communications distance | Distance between nodes: 100 m max. |
| LED display | - MS : Module status (Green / Red)<br>- NS : Network Status (Green / Red)<br>- L/A1 : Link/Act. PORT1 (Green)<br>- L/A2 : Link/Act. PORT2 (Green) |

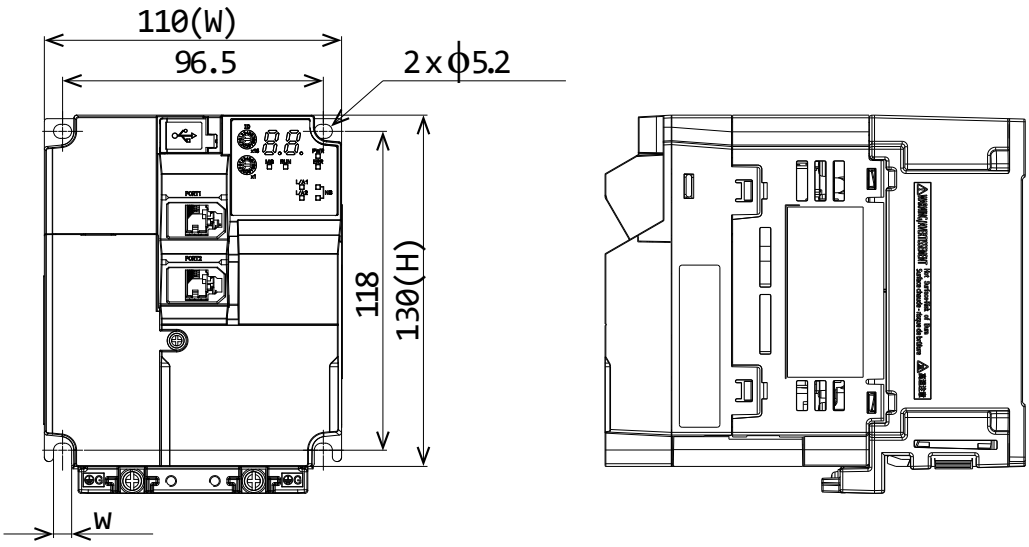
## 1-3-3 External Dimensions

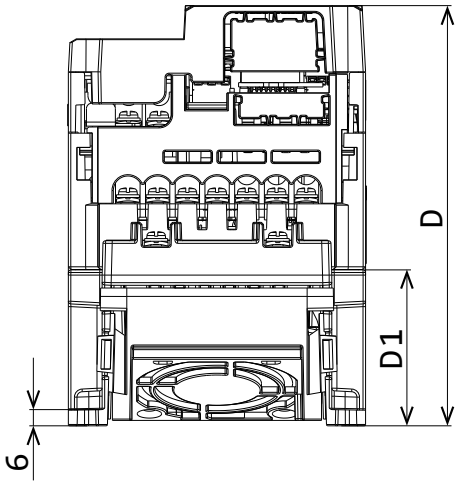


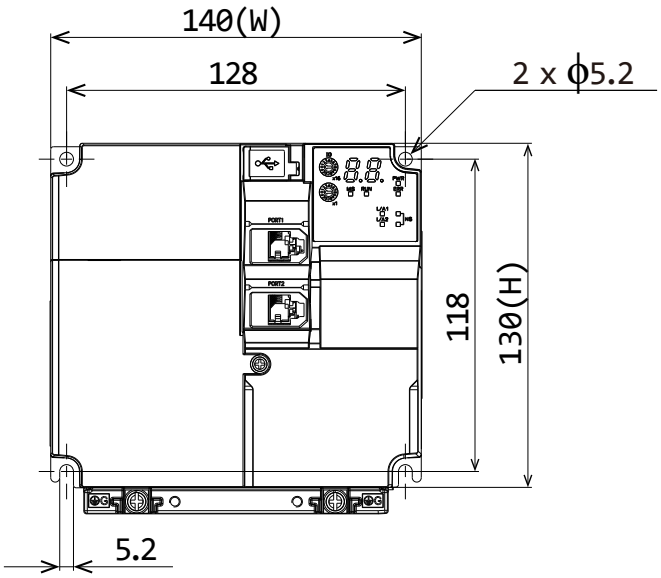


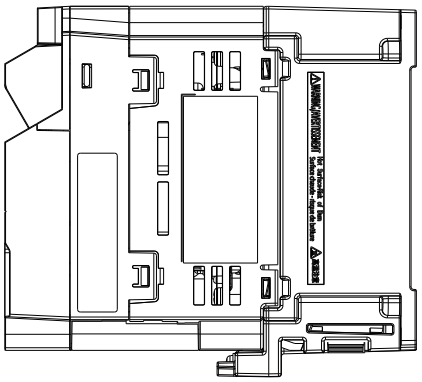

| Power supply | Model | W [mm] | H [mm] | D [mm] | D1 [mm] |
|---|---|---|---|---|---|
| Single-phase 200V | 3G3M1-AB002-EMP | 68 | 127 | 98 | 8 |
| | 3G3M1-AB004-EMP | | | 120 | 23 |
| | 3G3M1-AB007-EMP | | | 165 | 48 |
| Three-phase 200V | 3G3M1-A2002-EMP | | | 98 | 8 |
| | 3G3M1-A2004-EMP | | | 113 | 23 |
| | 3G3M1-A2007-EMP | | | 145 | 48 |

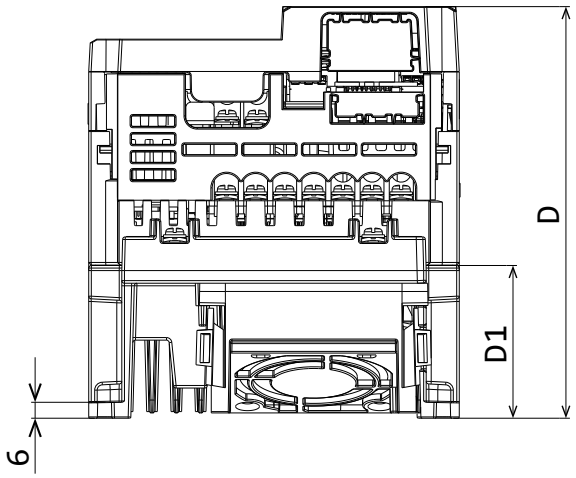


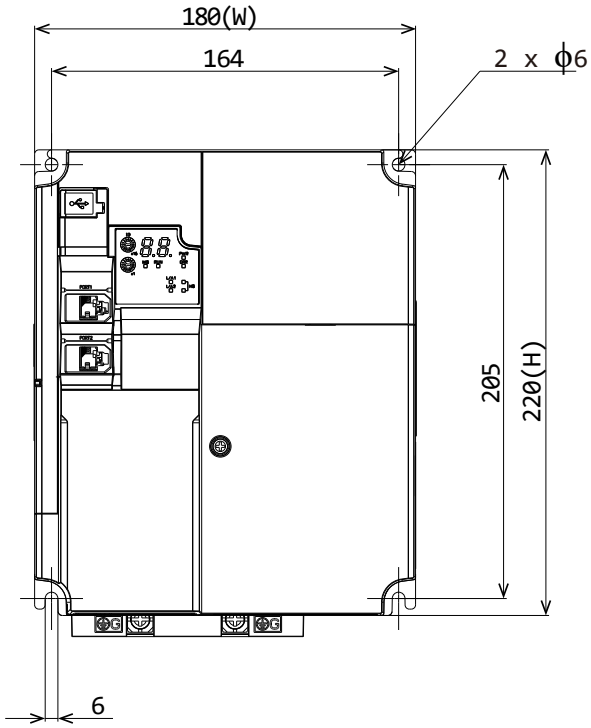

| Power supply | Model | W [mm] | H [mm] | D [mm] | D1 [mm] |
|---|---|---|---|---|---|
| Single-phase 200V | 3G3M1-AB015-EMP | 110 | 130 | 166 | 58 |
| Three-phase 200V | 3G3M1-A2015-EMP<br>3G3M1-A2022-EMP | | | 156 | |
| Three-phase 400V | 3G3M1-A4004-EMP | | | 132 | 38 |
| | 3G3M1-A4007-EMP<br>3G3M1-A4015-EMP<br>3G3M1-A4022-EMP | | | 156 | 58 |

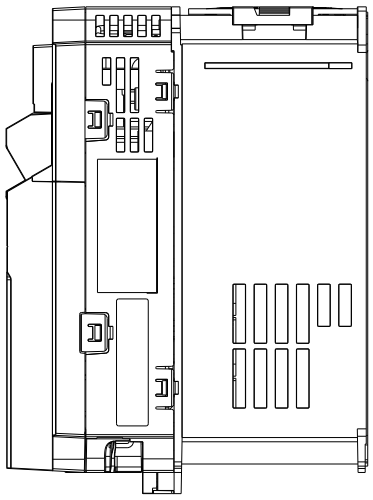


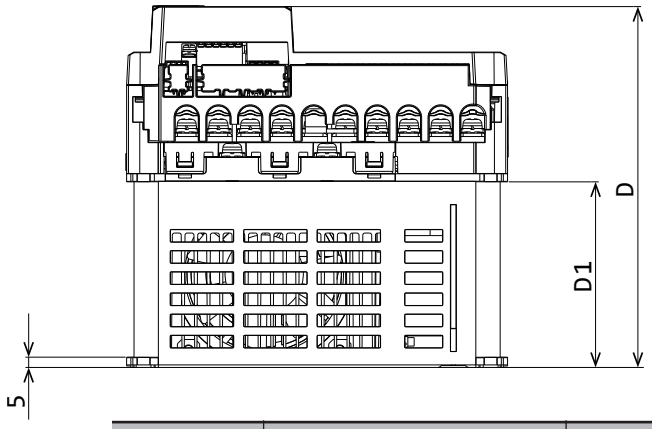





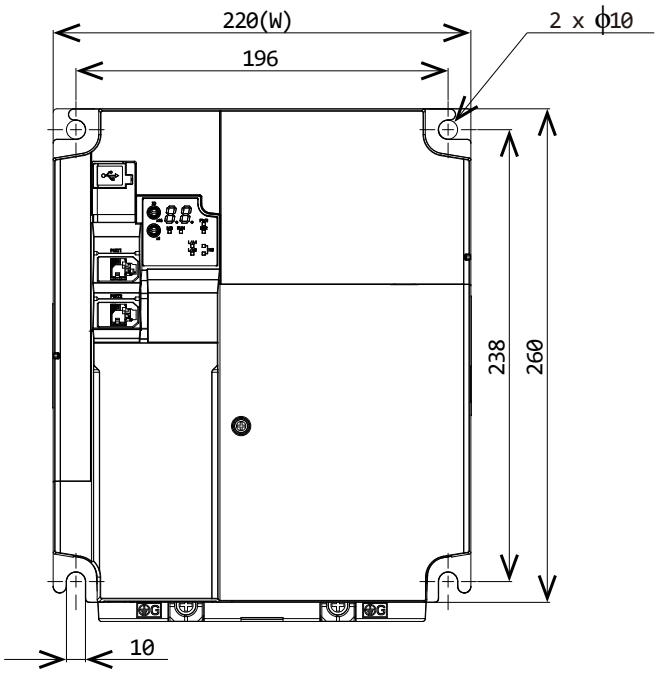

| Power supply | Model | W [mm] | H [mm] | D [mm] | D1 [mm] |
|---|---|---|---|---|---|
| Single-phase 200V | 3G3M1-AB022-EMP | 140 | 130 | 156 | 58 |
| Three-phase 200V | 3G3M1-A2037-EMP | | | | |
| Three-phase 400V | 3G3M1-A4030-EMP<br>3G3M1-A4040-EMP | | | | |

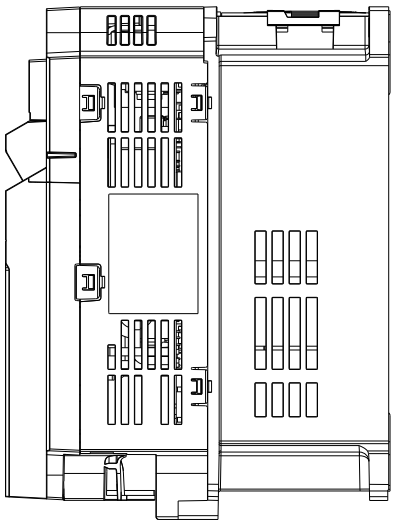


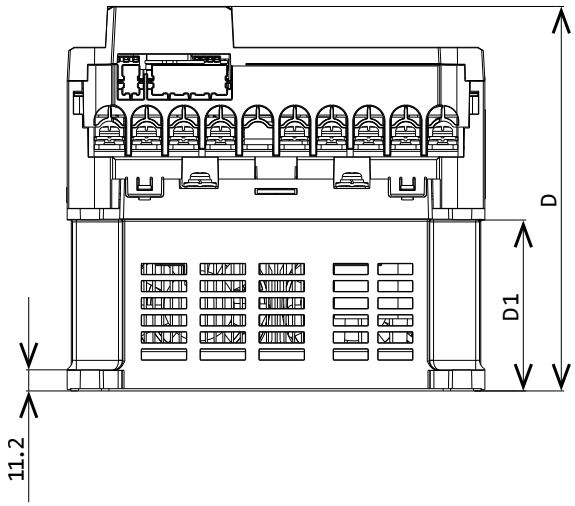





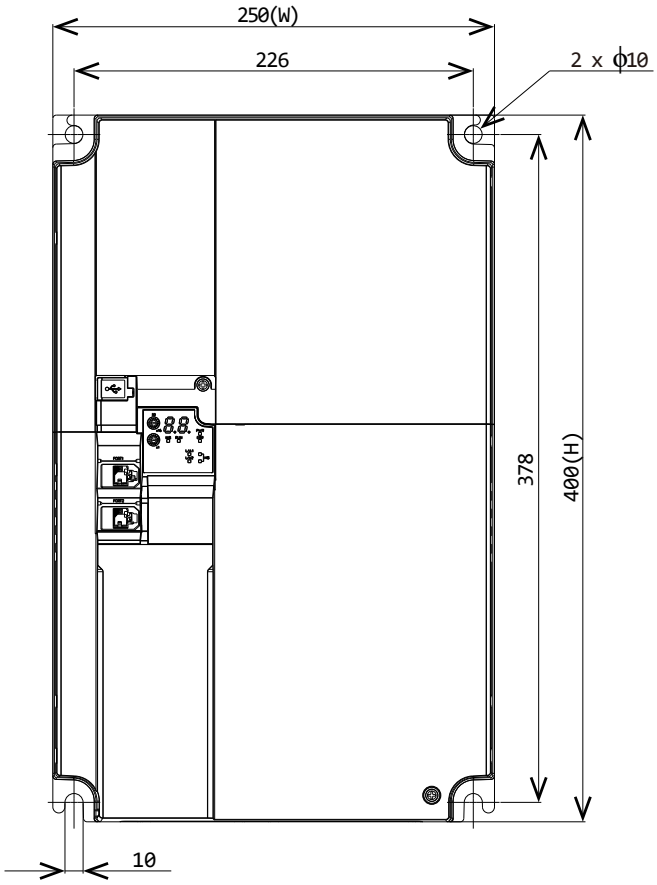

| Power supply | Model | W [mm] | H [mm] | D [mm] | D1 [mm] |
|---|---|---|---|---|---|
| Single-phase 200V | 3G3M1-AB037-EMP | 180 | 220 | 171 | 87.7 |
| Three-phase 200V | 3G3M1-A2055-EMP<br>3G3M1-A2075-EMP | | | | |
| Three-phase 400V | 3G3M1-A4055-EMP<br>3G3M1-A4075-EMP | | | | |

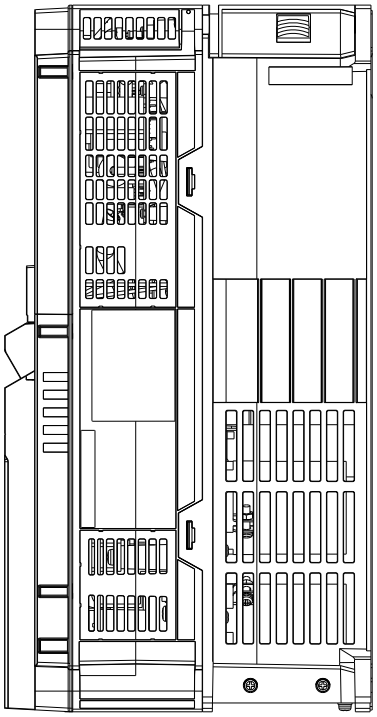


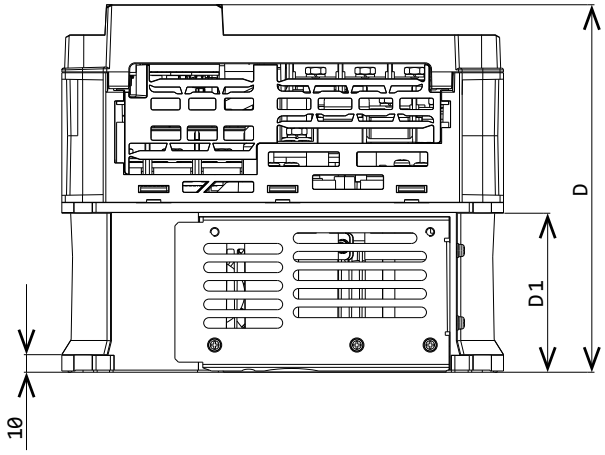






| Power supply | Model | W [mm] | H [mm] | D [mm] | D1 [mm] |
|---|---|---|---|---|---|
| Three-phase 200V | 3G3M1-A2110-EMP<br>3G3M1-A2150-EMP | 220 | 260 | 203 | 90 |
| Three-phase 400V | 3G3M1-A4110-EMP<br>3G3M1-A4150-EMP | | | | |






| Power supply | Model | W [mm] | H [mm] | D [mm] | D1 [mm] |
|---|---|---|---|---|---|
| Three-phase 200V | 3G3M1-A2185-EMP | 250 | 400 | 208 | 90 |
| Three-phase 400V | 3G3M1-A4185-EMP<br>3G3M1-A4220-EMP | | | | |

# 1-4 Restrictions

## Availability of Functions by Individual Control Method

Available functions are restricted depending on the selected control method.
“15:PM Vector control without speed and pole position sensor” and “16:PM Vector control with speed and pole position sensor” can be set to only 1st motor control.

| Function name | 1st Drive Control Selection (F042)/ 2nd Drive Control Selection (A014) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0: IM V/f control | 1: IM Dynamic torque vector control | 3: IM V/f control with speed sensor | 4: IM Dynamic torque vector control with speed sensor | 5: IM Vector control without speed sensor | 6: IM Vector control with speed sensor | 15: PM Vector control without speed and pole position sensor | 16: PM Vector control with speed and pole position sensor |
| Torque boost manual adjustment | • | | • | • | | | | |
| Invalidation of automatic voltage control (AVR) | • | | • | • | | | | |
| Energy-saving operation mode | • | • | • | • | | • | | |
| Motor sound (Tone) | | | | | • | • | • | • |
| Invalidation of slip compensation | • | | | | | | | |
| Direct current braking | • | • | • | • | • | | | |
| Startup DC injection braking | • | • | • | • | | | | |
| Starting with active matching frequency | • | • | | | • | | | |
| Current limiter, instantaneous overcurrent limiting | • | • | • | • | | | | |
| Torque limit | • | • | • | • | • | • | • | • |
| Torque control | | | | | • | • | | • |
| Torque bias | | | | | • | • | • | • |
| Automatic speed control (ASR), Notch filter | | | | | • | • | • | • |
| Zero speed control | | | | | • | • | | • |
| Servo Lock | | | | | | • | | • |
| Deceleration characteristics (heavy brake) | • | • | • | • | | • | | |
| Pre-excitation | | | | | • | • | | |
| Overload stop (contact stop) | • | • | • | • | | | | |
| Second control switch | • | • | • | • | • | • | | |
| Brake control | • | • | • | • | • | • | | • |

## Carrier Frequency Setting and Derating of Rated Output Current

Derating of the rated output current of the inverter may be required when a high carrier frequency is set, depending on the heavy/light load mode selection and operating temperature.
Use the inverter in an appropriate environment according to *A-7 Derating Table* on page A-276.

# 2

# Design

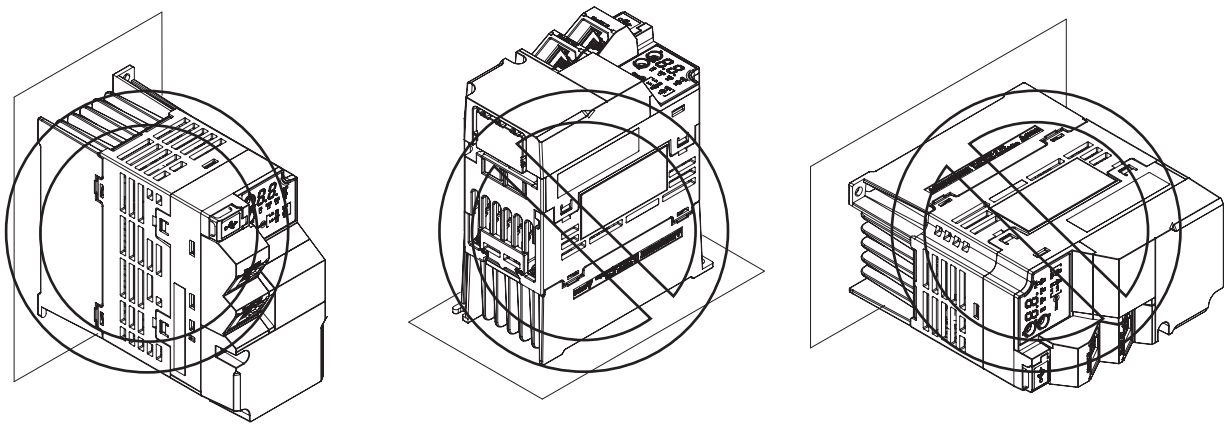


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# 2-1 Installation

## 2-1-1 Inverter Installation

Mount the 3G3M1 Series Inverter vertically on a wall with the product's longer sides upright so the model can be read correctly.
The material of the wall must be inflammable and capable of bearing weight such as a metal plate.



For the mounting dimensions, refer to *1-3-3 External Dimensions* on page 1-18.

## 2-1-2 Installation Environment

### Operating Environment Conditions

Install the inverter in a location that meets the following conditions.

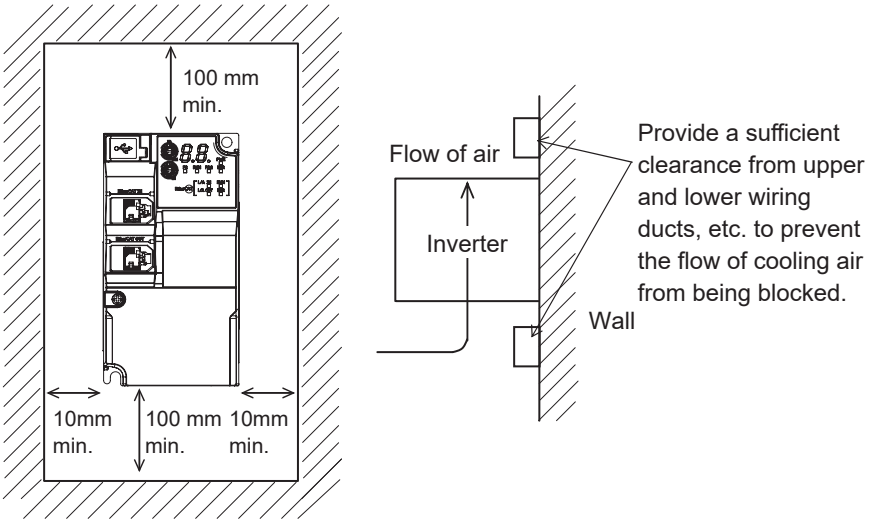
| Operating ambient temperature | Operating ambient humidity |
|---|---|
| −10 to 50°C | 5% to 95% (with no condensation) |

- Measure and check the ambient temperature at a point approx. 1 cm away from the center bot- tom of the inverter.
- For side-by-side installation, derating of the rated output current of the inverter may be required even at an ambient temperature of 40°C or lower.
- The inverter life (in particular, capacitor life) will be significantly shortened if the inverter is used at a higher ambient temperature.
- Do not install the inverter in hot and humid locations subject to condensation.
- Avoid installing the inverter in a dirty environment subject to oil mist, dust, or other airborne particles. Install the inverter in a clean place, or in a full-enclosure type panel.
- Take measures during installation and operation to prevent foreign objects such as metal particles, oil, and water from entering the inverter.
- Do not install the inverter in locations subject to direct sunlight.
- Do not install the inverter in locations subject to corrosive or flammable gases.

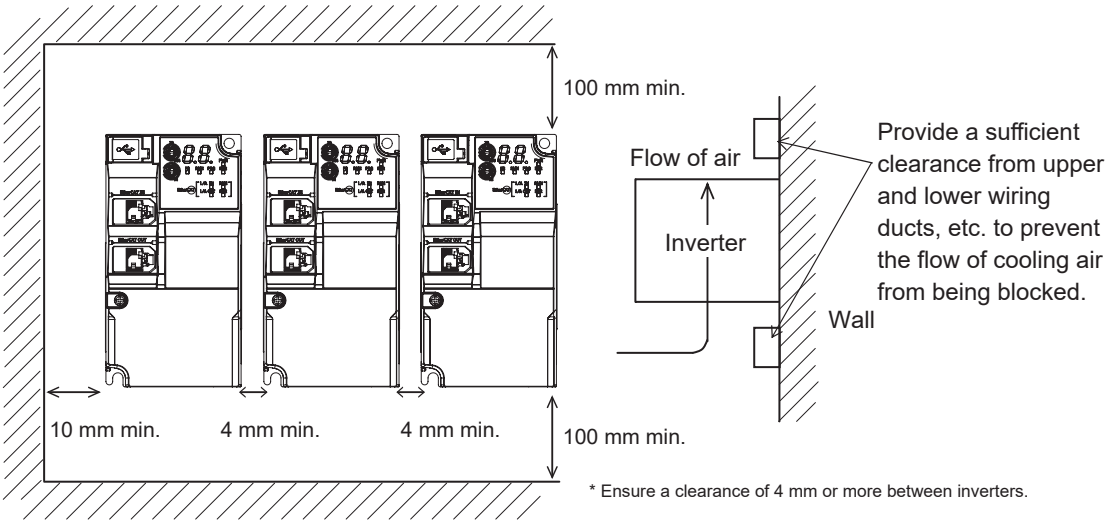
## Installation Conditions

Keep the inverter clear of heating elements such as a braking resistor or reactor.
If the inverter is installed in a control panel, take into consideration dimensions and ventilation to keep the ambient temperature within the range of the specifications.
To allow heat dispersion from inside the inverter (approx. 150°C or lower), provide the clearance specified in the figure below during installation.

### Standard installation



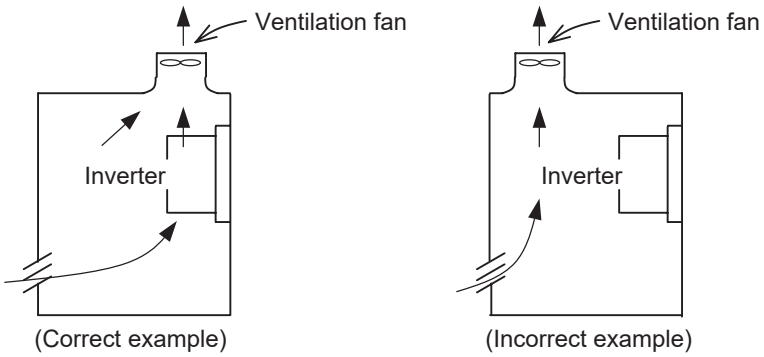

### Side-by-side installation




* Ensure a clearance of 4 mm or more between inverters.

## Ambient Temperature Control

To ensure reliable operation, use the inverter in an environment subject to minimal temperature rise as much as possible.
If you install a ventilation fan in a control panel where several inverters are installed, be careful about the layout of the inverters and the air intake and ventilation apertures.
Remember that poor air circulation around inverters causes an internal temperature rise, which may inversely affect the internal components of the inverters.




## Entry of Foreign Objects during Installation

Place a cover over the inverter or take other preventative measures to prevent foreign objects, such as drill filings, from entering the inverter during installation.
Be sure to remove the cover after installation is complete. Using the inverter with the cover placed results in poor ventilation, which causes the inverter to overheat.

## Heat generation by individual inverter model

The following table shows heat generation by individual inverter model for the calculation of heat radiation from a cabinet. Inverter heat generation also changes as the rated current changes according to the load mode.

| Power system | Inverter type | Standby power | Carrier frequency (Parameter No.F026)*1 | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | ND | HD | HND | | HHD | |
| | | | Factory shipment value | Factory shipment value | Factory shipment value | Maximum set value | Factory shipment value | Maximum set value |
| Three-phase 200 V | 3G3M1-A2002-EMP | 13 | - | - | 29 | 34 | 23 | 27 |
| | 3G3M1-A2004-EMP | 13 | - | - | 47 | 51 | 35 | 39 |
| | 3G3M1-A2007-EMP | 13 | - | - | 66 | 71 | 54 | 58 |
| | 3G3M1-A2015-EMP | 17 | - | - | 94 | 115 | 74 | 95 |
| | 3G3M1-A2022-EMP | 17 | - | - | 115 | 145 | 98 | 125 |
| | 3G3M1-A2037-EMP | 17 | - | - | 210 | 285 | 165 | 230 |
| | 3G3M1-A2055-EMP | 31 | - | - | 280 | 360 | 170 | 230 |

Unit: W

| Power system | Inverter type | Standby power | Carrier frequency (Parameter No.F026)*1 | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | ND | HD | HND | | HHD | |
| | | | Factory shipment value | Factory shipment value | Factory shipment value | Maximum set value | Factory shipment value | Maximum set value |
| Three-phase 200 V | 3G3M1-A2075-EMP | 31 | - | - | 440 | 540 | 280 | 360 |
| | 3G3M1-A2110-EMP | 34 | - | - | 520 | 700 | 440 | 540 |
| | 3G3M1-A2150-EMP | 31 | - | - | 640 | 810 | 520 | 700 |
| | 3G3M1-A2185-EMP | 38 | - | - | 770 | 970 | 660 | 860 |
| Three-phase 400 V | 3G3M1-A4004-EMP | 14 | 33 | 32 | 33 | 58 | 32 | 56 |
| | 3G3M1-A4007-EMP | 14 | 57 | 50 | 57 | 110 | 50 | 93 |
| | 3G3M1-A4015-EMP | 17 | 73 | 69 | 73 | 140 | 67 | 120 |
| | 3G3M1-A4022-EMP | 17 | 98 | 95 | 98 | 180 | 79 | 145 |
| | 3G3M1-A4030-EMP | 17 | 120 | 120 | 120 | 230 | 100 | 190 |
| | 3G3M1-A4040-EMP | 17 | 155 | 150 | 150 | 265 | 130 | 240 |
| | 3G3M1-A4055-EMP | 31 | 260 | 190 | 190 | 370 | 170 | 320 |
| | 3G3M1-A4075-EMP | 31 | 380 | 290 | 290 | 510 | 220 | 390 |
| | 3G3M1-A4110-EMP | 31 | 460 | 390 | 390 | 630 | 300 | 490 |
| | 3G3M1-A4150-EMP | 31 | 470 | 410 | 410 | 750 | 340 | 600 |
| | 3G3M1-A4185-EMP | 31 | 710 | 510 | 510 | 870 | 440 | 770 |
| | 3G3M1-A4220-EMP | 31 | 900 | 710 | 710 | 1000 | 510 | 900 |

| Power system | Inverter type | Standby power | Carrier frequency (Parameter No.F026)*1 | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | ND | HD | HND | | HHD | |
| | | | Factory shipment value | Factory shipment value | Factory shipment value | Maxi-mum set value | Factory shipment value | Maxi-mum set value |
| Single-phase 200 V | 3G3M1-AB002-EMP | 13 | - | - | 29 | 31 | 23 | 27 |
| | 3G3M1-AB004-EMP | 13 | - | - | 47 | 50 | 36 | 40 |
| | 3G3M1-AB007-EMP | 13 | - | - | 66 | 69 | 55 | 59 |
| | 3G3M1-AB015-EMP | 17 | - | - | 94 | 110 | 78 | 100 |
| | 3G3M1-AB022-EMP | 17 | - | - | 115 | 140 | 100 | 130 |
| | 3G3M1-AB037-EMP | 31 | - | - | - | - | 165 | 230 |

*1. The inverter generating loss at rated output current.
The maximum set value (max. carrier) differs depending on specification.

# 2-2 Removal of Each Part



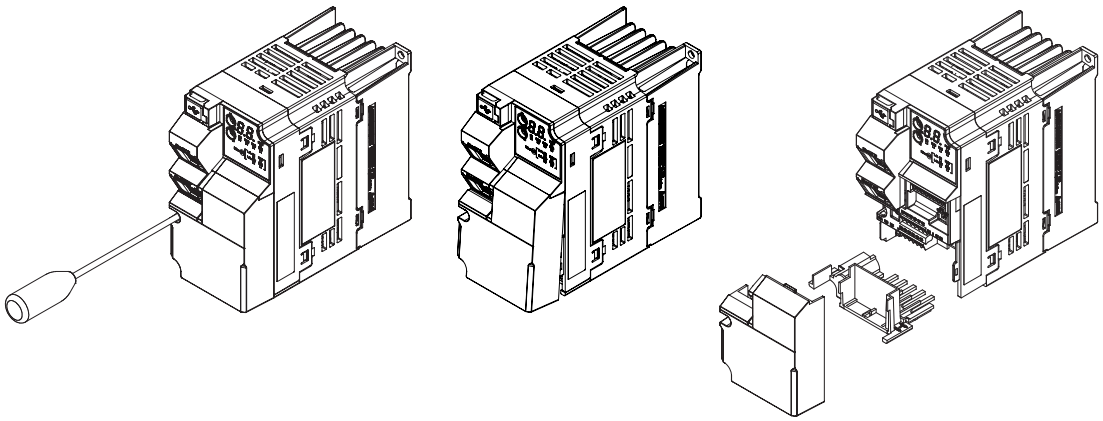
## 2-2-1 Removing Covers

Before wiring each terminal block, you need to remove the surface cover (terminal block cover and the backing plate).
This section describes how to remove these covers.

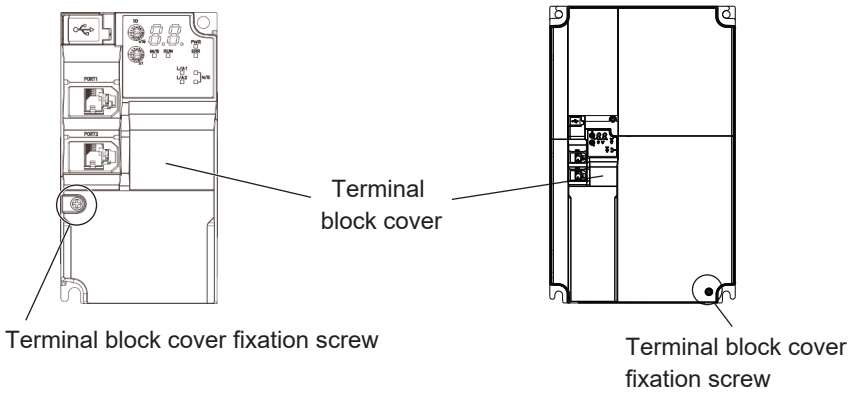
### Removing Terminal Block Cover

1 Loosen the terminal block cover fixation screw(s).

2 Remove the terminal block cover from the bottom.



You can find one terminal block cover fixation screw at left center for inverters with a capacity of 0.75 kW or lower, center for inverters with a capacity of 1.5 to 15 kW, and bottom right for inverters with a capacity of 18.5 kW or higher.

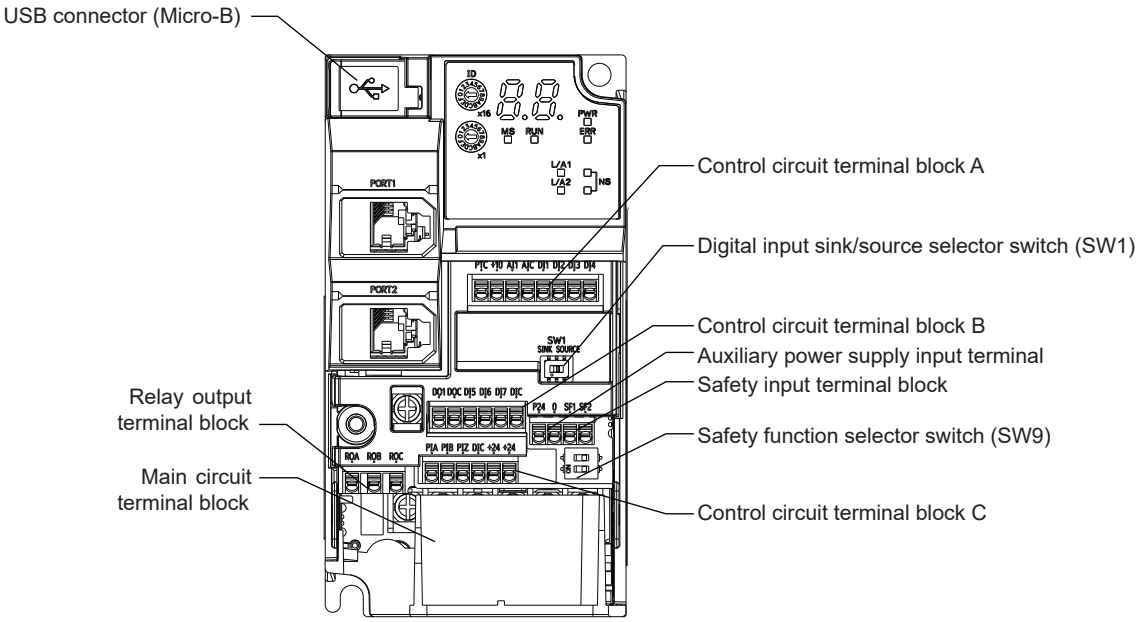



### Installing Terminal Block Cover

To install the terminal block cover, reverse the removal procedure.
Install the terminal block cover on the inverter from the top and press it until you here a click.
Tighten the terminal block cover fixing screws with the tightening torque of 0.3 Nm.

## 2-2-2 Terminal Blocks

Removing the terminal block cover and each connector cover reveals terminal blocks, connectors, and switches arranged as shown below.



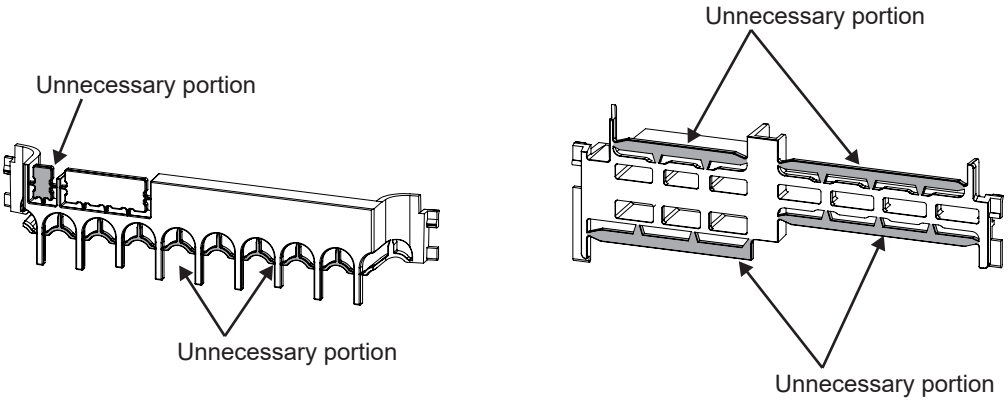

| Name | Description |
|---|---|
| Digital input sink/source selector switch (SW1) | The switch for switching which of sink or source the digital input terminals DI1 to DI7 are to be used for. (Factory default setting is SINK side) |
| Safety function selector switch (SW9) | Turn this switch OFF to use the safety function. Before you turn ON/OFF this switch, be sure to turn off the power supply. For details, refer to *8-6 Safety Function* on page 8-61. (Factory default setting is ON side (safety function disabled)) |
| USB connector | The Micro-B type USB connector for connecting a computer.<br>Use this connector to connect the inverter to the Inverter/Servo support tool Sysmac Studio. |
| Control circuit terminal block A, B, C | The terminal block for connecting various digital/analog input devices used for inverter control. |
| Safety input terminal block | The terminal block for connecting the safety input signal. |
| Relay output terminal block | The SPDT contact terminal block for relay output. |
| Main circuit terminal block | The terminal block for connecting the main power supply for the inverter, outputs to the motor, braking resistor, etc. |
| Auxiliary power supply input terminal | Backup power supply for control circuit/communication function. The P24 terminal is insulated from the +24 terminal.<br>For details on specifications, refer to *2-3-3 Arrangement and Function of Control Circuit Terminal Block* on page 2-12. |

**Note** For the description of the data display, refer to *Section 5 Operation and Test Run* on page 5-1.

## 2-2-3 Preparing Backing Plate

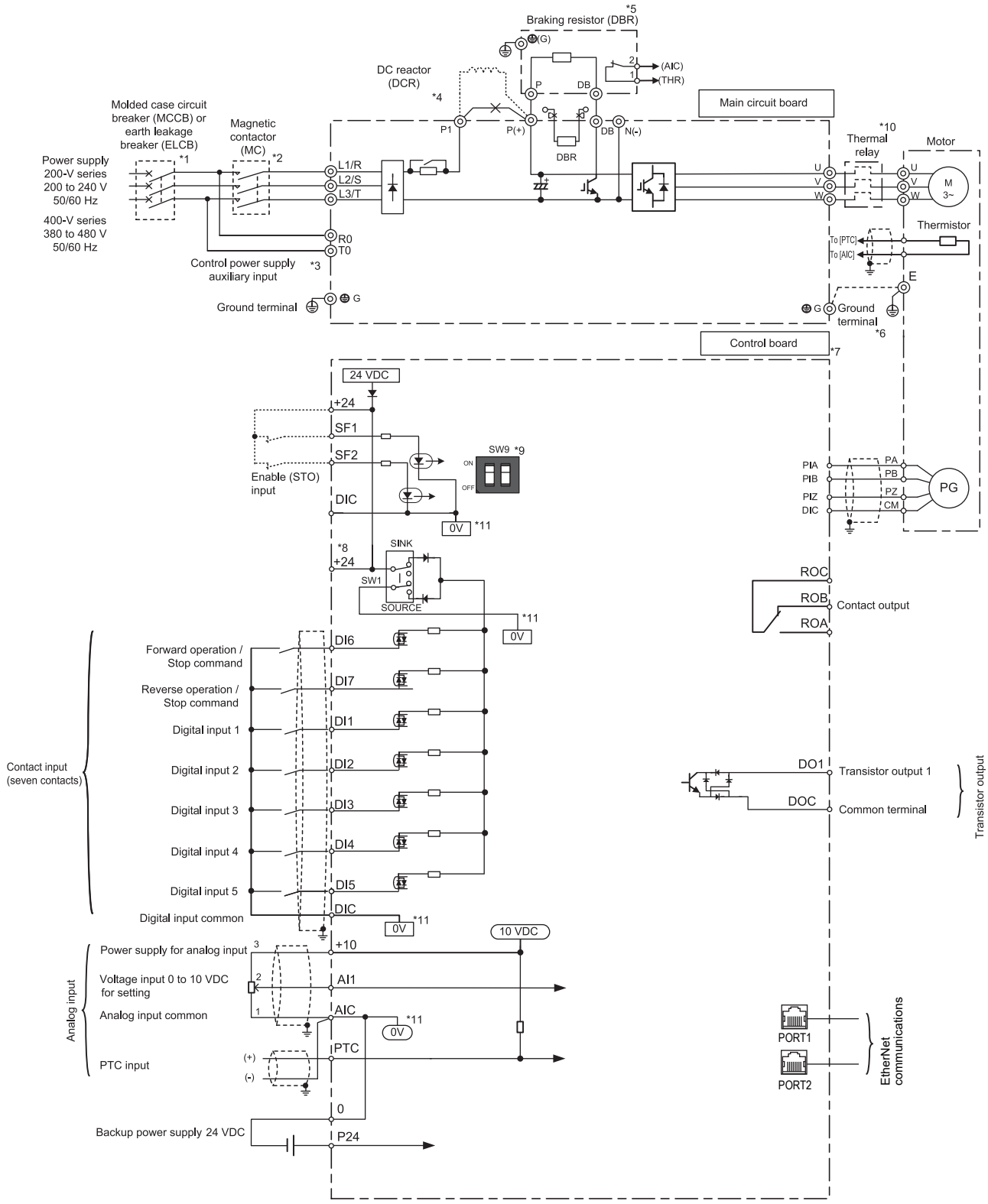
On some models, sometimes there is not enough space for wiring the main circuit. If this happens, before wiring, cut off the connecting points between the backing plate and unnecessary portions with nippers or a wire cutter.

Note that IP20 protection is no longer ensured when using the product with backing plate removed.



# 2-3 Wiring

## 2-3-1 Standard Connection Diagram



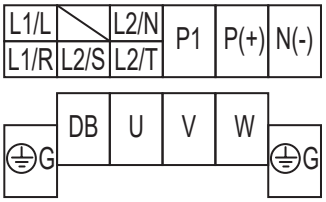
*1. To protect the wiring, install a molded case circuit breaker (MCCB) or earth leakage circuit breaker (ELCB) (with overcurrent protection function) recommended for each inverter on the inverter input side (primary side). Do not use circuit breakers whose rated current exceeds recommended values.
*2. The molded case circuit breaker and earth leakage circuit breaker are also used for insulation from the inverter's power supply. For this reason, install a magnetic contactor (MC) recommended for each inverter as required. When installing a magnetic contactor and solenoid or other coil near an inverter, connect surge absorbers in parallel.
*3. To enable a batch alarm signal when the protection function is activated even if the main power supply of the inverter is cut off or to display the Digital Operator at all times, connect these terminals to the power supply. (3G3M1-A2185 or higher or 3G3M1-A4185 or higher products) The inverter operates even when these terminals are not connected to the power supply.
*4. When connecting the optional DC reactor (DCR), remove the short-circuit bar between the main circuit terminals P1 and P(+) of the inverter before connecting.
When the capacity of the power transformer is 500 kVA or more and 10 times or more than the rated capacity of the inverter, or when a thyristor load is connected, use a DC reactor (DCR).
*5. As a transistor for braking is built into the inverter, the braking resistor can be directly connected between P(+) and DB.
*6. The terminal for grounding the motor. Connect this terminal, as required.
*7. Use twisted wire or shield wire for the control signal wire.
Generally, shield wire is grounded. However, when inductive noise from an external source is large, the influence of noise can sometimes be suppressed by connecting the shield wire to a DIC. Separate control signal wire as far as possible (at least 10 cm is recommended) from the wiring of the main circuit, and do not pass control signal wire through the same wiring duct. When wires cross, be sure to cross them so that they are almost vertical to the wiring of the main circuit.
*8. This switch on the printed circuit board is for specifying the operation setting of the inverter. For details, refer to *2-2-2 Terminal Blocks* on page 2-8 in the User's Manual.
*9. Safety function terminals SF1 and SF2 are disabled at SW9 (double-pole switch) on the printed circuit board before shipment from the factory. When using the SF1 and SF2 terminal functions, be sure to turn each SW9 switch OFF before connecting to these terminals.
*10. Cut off the molded case circuit breaker (MCCB) or magnetic contactor (MC) at the auxiliary contact (manual reset) of the thermal relay.
*11. [0V] and (0V) are separated and insulated.
*12. DC supply cannot use the internal pre-charge circuit.



## 2-3-2 Arrangement and Function of Main Circuit Terminal Block

The table below shows the arrangement of the main circuit terminal block and description of each terminal.

### Main Circuit Terminal Block




The terminal arrangement shown on the left is an example for the inverters with a capacity of 0.75 kW or lower.

| Terminal symbol | | Terminal name | Description |
|---|---|---|---|
| L1/R | L1/L | Main power supply input terminal | Connect the AC input power supply.<br>For single-phase 200-V type Inverters (3G3M1-AB□□□-EMP), connect these to the L1/L and L2/N terminals, respectively. |
| L2/S | | | |
| L3/T | L2/N | | |

| Terminal symbol | Terminal name | Description |
|---|---|---|
| U | Inverter output terminal | Connect a three-phase motor. |
| V | | |
| W | | |
| P1 | DC reactor connection terminal | Remove the short-circuit bar between the terminals P1 and P(+), and connect a DC reactor. |
| P(+) | | |
| P(+) | Braking resistor connection terminal | Connect a braking resistor (if a braking torque is required). |
| DB | | |
| P(+) | Regenerative braking unit connection terminal | Connect regenerative braking units (if a braking torque is required and that produced by the built-in braking circuit is insufficient). |
| N(-) | | |
| R0, T0 | Control power supply auxiliary input (Three-phase 400V and Single-phase 200V models of capacity 18.5 kW or more) | To hold a batch alarm signal when the protection function is activated even if the main power supply of the inverter is cut off or to display the data display on the front of the inverter, connect these terminals to the power supply. For details, refer to *2-3-4 Wiring for Main Circuit Terminals* on page 2-15). |
| G ⏚ | Ground terminal | This is the ground terminal. Connect this terminal to the ground. 200-V class should be connected under type-D grounding conditions; 400-V class should be connected under type-C grounding conditions. |

## 2-3-3 Arrangement and Function of Control Circuit Terminal Block

The table below shows the arrangement of the control circuit terminal block, and description and specifications of each terminal.

### Control Circuit Terminal Block

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | PTC | +10 | AI1 | AIC | DI1 | DI2 | DI3 | DI4 | |
| | | | DO1 | DOC | DI5 | DI6 | DI7 | DIC | | | |
| ROA | ROB | ROC | PIA | PIB | PIZ | DIC | +24 | +24 | P24 | 0 | SF1 | SF2 |

| Item | | Terminal symbol | Terminal name | Description | Specifications |
|---|---|---|---|---|---|
| Analog | Input | +10 | Power supply for analog input | This is a 10 VDC power supply for the AI1 terminal. | Maximum allowable current: 10 mA |
| | | AI1 | Analog voltage input | This is a -10 to 10 VDC analog voltage input. | Input impedance: 22 kΩ<br>Allowable input voltage range:<br>-15 to 10 VDC |
| | | AIC | Analog input common | Common terminal for the analog input. | |
| | | PTC | External thermistor input | Connect an external thermistor between the PTC and the AIC, and when an abnormal temperature is reached, an inverter trip is generated. (Set the inverter trip level at object H027.) | PTC type |

| Item | | | Terminal symbol | Terminal name | Description | Specifications |
|---|---|---|---|---|---|---|
| Digital | Power supply | | DIC | Input signal common | Common terminal for the digital input. | |
| | Input | Contact | DI1<br>DI2<br>DI3<br>DI4<br>DI5<br>DI6<br>DI7 | Multifunction input terminal | Select functions and allocate them to terminals DI1 to DI7. These terminals support both the sink logic and the source logic.<br>For details on the connection, refer to *Multifunction Input Terminals and Programmable Controller Connection* on page 2-61. | Voltage between each input terminal and the terminal DIC<br>ON voltage: 20 V min.<br>OFF voltage: 2 V max.<br>Allowable voltage: 27 VDC max.<br>Load current (DI1, DI2): 2.5 to 16 mA (at 27 V)<br>Load current (DI3 to DI7): 2.5 to 5 mA (at 27 V)<br>Internal resistance: 5.4 kΩ |
| | | | SF1<br>SF2 | Safety input | Turn ON the Safety Function Selector Switch to enable this terminal.<br>SF1 (Safety input 1)<br>SF2 (Safety input 2) | Voltage between each input terminal and the terminal DIC<br>ON voltage: 20 V min.<br>OFF voltage: 2 V max.<br>Allowable voltage: 27 VDC max.<br>Load current: 2.5 to 5 mA (at 27 V)<br>Internal resistance: 6.6 kΩ |
| | | Pulse | PIA<br>PIB<br>PIZ | Pulse input | This is pulse input for frequency setting.<br>This terminal accepts 5 to 24 VDC input signals. | Input pulse: 32 kHz max.<br>Internal resistance: 7.2 kΩ<br>Voltage between input and DIC:<br>5 to 24 VDC<br>ON voltage: 4 V min.<br>OFF voltage: 2 V max.<br>Allowable voltage: 27 VDC max. |

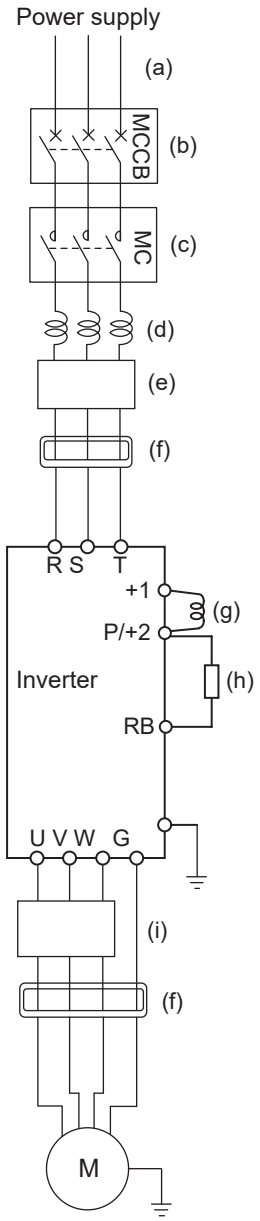
| Item | | | Terminal symbol | Terminal name | Description | Specifications |
|---|---|---|---|---|---|---|
| Digital | Output | Open collector | +24 | Power supply terminal for output signal | This is a 24 VDC power supply for the output signal. | Allowable current: 100mA max. |
| | | | DOC | Output signal common | Common terminal for multifunction output terminal DO1. | Allowable current: 100 mA max. |
| | | | DO1 | Multifunction output terminal | Select functions and allocate them to the DO1 terminal. These terminals support both the sink logic and the source logic. For details on the connection, refer to *Multifunction Output Terminals and Programmable Controller Connection* on page 2-62. | Open collector output<br>Across DO1-DOC<br>Allowable voltage: 48 VDC max.<br>Allowable current: 50mA max.<br>Voltage drop at power-on: 4 V max. |
| Multi-function relay output | | | R O A<br>ROB<br>ROC | Relay output terminal<br>Relay output common | Select the desired function and allocate it to these terminals. This is SPDT contact output.<br>Factory default values are NO contact between ROA-ROC and NC contact between ROB-ROC. | 250 VAC, 0.3 A, cosφ=0.3/48 VDC, 0.5 A |
| 24 VDC input | | | P24<br>0 | Auxiliary power supply input terminal | Backup power supply for control circuit/ communication function. The P24 terminal is insulated from the +24 terminal.<br>The protection function, motor operation, FSoE (STO), each I/O terminal, fan, braking transistor and inrush current protection circuit do not operate. | 24 VDC (22 to 26 V) 500 mA max. |



## 2-3-4 Wiring for Main Circuit Terminals

### Main Circuit Configuration Diagram

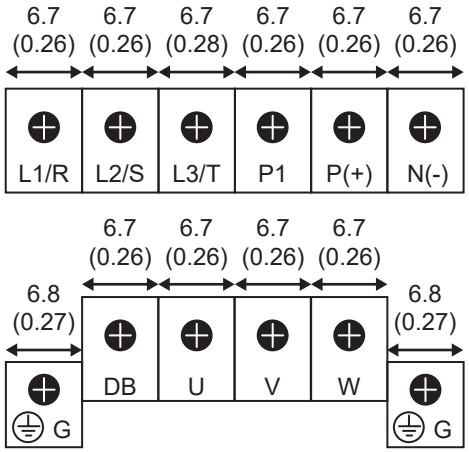
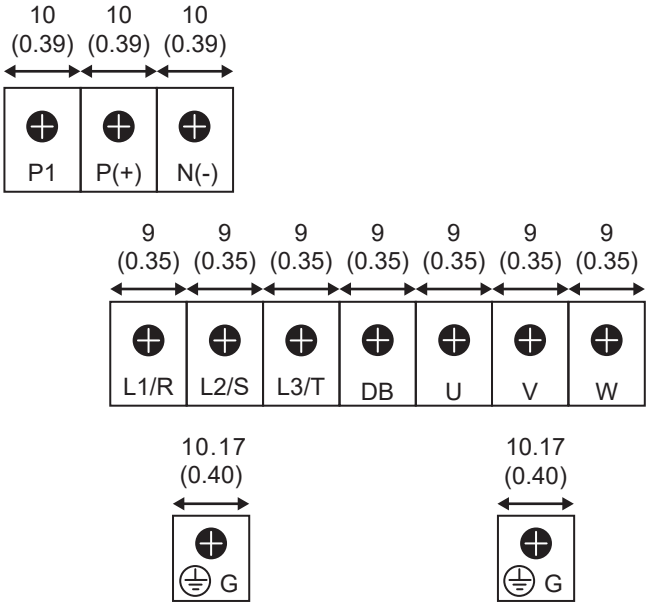
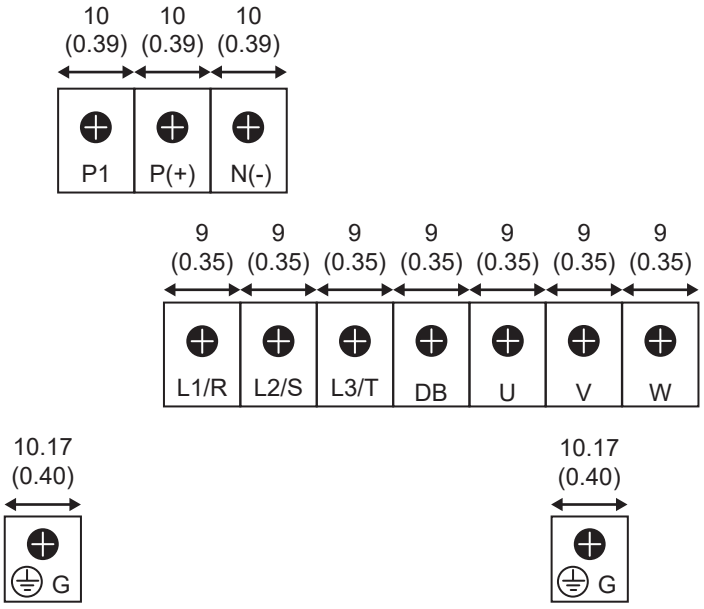
The diagram below shows the configuration of the inverter main circuit. The function of each peripheral component is also described.

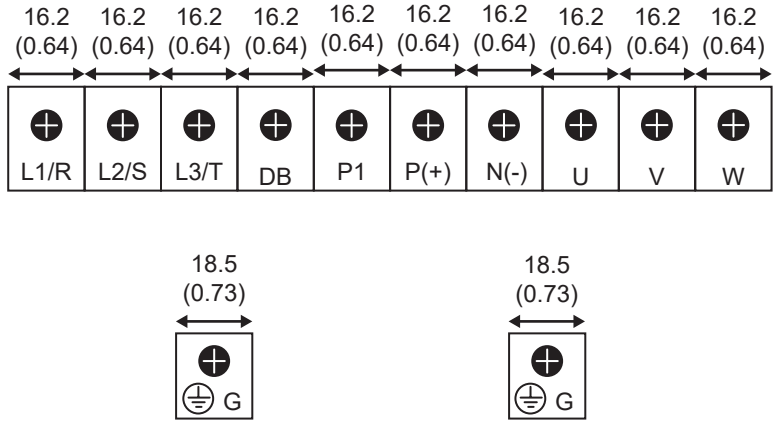
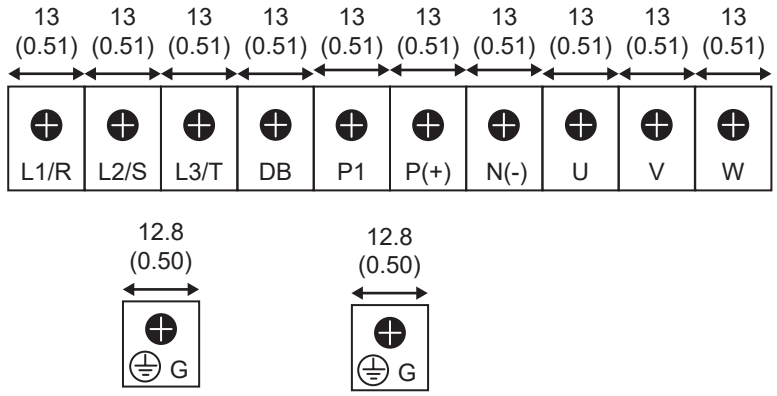
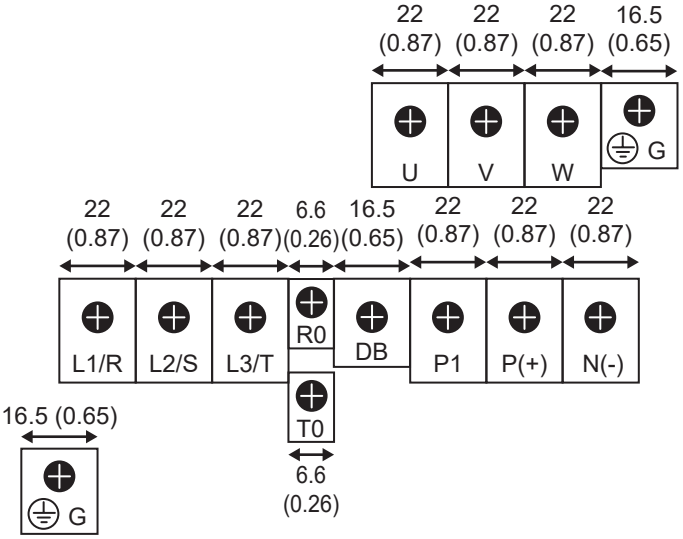



| Name | Function |
|---|---|
| (a) (b) (c) | Refer to *Recommended Cable Size, Wiring Device, and Crimp Terminal* on page 2-18. |
| (d) AC reactor | This is used as a harmonic suppression measure. It also helps improve the power factor. The AC reactor is used when the power supply voltage unbalance factor is 3% or more, the inverter capacity is 500 kVA or more, or rapid change in the power supply voltage occurs to reduce its effect. |
| (e) Input noise filter | This filter reduces the conductive noise generated in the inverter and transmitted via wires. Connect it to the primary side (input side) of the inverter. |
| (f) Radio noise filter | The inverter in operation may cause noise through the power supply wiring etc., which could affect radio receivers or other equipment nearby. This filter reduces such noise (radiated noise). |
| (g) DC reactor | This reactor helps suppress harmonics generated by the inverter. |
| (h) Braking resistor | These increase the amount of regenerative energy absorption when the inverter applies motor braking and are used to decrease the speed of an elevator or load with a large moment of inertia. All models of the 3G3M1 Series Inverter have built-in regenerative braking processing circuit. The regenerative braking unit is necessary only if a large braking torque is required and the built-in regenerative braking processing circuit cannot allow it. |
| (j) Output noise filter | This filter is installed between the inverter and the motor to reduce the radiated noise emitted from cables. It is used to reduce radio and television interference and prevent meter and sensor malfunction. |

## Arrangement of Main Circuit Terminals

The arrangement of terminals on the inverter main circuit terminal block is shown below.

| Applicable model | Terminal arrangement |
|---|---|
| 3G3M1-AB002/AB004/ AB007-EMP 3G3M1-A2002/A2004/ A2007-EMP |  <br>(For single-phase class, connect L1/L to L1/R and L2/N to L3/T.) |
| 3G3M1-AB015-EMP 3G3M1-A2015/A2022-EMP 3G3M1-A4004/ A4007/A4015/A4022-EMP |  <br>(For single-phase class, connect L1/L to L1/R and L2/N to L3/T.) |
| 3G3M1-AB022-EMP 3G3M1-A2037-EMP 3G3M1-A4030/A4040-EMP |  <br>(For single-phase class, connect L1/L to L1/R and L2/N to L3/T.) |

| Applicable model | Terminal arrangement |
|---|---|
| 3G3M1-AB037-EMP<br>3G3M1-A2055/A2075-EMP<br>3G3M1-A4055/A4075-EMP |  <br>(For single-phase class, connect L1/L to L1/R and L2/N to L3/T.) |
| 3G3M1-A2110/A2150-EMP<br>3G3M1-A4110/A4150-EMP |  |
| 3G3M1-A2185-EMP<br>3G3M1-A4185/A4220-EMP |  |

## Recommended Cable Size, Wiring Device, and Crimp Terminal

For inverter wiring, crimp terminal, and terminal screw tightening torque, refer to the table below.

- Each table shows an example of connecting the standard three-phase motor with four poles to an inverter.
- For the molded case circuit breaker (MCCB), select an appropriate product in consideration of the breaking capacity.

- For compliance with the UL standard requirements, be sure to perform wiring according to *2-4-2 UL/cUL Standards Cautions* on page 2-85, which includes the use of UL-compliant specified fuses and specified wiring materials.
- Tighten the terminal block screws with the specified torque. Weak tightening may result in a short-circuiting accident or fire. Conversely, overtightening these screws may cause damage to the terminal block or the inverter.



## Three-phase 200-V class (Panel internal temperature 50°C or less)

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Main power supply input (L1/R, L2/S, L3/T) | | | | | | | |
| | | | When DC reactor (DCR) is used | | | | Without DC reactor | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A2002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 | 0.9 | 2.0 | 2.0 | 2.0 | 1.8 |
| - | 3G3M1-A2002-EMP | 0.4 | 2.0 | 2.0 | 2.0 | 1.6 | 2.0 | 2.0 | 2.0 | 2.6 |
| 3G3M1-A2004-EMP | - | | 2.0 | 2.0 | 2.0 | 1.6 | 2.0 | 2.0 | 2.0 | 3.1 |
| - | 3G3M1-A2004-EMP | 0.75 | 2.0 | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 | 2.0 | 4.9 |
| 3G3M1-A2007-EMP | - | | 2.0 | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 | 2.0 | 5.3 |
| - | 3G3M1-A2007-EMP | 1.1 | 2.0 | 2.0 | 2.0 | 4.3 | 2.0 | 2.0 | 2.0 | 6.7 |
| 3G3M1-A2015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 5.7 | 2.0 | 2.0 | 2.0 | 9.5 |
| - | 3G3M1-A2015-EMP | 2.2 | 2.0 | 2.0 | 2.0 | 8.3 | 2.0 | 2.0 | 2.0 | 12.8 |
| 3G3M1-A2022-EMP | - | | 2.0 | 2.0 | 2.0 | 8.3 | 2.0 | 2.0 | 2.0 | 13.2 |
| - | 3G3M1-A2022-EMP | 3 | 2.0 | 2.0 | 2.0 | 11.7 | 3.5 | 2.0 | 2.0 | 17.9 |
| 3G3M1-A2037-EMP | - | 3.7 | 2.0 | 2.0 | 2.0 | 14.0 | 5.5 | 2.0 | 2.0 | 22.2 |
| - | 3G3M1-A2037-EMP | 5.5 | 3.5 | 2.0 | 2.0 | 19.9 | 8.0 | 3.5 | 2.0 | 28.5 |
| 3G3M1-A2055-EMP | - | | 5.5 | 2.0 | 2.0 | 21.1 | 8.0 | 3.5 | 3.5 | 31.5 |
| 3G3M1-A2075-EMP | 3G3M1-A2055-EMP | 7.5 | 8.0 | 3.5 | 2.0 | 28.8 | 14.0 | 5.5 | 5.5 | 42.7 |
| 3G3M1-A2110-EMP | 3G3M1-A2075-EMP | 11 | 14.0 | 5.5 | 5.5 | 42.2 | 22.1 | 14.0 | 8.0 | 60.7 |
| 3G3M1-A2150-EMP | 3G3M1-A2110-EMP | 15 | 22.0 | 14.0 | 8.0 | 57.6 | 38.0 | 14.0 | 14.0 | 80.0 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Main power supply input (L1/R, L2/S, L3/T) | | | | | | | |
| | | | When DC reactor (DCR) is used | | | | Without DC reactor | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A2185-EMP | 3G3M1-A2150-EMP | 18.5 | 38.0*1 | 14.0 | 14.0 | 71.0 | 60.0*2 | 22.0 | 14.0 | 97.0 |
| - | 3G3M1-A2185-EMP | 22 | 38.0*1 | 22.0 | 14.0 | 84.4 | 60.0*2 | 38.0*1 | 22.0 | 112.0 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Inverter output (U, V, W) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A2002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 | 1.6 | 2.0 | 2.0 | 2.0 | 1.3 |
| - | 3G3M1-A2002-EMP | 0.4 | - | - | - | - | 2.0 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A2004-EMP | - | | 2.0 | 2.0 | 2.0 | 3.0 | - | - | - | - |
| - | 3G3M1-A2004-EMP | 0.75 | - | - | - | - | 2.0 | 2.0 | 2.0 | 3.5 |
| 3G3M1-A2007-EMP | - | | 2.0 | 2.0 | 2.0 | 5.0 | - | - | - | - |
| - | 3G3M1-A2007-EMP | 1.1 | - | - | - | - | 2.0 | 2.0 | 2.0 | 6.0 |
| 3G3M1-A2015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 8.0 | - | - | - | - |
| - | 3G3M1-A2015-EMP | 2.2 | - | - | - | - | 2.0 | 2.0 | 2.0 | 9.6 |
| 3G3M1-A2022-EMP | - | | 2.0 | 2.0 | 2.0 | 11.0 | - | - | - | - |
| - | 3G3M1-A2022-EMP | 3 | - | - | - | - | 2.0 | 2.0 | 2.0 | 12.0 |
| 3G3M1-A2037-EMP | - | 3.7 | 3.5 | 2.0 | 2.0 | 17.5 | - | - | - | - |
| - | 3G3M1-A2037-EMP | 5.5 | - | - | - | - | 3.5 | 2.0 | 2.0 | 19.6 |
| 3G3M1-A2055-EMP | - | | 5.5 | 3.5 | 2.0 | 25.0 | - | - | - | - |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Inverter output (U, V, W) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A2075-EMP | 3G3M1-A2055-EMP | 7.5 | 8.0 | 3.5 | 3.5 | 33.0 | 8.0 | 3.5 | 2.0 | 30.0 |
| 3G3M1-A2110-EMP | 3G3M1-A2075-EMP | 11 | 14.0 | 8.0 | 5.5 | 47.0 | 14.0 | 5.5 | 3.5 | 40.0 |
| 3G3M1-A2150-EMP | 3G3M1-A2110-EMP | 15 | 22.0 | 14.0 | 8.0 | 60.0 | 22.0 | 14.0 | 5.5 | 56.0 |
| 3G3M1-A2185-EMP | 3G3M1-A2150-EMP | 18.5 | 38.0*1 | 14.0 | 14.0 | 76.0 | 38.0*1 | 14.0 | 8.0 | 69.0 |
| - | 3G3M1-A2185-EMP | 22 | - | - | - | - | 38.0*1 | 22.0 | 14.0 | 88.0 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | |
|---|---|---|---|---|---|---|
| | | | DC reactor connection (P1, P(+)) | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | |
| 3G3M1-A2002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 | 1.1 |
| - | 3G3M1-A2002-EMP | 0.4 | 2.0 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A2004-EMP | - | | 2.0 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A2004-EMP | 0.75 | 2.0 | 2.0 | 2.0 | 3.7 |
| 3G3M1-A2007-EMP | - | | 2.0 | 2.0 | 2.0 | 3.7 |
| - | 3G3M1-A2007-EMP | 1.1 | 2.0 | 2.0 | 2.0 | 5.3 |
| 3G3M1-A2015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 7.0 |
| - | 3G3M1-A2015-EMP | 2.2 | 2.0 | 2.0 | 2.0 | 10.2 |
| 3G3M1-A2022-EMP | - | | 2.0 | 2.0 | 2.0 | 10.2 |
| - | 3G3M1-A2022-EMP | 3 | 2.0 | 2.0 | 2.0 | 14.3 |
| 3G3M1-A2037-EMP | - | 3.7 | 3.5 | 2.0 | 2.0 | 17.1 |
| - | 3G3M1-A2037-EMP | 5.5 | 5.5 | 3.5 | 2.0 | 24.4 |
| 3G3M1-A2055-EMP | - | | 5.5 | 3.5 | 2.0 | 25.8 |
| 3G3M1-A2075-EMP | 3G3M1-A2055-EMP | 7.5 | 14.0 | 5.5 | 3.5 | 35.3 |
| 3G3M1-A2110-EMP | 3G3M1-A2075-EMP | 11 | 22.0 | 8.0 | 5.5 | 51.7 |
| 3G3M1-A2150-EMP | 3G3M1-A2110-EMP | 15 | 38.0 | 14.0 | 14.0 | 70.5 |
| 3G3M1-A2185-EMP | 3G3M1-A2150-EMP | 18.5 | 38.0*1 | 22.0 | 14.0 | 87.0 |
| - | 3G3M1-A2185-EMP | 22 | 60.0*2 | 22.0 | 22.0 | 103.4 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Brake resistance connection (P(+), DB) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A2002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 | 0.4 | 2.0 | 2.0 | 2.0 | 0.3 |
| - | 3G3M1-A2002-EMP | 0.4 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.4 |
| 3G3M1-A2004-EMP | - | | 2.0 | 2.0 | 2.0 | 0.5 | - | - | - | - |
| - | 3G3M1-A2004-EMP | 0.75 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.6 |
| 3G3M1-A2007-EMP | - | | 2.0 | 2.0 | 2.0 | 0.7 | - | - | - | - |
| - | 3G3M1-A2007-EMP | 1.1 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.8 |
| 3G3M1-A2015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 1.4 | - | - | - | - |
| - | 3G3M1-A2015-EMP | 2.2 | - | - | - | - | 2.0 | 2.0 | 2.0 | 1.5 |
| 3G3M1-A2022-EMP | - | | 2.0 | 2.0 | 2.0 | 1.7 | - | - | - | - |
| - | 3G3M1-A2022-EMP | 3 | - | - | - | - | 2.0 | 2.0 | 2.0 | 1.7 |
| 3G3M1-A2037-EMP | - | 3.7 | 2.0 | 2.0 | 2.0 | 2.4 | - | - | - | - |
| - | 3G3M1-A2037-EMP | 5.5 | - | - | - | - | 2.0 | 2.0 | 2.0 | 2.5 |
| 3G3M1-A2055-EMP | - | | 2.0 | 2.0 | 2.0 | 3.8 | - | - | - | - |
| 3G3M1-A2075-EMP | 3G3M1-A2055-EMP | 7.5 | 2.0 | 2.0 | 2.0 | 5.0 | 2.0 | 2.0 | 2.0 | 3.8 |
| 3G3M1-A2110-EMP | 3G3M1-A2075-EMP | 11 | 2.0 | 2.0 | 2.0 | 7.5 | 2.0 | 2.0 | 2.0 | 5.3 |
| 3G3M1-A2150-EMP | 3G3M1-A2110-EMP | 15 | 2.0 | 2.0 | 2.0 | 9.4 | 2.0 | 2.0 | 2.0 | 7.5 |
| 3G3M1-A2185-EMP | 3G3M1-A2150-EMP | 18.5 | 2.0 | 2.0 | 2.0 | 12.7 | 2.0 | 2.0 | 2.0 | 9.0 |
| - | 3G3M1-A2185-EMP | 22 | 2.0 | 2.0 | 2.0 | 13.8 | - | - | - | - |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | |
|---|---|---|---|---|---|
| | | | Inverter ground (G) | | |
| | | | Allowable temperature (Note 1) | | |
| HHD mode | HND mode | | 60°C | 75°C | 90°C |
| 3G3M1-A2002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A2002-EMP | 0.4 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A2004-EMP | - | | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A2004-EMP | 0.75 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A2007-EMP | - | | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A2007-EMP | 1.1 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A2015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A2015-EMP | 2.2 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A2022-EMP | - | | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A2022-EMP | 3 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A2037-EMP | - | 3.7 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A2037-EMP | 5.5 | 3.5 | 3.5 | 3.5 |
| 3G3M1-A2055-EMP | - | | 3.5 | 3.5 | 3.5 |
| 3G3M1-A2075-EMP | 3G3M1-A2055-EMP | 7.5 | 5.5 | 5.5 | 5.5 |
| 3G3M1-A2110-EMP | 3G3M1-A2075-EMP | 11 | 5.5 | 5.5 | 5.5 |
| 3G3M1-A2150-EMP | 3G3M1-A2110-EMP | 15 | 5.5 | 5.5 | 5.5 |
| 3G3M1-A2185-EMP | 3G3M1-A2150-EMP | 18.5 | 8.0 | 8.0 | 8.0 |
| - | 3G3M1-A2185-EMP | 22 | 8.0 | 8.0 | 8.0 |

## Three-phase 400-V class (Panel internal temperature 50°C or less)

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] Main power supply input (L1/R, L2/S, L3/T) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | When DC reactor (DCR) is used | | | | Without DC reactor (DCR) | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A4004-EMP | - | 0.4 | 2.0 | 2.0 | 2.0 | 0.9 | 2.0 | 2.0 | 2.0 | 1.7 |
| - | 3G3M1-A4004-EMP | 0.75 | 2.0 | 2.0 | 2.0 | 1.5 | 2.0 | 2.0 | 2.0 | 2.7 |
| 3G3M1-A4007-EMP | - | | 2.0 | 2.0 | 2.0 | 1.6 | 2.0 | 2.0 | 2.0 | 3.1 |
| - | 3G3M1-A4007-EMP | 1.1 | 2.0 | 2.0 | 2.0 | 2.1 | 2.0 | 2.0 | 2.0 | 3.9 |
| 3G3M1-A4015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 | 2.0 | 5.9 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] Main power supply input (L1/R, L2/S, L3/T) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | When DC reactor (DCR) is used | | | | Without DC reactor (DCR) | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| - | 3G3M1-A4015-EMP | 2.2 | 2.0 | 2.0 | 2.0 | 4.2 | 2.0 | 2.0 | 2.0 | 7.3 |
| 3G3M1-A4022-EMP | - | | 2.0 | 2.0 | 2.0 | 4.4 | 2.0 | 2.0 | 2.0 | 8.2 |
| - | 3G3M1-A4022-EMP | 3 | 2.0 | 2.0 | 2.0 | 5.8 | 2.0 | 2.0 | 2.0 | 11.3 |
| 3G3M1-A4030-EMP | - | | | | | | | | | |
| - | 3G3M1-A4030-EMP | 3.7 | 2.0 | 2.0 | 2.0 | 7.3 | 2.0 | 2.0 | 2.0 | 13.0 |
| 3G3M1-A4040-EMP | - | | | | | | | | | |
| - | 3G3M1-A4040-EMP | 5.5 | 2.0 | 2.0 | 2.0 | 10.1 | 3.5 | 2.0 | 2.0 | 16.8 |
| 3G3M1-A4055-EMP | - | | 2.0 | 2.0 | 2.0 | 10.6 | 3.5 | 2.0 | 2.0 | 17.3 |
| 3G3M1-A4075-EMP | 3G3M1-A4055-EMP | 7.5 | 2.0 | 2.0 | 2.0 | 14.4 | 5.5 | 2.0 | 2.0 | 23.2 |
| 3G3M1-A4110-EMP | 3G3M1-A4075-EMP | 11 | 5.5 | 2.0 | 2.0 | 21.1 | 8.0 | 3.5 | 3.5 | 33.0 |
| 3G3M1-A4150-EMP | 3G3M1-A4110-EMP | 15 | 8.0 | 3.5 | 2.0 | 28.8 | 14.0 | 5.5 | 5.5 | 43.8 |
| 3G3M1-A4185-EMP | 3G3M1-A4150-EMP | 18.5 | 14.0 | 5.5 | 3.5 | 35.5 | 22.0 | 8.0 | 5.5 | 52.3 |
| 3G3M1-A4220-EMP | 3G3M1-A4185-EMP | 22 | 14.0 | 5.5 | 5.5 | 42.2 | 22.0 | 14.0 | 8.0 | 60.6 |
| - | 3G3M1-A4220-EMP | 30 | 22.0 | 14.0 | 8.0 | 57.0 | 38.0*1 | 14.0 | 14.0 | 77.9 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Inverter output (U, V, W) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A4004-EMP | - | 0.4 | 2.0 | 2.0 | 2.0 | 1.8 | - | - | - | - |
| - | 3G3M1-A4004-EMP | 0.75 | - | - | - | - | 2.0 | 2.0 | 2.0 | 2.1 |
| 3G3M1-A4007-EMP | - | | 2.0 | 2.0 | 2.0 | 3.4 | - | - | - | - |
| - | 3G3M1-A4007-EMP | 1.1 | - | - | - | - | 2.0 | 2.0 | 2.0 | 4.1 |
| 3G3M1-A4015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 4.8 | - | - | - | - |
| - | 3G3M1-A4015-EMP | 2.2 | - | - | - | - | 2.0 | 2.0 | 2.0 | 5.5 |
| 3G3M1-A4022-EMP | - | | 2.0 | 2.0 | 2.0 | 5.5 | - | - | - | - |
| - | 3G3M1-A4022-EMP | 3 | - | - | - | - | 2.0 | 2.0 | 2.0 | 6.9 |
| 3G3M1-A4030-EMP | - | | | | | | | | | |
| - | 3G3M1-A4030-EMP | 3.7 | 2.0 | 2.0 | 2.0 | 9.2 | - | - | - | - |
| 3G3M1-A4040-EMP | - | | | | | | | | | |
| - | 3G3M1-A4040-EMP | 5.5 | - | - | - | - | 2.0 | 2.0 | 2.0 | 11.1 |
| 3G3M1-A4055-EMP | - | | 2.0 | 2.0 | 2.0 | 14.8 | - | - | - | - |
| 3G3M1-A4075-EMP | 3G3M1-A4055-EMP | 7.5 | 3.5 | 2.0 | 2.0 | 18.0 | 3.5 | 2.0 | 2.0 | 17.5 |
| 3G3M1-A4110-EMP | 3G3M1-A4075-EMP | 11 | 5.5 | 2.0 | 2.0 | 24.0 | 5.5 | 2.0 | 2.0 | 23.0 |
| 3G3M1-A4150-EMP | 3G3M1-A4110-EMP | 15 | 8.0 | 3.5 | 2.0 | 31.0 | 8.0 | 5.5 | 3.5 | 31.0 |
| 3G3M1-A4185-EMP | 3G3M1-A4150-EMP | 18.5 | 14.0 | 5.5 | 3.5 | 39.0 | 14.0 | 5.5 | 3.5 | 38.0 |
| 3G3M1-A4220-EMP | 3G3M1-A4185-EMP | 22 | 14.0 | 8.0 | 5.5 | 45.0 | 14.0 | 8.0 | 5.5 | 45.0 |
| - | 3G3M1-A4220-EMP | 30 | - | - | - | - | 22.0 | 14.0 | 8.0 | 60.0 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | |
|---|---|---|---|---|---|---|
| | | | DC reactor connection v(P1, P(+)) | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | |
| 3G3M1-A4004-EMP | - | 0.4 | 2.0 | 2.0 | 2.0 | 1.0 |
| - | 3G3M1-A4004-EMP | 0.75 | 2.0 | 2.0 | 2.0 | 1.8 |
| 3G3M1-A4007-EMP | - | | 2.0 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A4007-EMP | 1.1 | 2.0 | 2.0 | 2.0 | 2.6 |
| 3G3M1-A4015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 3.7 |
| - | 3G3M1-A4015-EMP | 2.2 | 2.0 | 2.0 | 2.0 | 5.1 |
| 3G3M1-A4022-EMP | - | | 2.0 | 2.0 | 2.0 | 5.4 |
| - | 3G3M1-A4022-EMP | 3 | 2.0 | 2.0 | 2.0 | 7.1 |
| 3G3M1-A4030-EMP | - | | | | | |
| - | 3G3M1-A4030-EMP | 3.7 | 2.0 | 2.0 | 2.0 | 8.9 |
| 3G3M1-A4040-EMP | - | | | | | |
| - | 3G3M1-A4040-EMP | 5.5 | 2.0 | 2.0 | 2.0 | 12.4 |
| 3G3M1-A4055-EMP | - | | 2.0 | 2.0 | 2.0 | 13.0 |
| 3G3M1-A4075-EMP | 3G3M1-A4055-EMP | 7.5 | 3.5 | 2.0 | 2.0 | 17.6 |
| 3G3M1-A4110-EMP | 3G3M1-A4075-EMP | 11 | 5.5 | 3.5 | 2.0 | 25.8 |
| 3G3M1-A4150-EMP | 3G3M1-A4110-EMP | 15 | 14.0 | 5.5 | 3.5 | 35.3 |
| 3G3M1-A4185-EMP | 3G3M1-A4150-EMP | 18.5 | 14.0 | 5.5 | 5.5 | 43.5 |
| 3G3M1-A4220-EMP | 3G3M1-A4185-EMP | 22 | 22.0 | 8.0 | 5.5 | 51.7 |
| - | 3G3M1-A4220-EMP | 30 | 38.0*1 | 14.0 | 8.0 | 69.8 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Brake resistance connection (P(+), DB) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A4004-EMP | - | 0.4 | 2.0 | 2.0 | 2.0 | 0.4 | - | - | - | - |
| - | 3G3M1-A4004-EMP | 0.75 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.4 |
| 3G3M1-A4007-EMP | - | | 2.0 | 2.0 | 2.0 | 0.5 | - | - | - | - |
| - | 3G3M1-A4007-EMP | 1.1 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.6 |
| 3G3M1-A4015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 0.7 | - | - | - | - |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Brake resistance connection (P(+), DB) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| - | 3G3M1-A4015-EMP | 2.2 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.8 |
| 3G3M1-A4022-EMP | - | | 2.0 | 2.0 | 2.0 | 0.9 | - | - | - | - |
| - | 3G3M1-A4022-EMP | 3 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.9 |
| 3G3M1-A4030-EMP | - | | | | | | | | | |
| - | 3G3M1-A4030-EMP | 3.7 | 2.0 | 2.0 | 2.0 | 1.2 | - | - | - | - |
| 3G3M1-A4040-EMP | - | | | | | | | | | |
| - | 3G3M1-A4040-EMP | 5.5 | - | - | - | - | 2.0 | 2.0 | 2.0 | 1.3 |
| 3G3M1-A4055-EMP | - | | 2.0 | 2.0 | 2.0 | 1.9 | - | - | | - |
| 3G3M1-A4075-EMP | 3G3M1-A4055-EMP | 7.5 | 2.0 | 2.0 | 2.0 | 2.5 | 2.0 | 2.0 | 2.0 | 1.9 |
| 3G3M1-A4110-EMP | 3G3M1-A4075-EMP | 11 | 2.0 | 2.0 | 2.0 | 3.8 | 2.0 | 2.0 | 2.0 | 2.7 |
| 3G3M1-A4150-EMP | 3G3M1-A4110-EMP | 15 | 2.0 | 2.0 | 2.0 | 4.7 | 2.0 | 2.0 | 2.0 | 3.8 |
| 3G3M1-A4185-EMP | 3G3M1-A4150-EMP | 18.5 | 2.0 | 2.0 | 2.0 | 6.5 | 2.0 | 2.0 | 2.0 | 4.5 |
| 3G3M1-A4220-EMP | 3G3M1-A4185-EMP | 22 | 2.0 | 2.0 | 2.0 | 7.1 | 2.0 | 2.0 | 2.0 | 6.2 |
| - | 3G3M1-A4220-EMP | 30 | - | - | - | - | 2.0 | 2.0 | 2.0 | 7.2 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | |
|---|---|---|---|---|---|
| | | | Inverter ground (G) | | |
| | | | Allowable temperature (Note 1) | | |
| HHD mode | HND mode | | 60°C | 75°C | 90°C |
| 3G3M1-A4004-EMP | - | 0.4 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A4004-EMP | 0.75 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4007-EMP | - | | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A4007-EMP | 1.1 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | |
|---|---|---|---|---|---|
| | | | Inverter ground (G) | | |
| | | | Allowable temperature (Note 1) | | |
| HHD mode | HND mode | | 60°C | 75°C | 90°C |
| - | 3G3M1-A4015-EMP | 2.2 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4022-EMP | - | | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A4022-EMP | 3 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4030-EMP | - | | | | |
| - | 3G3M1-A4030-EMP | 3.7 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4040-EMP | - | | | | |
| - | 3G3M1-A4040-EMP | 5.5 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4055-EMP | - | | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4075-EMP | 3G3M1-A4055-EMP | 7.5 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4110-EMP | 3G3M1-A4075-EMP | 11 | 3.5 | 3.5 | 3.5 |
| 3G3M1-A4150-EMP | 3G3M1-A4110-EMP | 15 | 5.5 | 5.5 | 5.5 |
| 3G3M1-A4185-EMP | 3G3M1-A4150-EMP | 18.5 | 5.5 | 5.5 | 5.5 |
| 3G3M1-A4220-EMP | 3G3M1-A4185-EMP | 22 | 5.5 | 5.5 | 5.5 |
| - | 3G3M1-A4220-EMP | 30 | 8.0 | 8.0 | 8.0 |

## Single-phase 200-V class (Panel internal temperature 50°C or less)

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] Main power supply input (L1/R, L2/S, L3/T) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | When DC reactor (DCR) is used | | | | Without DC reactor (DCR) | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-AB002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 3.3 |
| - | 3G3M1-AB002-EMP | 0.4 | 2.0 | 2.0 | 2.0 | 3.7 | 2.0 | 2.0 | 2.0 | 3.6 |
| 3G3M1-AB004-EMP | - | | 2.0 | 2.0 | 2.0 | 3.5 | 2.0 | 2.0 | 2.0 | 5.4 |
| - | 3G3M1-AB004-EMP | 0.55 | 2.0 | 2.0 | 2.0 | 4.6 | 2.0 | 2.0 | 2.0 | 7.3 |
| 3G3M1-AB007-EMP | - | 0.75 | 2.0 | 2.0 | 2.0 | 6.4 | 2.0 | 2.0 | 2.0 | 9.7 |
| - | 3G3M1-AB007-EMP | 1.1 | 2.0 | 2.0 | 2.0 | 9.4 | 2.0 | 2.0 | 2.0 | 13.8 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] Main power supply input (L1/R, L2/S, L3/T) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | When DC reactor (DCR) is used | | | | Without DC reactor (DCR) | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-AB015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 11.6 | 3.5 | 2.0 | 2.0 | 16.4 |
| - | 3G3M1-AB015-EMP | 2.2 | 3.5 | 2.0 | 2.0 | 17.9 | 3.5 | 2.0 | 2.0 | 20.2 |
| 3G3M1-AB022-EMP | - | | 3.5 | 2.0 | 2.0 | 17.5 | 5.5 | 2.0 | 2.0 | 22.0 |
| - | 3G3M1-AB022-EMP | 3 | 5.5 | 3.5 | 2.0 | 25.0 | 5.5 | 2.0 | 2.0 | 24.0 |
| 3G3M1-AB037-EMP | - | 3.7 | 8.0 | 3.5 | 3.5 | 31.8 | 14.0 | 8.0 | 5.5 | 45.4 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] Inverter output (U, V, W) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | HHD mode | | | | HND mode | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-AB002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 | 1.6 | - | - | - | - |
| - | 3G3M1-AB002-EMP | 0.4 | - | - | - | - | 2.0 | 2.0 | 2.0 | 1.9 |
| 3G3M1-AB004-EMP | - | | 2.0 | 2.0 | 2.0 | 3.0 | - | - | - | - |
| - | 3G3M1-AB004-EMP | 0.55 | - | - | - | - | 2.0 | 2.0 | 2.0 | 3.5 |
| 3G3M1-AB007-EMP | - | 0.75 | 2.0 | 2.0 | 2.0 | 5.0 | - | - | - | - |
| - | 3G3M1-AB007-EMP | 1.1 | - | - | - | - | 2.0 | 2.0 | 2.0 | 6.0 |
| 3G3M1-AB015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 8.0 | - | - | - | - |
| - | 3G3M1-AB015-EMP | 2.2 | - | - | - | - | 2.0 | 2.0 | 2.0 | 9.6 |
| 3G3M1-AB022-EMP | - | | 2.0 | 2.0 | 2.0 | 11.0 | - | - | - | - |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Inverter output (U, V, W) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| - | 3G3M1-AB022-EMP | 3 | - | - | - | - | 2.0 | 2.0 | 2.0 | 12.0 |
| 3G3M1-AB037-EMP | - | 3.7 | 3.5 | 2.0 | 2.0 | 17.5 | - | - | - | - |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | |
|---|---|---|---|---|---|---|
| | | | DC reactor connection (P1, P(+)) | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | |
| 3G3M1-AB002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 | 2.4 |
| - | 3G3M1-AB002-EMP | 0.4 | 2.0 | 2.0 | 2.0 | 4.5 |
| 3G3M1-AB004-EMP | - | | 2.0 | 2.0 | 2.0 | 4.3 |
| - | 3G3M1-AB004-EMP | 0.55 | 2.0 | 2.0 | 2.0 | 5.6 |
| 3G3M1-AB007-EMP | - | 0.75 | 2.0 | 2.0 | 2.0 | 7.8 |
| - | 3G3M1-AB007-EMP | 1.1 | 2.0 | 2.0 | 2.0 | 11.5 |
| 3G3M1-AB015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 14.2 |
| - | 3G3M1-AB015-EMP | 2.2 | 5.5 | 2.0 | 2.0 | 21.9 |
| 3G3M1-AB022-EMP | - | | 3.5 | 2.0 | 2.0 | 21 |
| - | 3G3M1-AB022-EMP | 3 | 8.0 | 3.5 | 2.0 | 30.6 |
| 3G3M1-AB037-EMP | - | 3.7 | 14.0 | 5.5 | 3.5 | 38.9 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Brake resistance connection (P(+), DB) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-AB002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 | 0.4 | - | - | - | - |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Brake resistance connection (P(+), DB) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| - | 3G3M1-AB002-EMP | 0.4 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.4 |
| 3G3M1-AB004-EMP | - | | 2.0 | 2.0 | 2.0 | 0.5 | - | - | - | - |
| - | 3G3M1-AB004-EMP | 0.55 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.6 |
| 3G3M1-AB007-EMP | - | 0.75 | 2.0 | 2.0 | 2.0 | 0.7 | - | - | - | - |
| - | 3G3M1-AB007-EMP | 1.1 | - | - | - | - | 2.0 | 2.0 | 2.0 | 1.1 |
| 3G3M1-AB015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 1.4 | - | - | - | - |
| - | 3G3M1-AB015-EMP | 2.2 | - | - | - | - | 2.0 | 2.0 | 2.0 | 1.5 |
| 3G3M1-AB022-EMP | - | | 2.0 | 2.0 | 2.0 | 1.7 | - | - | - | - |
| - | 3G3M1-AB022-EMP | 3 | - | - | - | - | 2.0 | 2.0 | 2.0 | 1.9 |
| 3G3M1-AB037-EMP | - | 3.7 | 2.0 | 2.0 | 2.0 | 2.4 | - | - | - | - |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | |
|---|---|---|---|---|---|
| | | | Inverter ground (G) | | |
| | | | Allowable temperature (Note 1) | | |
| HHD mode | HND mode | | 60°C | 75°C | 90°C |
| 3G3M1-AB002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-AB002-EMP | 0.4 | 2.0 | 2.0 | 2.0 |
| 3G3M1-AB004-EMP | - | | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-AB004-EMP | 0.55 | 2.0 | 2.0 | 2.0 |
| 3G3M1-AB007-EMP | - | 0.75 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-AB007-EMP | 1.1 | 2.0 | 2.0 | 2.0 |
| 3G3M1-AB015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-AB015-EMP | 2.2 | 2.0 | 2.0 | 2.0 |
| 3G3M1-AB022-EMP | - | | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-AB022-EMP | 3 | 2.0 | 2.0 | 2.0 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | |
|---|---|---|---|---|---|
| | | | Inverter ground (G) | | |
| | | | Allowable temperature (Note 1) | | |
| HHD mode | HND mode | | 60°C | 75°C | 90°C |
| 3G3M1-AB037-EMP | - | 3.7 | 3.5 | 3.5 | 3.5 |

## Three-phase 200-V class (Panel internal temperature 40°C or less)

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] Main power supply input (L1/R, L2/S, L3/T) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | When DC reactor (DCR) is used | | | | Without DC reactor | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A2002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 | 0.9 | 2.0 | 2.0 | 2.0 | 1.8 |
| - | 3G3M1-A2002-EMP | 0.4 | 2.0 | 2.0 | 2.0 | 1.6 | 2.0 | 2.0 | 2.0 | 2.6 |
| 3G3M1-A2004-EMP | - | | 2.0 | 2.0 | 2.0 | 1.6 | 2.0 | 2.0 | 2.0 | 3.1 |
| - | 3G3M1-A2004-EMP | 0.75 | 2.0 | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 | 2.0 | 4.9 |
| 3G3M1-A2007-EMP | - | | 2.0 | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 | 2.0 | 5.3 |
| - | 3G3M1-A2007-EMP | 1.1 | 2.0 | 2.0 | 2.0 | 4.3 | 2.0 | 2.0 | 2.0 | 6.7 |
| 3G3M1-A2015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 5.7 | 2.0 | 2.0 | 2.0 | 9.5 |
| - | 3G3M1-A2015-EMP | 2.2 | 2.0 | 2.0 | 2.0 | 8.3 | 2.0 | 2.0 | 2.0 | 12.8 |
| 3G3M1-A2022-EMP | - | | 2.0 | 2.0 | 2.0 | 8.3 | 2.0 | 2.0 | 2.0 | 13.2 |
| - | 3G3M1-A2022-EMP | 3 | 2.0 | 2.0 | 2.0 | 11.7 | 2.0 | 2.0 | 2.0 | 17.9 |
| 3G3M1-A2037-EMP | - | 3.7 | 2.0 | 2.0 | 2.0 | 14.0 | 3.5 | 2.0 | 2.0 | 22.2 |
| - | 3G3M1-A2037-EMP | 5.5 | 2.0 | 2.0 | 2.0 | 19.9 | 3.5 | 2.0 | 2.0 | 28.5 |
| 3G3M1-A2055-EMP | - | | 2.0 | 2.0 | 2.0 | 21.1 | 5.5 | 3.5 | 2.0 | 31.5 |
| 3G3M1-A2075-EMP | 3G3M1-A2055-EMP | 7.5 | 3.5 | 2.0 | 2.0 | 28.8 | 8.0 | 5.5 | 3.5 | 42.7 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] Main power supply input (L1/R, L2/S, L3/T) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | When DC reactor (DCR) is used | | | | Without DC reactor | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A2110-EMP | 3G3M1-A2075-EMP | 11 | 8.0 | 5.5 | 3.5 | 42.2 | 14.0 | 8.0 | 5.5 | 60.7 |
| 3G3M1-A2150-EMP | 3G3M1-A2110-EMP | 15 | 14.0 | 8.0 | 5.5 | 57.6 | 22.0 | 14.0 | 14.0 | 80.0 |
| 3G3M1-A2185-EMP | 3G3M1-A2150-EMP | 18.5 | 14.0 | 14.0 | 8.0 | 71.0 | 38.0*1 | 22.0 | 14.0 | 97.0 |
| - | 3G3M1-A2185-EMP | 22 | 22.0 | 14.0 | 14.0 | 84.4 | 38.0*1 | 22.0 | 14.0 | 112.0 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] Inverter output (U, V, W) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | HHD mode | | | | HND mode | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A2002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 | 1.6 | 2.0 | 2.0 | 2.0 | 1.3 |
| - | 3G3M1-A2002-EMP | 0.4 | - | - | - | - | 2.0 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A2004-EMP | - | | 2.0 | 2.0 | 2.0 | 3.0 | - | - | - | - |
| - | 3G3M1-A2004-EMP | 0.75 | - | - | - | - | 2.0 | 2.0 | 2.0 | 3.5 |
| 3G3M1-A2007-EMP | - | | 2.0 | 2.0 | 2.0 | 5.0 | - | - | - | - |
| - | 3G3M1-A2007-EMP | 1.1 | - | - | - | - | 2.0 | 2.0 | 2.0 | 6.0 |
| 3G3M1-A2015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 8.0 | - | - | - | - |
| - | 3G3M1-A2015-EMP | 2.2 | - | - | - | - | 2.0 | 2.0 | 2.0 | 9.6 |
| 3G3M1-A2022-EMP | - | | 2.0 | 2.0 | 2.0 | 11.0 | - | - | - | - |
| - | 3G3M1-A2022-EMP | 3 | - | - | - | - | 2.0 | 2.0 | 2.0 | 12.0 |
| 3G3M1-A2037-EMP | - | 3.7 | 2.0 | 2.0 | 2.0 | 17.5 | - | - | - | - |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Inverter output (U, V, W) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| - | 3G3M1-A2037-EMP | 5.5 | - | - | - | - | 2.0 | 2.0 | 2.0 | 19.6 |
| 3G3M1-A2055-EMP | - | | 3.5 | 2.0 | 2.0 | 25.0 | - | - | - | - |
| 3G3M1-A2075-EMP | 3G3M1-A2055-EMP | 7.5 | 5.5 | 3.5 | 2.0 | 33.0 | 3.5 | 3.5 | 2.0 | 30.0 |
| 3G3M1-A2110-EMP | 3G3M1-A2075-EMP | 11 | 8.0 | 5.5 | 3.5 | 47.0 | 5.5 | 5.5 | 3.5 | 40.0 |
| 3G3M1-A2150-EMP | 3G3M1-A2110-EMP | 15 | 14.0 | 8.0 | 5.5 | 60.0 | 14.0 | 8.0 | 5.5 | 56.0 |
| 3G3M1-A2185-EMP | 3G3M1-A2150-EMP | 18.5 | 22.0 | 14.0 | 8.0 | 76.0 | 14.0 | 14.0 | 8.0 | 69.0 |
| - | 3G3M1-A2185-EMP | 22 | 22.0 | 14.0 | 14.0 | 90.0 | 22.0 | 14.0 | 14.0 | 88.0 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | |
|---|---|---|---|---|---|---|
| | | | DC reactor connection (P1, P(+)) | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | |
| 3G3M1-A2002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 | 1.1 |
| - | 3G3M1-A2002-EMP | 0.4 | 2.0 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A2004-EMP | - | | 2.0 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A2004-EMP | 0.75 | 2.0 | 2.0 | 2.0 | 3.7 |
| 3G3M1-A2007-EMP | - | | 2.0 | 2.0 | 2.0 | 3.7 |
| - | 3G3M1-A2007-EMP | 1.1 | 2.0 | 2.0 | 2.0 | 5.3 |
| 3G3M1-A2015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 7.0 |
| - | 3G3M1-A2015-EMP | 2.2 | 2.0 | 2.0 | 2.0 | 10.2 |
| 3G3M1-A2022-EMP | - | | 2.0 | 2.0 | 2.0 | 10.2 |
| - | 3G3M1-A2022-EMP | 3 | 2.0 | 2.0 | 2.0 | 14.3 |
| 3G3M1-A2037-EMP | - | 3.7 | 2.0 | 2.0 | 2.0 | 17.1 |
| - | 3G3M1-A2037-EMP | 5.5 | 3.5 | 2.0 | 2.0 | 24.4 |
| 3G3M1-A2055-EMP | - | | 3.5 | 2.0 | 2.0 | 25.8 |
| 3G3M1-A2075-EMP | 3G3M1-A2055-EMP | 7.5 | 5.5 | 3.5 | 3.5 | 35.3 |
| 3G3M1-A2110-EMP | 3G3M1-A2075-EMP | 11 | 14.0 | 5.5 | 5.5 | 51.7 |
| 3G3M1-A2150-EMP | 3G3M1-A2110-EMP | 15 | 14.0 | 14.0 | 8.0 | 70.5 |
| 3G3M1-A2185-EMP | 3G3M1-A2150-EMP | 18.5 | 22.0 | 14.0 | 14.0 | 87.0 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | |
|---|---|---|---|---|---|---|
| | | | DC reactor connection (P1, P(+)) | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | |
| - | 3G3M1-A2185-EMP | 22 | 38.0*1 | 22.0 | 14.0 | 103.4 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Brake resistance connection (P(+), DB) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A2002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 | 0.4 | 2.0 | 2.0 | 2.0 | 0.3 |
| - | 3G3M1-A2002-EMP | 0.4 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.4 |
| 3G3M1-A2004-EMP | - | | 2.0 | 2.0 | 2.0 | 0.5 | - | - | - | - |
| - | 3G3M1-A2004-EMP | 0.75 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.6 |
| 3G3M1-A2007-EMP | - | | 2.0 | 2.0 | 2.0 | 0.7 | - | - | - | - |
| - | 3G3M1-A2007-EMP | 1.1 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.8 |
| 3G3M1-A2015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 1.4 | - | - | - | - |
| - | 3G3M1-A2015-EMP | 2.2 | - | - | - | - | 2.0 | 2.0 | 2.0 | 1.5 |
| 3G3M1-A2022-EMP | - | | 2.0 | 2.0 | 2.0 | 1.7 | - | - | - | - |
| - | 3G3M1-A2022-EMP | 3 | - | - | - | - | 2.0 | 2.0 | 2.0 | 1.7 |
| 3G3M1-A2037-EMP | - | 3.7 | 2.0 | 2.0 | 2.0 | 2.4 | - | - | - | - |
| - | 3G3M1-A2037-EMP | 5.5 | - | - | - | - | 2.0 | 2.0 | 2.0 | 2.5 |
| 3G3M1-A2055-EMP | - | | 2.0 | 2.0 | 2.0 | 3.8 | - | - | - | - |
| 3G3M1-A2075-EMP | 3G3M1-A2055-EMP | 7.5 | 2.0 | 2.0 | 2.0 | 5.0 | 2.0 | 2.0 | 2.0 | 3.8 |
| 3G3M1-A2110-EMP | 3G3M1-A2075-EMP | 11 | 2.0 | 2.0 | 2.0 | 7.5 | 2.0 | 2.0 | 2.0 | 5.3 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Brake resistance connection (P(+), DB) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A2150-EMP | 3G3M1-A2110-EMP | 15 | 2.0 | 2.0 | 2.0 | 9.4 | 2.0 | 2.0 | 2.0 | 7.5 |
| 3G3M1-A2185-EMP | 3G3M1-A2150-EMP | 18.5 | 2.0 | 2.0 | 2.0 | 12.7 | 2.0 | 2.0 | 2.0 | 9.0 |
| - | 3G3M1-A2185-EMP | 22 | 2.0 | 2.0 | 2.0 | 13.8 | 2.0 | 2.0 | 2.0 | 12.0 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | |
|---|---|---|---|---|---|
| | | | Inverter ground (G) | | |
| | | | Allowable temperature (Note 1) | | |
| HHD mode | HND mode | | 60°C | 75°C | 90°C |
| 3G3M1-A2002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A2002-EMP | 0.4 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A2004-EMP | - | | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A2004-EMP | 0.75 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A2007-EMP | - | | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A2007-EMP | 1.1 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A2015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A2015-EMP | 2.2 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A2022-EMP | - | | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A2022-EMP | 3 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A2037-EMP | - | 3.7 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A2037-EMP | 5.5 | 3.5 | 3.5 | 3.5 |
| 3G3M1-A2055-EMP | - | | 3.5 | 3.5 | 3.5 |
| 3G3M1-A2075-EMP | 3G3M1-A2055-EMP | 7.5 | 5.5 | 5.5 | 5.5 |
| 3G3M1-A2110-EMP | 3G3M1-A2075-EMP | 11 | 5.5 | 5.5 | 5.5 |
| 3G3M1-A2150-EMP | 3G3M1-A2110-EMP | 15 | 5.5 | 5.5 | 5.5 |
| 3G3M1-A2185-EMP | 3G3M1-A2150-EMP | 18.5 | 8.0 | 8.0 | 8.0 |
| - | 3G3M1-A2185-EMP | 22 | 8.0 | 8.0 | 8.0 |

## Three-phase 400-V class (Panel internal temperature 40°C or less)

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] Main power supply input (L1/R, L2/S, L3/T) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | When DC reactor (DCR) is used | | | | Without DC reactor (DCR) | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A4004-EMP | - | 0.4 | 2.0 | 2.0 | 2.0 | 0.9 | 2.0 | 2.0 | 2.0 | 1.7 |
| - | 3G3M1-A4004-EMP | 0.75 | 2.0 | 2.0 | 2.0 | 1.5 | 2.0 | 2.0 | 2.0 | 2.7 |
| 3G3M1-A4007-EMP | - | | 2.0 | 2.0 | 2.0 | 1.6 | 2.0 | 2.0 | 2.0 | 3.1 |
| - | 3G3M1-A4007-EMP | 1.1 | 2.0 | 2.0 | 2.0 | 2.1 | 2.0 | 2.0 | 2.0 | 3.9 |
| 3G3M1-A4015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 3.0 | 2.0 | 2.0 | 2.0 | 5.9 |
| - | 3G3M1-A4015-EMP | 2.2 | 2.0 | 2.0 | 2.0 | 4.2 | 2.0 | 2.0 | 2.0 | 7.3 |
| 3G3M1-A4022-EMP | - | | 2.0 | 2.0 | 2.0 | 4.4 | 2.0 | 2.0 | 2.0 | 8.2 |
| - | 3G3M1-A4022-EMP | 3 | 2.0 | 2.0 | 2.0 | 5.8 | 2.0 | 2.0 | 2.0 | 11.3 |
| 3G3M1-A4030-EMP | - | | | | | | | | | |
| - | 3G3M1-A4030-EMP | 3.7 | 2.0 | 2.0 | 2.0 | 7.3 | 2.0 | 2.0 | 2.0 | 13.0 |
| 3G3M1-A4040-EMP | - | | | | | | | | | |
| - | 3G3M1-A4040-EMP | 5.5 | 2.0 | 2.0 | 2.0 | 10.1 | 2.0 | 2.0 | 2.0 | 16.8 |
| 3G3M1-A4055-EMP | - | | 2.0 | 2.0 | 2.0 | 10.6 | 2.0 | 2.0 | 2.0 | 17.3 |
| 3G3M1-A4075-EMP | 3G3M1-A4055-EMP | 7.5 | 2.0 | 2.0 | 2.0 | 14.4 | 3.5 | 2.0 | 2.0 | 23.2 |
| 3G3M1-A4110-EMP | 3G3M1-A4075-EMP | 11 | 2.0 | 2.0 | 2.0 | 21.1 | 5.5 | 3.5 | 2.0 | 33.0 |
| 3G3M1-A4150-EMP | 3G3M1-A4110-EMP | 15 | 3.5 | 2.0 | 2.0 | 28.8 | 8.0 | 5.5 | 3.5 | 43.8 |
| 3G3M1-A4185-EMP | 3G3M1-A4150-EMP | 18.5 | 5.5 | 3.5 | 3.5 | 35.5 | 14.0 | 8.0 | 5.5 | 52.3 |
| 3G3M1-A4220-EMP | 3G3M1-A4185-EMP | 22 | 8.0 | 5.5 | 3.5 | 42.2 | 14.0 | 8.0 | 5.5 | 60.6 |
| - | 3G3M1-A4220-EMP | 30 | 14.0 | 8.0 | 5.5 | 57.0 | 22.0 | 14.0 | 8.0 | 77.9 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Inverter output (U, V, W) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A4004-EMP | - | 0.4 | 2.0 | 2.0 | 2.0 | 1.8 | - | - | - | - |
| - | 3G3M1-A4004-EMP | 0.75 | - | - | - | - | 2.0 | 2.0 | 2.0 | 2.1 |
| 3G3M1-A4007-EMP | - | | 2.0 | 2.0 | 2.0 | 3.4 | - | - | - | - |
| - | 3G3M1-A4007-EMP | 1.1 | - | - | - | - | 2.0 | 2.0 | 2.0 | 4.1 |
| 3G3M1-A4015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 4.8 | - | - | - | - |
| - | 3G3M1-A4015-EMP | 2.2 | - | - | - | - | 2.0 | 2.0 | 2.0 | 5.5 |
| 3G3M1-A4022-EMP | - | | 2.0 | 2.0 | 2.0 | 5.5 | - | - | - | - |
| - | 3G3M1-A4022-EMP | 3 | - | - | - | - | 2.0 | 2.0 | 2.0 | 6.9 |
| 3G3M1-A4030-EMP | - | | | | | | | | | |
| - | 3G3M1-A4030-EMP | 3.7 | 2.0 | 2.0 | 2.0 | 9.2 | - | - | - | - |
| 3G3M1-A4040-EMP | - | | | | | | | | | |
| - | 3G3M1-A4040-EMP | 5.5 | - | - | - | - | 2.0 | 2.0 | 2.0 | 11.1 |
| 3G3M1-A4055-EMP | - | | 2.0 | 2.0 | 2.0 | 14.8 | - | - | - | - |
| 3G3M1-A4075-EMP | 3G3M1-A4055-EMP | 7.5 | 2.0 | 2.0 | 2.0 | 18.0 | 2.0 | 2.0 | 2.0 | 17.5 |
| 3G3M1-A4110-EMP | 3G3M1-A4075-EMP | 11 | 3.5 | 2.0 | 2.0 | 24.0 | 3.5 | 2.0 | 2.0 | 23.0 |
| 3G3M1-A4150-EMP | 3G3M1-A4110-EMP | 15 | 5.5 | 3.5 | 2.0 | 31.0 | 5.5 | 3.5 | 2.0 | 31.0 |
| 3G3M1-A4185-EMP | 3G3M1-A4150-EMP | 18.5 | 5.5 | 3.5 | 3.5 | 39.0 | 5.5 | 3.5 | 3.5 | 38.0 |
| 3G3M1-A4220-EMP | 3G3M1-A4185-EMP | 22 | 8.0 | 5.5 | 3.5 | 45.0 | 8.0 | 5.5 | 3.5 | 45.0 |
| - | 3G3M1-A4220-EMP | 30 | - | - | - | - | 14.0 | 8.0 | 5.5 | 60.0 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm$^2$] Maximum applicable motor capacity [kW] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Main power supply input (L1/R, L2/S, L3/T) | | | | | | | |
| | | | When DC reactor (DCR) is used | | | | Without DC reactor (DCR) | | | |
| HD mode | ND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A4004-EMP | 3G3M1-A4004-EMP | 0.75 | 2.0 | 2.0 | 2.0 | 1.5 | 2.0 | 2.0 | 2.0 | 2.7 |
| 3G3M1-A4007-EMP | - | 1.1 | 2.0 | 2.0 | 2.0 | 2.1 | 2.0 | 2.0 | 2.0 | 3.9 |
| - | 3G3M1-A4007-EMP | 1.5 | 2.0 | 2.0 | 2.0 | 2.9 | 2.0 | 2.0 | 2.0 | 4.8 |
| 3G3M1-A4015-EMP | 3G3M1-A4015-EMP | 2.2 | 2.0 | 2.0 | 2.0 | 4.2 | 2.0 | 2.0 | 2.0 | 7.3 |
| 3G3M1-A4022-EMP | 3G3M1-A4022-EMP | 3 | 2.0 | 2.0 | 2.0 | 5.8 | 2.0 | 2.0 | 2.0 | 11.3 |
| 3G3M1-A4030-EMP | 3G3M1-A4030-EMP | 5.5 | 2.0 | 2.0 | 2.0 | 10.1 | 2.0 | 2.0 | 2.0 | 16.8 |
| 3G3M1-A4040-EMP | 3G3M1-A4040-EMP | | | | | | | | | |
| 3G3M1-A4055-EMP | - | 7.5 | 2.0 | 2.0 | 2.0 | 14.4 | 3.5 | 2.0 | 2.0 | 23.2 |
| 3G3M1-A4075-EMP | 3G3M1-A4055-EMP | 11 | 2.0 | 2.0 | 2.0 | 21.1 | 5.5 | 3.5 | 2.0 | 33.0 |
| 3G3M1-A4110-EMP | 3G3M1-A4075-EMP | 15 | 3.5 | 2.0 | 2.0 | 28.8 | 8.0 | 5.5 | 3.5 | 43.8 |
| 3G3M1-A4150-EMP | 3G3M1-A4110-EMP | 18.5 | 5.5 | 3.5 | 3.5 | 35.5 | 14.0 | 8.0 | 5.5 | 52.3 |
| 3G3M1-A4185-EMP | 3G3M1-A4150-EMP | 22 | 8.0 | 5.5 | 3.5 | 42.2 | 14.0 | 8.0 | 5.5 | 60.6 |
| 3G3M1-A4220-EMP | 3G3M1-A4185-EMP | 30 | 14.0 | 8.0 | 5.5 | 57.0 | 22.0 | 14.0 | 8.0 | 77.9 |
| - | 3G3M1-A4220-EMP | 37 | 14.0 | 14.0 | 8.0 | 68.5 | 38*1 | 14.0 | 14.0 | 94.3 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Inverter output (U, V, W) | | | | | | | |
| | | | HD mode | | | | ND mode | | | |
| HD mode | ND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A4004-EMP | 3G3M1-A4004-EMP | 0.75 | 2.0 | 2.0 | 2.0 | 1.8 | 2.0 | 2.0 | 2.0 | 2.1 |
| 3G3M1-A4007-EMP | - | 1.1 | 2.0 | 2.0 | 2.0 | 3.4 | - | - | - | - |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Inverter output (U, V, W) | | | | | | | |
| | | | HD mode | | | | ND mode | | | |
| HD mode | ND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| - | 3G3M1-A4007-EMP | 1.5 | - | - | - | - | 2.0 | 2.0 | 2.0 | 4.1 |
| 3G3M1-A4015-EMP | 3G3M1-A4015-EMP | 2.2 | 2.0 | 2.0 | 2.0 | 5.0 | 2.0 | 2.0 | 2.0 | 5.5 |
| 3G3M1-A4022-EMP | 3G3M1-A4022-EMP | 3 | 2.0 | 2.0 | 2.0 | 6.3 | 2.0 | 2.0 | 2.0 | 6.9 |
| 3G3M1-A4030-EMP | 3G3M1-A4030-EMP | 5.5 | 2.0 | 2.0 | 2.0 | 11.1 | 2.0 | 2.0 | 2.0 | 12.0 |
| 3G3M1-A4040-EMP | 3G3M1-A4040-EMP | | | | | | | | | |
| 3G3M1-A4055-EMP | - | 7.5 | 2.0 | 2.0 | 2.0 | 17.5 | - | - | - | - |
| 3G3M1-A4075-EMP | 3G3M1-A4055-EMP | 11 | 3.5 | 2.0 | 2.0 | 23.0 | 2.0 | 2.0 | 2.0 | 21.5 |
| 3G3M1-A4110-EMP | 3G3M1-A4075-EMP | 15 | 5.5 | 3.5 | 2.0 | 31.0 | 3.5 | 2.0 | 2.0 | 28.5 |
| 3G3M1-A4150-EMP | 3G3M1-A4110-EMP | 18.5 | 5.5 | 3.5 | 3.5 | 38.0 | 5.5 | 3.5 | 3.5 | 37.0 |
| 3G3M1-A4185-EMP | 3G3M1-A4150-EMP | 22 | 8.0 | 5.5 | 3.5 | 45.0 | 8.0 | 5.5 | 3.5 | 44.0 |
| 3G3M1-A4220-EMP | 3G3M1-A4185-EMP | 30 | 14.0 | 8.0 | 5.5 | 60.0 | 14.0 | 8.0 | 5.5 | 59.0 |
| - | 3G3M1-A4220-EMP | 37 | - | - | - | - | 22.0 | 14.0 | 8.0 | 72.0 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | |
|---|---|---|---|---|---|---|
| | | | DC reactor connection (P1, P(+)) | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | |
| 3G3M1-A4004-EMP | - | 0.4 | 2.0 | 2.0 | 2.0 | 1.0 |
| - | 3G3M1-A4004-EMP | 0.75 | 2.0 | 2.0 | 2.0 | 1.8 |
| 3G3M1-A4007-EMP | - | | 2.0 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A4007-EMP | 1.1 | 2.0 | 2.0 | 2.0 | 2.6 |
| 3G3M1-A4015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 3.7 |
| - | 3G3M1-A4015-EMP | 2.2 | 2.0 | 2.0 | 2.0 | 5.1 |
| 3G3M1-A4022-EMP | - | | 2.0 | 2.0 | 2.0 | 5.4 |
| - | 3G3M1-A4022-EMP | 3 | 2.0 | 2.0 | 2.0 | 7.1 |
| 3G3M1-A4030-EMP | - | | | | | |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | |
|---|---|---|---|---|---|---|
| | | | DC reactor connection (P1, P(+)) | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | |
| - | 3G3M1-A4030-EMP | 3.7 | 2.0 | 2.0 | 2.0 | 8.9 |
| 3G3M1-A4040-EMP | - | | | | | |
| - | 3G3M1-A4040-EMP | 5.5 | 2.0 | 2.0 | 2.0 | 12.4 |
| 3G3M1-A4055-EMP | - | | 2.0 | 2.0 | 2.0 | 13.0 |
| 3G3M1-A4075-EMP | 3G3M1-A4055-EMP | 7.5 | 2.0 | 2.0 | 2.0 | 17.6 |
| 3G3M1-A4110-EMP | 3G3M1-A4075-EMP | 11 | 3.5 | 2.0 | 2.0 | 25.8 |
| 3G3M1-A4150-EMP | 3G3M1-A4110-EMP | 15 | 5.5 | 3.5 | 3.5 | 35.3 |
| 3G3M1-A4185-EMP | 3G3M1-A4150-EMP | 18.5 | 8.0 | 5.5 | 3.5 | 43.5 |
| 3G3M1-A4220-EMP | 3G3M1-A4185-EMP | 22 | 14.0 | 5.5 | 5.5 | 51.7 |
| - | 3G3M1-A4220-EMP | 30 | 14.0 | 14.0 | 8.0 | 69.8 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Brake resistance connection (P(+), DB) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A4004-EMP | - | 0.4 | 2.0 | 2.0 | 2.0 | 0.4 | - | - | - | - |
| - | 3G3M1-A4004-EMP | 0.75 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.4 |
| 3G3M1-A4007-EMP | - | | 2.0 | 2.0 | 2.0 | 0.5 | - | - | - | - |
| - | 3G3M1-A4007-EMP | 1.1 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.6 |
| 3G3M1-A4015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 0.7 | - | - | - | - |
| - | 3G3M1-A4015-EMP | 2.2 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.8 |
| 3G3M1-A4022-EMP | - | | 2.0 | 2.0 | 2.0 | 0.9 | - | - | - | - |
| - | 3G3M1-A4022-EMP | 3 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.9 |
| 3G3M1-A4030-EMP | - | | | | | | | | | |
| - | 3G3M1-A4030-EMP | 3.7 | 2.0 | 2.0 | 2.0 | 1.2 | - | - | - | - |
| 3G3M1-A4040-EMP | - | | | | | | | | | |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Brake resistance connection (P(+), DB) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| - | 3G3M1-A4040-EMP | 5.5 | - | - | - | - | 2.0 | 2.0 | 2.0 | 1.3 |
| 3G3M1-A4055-EMP | - | | 2.0 | 2.0 | 2.0 | 1.9 | - | - | - | - |
| 3G3M1-A4075-EMP | 3G3M1-A4055-EMP | 7.5 | 2.0 | 2.0 | 2.0 | 2.5 | 2.0 | 2.0 | 2.0 | 1.9 |
| 3G3M1-A4110-EMP | 3G3M1-A4075-EMP | 11 | 2.0 | 2.0 | 2.0 | 3.8 | 2.0 | 2.0 | 2.0 | 2.7 |
| 3G3M1-A4150-EMP | 3G3M1-A4110-EMP | 15 | 2.0 | 2.0 | 2.0 | 4.7 | 2.0 | 2.0 | 2.0 | 3.8 |
| 3G3M1-A4185-EMP | 3G3M1-A4150-EMP | 18.5 | 2.0 | 2.0 | 2.0 | 6.5 | 2.0 | 2.0 | 2.0 | 4.5 |
| 3G3M1-A4220-EMP | 3G3M1-A4185-EMP | 22 | 2.0 | 2.0 | 2.0 | 7.1 | 2.0 | 2.0 | 2.0 | 6.2 |
| - | 3G3M1-A4220-EMP | 30 | - | - | - | - | 2.0 | 2.0 | 2.0 | 7.2 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | |
|---|---|---|---|---|---|
| | | | Inverter ground (G) | | |
| | | | Allowable temperature (Note 1) | | |
| HHD mode | HND mode | | 60°C | 75°C | 90°C |
| 3G3M1-A4004-EMP | - | 0.4 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A4004-EMP | 0.75 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4007-EMP | - | | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A4007-EMP | 1.1 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A4015-EMP | 2.2 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4022-EMP | - | | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A4022-EMP | 3 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4030-EMP | - | | | | |
| - | 3G3M1-A4030-EMP | 3.7 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4040-EMP | - | | | | |
| - | 3G3M1-A4040-EMP | 5.5 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4055-EMP | - | | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4075-EMP | 3G3M1-A4055-EMP | 7.5 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4110-EMP | 3G3M1-A4075-EMP | 11 | 3.5 | 3.5 | 3.5 |
| 3G3M1-A4150-EMP | 3G3M1-A4110-EMP | 15 | 5.5 | 5.5 | 5.5 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | |
|---|---|---|---|---|---|
| | | | Inverter ground (G) | | |
| | | | Allowable temperature (Note 1) | | |
| HHD mode | HND mode | | 60°C | 75°C | 90°C |
| 3G3M1-A4185-EMP | 3G3M1-A4150-EMP | 18.5 | 5.5 | 5.5 | 5.5 |
| 3G3M1-A4220-EMP | 3G3M1-A4185-EMP | 22 | 5.5 | 5.5 | 5.5 |
| - | 3G3M1-A4220-EMP | 30 | 8.0 | 8.0 | 8.0 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | |
|---|---|---|---|---|---|---|
| | | | DC reactor connection (P1, P(+)) | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] |
| HD mode | ND mode | | 60°C | 75°C | 90°C | |
| 3G3M1-A4004-EMP | 3G3M1-A4004-EMP | 0.75 | 2.0 | 2.0 | 2.0 | 1.8 |
| 3G3M1-A4007-EMP | - | 1.1 | 2.0 | 2.0 | 2.0 | 2.6 |
| - | 3G3M1-A4007-EMP | 1.5 | 2.0 | 2.0 | 2.0 | 3.6 |
| 3G3M1-A4015-EMP | 3G3M1-A4015-EMP | 2.2 | 2.0 | 2.0 | 2.0 | 5.1 |
| 3G3M1-A4022-EMP | 3G3M1-A4022-EMP | 3 | 2.0 | 2.0 | 2.0 | 7.1 |
| 3G3M1-A4030-EMP | 3G3M1-A4030-EMP | 5.5 | 2.0 | 2.0 | 2.0 | 12.4 |
| 3G3M1-A4040-EMP | 3G3M1-A4040-EMP | | | | | |
| 3G3M1-A4055-EMP | - | 7.5 | 2.0 | 2.0 | 2.0 | 17.6 |
| 3G3M1-A4075-EMP | 3G3M1-A4055-EMP | 11 | 3.5 | 2.0 | 2.0 | 25.8 |
| 3G3M1-A4110-EMP | 3G3M1-A4075-EMP | 15 | 5.5 | 3.5 | 3.5 | 35.3 |
| 3G3M1-A4150-EMP | 3G3M1-A4110-EMP | 18.5 | 8.0 | 5.5 | 3.5 | 43.5 |
| 3G3M1-A4185-EMP | 3G3M1-A4150-EMP | 22 | 14.0 | 5.5 | 5.5 | 51.7 |
| 3G3M1-A4220-EMP | 3G3M1-A4185-EMP | 30 | 14.0 | 14.0 | 8.0 | 69.8 |
| - | 3G3M1-A4220-EMP | 37 | 22.0 | 14.0 | 14.0 | 83.9 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Brake resistance connection (P(+), DB) | | | | | | | |
| | | | HD mode | | | | ND mode | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| HD mode | ND mode | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A4004-EMP | 3G3M1-A4004-EMP | 0.75 | 2.0 | 2.0 | 2.0 | 0.4 | 2.0 | 2.0 | 2.0 | 0.4 |
| 3G3M1-A4007-EMP | - | 1.1 | 2.0 | 2.0 | 2.0 | 0.6 | - | - | - | - |
| - | 3G3M1-A4007-EMP | 1.5 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.6 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Brake resistance connection (P(+), DB) | | | | | | | |
| | | | HD mode | | | | ND mode | | | |
| HD mode | ND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-A4015-EMP | 3G3M1-A4015-EMP | 2.2 | 2.0 | 2.0 | 2.0 | 0.8 | 2.0 | 2.0 | 2.0 | 0.8 |
| 3G3M1-A4022-EMP | 3G3M1-A4022-EMP | 3 | 2.0 | 2.0 | 2.0 | 0.9 | 2.0 | 2.0 | 2.0 | 0.9 |
| 3G3M1-A4030-EMP | 3G3M1-A4030-EMP | 5.5 | 2.0 | 2.0 | 2.0 | 1.3 | 2.0 | 2.0 | 2.0 | 1.3 |
| 3G3M1-A4040-EMP | 3G3M1-A4040-EMP | | | | | | | | | |
| 3G3M1-A4055-EMP | - | 7.5 | 2.0 | 2.0 | 2.0 | 1.9 | - | - | - | - |
| 3G3M1-A4075-EMP | 3G3M1-A4055-EMP | 11 | 2.0 | 2.0 | 2.0 | 2.7 | 2.0 | 2.0 | 2.0 | 2.3 |
| 3G3M1-A4110-EMP | 3G3M1-A4075-EMP | 15 | 2.0 | 2.0 | 2.0 | 3.8 | 2.0 | 2.0 | 2.0 | 3.1 |
| 3G3M1-A4150-EMP | 3G3M1-A4110-EMP | 18.5 | 2.0 | 2.0 | 2.0 | 4.5 | 2.0 | 2.0 | 2.0 | 4.2 |
| 3G3M1-A4185-EMP | 3G3M1-A4150-EMP | 22 | 2.0 | 2.0 | 2.0 | 6.2 | 2.0 | 2.0 | 2.0 | 4.9 |
| 3G3M1-A4220-EMP | 3G3M1-A4185-EMP | 30 | 2.0 | 2.0 | 2.0 | 7.2 | 2.0 | 2.0 | 2.0 | 7.2 |
| - | 3G3M1-A4220-EMP | 37 | - | - | - | - | 2.0 | 2.0 | 2.0 | 8.0 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | |
|---|---|---|---|---|---|
| | | | Inverter ground (G) | | |
| | | | Allowable temperature (Note 1) | | |
| HD mode | ND mode | | 60°C | 75°C | 90°C |
| 3G3M1-A4004-EMP | 3G3M1-A4004-EMP | 0.75 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4007-EMP | - | 1.1 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-A4007-EMP | 1.5 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4015-EMP | 3G3M1-A4015-EMP | 2.2 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4022-EMP | 3G3M1-A4022-EMP | 3 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4030-EMP | 3G3M1-A4030-EMP | 5.5 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4040-EMP | 3G3M1-A4040-EMP | | | | |
| 3G3M1-A4055-EMP | - | 7.5 | 2.0 | 2.0 | 2.0 |
| 3G3M1-A4075-EMP | 3G3M1-A4055-EMP | 11 | 3.5 | 3.5 | 3.5 |
| 3G3M1-A4110-EMP | 3G3M1-A4075-EMP | 15 | 5.5 | 5.5 | 5.5 |
| 3G3M1-A4150-EMP | 3G3M1-A4110-EMP | 18.5 | 5.5 | 5.5 | 5.5 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | |
|---|---|---|---|---|---|
| | | | Inverter ground (G) | | |
| | | | Allowable temperature (Note 1) | | |
| HD mode | ND mode | | 60°C | 75°C | 90°C |
| 3G3M1-A4185-EMP | 3G3M1-A4150-EMP | 22 | 5.5 | 5.5 | 5.5 |
| 3G3M1-A4220-EMP | 3G3M1-A4185-EMP | 30 | 8.0 | 8.0 | 8.0 |
| - | 3G3M1-A4220-EMP | 37 | 8.0 | 8.0 | 8.0 |

## Single-phase 200-V class (Panel internal temperature 40°C or less)

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Main power supply input (L1/R, L2/S, L3/T) | | | | | | | |
| | | | When DC reactor (DCR) is used | | | | Without DC reactor (DCR) | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-AB002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 3.3 |
| - | 3G3M1-AB002-EMP | 0.4 | 2.0 | 2.0 | 2.0 | 3.7 | 2.0 | 2.0 | 2.0 | 4.9 |
| 3G3M1-AB004-EMP | - | | 2.0 | 2.0 | 2.0 | 3.5 | 2.0 | 2.0 | 2.0 | 5.4 |
| - | 3G3M1-AB004-EMP | 0.55 | 2.0 | 2.0 | 2.0 | 4.6 | 2.0 | 2.0 | 2.0 | 7.3 |
| 3G3M1-AB007-EMP | - | 0.75 | 2.0 | 2.0 | 2.0 | 6.4 | 2.0 | 2.0 | 2.0 | 9.7 |
| - | 3G3M1-AB007-EMP | 1.1 | 2.0 | 2.0 | 2.0 | 9.4 | 2.0 | 2.0 | 2.0 | 13.8 |
| 3G3M1-AB015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 11.6 | 2.0 | 2.0 | 2.0 | 16.4 |
| - | 3G3M1-AB015-EMP | 2.2 | 2.0 | 2.0 | 2.0 | 17.9 | 2.0 | 2.0 | 2.0 | 20.2 |
| 3G3M1-AB022-EMP | - | | 2.0 | 2.0 | 2.0 | 17.5 | 2.0 | 2.0 | 2.0 | 22.0 |
| - | 3G3M1-AB022-EMP | 3 | 3.5 | 2.0 | 2.0 | 25.0 | 3.5 | 2.0 | 2.0 | 26.0 |
| 3G3M1-AB037-EMP | - | 3.7 | 5.5 | 3.5 | 2.0 | 31.8 | 8.0 | 5.5 | 3.5 | 45.4 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Inverter output (U, V, W) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-AB002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 | 1.6 | - | - | - | - |
| - | 3G3M1-AB002-EMP | 0.4 | - | - | - | - | 2.0 | 2.0 | 2.0 | 1.9 |
| 3G3M1-AB004-EMP | - | | 2.0 | 2.0 | 2.0 | 3.0 | - | - | - | - |
| - | 3G3M1-AB004-EMP | 0.55 | - | - | - | - | 2.0 | 2.0 | 2.0 | 3.5 |
| 3G3M1-AB007-EMP | - | 0.75 | 2.0 | 2.0 | 2.0 | 5.0 | - | - | - | - |
| - | 3G3M1-AB007-EMP | 1.1 | - | - | - | - | 2.0 | 2.0 | 2.0 | 6.0 |
| 3G3M1-AB015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 8.0 | - | - | - | - |
| - | 3G3M1-AB015-EMP | 2.2 | - | - | - | - | 2.0 | 2.0 | 2.0 | 9.6 |
| 3G3M1-AB022-EMP | - | | 2.0 | 2.0 | 2.0 | 11.0 | - | - | - | - |
| - | 3G3M1-AB022-EMP | 3 | - | - | - | - | 2.0 | 2.0 | 2.0 | 12.0 |
| 3G3M1-AB037-EMP | - | 3.7 | 2.0 | 2.0 | 2.0 | 17.5 | - | - | - | - |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | |
|---|---|---|---|---|---|---|
| | | | DC reactor connection (P1, P(+)) | | | |
| HHD mode | HND mode | | Allowable temperature (Note 1) | | | Current value [A] |
| | | | 60°C | 75°C | 90°C | |
| 3G3M1-AB002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 | 2.4 |
| - | 3G3M1-AB002-EMP | 0.4 | 2.0 | 2.0 | 2.0 | 4.5 |
| 3G3M1-AB004-EMP | - | | 2.0 | 2.0 | 2.0 | 4.3 |
| - | 3G3M1-AB004-EMP | 0.55 | 2.0 | 2.0 | 2.0 | 5.6 |
| 3G3M1-AB007-EMP | - | 0.75 | 2.0 | 2.0 | 2.0 | 7.8 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | |
|---|---|---|---|---|---|---|
| | | | DC reactor connection (P1, P(+)) | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | |
| - | 3G3M1-AB007-EMP | 1.1 | 2.0 | 2.0 | 2.0 | 11.5 |
| 3G3M1-AB015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 14.2 |
| - | 3G3M1-AB015-EMP | 2.2 | 2.0 | 2.0 | 2.0 | 21.9 |
| 3G3M1-AB022-EMP | - | | 2.0 | 2.0 | 2.0 | 21.4 |
| - | 3G3M1-AB022-EMP | 3 | 2.0 | 2.0 | 2.0 | 30.6 |
| 3G3M1-AB037-EMP | - | 3.7 | 5.5 | 3.5 | 3.5 | 38.9 |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Brake resistance connection (P(+), DB) | | | | | | | |
| | | | HHD mode | | | | HND mode | | | |
| | | | Allowable temperature (Note 1) | | | Current value [A] | Allowable temperature (Note 1) | | | Current value [A] |
| HHD mode | HND mode | | 60°C | 75°C | 90°C | | 60°C | 75°C | 90°C | |
| 3G3M1-AB002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 | 0.4 | - | - | - | - |
| - | 3G3M1-AB002-EMP | 0.4 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.4 |
| 3G3M1-AB004-EMP | - | | 2.0 | 2.0 | 2.0 | 0.5 | - | - | - | - |
| - | 3G3M1-AB004-EMP | 0.55 | - | - | - | - | 2.0 | 2.0 | 2.0 | 0.6 |
| 3G3M1-AB007-EMP | - | 0.75 | 2.0 | 2.0 | 2.0 | 0.7 | - | - | - | - |
| - | 3G3M1-AB007-EMP | 1.1 | - | - | - | - | 2.0 | 2.0 | 2.0 | 1.1 |
| 3G3M1-AB015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 | 1.4 | - | - | - | - |
| - | 3G3M1-AB015-EMP | 2.2 | - | - | - | - | 2.0 | 2.0 | 2.0 | 1.5 |
| 3G3M1-AB022-EMP | - | | 2.0 | 2.0 | 2.0 | 1.7 | - | - | - | - |
| - | 3G3M1-AB022-EMP | 3 | - | - | - | - | 2.0 | 2.0 | 2.0 | 1.9 |
| 3G3M1-AB037-EMP | - | 3.7 | 2.0 | 2.0 | 2.0 | 2.4 | - | - | - | - |

| Model | | Maximum applicable motor capacity [kW] | Recommended wire size [mm2] | | |
|---|---|---|---|---|---|
| | | | Inverter ground (G) | | |
| | | | Allowable temperature (Note 1) | | |
| HHD mode | HND mode | | 60°C | 75°C | 90°C |
| 3G3M1-AB002-EMP | - | 0.2 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-AB002-EMP | 0.4 | 2.0 | 2.0 | 2.0 |
| 3G3M1-AB004-EMP | - | | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-AB004-EMP | 0.55 | 2.0 | 2.0 | 2.0 |
| 3G3M1-AB007-EMP | - | 0.75 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-AB007-EMP | 1.1 | 2.0 | 2.0 | 2.0 |
| 3G3M1-AB015-EMP | - | 1.5 | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-AB015-EMP | 2.2 | 2.0 | 2.0 | 2.0 |
| 3G3M1-AB022-EMP | - | | 2.0 | 2.0 | 2.0 |
| - | 3G3M1-AB022-EMP | 3 | 2.0 | 2.0 | 2.0 |
| 3G3M1-AB037-EMP | - | 3.7 | 3.5 | 3.5 | 3.5 |

Note 1: At an allowable temperature of 60°C, use 600 V IV insulated wire, at 75°C 600 V HIV insulated wire, and at 90°C 600 V crosslinked polyethylene insulated wire.

Note 2: When the recommended wire size is 38 $mm^2$, use crimped terminal model No. 38-6 made by J.S.T. Mfg. Co., Ltd. or an equivalent product (*1 in table).

Note 3: When the recommended wire size is 60$mm^2$, use crimped terminal model No. 60-6 made by J.S.T. Mfg. Co., Ltd. or an equivalent product (*2 in table).

### Tightening torque

| Model | | Screw specification | | | | | |
|---|---|---|---|---|---|---|---|
| | | Main circuit | | For ground | | Control power supply auxiliary input (R0, T0) | |
| | | Terminal screw size | Tightening torque [N·m] | Terminal screw size | Tightening torque [N·m] | Terminal screw size | Tightening torque [N·m] |
| Three-phase 200 V | 3G3M1-A2002-EMP | M3.5 | 0.8 | M3.5 | 1.2 | - | - |
| | 3G3M1-A2004-EMP | | | | | | |
| | 3G3M1-A2007-EMP | | | | | | |
| | 3G3M1-A2015-EMP | M4 | 1.2 | M4 | 1.8 | - | - |
| | 3G3M1-A2022-EMP | | | | | | |
| | 3G3M1-A2037-EMP | | | | | | |
| | 3G3M1-A2055-EMP | M5 | 3 | M5 | 3 | - | - |
| | 3G3M1-A2075-EMP | | | | | | |
| | 3G3M1-A2110-EMP | M6 | 3 | M6 | 3 | - | - |
| | 3G3M1-A2150-EMP | | | | | | |
| | 3G3M1-A2185-EMP | M6 (No.3) | 5.8 | M6 (No.3) | 5.8 | M3.5 | 1.2 |
| Three-phase 400 V | 3G3M1-A4004-EMP | M4 | 1.2 | M4 | 1.8 | - | - |
| | 3G3M1-A4007-EMP | | | | | | |
| | 3G3M1-A4015-EMP | | | | | | |
| | 3G3M1-A4022-EMP | | | | | | |
| | 3G3M1-A4030-EMP | | | | | | |
| | 3G3M1-A4040-EMP | | | | | | |
| | 3G3M1-A4055-EMP | M5 | 3 | M5 | 3 | - | - |
| | 3G3M1-A4075-EMP | | | | | | |
| | 3G3M1-A4110-EMP | M6 | 3 | M6 | 3 | - | - |
| | 3G3M1-A4150-EMP | | | | | | |
| | 3G3M1-A4185-EMP | M6 (No.3) | 5.8 | M6 (No.3) | 5.8 | M3.5 | 1.2 |
| | 3G3M1-A4220-EMP | | | | | | |
| Single-phase 200 V | 3G3M1-AB002-EMP | M3.5 | 0.8 | M3.5 | 1.2 | - | - |
| | 3G3M1-AB004-EMP | | | | | | |
| | 3G3M1-AB007-EMP | | | | | | |
| | 3G3M1-AB015-EMP | M4 | 1.2 | M4 | 1.8 | - | - |
| | 3G3M1-AB022-EMP | | | | | | |
| | 3G3M1-AB037-EMP | M5 | 3 | M5 | 3 | - | - |

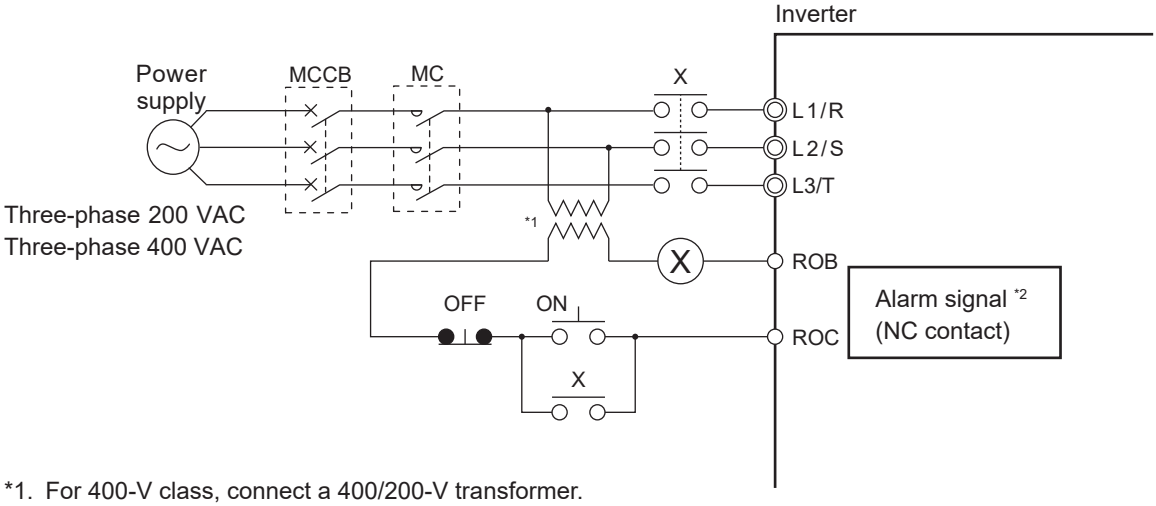
## Wiring for Main Power Supply Input Terminals (L1/R, L2/S, L3/T)

The following describes the wiring for the main power supply input terminals and for peripheral equipment.

## Installing molded case circuit breaker

If the inverter's protective function is activated, the inverter internal circuit may be damaged depending on the condition.
Be sure to connect the main power supply input terminals (L1/R, L2/S, L3/T) to the power supply via a molded case circuit breaker (MCCB) according to each inverter.

- When using multiple inverters, install one MCCB per inverter.
- Determine the capacity of the MCCB according to the molded case circuit breaker (MCCB) value shown in the previous table.
- Determine the time characteristic of the MCCB upon due consideration of the time characteristic of the inverter's overheat protection function (150% of the rated output current for one minute).
- If you must share one MCCB with multiple inverters or other equipment, construct a sequence that turns OFF the power supply via the alarm output signal, as shown in the figure below.




*1. For 400-V class, connect a 400/200-V transformer.
*2. Set the Output Terminal [ROA, ROB] Function Selection (E027) to "1099: AL (Alarm signal)."

## Installing earth leakage breaker

When selecting the earth leakage breaker to use between the power supply and the main power supply input terminals (L1/R, L2/S, L3/T), consider the following.

High-frequency leakage current from inverter

The inverter produces a high-frequency leakage current due to its high-speed output switching. In general, a leakage current of approx. 100 mA will flow for the power cable length of 1 m per inverter. Moreover, an additional leakage current of approx. 5 mA will flow with the increasing length by 1 m.
Therefore, an earth leakage breaker to use in the power input section must be dedicated for the inverter, which removes high-frequency leakage current and detects only the leakage current in a frequency range that is dangerous to the human body.

- Select a special earth leakage breaker for the inverter with a sensitivity current rating of 10 mA or higher per inverter.
- If you use a general earth leakage breaker (which detects high-frequency leakage current), select one with a sensitivity current rating of 200 mA or higher per inverter and an operation time of 0.1 s or longer.

Leakage current from EMC noise filter

The EMC noise filter is designed to comply with European CE standards.

Specifically, it is designed to meet the neutral-point grounding requirement of the European power supply specifications. Therefore, using the EMC noise filter with the phase S grounding causes an increase of leakage current.

For use with the phase S grounding, it is recommended to use the Input Noise Filter.

- OMRON currently plans to support the EMC noise filters for the 3G3M1 Series.

## Installing magnetic contactor

To shut off the main circuit power supply with a sequence, you can use a magnetic contactor (MC) on the inverter side closer than a molded case circuit breaker (MCCB).

- Do not attempt to run/stop the inverter by turning ON/OFF a magnetic contactor.
  Instead, use the RUN command signal (FW/RV) via the control circuit terminal block of the inverter.
- Construct a sequence that turns OFF the power supply via the alarm output signal of the inverter.
- To use one or more braking resistors/regenerative braking units, construct a sequence that turns OFF a magnetic contactor via a thermal relay contact in each unit.

## Inrush current flow when the inverter power supply is turned ON

When the inverter power supply is turned ON, the charging current, which is called inrush current, flows in the main circuit board capacitor.

The table below shows the reference values at a power supply voltage of 200 V or 400 V when the power supply impedance is low. Take this into consideration when selecting the inverter power supply.

- With a low-speed no-fuse breaker, an inrush current 10 times the rated current can flow for 20 ms.
- To turn ON the power supply for multiple inverters simultaneously, select a no-fuse breaker whose 20-ms allowable current rating is greater than the total inrush current of the inverters.

| Single-phase/Three-phase 200-V class | |
|---|---|
| **3G3M1-□-EMP** | **Inrush current value (Ao-p)** |
| A2002 to A2037<br>AB002 to AB022 | 12 |
| A2055, A2075, AB037 | 126 |
| A2110, A2150 | 251 |
| A2185 | 145 |

| Three-phase 400-V class | |
|---|---|
| **3G3M1-□-EMP** | **Inrush current value (Ao-p)** |
| A4004 to A4040 | 13 |
| A4055, A4075 | 41 |
| A4110, A4150 | 81 |
| A4185, A4220 | 148 |

## Main power supply phase loss and single-phase input

To use a single-phase power supply, use a single-phase 200-V class inverter.

Using a single-phase power supply to supply power to a three-phase 200-V or three-phase 400-V class inverter may cause damage to the inverter.

Be sure to check that the three-phase power supply is wired properly before using the inverter.

## Power supply environment

In the following cases, the internal converter module (rectifier) may be damaged.

Take countermeasures such as installing an AC reactor on the main circuit input side of the inverter.

- The power supply voltage unbalance factor is 3% or more.

- The power supply capacity is at least 10 times larger than the inverter capacity and, at the same time, 500 kVA or more.
- Rapid change in the power supply voltage occurs.

Example) When the phase advance capacitor is turned ON/OFF, the inverter may detect an overvoltage or the rectifier may be damaged.

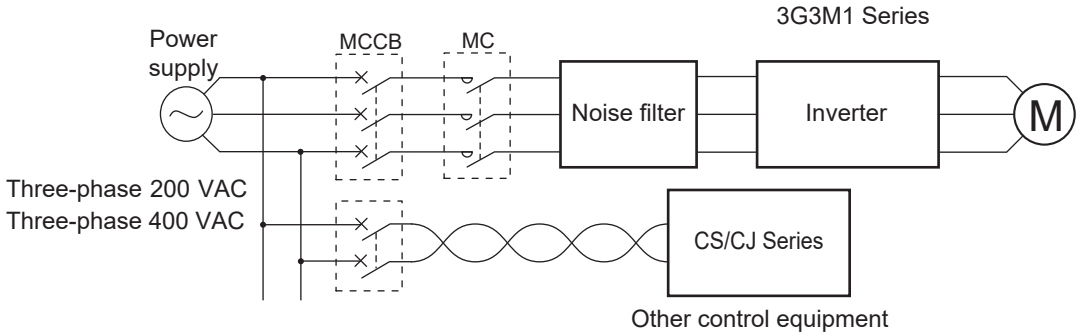
### Installing input surge absorber

When using an inductive load (such as a magnetic contactor, magnetic relay, magnetic valve, solenoid, or electromagnetic brake), use a surge absorber or diode together.

### Installing input noise filter

The inverter performs high-speed output switching, which may cause the noise flow from the inverter to power supply lines that negatively affects on peripheral equipment.
Therefore, it is recommended to use an input noise filter to reduce noise flowing out to power supply lines.
This also helps reduce noise that enters the inverter from power supply lines.

Input noise filter for inverter (for general use)

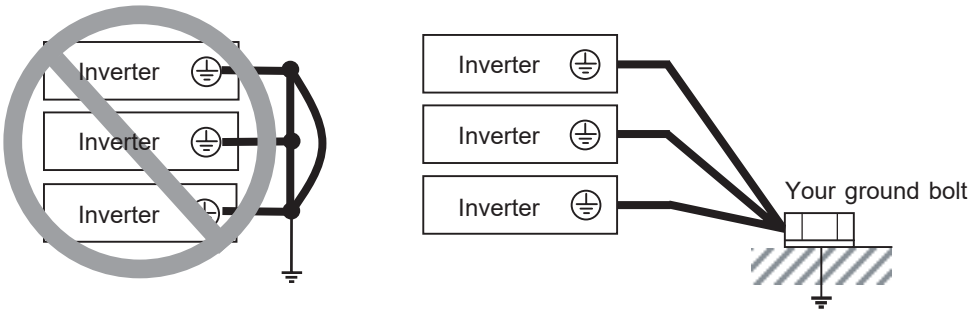



## Wiring for Ground Terminal (G ⏚)

To prevent electric shock, be sure to ground the inverter and the motor.
The 200-V class should be connected to the ground terminal under type-D grounding conditions (conventional type 3 grounding conditions: 100 Ω or less ground resistance), the 400-V class should be connected to the ground terminal under type-C grounding conditions (conventional special type 3 grounding conditions: 10 Ω or less ground resistance).

For the ground cable, use the applicable cable or a cable with a larger diameter. Make the cable length as short as possible.

When several inverters are connected, the ground cable must not be connected across several inverters or looped. Otherwise, the inverters and peripheral control equipment may malfunction.






## Harmonic Current Measures and DC/AC Reactor Wiring (P1, P(+))

In recent years, there is an increasing concern about harmonic currents generated from industrial machinery.

Harmonic measures must be implemented as *Guideline of Countermeasures Taken by Users against Higher Harmonics Received at High Voltages or Extremely High Voltages* was established by the Ministry of International Trade and Industry (current: Ministry of Economy, Trade and Industry) in September, 1994.

The following provides an overview of harmonics and measures against harmonics implemented in this inverter.

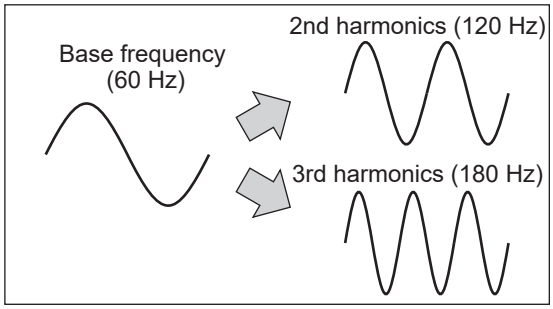
### Harmonics

The voltage or current whose frequency is an integral multiple of certain standard frequency (base frequency) is called a harmonic.

If a commercial power supply frequency of 60 Hz (50 Hz) is the reference frequency, the harmonics of that signal is:

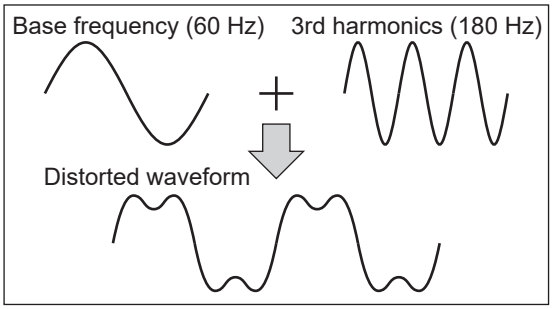
x2 = 120 Hz (100 Hz),

x3 = 180 Hz (150 Hz), and so on.



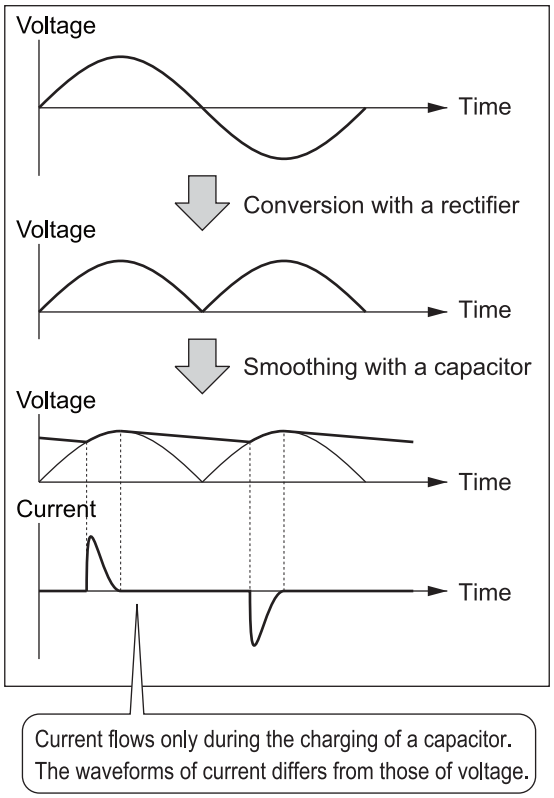

### Reason why harmonics cause problems

As the number of harmonics increases, the wave- form of the commercial supply has more distortion. This distortion causes the malfunction of the con- nected equipment or leads to abnormal heat genera- tion.



## Causes of harmonics

- General electrical equipment internally converts AC input power (commercial power) into DC power. At this time, harmonic currents occur because of the difference in the current flow direction between AC power and DC power.
- In an AC-to-DC power conversion, the rectifier converts the input power into a unidirectional voltage, which is then smoothened by the capacitor. As a result, the current charged into the capacitor has a waveform that contains harmonic components.
- This inverter also performs an AC-to-DC conversion as with other electrical equipment, which allows current with harmonic components to flow. In particular, the inverter has more current than other equipment, so the number of harmonic components in current is larger.




## DC/AC reactor

To suppress harmonic currents, use the DC (direct current) and AC (alternating current) reactors.
The DC/AC reactor functions to suppress a steep change in the current.
The DC reactor has a higher harmonics suppression ability, so even higher suppression ability can be expected when used in conjunction with the AC reactor.
Suppressing harmonic currents also leads to the improvement in the power factor on the input or output side of the inverter.

## Before wiring

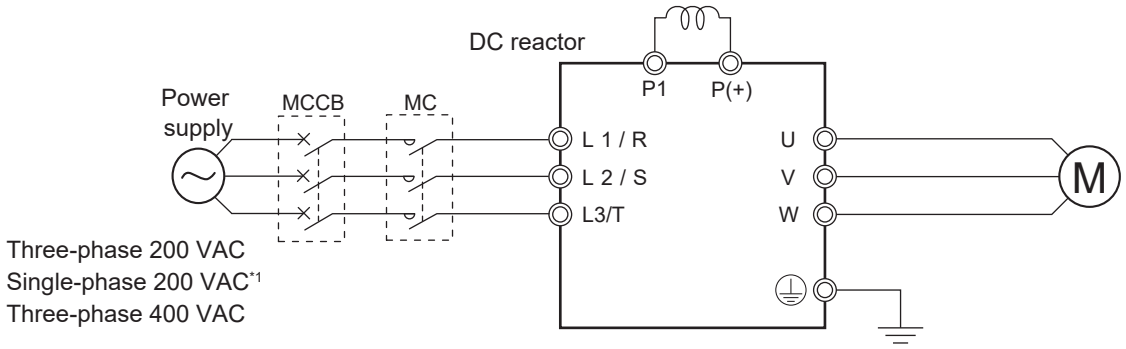
The DC reactor is connected to the DC power supply located inside the inverter.
Before wiring, be sure to turn OFF the power supply and make sure that the charge indicator is not lit.
Do not touch the interior of the inverter during inverter operation. Doing so may result in electric shock or burn injury.

By factory default, a short-circuit bar is connected between the terminals P1 and P(+). Before connecting the DC reactor, remove this short-circuit bar.
Note that the length of the DC reactor connection cable must be 10 m or shorter.

Remove the short-circuit bar only if you connect the DC reactor for use.
If you remove the short-circuit bar with the DC reactor unconnected, the inverter cannot operate because no power is supplied to its main circuit.

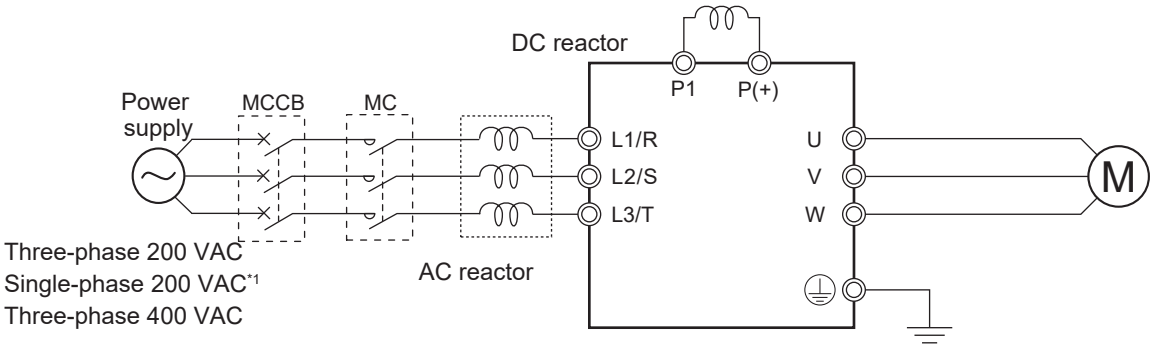
## Wiring method

With DC reactor




*1. Connect to the terminals L1/L and L2/N on the single-phase 200-VAC inverter.

With DC reactor and AC reactor




*1. Connect to the terminals L1/L and L2/N on the single-phase 200-VAC inverter.

## Effect of reactors

Through the use of the DC/AC reactor, the rate of harmonic current occurrences can be reduced as shown in the table of typical examples below.

| Measure against harmonics | Harmonic current occurrence rate [%] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 5th | 7th | 11th | 13th | 17th | 19th | 23th | 25th |
| None (Inverter only) | 65 | 41 | 8.5 | 7.7 | 4.3 | 3.1 | 2.6 | 1.8 |
| AC reactor | 38 | 14.5 | 7.4 | 3.4 | 3.2 | 1.9 | 1.7 | 1.3 |
| DC reactor | 30 | 13 | 8.4 | 5 | 4.7 | 3.2 | 3.0 | 2.2 |
| With DC and AC reactors | 28 | 9.1 | 7.2 | 4.1 | 3.2 | 2.4 | 1.6 | 1.4 |

## Guideline for reactor selection

When implementing measures against harmonics, first install a DC reactor and evaluate its effect. Then, if further reduction is required, add an AC reactor.

To implement harmonic countermeasures in consideration of the power supply environment (such as rapid change in the power supply voltage), first install an AC reactor and evaluate its effect. If further reduction is required, add a DC reactor.

If you have multiple inverters and use the AC reactor, use one AC reactor for each inverter. Using only one AC reactor for more than one inverter does not provide sufficient reduction

## Wiring for Inverter Output Terminals (U, V, W)

The following describes the wiring for the inverter output terminals (U, V, W).

### Never connect power supply to output terminals

Never connect the power supply to the output terminals U, V, W.
The inverter is damaged internally if power supply voltage is applied to the output terminals.

### Never short or ground output terminals

Do not touch the output terminals with bare hand or contact the output wires with the inverter's case. Doing so may result in electric shock or ground fault.
Be careful not to short the output wires.

### Do not use phase advance capacitors and noise filters for general-purpose power supplies or for the input side

Never connect a phase advance capacitor or LC/RC noise filter for general-purpose power supplies to the output circuit.
Doing so may result in damage to the inverter or burnout of these parts.

### Do not use magnetic switches

Do not connect any magnetic switch or magnet contactor to the output circuit.
If a load is connected to the inverter when running, the inverter's overcurrent protection circuit is activated due to the inrush current.

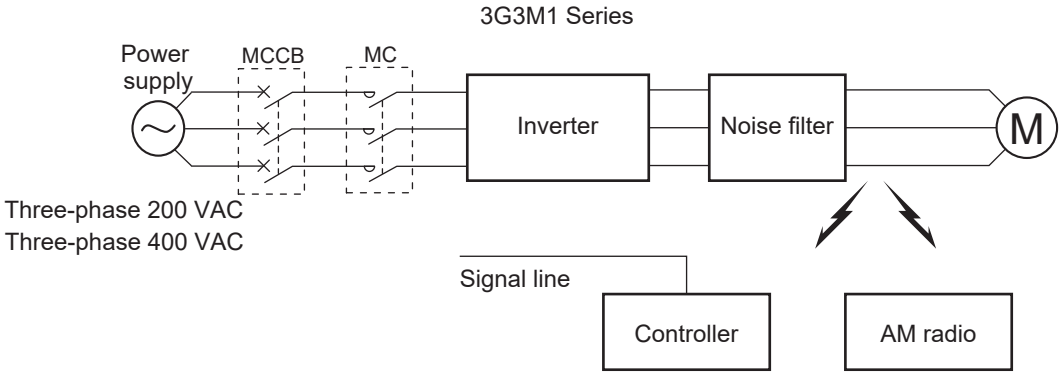
### Precautions for connecting more than one motor to inverter's output terminals

If connecting more than one motors to the output terminals of the inverter, note the following three points.

- Make sure that the rated current of the inverter is higher than the sum of the rated current values of the connected motors.
- The inverter cannot provide overload protection for individual motors, because it only detects a sum of the current values for all the connected motors.
  Install a thermal relay for each motor. The RC value of each thermal relay must be 1.1 times larger than the rated current of the motor.
- Set the inverter to detect only overloading that occurred in it by setting the Electronic Thermal Level to the rated output current of the inverter.

### Installing output noise filter

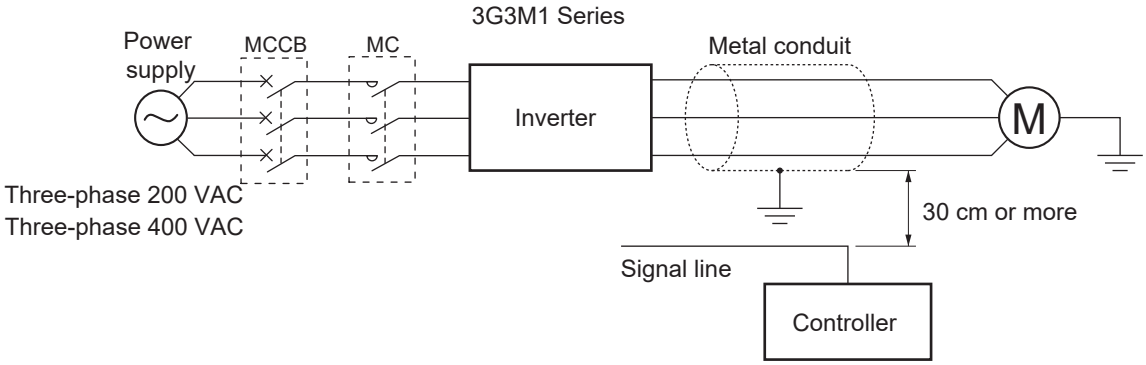
Connecting a noise filter to the output side of the inverter enables the reduction of radio noise and inductive noise.




| Noise | Description |
|---|---|
| Inductive noise | Produced by electromagnetic induction, this noise causes malfunction of control equipment due to noise in signal lines. |
| Radio noise | The electromagnetic waves emitted from the inverter body or cables cause noise in radio receivers. |

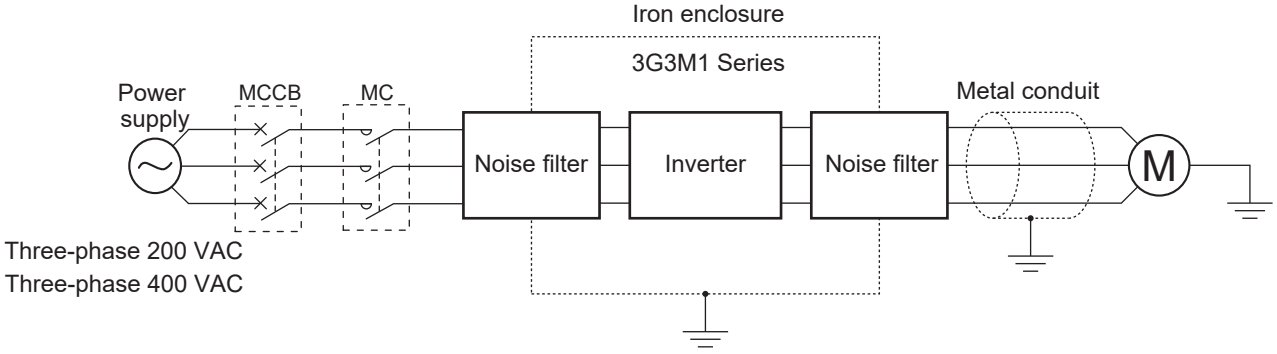
## Measures against inductive noise

In addition to the noise filter described above, you can suppress the inductive noise produced on the output side by connecting a bundle of wires through a grounded metal conduit. Moreover, moving the conduit 30 cm or more away from signal lines helps the reduction of induc- tive noise.




## Measures against radio noise

Besides the I/O wires, radio noise is radiated from the inverter itself.
This radio noise can be reduced by installing noise filters on both the input and output sides of the inverter and by installing and shielding the inverter body in a grounded iron enclosure etc. Keep the cables between the inverter and the motor as short as possible.



### Cable length between inverter and motor

If the length of the cables between the inverter and the motor is long, consider how to address the following problems.

- Voltage drop in output cables
  As the cable length between the inverter and the motor increases, the resistance in the cables becomes higher and accordingly the amount of voltage drop in the inverter output voltage becomes larger. This causes a decrease in the voltage that is applied to the motor, which results in a low output torque.
  If the cables are long, take measures to reduce the resistance, for example, by selecting cables whose wire diameter is larger than specified.
- Surge in long cables
  If the cable length exceeds 20 m, a surge voltage (approx. 1200 V max. for 400-V class) may be generated at the motor terminal depending on the stray capacitance or inductance of the cable, which may result in motor burnout.
  In particular, when using a 400-V class inverter with a cable length of over 20 m, it is recommended to use a dedicated inverter motor. Dedicated inverter motors are designed to support the above surge voltage level.
- Leakage current from output cables
  As the cable length between the inverter and the motor increases, stray capacitance increases between the inverter output and the ground. The increase in the stray capacitance on the output side of the inverter causes an increase of the high-frequency leakage current.
  This high-frequency leakage current may negatively affect on the current detector in the inverter output section or peripheral equipment.
  It is recommended to keep the wiring distance between the inverter and the motor at 100 m or shorter. If your system configuration requires the wiring distance of over 100 m, take measures to decrease the stray capacitance. The applicable measures are such as not wiring in a metal duct and using a separate cable for each phase.
  In addition, set a carrier frequency appropriate for the wiring distance between the inverter and the motor.

| Capacity | Wiring distance between inverter and motor |
|---|---|
| 3.7 kW max. | 50 m max. |
| 5.5 kW min. | 100 m max. |

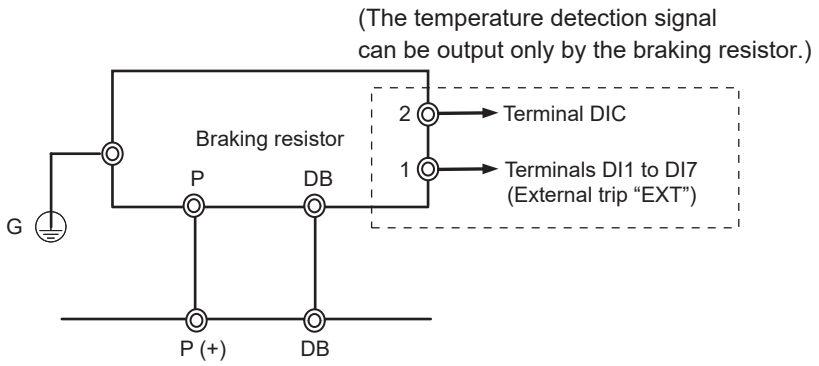
## External Braking Resistor Connection Terminal (P(+), DB)

When driving a load with a large inertia or a vertical axis, regenerated energy is fed back to the inverter when it is decelerating or generating downward movement.
If the amount of regenerative energy exceeds the amount allowable for the inverter, an overvoltage is detected. Use braking resistors to prevent this.

### Using built-in regenerative braking circuit

All models of the 3G3M1 Series Inverter have built-in regenerative braking circuit.
To improve the braking capacity, connect the external braking resistor to these terminals (P(+), DB).

- Wiring diagram



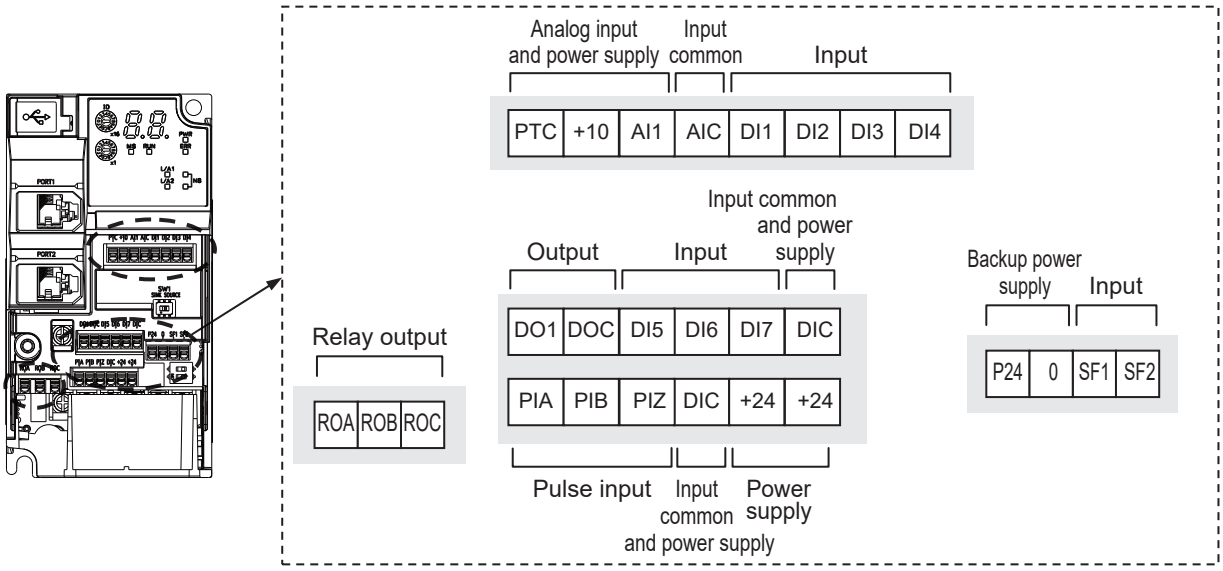

## 2-3-5 Wiring for Control Circuit Terminals

### Wiring for Control Circuit Terminals

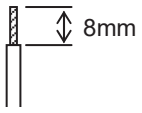
- The AIC terminal (common terminal of the analog input), DIC terminal (common terminal of the analog input) and DOC terminal (common terminal of the digital output) are mutually insulated from each other.
  Do not short-circuit or ground these common terminals.
  In addition, do not ground these common terminals via external equipment.
  When finished wiring, check the external equipment ground conditions.
- For wiring to the control circuit terminals, use twisted-pair shielded cables (recommended diameter: 0.75 $mm^2$). Connect the sheathed shielded cable to each common terminal. The cable length should be 20 m or shorter.
- Twist a cable connected to the terminal PTC (thermistor input) with a cable of the terminal AIC individually, and separate them from other AIC common cables. Since the current flowing through the thermistor is weak, separate the thermistor cable from main circuit cable (power cable). The thermistor connection cable should be 20 m or shorter.
- To use a relay for a multifunction output terminal, connect a surge-absorbing diode in parallel with the coil.
- The control circuit terminal block has three rows of terminals. Start wiring from the lower terminals. Wiring from the upper terminals makes it difficult to wire the lower terminals.

## Arrangement of Control Circuit Terminal Blocks

The arrangement of terminals on the control circuit terminal block is shown below.




| | Applicable wire | | |
|---|---|---|---|
| | **Solid wire $mm^2$ (AWG)** | **Stranded wire $mm^2$ (AWG)** | **Ferrule $mm^2$ (AWG)** |
| Other than below | 0.2 to 1.5 (AWG24 to 16) | 0.2 to 1.0 (AWG24 to 17) | 0.25 to 0.75 (AWG24 to 18) |
| ROA/ROB/ROC SF1/SF2 | 0.2 to 1.5 (AWG24 to 16) | 0.2 to 1.0 (AWG24 to 17) | 0.25 to 0.75 (AWG24 to 18) |

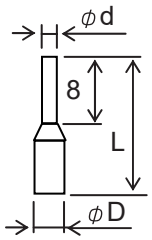



Sheath strip length should be approx. 8 mm for solid/ stranded wire

## Recommended Terminal

To improve ease of wiring and reliability in connection, it is recommended to use ferrules with the following specifications for signal wires.

| Wire size $mm^2$ (AWG) | Ferrule type*1 | L [mm] | ϕd [mm] | ϕD [mm] |
|---|---|---|---|---|
| 0.25 (24) | AI 0.25-8YE | 12.5 | 0.8 | 2.0 |
| 0.34 (22) | AI 0.34-8TQ | 12.5 | 0.8 | 2.0 |
| 0.5 (20) | AI 0.5-8WH | 14 | 1.1 | 2.5 |
| 0.75 (18) | AI 0.75-8GY | 14 | 1.3 | 2.8 |



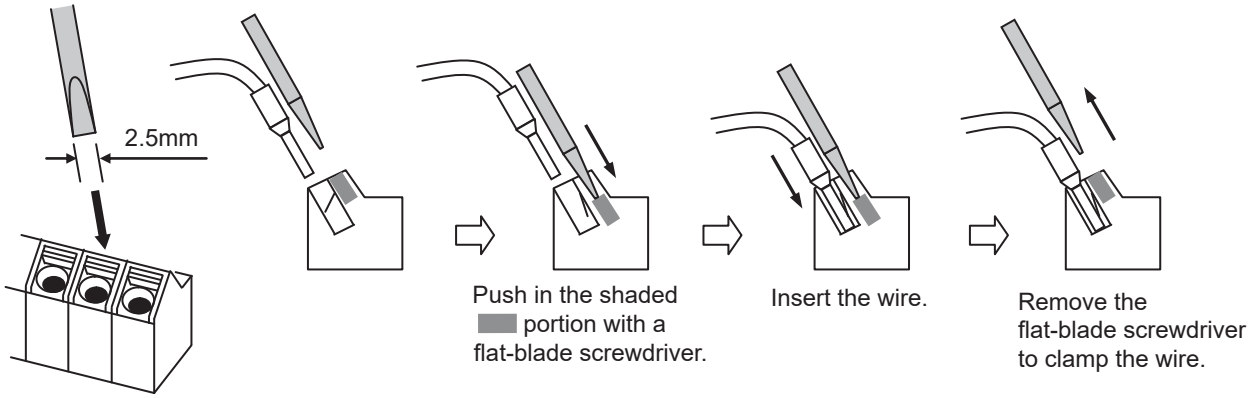

*1. Manufacturer: PHOENIX CONTACT Crimping tool: CRIMPFOX 6

## Wiring Method

***1*** Push in the orange colored portion of the control circuit terminal block with a flat-blade screw- driver (blade width: 2.5 mm max.) to open the wire insertion hole.

***2*** With the flat-blade screwdriver pushed in, insert the wire or ferrule into the wire insertion (round) hole.

**3** Remove the flat-blade screwdriver to clamp the wire.



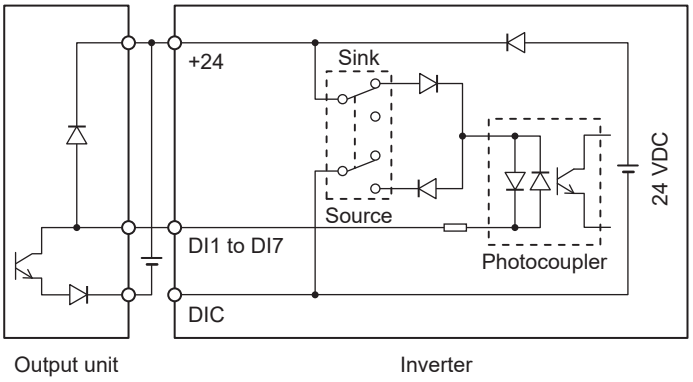

**Note** To disconnect, pull out the wire with the shaded ( ) portion pushed in with a flat-blade screwdriver.

## Selecting Input Control Logic

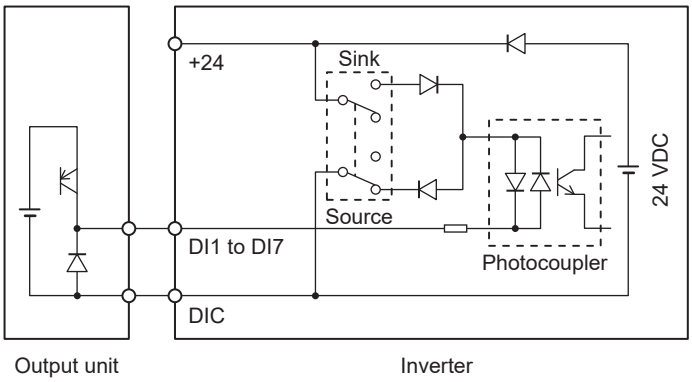
By factory default, the multifunction input terminals are set to sink logic (NPN).
To change the input control logic to source logic (PNP), switch SW1 to the SOURCE side.

## Multifunction Input Terminals and Programmable Controller Connection

### Sink logic

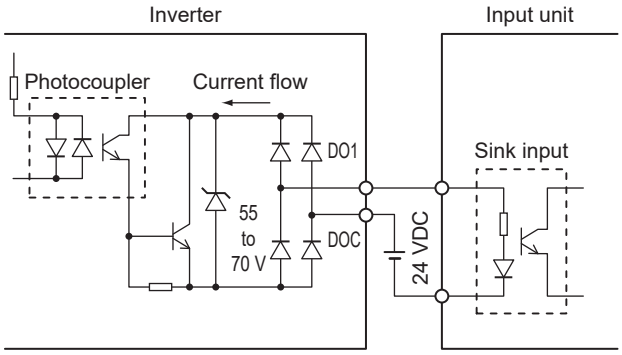


### Source logic

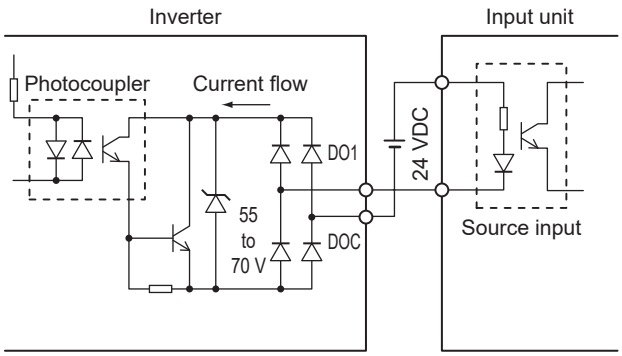



## Multifunction Output Terminals and Programmable Controller Connection

### Sink logic




### Source logic




## 2-3-6 Recommended Encoder and Its Wiring

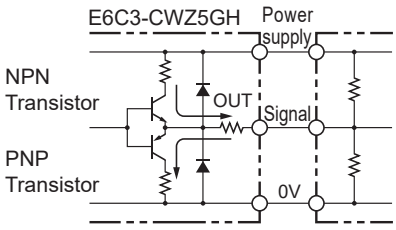
For the pulse train input function of the 3G3M1 Series inverter, be sure to use a complementary output type encoder.

In addition, for encoder cable connection, always use a shielded cable and connect it to the DIC terminal of the inverter's control circuit terminal block.

If an open collector output encoder is used, the inverter may not recognize the rotation in the forward or reverse direction. This is because, as the length of the encoder cable increases, its stray capacitance becomes larger, which causes the inverter to falsely recognize the crosstalk signal from the encoder.

### Complementary output

Complementary output is a method of outputting via two transistors.
The wiring is connected to the 0 V side when output is ON and to the power supply side when output is OFF.
This design does not allow the wiring to be left open (at high impedance) as in the case of open collector output encoders.
Therefore, this provides a stable output from the encoder.




### Recommended product

E6C3-CWZ5GH (Manufacturer: OMRON)

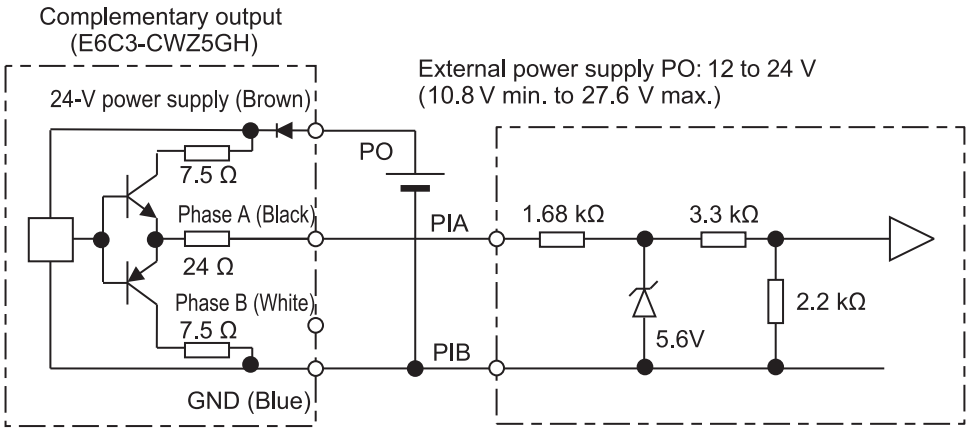
## Encoder Input

For pulse train input, use the pulse train input PIA and PIB terminals of the control circuit terminals. Be sure to use a complementary output type encoder.

## Wiring for Phase A and B 90° Phase Difference Pulse Train (d014 = 2 or 3)

Connect the phase A and B 90° phase difference pulse train as shown in the diagram below.

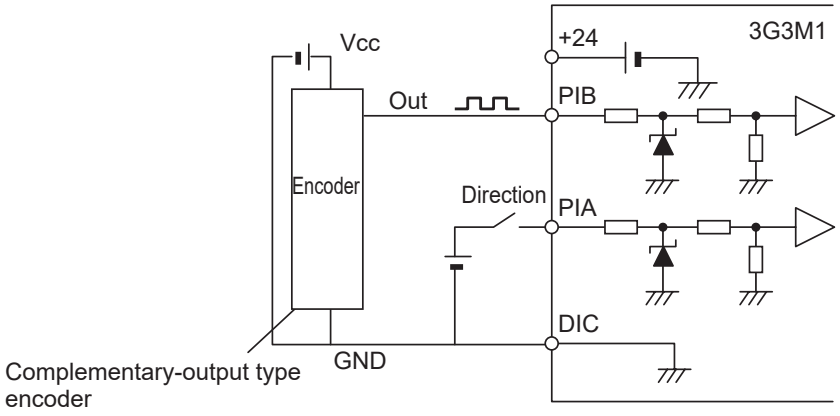
- Connect the phase A signal to the pulse input PIA terminal and the phase B signal to the pulse train input PIB terminal.
- The +24 V terminal of the inverter control circuit terminal block is for a 100 mA maximum 24 V power supply. This terminal can be used for the encoder power supply if the consumption current for the input terminals in use and the encoder power supply is allowable. However, note that this terminal must be isolated from any 24 V system power supply for other than the encoder and inverter.

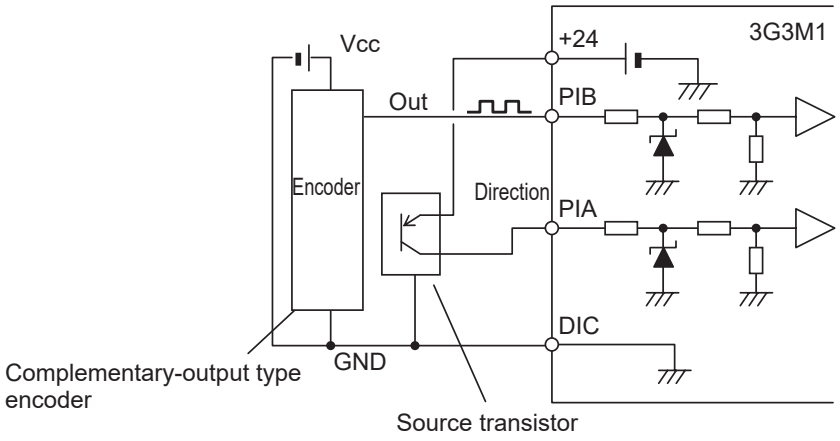


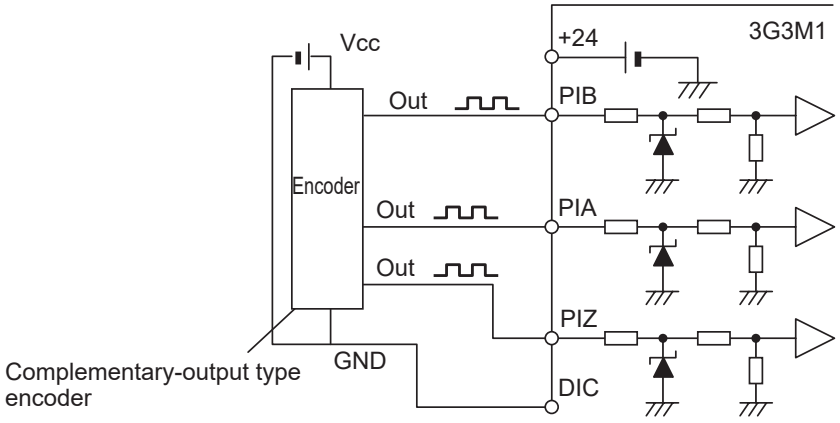
## Wiring for Single-phase Pulse Signal and Direction Signal (d014 = 0)

Connect the single-phase pulse signal or single-phase pulse + direction signal as shown in the diagram below.

- Connect the direction signal to the pulse train input PIA terminal and the single-phase pulse to the pulse train input PIB terminal.
- The +24 V terminal of the inverter control circuit terminal block is for a 100 mA maximum 24 V power supply. This terminal can be used for the encoder power supply if the consumption current for the input terminals in use and the encoder power supply is allowable. However, note that this terminal must be isolated from any 24 V system power supply for other than the encoder and inverter.



## Wiring for Forward Rotation Pulse/Reverse Rotation Pulse (d014 = 1)

Connect the forward rotation pulse/reverse rotation pulse as shown in the diagram below.

- Connect the forward rotation pulse to the pulse train input PIA terminal and the reverse rotation pulse to the pulse train input PIB terminal.
- The +24 V terminal of the inverter control circuit terminal block is for a 100 mA maximum 24 V power supply. This terminal can be used for the encoder power supply if the consumption current for the input terminals in use and the encoder power supply is allowable. However, note that this terminal must be isolated from any 24 V system power supply for other than the encoder and inverter.



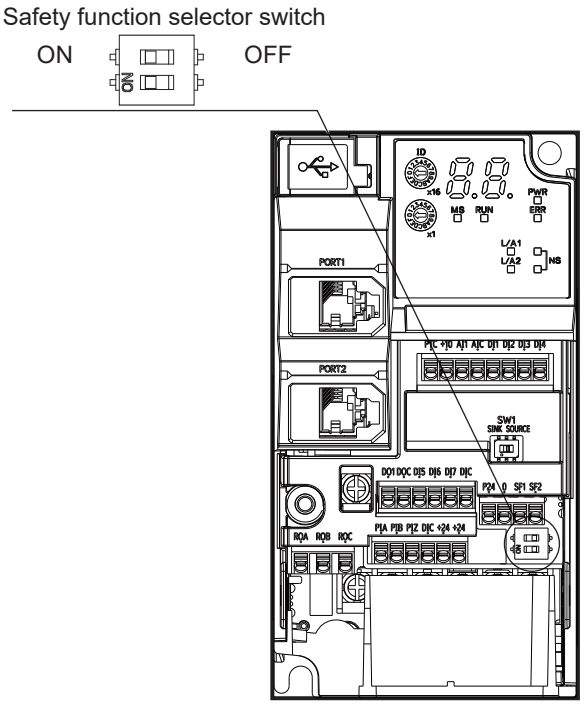
# 2-3-7 Safety Function

The safety function is designed so that the safety stop function of category 0 (uncontrolled stop) is used to meet the safety standards of PL-e under ISO 13849-1.
The safety input function allows the inverter output when current flows in both the terminals SF1 and SF2.
When the safety input function is activated, in compliance with the above standards, the output transistor operation of the inverter is stopped safely (by shutting off its output). As a result, the motor stops with free run.
For details, refer to *8-6 Safety Function* on page 8-61.

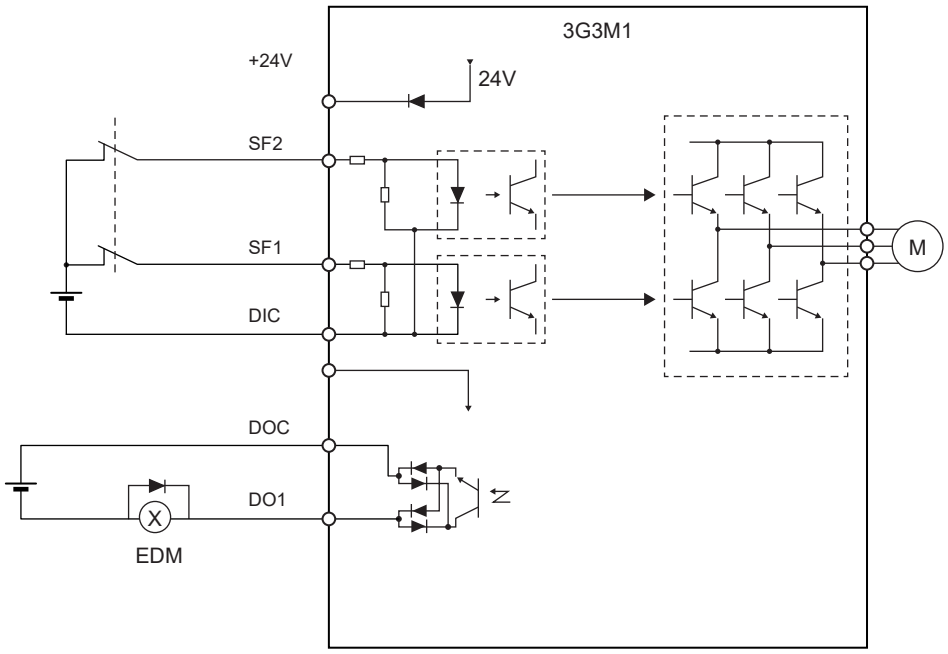
## Safety Function Settings

To use the safety function, it must be set beforehand. By default, the safety function is disabled.
Use of the safety function is enabled by turning SW9 OFF.
With the inverter power supply turned OFF, turn OFF the safety function selector switch SW9. When using EDM output (safety monitor output), set “102: EDM (safety monitor)” at the multifunction output terminal.

When the safety function is used→Both OFF
When the safety function is not used→Both ON
When only one is ON, the logic of the SF1 and SF2 signals no longer matches and this causes an ECF alarm.




## Wiring Example




In the factory default state, operation is always enabled by the short-circuit bars as shown in the figure above.

For details on connection with safety devices, refer to *8-6 Safety Function* on page 8-61.

# 2-4 Others

## 2-4-1 Compliance with EU Directives and UKCA

This section provides conditions that must be met for compliance with European EU Directives.
Take measures to meet the conditions shown here for the entire system as well as peripheral equipment.
For the system that incorporates this inverter, perform the final compliance verification separately on the whole system.

### Directives and Legislation

| EU Declaration of Conformity |
|---|
| OMRON declares that 3G3M1 Series conform with the requirements of the following EU Directive<br>EMC Directive 2014/30/EU<br>Machinery Directive 2006/42/EC |
| **UKCA Declaration of Conformity** |
| OMRON declares that 3G3M1 Series conform with the requirements of the following UK legislation<br>(2016 No.1091) Electromagnetic Compatibility Regulations<br>(2008 No.1597) Supply of Machinery (Safety) Regulations |

### Applicable Standards

The 3G3M1 Series complies with the following standards.

| Standard | Applicable standard |
|---|---|
| EMC | EN 61800-3:2004/A1:2012,<br>IEC 61800-3:2017 |
| Electrical Safety (Machinery Directive/LVD) | EN 61800-5-1:2007,<br>EN 61800-5-1:2007/A1:2017,<br>EN 61800-5-1:2007/A11:2021 |
| Functional Safety (Machinery Directive) | The safety functions in 3G3M1 Series are designed and manufactured in accordance with the following standards:<br>• EN 61800-5-2: 2017<br>• EN ISO 13849-1: 2023, PL e / Safety category 3 |

- This product is designed for industrial environments.
  If used in a residential environment, it may cause radio interference. In that case, it is necessary to take appropriate measures against radio interference.
- This product is not intended to be connected to a power grid that supplies residential facilities.

## Concepts of Compliance

**⚠ WARNING**

There are conditions for compliance with the EU Low Voltage Directive and Machinery Directive. Strictly observe the conditions listed in the instruction manual or user's manual.
Not doing so may result in a serious injury due to an electric shock or fire.



### EMC

OMRON products are the electrical devices incorporated and used in various machines or manufacturing equipment. For this reason, OMRON makes efforts to manufacture products that meet the related EMC standards so that the machines or equipment in which they are incorporated can easily comply with the EMC standards.
The 3G3M1 Series Inverter complies with EN61800-3 when installed and wired to equipment according to the methods described below. However, the customer's machines and equipment vary in type, and in addition, EMC performance depends on the configuration and electrical characteristics of mechanical parts, and the configuration, wiring and location of the control panel. This does not allow OMRON to verify compliance under the customer's usage conditions.
Please perform the final verification on the EMC compliance of your machines or the entire system at your own responsibility.

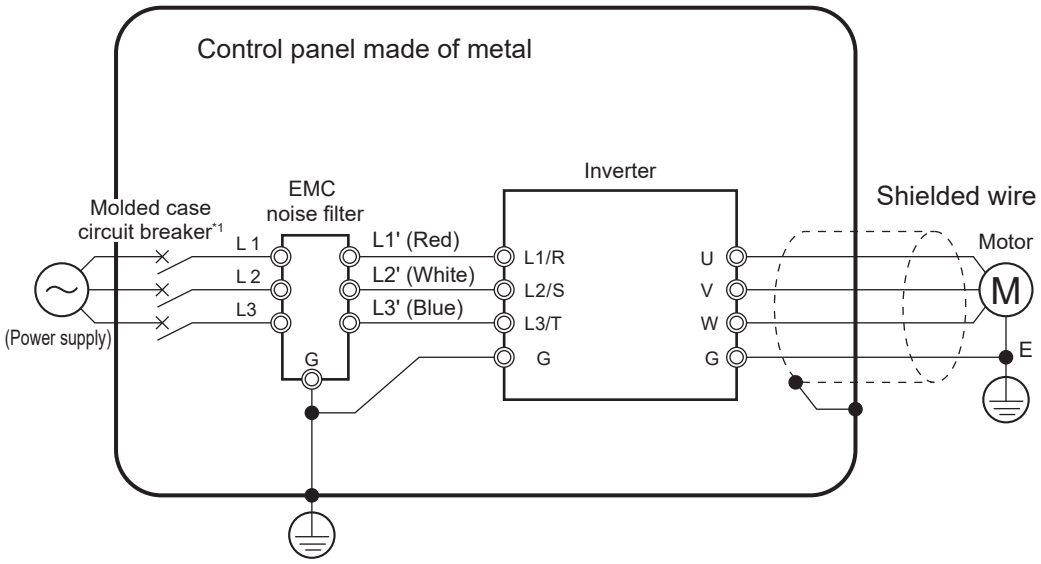
### EMC noise filters

OMRON is currently preparing a line up of EMC noise filters.

### Wiring for power supply

Keep the ground cable as short as possible.
Place the inverter and the noise filter on the same earth (ground) plate.
Always connect the power supply input terminals (L1/R, L2/S, L3/T) of the inverter to the power supply via an EMC noise filter.
Keep the cable between the inverter and the EMC noise filter as short as possible (40 cm maximum).

Connection Example



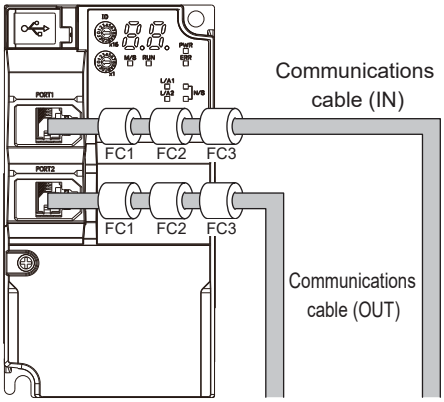

## Wiring between inverter and motor

For cables between the inverter and motor, be sure to use shield braided cables.
Keep the cables as short as possible.

## Wiring of communications cables

Install the 3 ferrite cores shown below near the communications connectors of the communications cables that are connected to the communications connector (IN) and the communications connector (OUT). (When the communications cables are not connected to the OUT side, IN side only)

| Symbol | Name | Manufacturer | Model |
|---|---|---|---|
| FC1, FC2, FC3 | Ferrite core | NEC TOKIN | ESD-SR-160 |

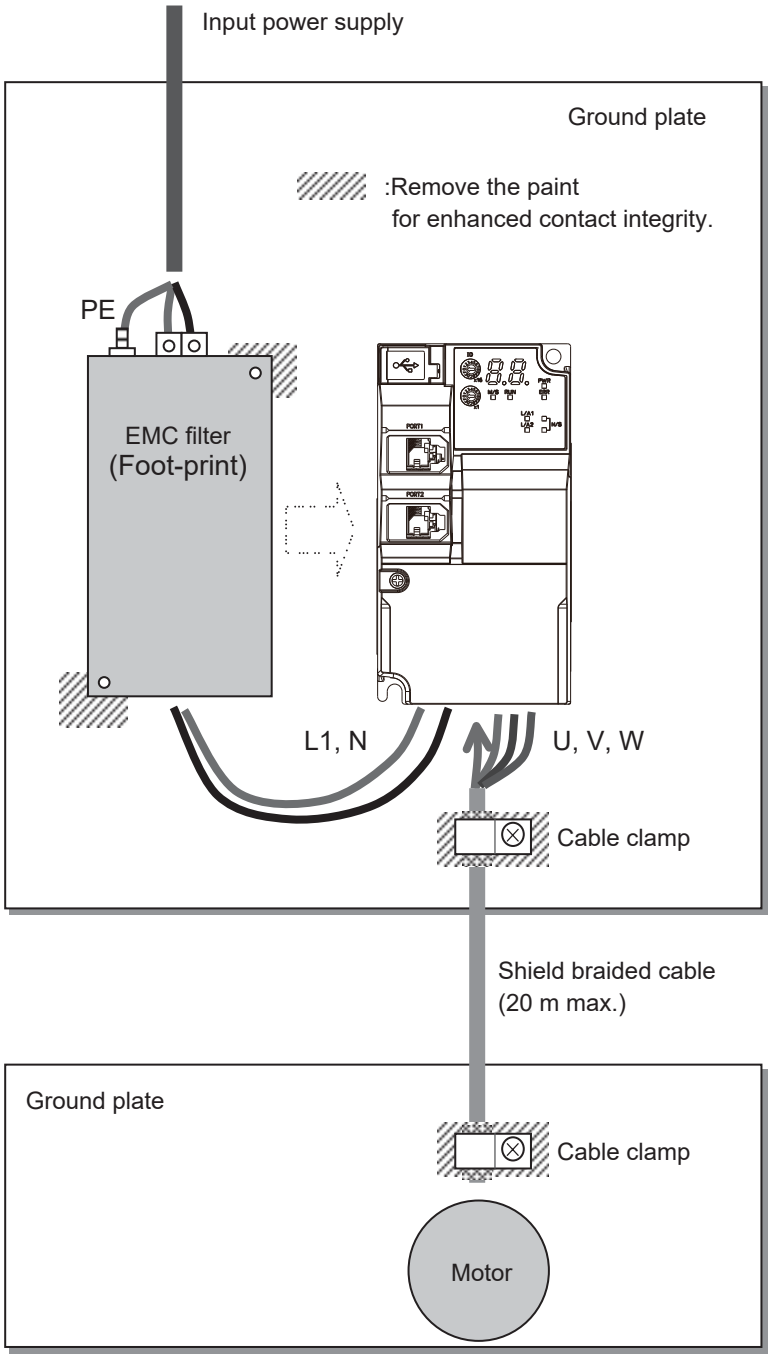



## Measures against noise for compliance with EMC Directive

- Keep the power cable of the inverter and the EMC noise filter wiring as short as possible. Use a shield braided cable.
- For the shield braided cable, use a tinned copper shielded cable with a shield factor of 85%.
- Be sure to connect the ground cable separately from the shielded cable. Use the ground cable as thick and short as possible to wire.

- Use shield braided cables for connection between the inverter and the motor. Keep the cables as short as possible at a length 20 m or less, with the cable shield grounded at each end. Installing a clamp filter near the inverter output terminals is an effective countermeasure.
- Ground the motor frame, the shield of the motor cable, and the terminal housing adequately. The motor terminal housing may not contact with the chassis due to the rubber bushing or the screw hole for motor ground terminal may be coated.
  Check the contact performance. If there is any problem, take measures to enhance contact performance.
- Use shielded cables for wiring to the control circuit terminal blocks and communications lines and ground the shield of each cable on the inverter side. Grounding the cables at each end may in- crease the effect.
- Connect the cable shield directly to a ground plate with a conductive cable clamp. At this time, keep the shield strip length as short as possible.
- Make the contact area between the EMC noise filter/inverter and the ground plate as large as possible to enhance contact performance. At this time, remove the paint etc. from the ground plate.
- For the control panel door, use a conductive gasket to improve the shielding effect.
- In the same control panel, do not install equipment that generates non-EMC-compliant electromagnetic waves.
- Avoid conductor loops that encompass large areas.
- As a measure against harmonic distortion, an AC/DC reactor or harmonic suppression equipment is required.
- Avoid placing noise-generating cables (such as power cables and motor cables of the inverter) in parallel with signal cables and allow a clearance of at least 25 cm between them.
  If you cannot avoid crossing two types of cables, keep them at right angles to each other.

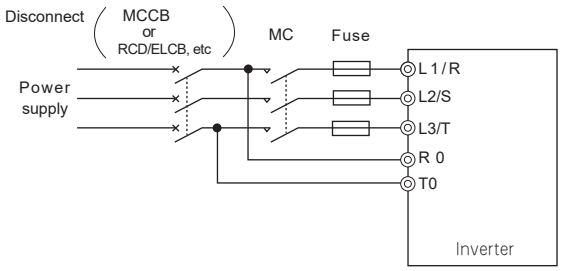
### Wiring example for single-phase 200-V class




### Low-voltage directive (electrical safety)

The 3G3M1 Series Inverter complies with EN61800-5-1 when installed and wired to equipment according to the methods described below.

- The 3G3M1 Series Inverter is an open type device. Be sure to install it inside the control panel.
- To satisfy electrical safety requirements, the inverter must be protected with fuses in case a short-circuiting accident occurs. Be sure to install fuses on the power supply side of the inverter. The fuses should be one of the product listed in the following section *Measures to comply with EU Low Voltage Directive* on page 2-72.
  - Use one set of fuses per inverter.




- The control power supply auxiliary input terminals (R0 and T0) are for models of motor capacity 18.5 kW or more.

- Use the crimp terminal with an insulation sleeve to connect to the main circuit terminals.

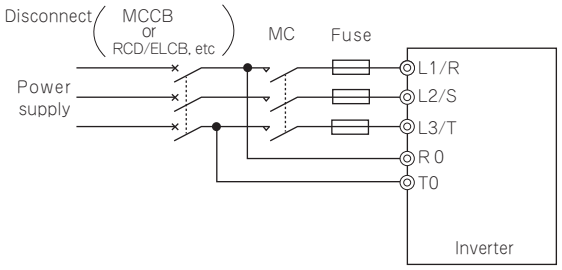
## Measures to comply with EU Low Voltage Directive

- **Be sure to ground the ground terminal ⏚ G. Do not use only an earth leakage circuit breaker* (RCD: Residual-current-operated protective device/ELCB: Earth Leakage Circuit Breaker) as protection against electric shock. Also, use ground cable of the size of the power line or larger diameter.**
  ***With overcurrent protection function**
- **To protect against high voltage that accompanies inverter damage and the risk of accidents, install a fuse having the rating specified in the table below on the power supply side.**
- **Breaking capacity 10 kA or more, rated voltage 500 V or less.**

| Power supply line | Standard applicable motor (kW) | Inverter model | Specifications | Fuse rating (A) |
|---|---|---|---|---|
| Three-phase 200V | 0.2 | - | HND | 50 (IEC 60269-4) |
| | | 3G3M1-A2002-EMP | HHD | 50 (IEC 60269-4) |
| | 0.4 | | HND | |
| | | 3G3M1-A2004-EMP | HHD | 50 (IEC 60269-4) |
| | 0.75 | | HND | |
| | | 3G3M1-A2007-EMP | HHD | 50 (IEC 60269-4) |
| | 1.1 | | HND | |
| | 1.5 | 3G3M1-A2015-EMP | HHD | 80 (IEC 60269-4) |
| | 2.2 | | HND | |
| | | 3G3M1-A2022-EMP | HHD | 125 (IEC 60269-4) |
| | 3 | | HND | |
| | 3.7 | 3G3M1-A2037-EMP | HHD | 125 (IEC 60269-4) |
| | 5.5 | | HND | |
| | | 3G3M1-A2055-EMP | HHD | 160 (IEC 60269-4) |
| | 7.5 | | HND | |
| | | 3G3M1-A2075-EMP | HHD | 200 (IEC 60269-4) |
| | 11 | | HND | |
| | | 3G3M1-A2110-EMP | HHD | 200 (IEC 60269-4) |
| | 15 | | HND | |
| | | 3G3M1-A2150-EMP | HHD | 250 (IEC 60269-4) |
| | 18.5 | | HND | |
| | | 3G3M1-A2185-EMP | HHD | 250 (IEC 60269-4) |
| | 22 | | HND | |

| Power supply line | Standard applicable motor (kW) | Inverter model | Specifications | Fuse rating (A) |
|---|---|---|---|---|
| Three-phase 400V | 0.4 | 3G3M1-A4004-EMP | HHD | 50 (IEC 60269-4) |
| | 0.75 | | HND | |
| | | | HD | |
| | | | ND | |
| | | 3G3M1-A4007-EMP | HHD | 50 (IEC 60269-4) |
| | 1.1 | | HND | |
| | | | HD | |
| | 1.5 | | ND | |
| | | 3G3M1-A4015-EMP | HHD | 50 (IEC 60269-4) |
| | 2.2 | | HND | |
| | | | HD | |
| | | | ND | |
| | | 3G3M1-A4022-EMP | HHD | 63 (IEC 60269-4) |
| | 3.0 | | HND | |
| | | | HD | |
| | | | ND | |
| | | 3G3M1-A4030-EMP | HHD | 63 (IEC 60269-4) |
| | 4.0 | | HND | |
| | | | HD | |
| | | | ND | |
| | | 3G3M1-A4040-EMP | HHD | 63 (IEC 60269-4) |
| | 5.5 | | HND | |
| | | | HD | |
| | | | ND | |
| | | 3G3M1-A4055-EMP | HHD | 100 (IEC 60269-4) |
| | 7.5 | | HND | |
| | | | HD | |
| | | 3G3M1-A4075-EMP | HHD | 100 (IEC 60269-4) |
| | 11 | 3G3M1-A4055-EMP | ND | 100 (IEC 60269-4) |
| | | 3G3M1-A4075-EMP | HND | 100 (IEC 60269-4) |
| | | | HD | |
| | | 3G3M1-A4110-EMP | HHD | 125 (IEC 60269-4) |
| | 15 | 3G3M1-A4075-EMP | ND | 100 (IEC 60269-4) |
| | | 3G3M1-A4110-EMP | HND | 125 (IEC 60269-4) |
| | | | HD | |
| | | 3G3M1-A4150-EMP | HHD | 160 (IEC 60269-4) |

| Power supply line | Standard applicable motor (kW) | Inverter model | Specifications | Fuse rating (A) |
|---|---|---|---|---|
| Three-phase 400V | 18.5 | 3G3M1-A4110-EMP | ND | 125 (IEC 60269-4) |
| | | 3G3M1-A4150-EMP | HND | 160 (IEC 60269-4) |
| | | | HD | |
| | | 3G3M1-A4185-EMP | HHD | 160 (IEC 60269-4) |
| | 22 | 3G3M1-A4150-EMP | ND | 160 (IEC 60269-4) |
| | | 3G3M1-A4185-EMP | HND | 160 (IEC 60269-4) |
| | | | HD | |
| | | 3G3M1-A4220-EMP | HHD | 200 (IEC 60269-4) |
| | 30 | 3G3M1-A4185-EMP | ND | 160 (IEC 60269-4) |
| | | 3G3M1-A4220-EMP | HND | 200 (IEC 60269-4) |
| | | | HD | |
| | 37 | | ND | |
| Single-phase 200V | 0.2 | 3G3M1-AB002-EMP | HHD | 50 (IEC 60269-4) |
| | 0.4 | | HND | |
| | | 3G3M1-AB004-EMP | HHD | 50 (IEC 60269-4) |
| | 0.55 | | HND | |
| | 0.75 | 3G3M1-AB007-EMP | HHD | 50 (IEC 60269-4) |
| | 1.1 | | HND | |
| | 1.5 | 3G3M1-AB015-EMP | HHD | 125 (IEC 60269-4) |
| | 2.2 | | HND | |
| | | 3G3M1-AB022-EMP | HHD | 125 (IEC 60269-4) |
| | 3 | | HND | |
| | 3.7 | 3G3M1-AB037-EMP | HHD | 160 (IEC 60269-4) |




- **Use a molded case circuit breaker (MCCB), residual current device (RCD) or earth leakage circuit breaker (ELCB), and magnetic contactor (MC) that are compliance with EN or IEC Standards.**
- **When using a residual current device (RCD) or earth leakage circuit breaker (ELCB) as protection against electric shock through direct or indirect contact with the power line or node, be sure to install a RCD or ELCB of type B (DC capable) model on the input side (primary side) of the inverter.**

| Power supply line | Standard applicable motor (kW) | Inverter model | Specifications | Molded case circuit breaker (MCCB)*1 | | Earth leakage circuit breaker (RCD/ ELCB)*1 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Rated current | | Rated current | | Sensitivity current*2 | Max. fault loop impedance |
| | | | | With DC reactor | Without DC reactor | With DC reactor | Without DC reactor | | |
| Three-phase 200V | 0.2 | 3G3M1-A2002-EMP | HHD | 5 | 5 | 5 | 5 | 30 mA | 200 Ω |
| | 0.4 | | HND | | | | | | |
| | | 3G3M1-A2004-EMP | HHD | | | | | | |
| | 0.75 | | HND | | 10 | | 10 | | |
| | | 3G3M1-A2007-EMP | HHD | | | | | | |
| | 1.1 | | HND | 10 | | 10 | | | |
| | 1.5 | 3G3M1-A2015-EMP | HHD | | 15 | | 15 | | |
| | 2.2 | | HND | | 20 | | 20 | | |
| | | 3G3M1-A2022-EMP | HHD | | | | | | |
| | 3 | | HND | 20 | 30 | 20 | 30 | | |
| | 3.7 | 3G3M1-A2037-EMP | HHD | | | | | | |
| | 5.5 | | HND | 30 | 40 | 30 | 40 | | |
| | | 3G3M1-A2055-EMP | HHD | | 50 | | 50 | | |
| | 7.5 | | HND | 40 | 75 | 40 | 75 | | |
| | | 3G3M1-A2075-EMP | HHD | | | | | | |
| | 11 | | HND | 50 | 100 | 50 | 100 | | |
| | | 3G3M1-A2110-EMP | HHD | | | | | | |
| | 15 | | HND | 75 | 125 | 75 | 125 | | |
| | | 3G3M1-A2150-EMP | HHD | | | | | | |
| | 18.5 | | HND | 100 | 150 | 100 | 150 | | |
| | | 3G3M1-A2185-EMP | HHD | | | | | | |
| | 22 | | HND | | 175 | | 175 | | |

*1. The frame size and model of MCCB, RCD or ELCB (with overcurrent protection function) differ according to the capacity of the power transformer. For details on selection method, refer to related technical data.

*2. The sensitivity current setting of the TT system differs according to each country. Follow the instructions of the relevant authority.

| Power supply line | Standard applicable motor (kW) | Inverter model | Specifications | Molded case circuit breaker (MCCB)*1 | | Earth leakage circuit breaker (RCD/ ELCB)*1 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Rated current | | Rated current | | Sensitivity current*2 | Max. fault loop impedance |
| | | | | With DC reactor | Without DC reactor | With DC reactor | Without DC reactor | | |
| Three - phase 400V | 0.4 | 3G3M1-A4004-EMP | HHD | 5 | 5 | 5 | 5 | 30 mA | 20 Ω |
| | 0.75 | | HND | | | | | | |
| | | | HD | | | | | | |
| | | | ND | | | | | | |
| | | 3G3M1-A4007-EMP | HHD | | | | | | |
| | 1.1 | | HND | | | | | | |
| | | | HD | | | | | | |
| | 1.5 | | ND | | | | | | |
| | | 3G3M1-A4015-EMP | HHD | | 10 | | 10 | | |
| | 2.2 | | HND | | | | | | |
| | | | HD | | | | | | |
| | | | ND | | | | | | |
| | | 3G3M1-A4022-EMP | HHD | 10 | 15 | 10 | 15 | | |
| | 3.0 | | HND | | | | | | |
| | | | HD | | | | | | |
| | | | ND | | | | | | |
| | | 3G3M1-A4030-EMP | HHD | | | | | | |
| | 4.0 | | HND | | 20 | | 20 | | |
| | | | HD | | | | | | |
| | | | ND | | | | | | |
| | | 3G3M1-A4040-EMP | HHD | | | | | | |
| | 5.5 | | HND | 15 | 30 | 15 | 30 | | |
| | | | HD | | | | | | |
| | | | ND | | | | | | |
| | | 3G3M1-A4055-EMP | HHD | | | | | | |
| | 7.5 | | HND | 20 | 40 | 20 | 40 | | |
| | | 3G3M1-A4075-EMP | HD | | | | | | |
| | | | HHD | | | | | | |
| | 11 | 3G3M1-A4055-EMP | ND | 30 | 50 | 30 | 50 | | |
| | | 3G3M1-A4075-EMP | HND | | | | | | |
| | | | HD | | | | | | |
| | | 3G3M1-A4110-EMP | HHD | | | | | | |

| Power supply line | Standard applicable motor (kW) | Inverter model | Specifications | Molded case circuit breaker (MCCB)*1 | | Earth leakage circuit breaker (RCD/ ELCB)*1 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Rated current | | Rated current | | Sensitivity current*2 | Max. fault loop impedance |
| | | | | With DC reactor | Without DC reactor | With DC reactor | Without DC reactor | | |
| Three - phase 400V | 15 | 3G3M1-A4075-EMP | ND | 40 | 60 | 40 | 60 | 100mA | 20 Ω |
| | | 3G3M1-A4110-EMP | HND | | | | | | |
| | | | HD | | | | | | |
| | | 3G3M1-A4150-EMP | HHD | | | | | | |
| | 18.5 | 3G3M1-A4110-EMP | ND | | 75 | | 75 | | |
| | | 3G3M1-A4150-EMP | HND | | | | | | |
| | | | HD | | | | | | |
| | | 3G3M1-A4185-EMP | HHD | | | | | | |
| | 22 | 3G3M1-A4150-EMP | ND | 50 | 100 | 50 | 100 | | |
| | | 3G3M1-A4185-EMP | HND | | | | | | |
| | | | HD | | | | | | |
| | | 3G3M1-A4220-EMP | HHD | | | | | | |
| | 30 | 3G3M1-A4185-EMP | ND | 75 | 125 | 75 | 125 | | |
| | | 3G3M1-A4220-EMP | HND | | | | | | |
| | | | HD | | | | | | |
| | 37 | | ND | 100 | | 100 | | | |

*1. The frame size and model of MCCB, RCD or ELCB (with overcurrent protection function) differ according to the capacity of the power transformer. For details on selection method, refer to related technical data.

*2. The sensitivity current setting of the TT system differs according to each country. Follow the instructions of the relevant authority.

| Power supply line | Standard applicable motor (kW) | Inverter model | Specifications | Molded case circuit breaker (MCCB)*1 | | Earth leakage circuit breaker (RCD/ ELCB)*1 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Rated current | | Rated current | | Sensitivity current*2 | Max. fault loop impedance |
| | | | | With DC reactor | Without DC reactor | With DC reactor | Without DC reactor | | |
| Single-phase 200V | 0.2 | 3G3M1-AB002-EMP | HHD | 5 | 5 | 5 | 5 | 30 mA | 200 Ω |
| | 0.4 | | HND | | 10 | | 10 | | |
| | | 3G3M1-AB004-EMP | HHD | | | | | | |
| | 0.55 | | HND | 10 | | 10 | | | |
| | 0.75 | 3G3M1-AB007-EMP | HHD | | 15 | | 15 | | |
| | 1.1 | | HND | 15 | 20 | 15 | 20 | | |
| | 1.5 | 3G3M1-AB015-EMP | HHD | | | | | | |
| | 2.2 | | HND | 30 | 30 | 30 | 30 | | |
| | | 3G3M1-AB022-EMP | HHD | | | | | | |
| | 3 | | HND | | 40 | | 40 | | |
| | 3.7 | 3G3M1-AB037-EMP | HHD | 40 | 60 | 40 | 60 | | |

*1. The frame size and model of MCCB, RCD or ELCB (with overcurrent protection function) differ according to the capacity of the power transformer. For details on selection method, refer to related technical data.

*2. The sensitivity current setting of the TT system differs according to each country. Follow the instructions of the relevant authority.

- **Use the inverter in an environment that does not exceed pollution degree 2. In pollution degree 3 or 4 environments, install the inverter in a panel that satisfies IP rating IP54 or higher.**
- **To prevent operators from electric shock caused by live parts, install the inverter, AC reactor (ACR) or DC reactor (DCR), and input filter or output filter inside a panel with IP2X or higher. When an operator can easily touch the panel, ensure that the protection grade of the top surface of the panel is IP4X or higher.**
- **Do not directly connect copper wire to the ground terminal. Use tin-plated or equivalent-plated crimped terminals for connections.**
- **When the inverter is used at locations 2,000 m or higher above sea level, the insulation of the control circuit is the basic insulation. The inverter cannot be used at locations 3,000 m above sea level.**
- **Use wires stipulated in IEC60364-5-52.**

| Power supply line | Standard applicable motor (kW) | Inverter model | Specifications | Molded case circuit breaker (MCCB) or earth leakage circuit breaker (RCD/ELCB) rated current[*1] | | Recommended wire size ($mm^2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | For main circuit | | | | | | | For control circuit terminal | Control power supply auxiliary input R0, T0 |
| | | | | | | Main power supply input [L1/R, L2/S, L3/T][*2] | | Inverter ground [⏚] [*2*3] | | Inverter output [U, V, W][*2] | For DC reactor connection [P1, P(+)] | For braking resistor connection [P(+), DB][*2] | | |
| | | | | With DC reactor | Without DC reactor | With DC reactor | Without DC reactor | With DC reactor | Without DC reactor | | | | | |
| Three - phase 200V | 0.2 | 3G3M1-A2002-EMP | HHD | 5 | 5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 0.75 | - |
| | 0.4 | | HND | | | | | | | | | | | |
| | | 3G3M1-A2004-EMP | HHD | | | | | | | | | | | |
| | 0.75 | | HND | | 10 | | | | | | | | | |
| | | 3G3M1-A2007-EMP | HHD | | | | | | | | | | | |
| | 1.1 | | HND | 10 | | | | | | | | | | |
| | 1.5 | 3G3M1-A2015-EMP | HHD | | 15 | | | | | | | | | |
| | 2.2 | | HND | | 20 | | | | | | | | | |
| | | 3G3M1-A2022-EMP | HHD | | | | | | | | | | | |
| | 3 | | HND | 20 | 30 | | | | | | | | | |
| | 3.7 | 3G3M1-A2037-EMP | HHD | | | | 4 | | 4 | | | | | |
| | 5.5 | | HND | 30 | 40 | | 6 | | 6 | | 4 | | | |
| | | 3G3M1-A2055-EMP | HHD | | 50 | 4 | | 4 | | 4 | | | | |
| | 7.5 | | HND | 40 | 75 | 6 | 10 | 6 | 10 | 6 | 10 | | | |
| | | 3G3M1-A2075-EMP | HHD | | | | | | | | | | | |
| | 11 | | HND | 50 | 100 | 10 | 16 | 10 | 16 | 10 | 16 | | | |
| | | 3G3M1-A2110-EMP | HHD | | | | | | | | | | | |
| | 15 | | HND | 75 | 125 | 16 | 25 | 16 | 16 | 16 | 25 | | | |
| | | 3G3M1-A2150-EMP | HHD | | | | | | | | | | | |
| | 18.5 | | HND | 100 | 150 | 25 | 35 | | | 25 | 35 | | | |
| | | 3G3M1-A2185-EMP | HHD | | | | | | | | | | | 2.5 |
| | 22 | | HND | | 175 | 35 | 50 | | 25 | 35 | | | | |

*1. The frame size and model of MCCB, RCD or ELCB (with overcurrent protection function) differ according to the capacity of the power transformer. For details on selection method, refer to related technical data.

*2. The recommended size of wire to the main circuit terminal is the size when PVC wire having an allowable temperature of 70°C and a rated voltage of 600 V is used, and the ambient temperature is 40°C.

*3. Only one wire of recommended size can be connected to the ground terminal.

| Power supply line | Standard applicable motor (kW) | Inverter model | Specifications | Molded case circuit breaker (MCCB) or earth leakage circuit breaker (RCD/ELCB) rated current[*1] | | Recommended wire size ($mm^2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | For main circuit | | | | | | | For control circuit terminal | Control power supply auxiliary input R0, T0 |
| | | | | | | Main power supply input [L1/R, L2/S, L3/T][*2] | | Inverter ground [⏚][*2*3] | | Inverter output [U, V, W][*2] | For DC reactor connection [P1, P(+)] | For braking resistor connection [P(+), DB][*2] | | |
| | | | | With DC reactor | Without DC reactor | With DC reactor | Without DC reactor | With DC reactor | Without DC reactor | | | | | |
| Three - phase 400V | 0.4 | 3G3M1-A4004-EMP | HHD | 5 | 5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 0.75 | - |
| | 0.75 | | HND | | | | | | | | | | | |
| | | | HD | | | | | | | | | | | |
| | | | ND | | | | | | | | | | | |
| | | 3G3M1-A4007-EMP | HHD | | | | | | | | | | | |
| | 1.1 | | HND | | | | | | | | | | | |
| | | | HD | | | | | | | | | | | |
| | 1.5 | | ND | | | | | | | | | | | |
| | | 3G3M1-A4015-EMP | HHD | | 10 | | | | | | | | | |
| | 2.2 | | HND | | | | | | | | | | | |
| | | | HD | | | | | | | | | | | |
| | | | ND | | | | | | | | | | | |
| | | 3G3M1-A4022-EMP | HHD | 10 | 15 | | | | | | | | | |
| | 3.0 | | HND | | | | | | | | | | | |
| | | | HD | | | | | | | | | | | |
| | | | ND | | | | | | | | | | | |
| | | 3G3M1-A4030-EMP | HHD | | | | | | | | | | | |
| | 4.0 | | HND | | 20 | | | | | | | | | |
| | | | HD | | | | | | | | | | | |
| | | | ND | | | | | | | | | | | |
| | | 3G3M1-A4040-EMP | HHD | | | | | | | | | | | |
| | 5.5 | | HND | 15 | 30 | | | | | | | | | |
| | | | HD | | | | | | | | | | | |
| | | | ND | | | | | | | | | | | |
| | | 3G3M1-A4055-EMP | HHD | | | | | | | | | | | |
| | 7.5 | | HND | 20 | 40 | | 4 | | 4 | | | | | |
| | | | HD | | | | | | | | | | | |
| | | 3G3M1-A4075-EMP | HHD | | | | | | | | | | | |

| Power supply line | Standard applicable motor (kW) | Inverter model | Specifications | Molded case circuit breaker (MCCB) or earth leakage circuit breaker (RCD/ELCB) rated current[*1] | | Recommended wire size ($mm^2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | For main circuit | | | | | | | For control circuit terminal | Control power supply auxiliary input R0, T0 |
| | | | | | | Main power supply input [L1/R, L2/S, L3/T][*2] | | Inverter ground [⏚][*2*3] | | Inverter output [U, V, W][*2] | For DC reactor connection [P1, P(+)] | For braking resistor connection [P(+), DB][*2] | | |
| | | | | With DC reactor | Without DC reactor | With DC reactor | Without DC reactor | With DC reactor | Without DC reactor | | | | | |
| Three - phase 400 V | 11 | 3G3M1-A4055-EMP | ND | 30 | 50 | 4 | 6 | 4 | 6 | 4 | 4 | 2.5 | 0.75 | - |
| | | 3G3M1-A4075-EMP | HND | | | | | | | | | | | |
| | | | HD | | | | | | | | | | | |
| | | 3G3M1-A4110-EMP | HHD | | | | 10 | | 10 | | | | | |
| | 15 | 3G3M1-A4075-EMP | ND | 40 | 69 | 6 | | 6 | | 6 | 10 | | | |
| | | 3G3M1-A4110-EMP | HND | | | | | | | | | | | |
| | | | HD | | | | | | | | | | | |
| | | 3G3M1-A4150-EMP | HHD | | | | | | | | | | | |
| | 18.5 | 3G3M1-A4110-EMP | ND | | 75 | 10 | 16 | 10 | 16 | 10 | | | | |
| | | 3G3M1-A4150-EMP | HND | | | | | | | | | | | |
| | | | HD | | | | | | | | | | | |
| | | 3G3M1-A4185-EMP | HHD | | | | | | | | | | | 2.5 |
| | 22 | 3G3M1-A4075-EMP | ND | 50 | 100 | | | | | | 16 | | | - |
| | | 3G3M1-A4185-EMP | HND | | | | | | | | | | | 2.5 |
| | | | HD | | | | | | | | | | | |
| | | 3G3M1-A4220-EMP | HHD | | | | | | | | | | | |
| | 30 | 3G3M1-A4185-EMP | ND | 75 | 125 | 16 | 25 | 16 | | 16 | 25 | | | |
| | | 3G3M1-A4220-EMP | HND | | | | | | | | | | | |
| | | | HD | | | | | | | | | | | |
| | 37 | | ND | 100 | | 25 | 35 | | | 25 | | | | |

*1. The frame size and model of MCCB, RCD or ELCB (with overcurrent protection function) differ according to the capacity of the power transformer. For details on selection method, refer to related technical data.

*2. The recommended size of wire to the main circuit terminal is the size when PVC wire having an allowable temperature of 70°C and a rated voltage of 600 V is used, and the ambient temperature is 40°C.

*3. Only one wire of recommended size can be connected to the ground terminal.

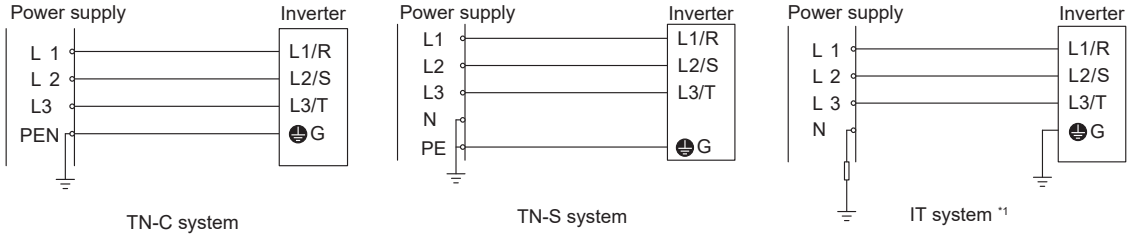
| Power supply line | Standard applicable motor (kW) | Inverter model | Specifications | Molded case circuit breaker (MCCB) or earth leakage circuit breaker (RCD/ELCB) rated current*1 | | Recommended wire size ($mm^2$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | For main circuit | | | | | | | For control circuit terminal | Control power supply auxiliary input R0, T0 |
| | | | | | | Main power supply input [L1/R, L2/S, L3/T]*2 | | Inverter ground [⏚]*2*3 | | Inverter output [U, V, W]*2 | For DC reactor connection [P1, P(+)] | For braking resistor connection [P(+), DB]*2 | | |
| | | | | With DC reactor | Without DC reactor | With DC reactor | Without DC reactor | With DC reactor | Without DC reactor | | | | | |
| Single-phase 200 V | 0.2 | 3G3M1-AB002-EMP | HHD | 5 | 5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 0.75 | - |
| | 0.4 | | HND | | 10 | | | | | | | | | |
| | | 3G3M1-AB004-EMP | HHD | | | | | | | | | | | |
| | 0.55 | | HND | 10 | | | | | | | | | | |
| | 0.75 | 3G3M1-AB007-EMP | HHD | | 15 | | | | | | | | | |
| | 1.1 | | HND | 15 | 20 | | | | | | | | | |
| | 1.5 | 3G3M1-AB015-EMP | HHD | | | | | | | | | | | |
| | 2.2 | | HND | 30 | 30 | | 4 | | 4 | | 4 | | | |
| | | 3G3M1-AB022-EMP | HHD | 20 | | | | | | | | | | |
| | 3.0 | | HND | 30 | 40 | 4 | | 4 | | | 6 | | | |
| | 3.7 | 3G3M1-AB037-EMP | HHD | 40 | 60 | 6 | 10 | 6 | 10 | | 10 | | | |

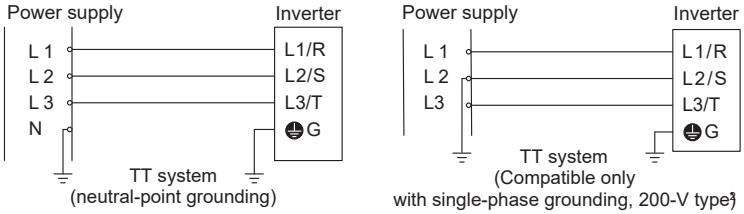
*1. The frame size and model of MCCB, RCD or ELCB (with overcurrent protection function) differ according to the capacity of the power transformer. For details on selection method, refer to related technical data.

*2. The recommended size of wire to the main circuit terminal is the size when PVC wire having an allowable temperature of 70°C and a rated voltage of 600 V is used, and the ambient temperature is 40°C.

*3. Only one wire of recommended size can be connected to the ground terminal.

- **Use this product on the following power supply system.**






*1. The following IT system power supply is supported.

| | |
|---|---|
| When the power supply system is not grounded at all | The insulation between the control interface and the main circuit of the inverter is the basic insulation. Accordingly, do not connect the SELV circuit directly from an external controller. (Connect using additional insulation.)<br>Install a ground fault detector, and cut off the power supply within five seconds of a ground fault. |
| When the neutral point is grounded through an impedance | |
| When a single phase of the power supply is grounded through an impedance | Not supported. |

*2. TT systems to which a single phase of a 400 V power supply is directly grounded are not supported.

- A solid-state motor overload protection function (motor overload protection by electronic thermal relay) is mounted on each model. The protection level can be set at objects F010 to F012
- Thermal memory function is not supported.
-

## Compliance with EMC Directive and Low Voltage Directive

(Manufacturer)

Fuji Electric Co., Ltd.
5520, Minami Tamagaki-cho, Suzuka-city, Mie 513-8633, Japan

(Importer)

OMRON Europe B.V. (Importer in EU)

Wegalaan 67-69, 2132 JD Hoofddorp, The Netherlands

Cautions when exporting to Europe

- Not all OMRON products in Europe are imported through the above importer. When a different importer is exporting OMRON products to Europe, those importer is responsible to clarify their name and address as an importer and clearly indicate to the customer.

## Ecodesign Directive

We provide the VSD efficiency information regarding to motor regulation.
For details, please visit the following website.
https://industrial.omron.eu/en/company-info/environmental/ecodesign-directive



## 2-4-2 UL/cUL Standards Cautions

**⚠ Caution**

UL and cUL compliance is subject to conditions. Strictly observe the conditions listed in the instruction manual or user's manual.
Not doing so may result in fire or accidents.

The warnings and instructions in this section summarizes the procedures necessary to ensure an inverter installation complies with Underwriters Laboratories guidelines.
Applicable Standards: UL61800-5-1, C22.2 No.274-17

- Use UL certified 60/75°C Cu wire only.
- Use Class1 wire for control circuits.
- This inverter is suitable for use on circuits where the delivering current (SCCR) is limited to 100 kA or less when protected by external Semiconductor Fuse with UL 61800-5-1 recognition. See next section for details of fuses.
- This inverter should be installed in an environment of pollution degree 2 and an overvoltage class III.
- Maximum surrounding air temperature is as below.

| Inverter Type | HHD/HND | HD/ND |
|---|---|---|
| 3G3M1-A2002-EMP, 3G3M1-A2004-EMP, 3G3M1-A2007-EMP, 3G3M1-A2015-EMP, 3G3M1-A2055-EMP, 3G3M1-A2075-EMP, 3G3M1-A2110-EMP, 3G3M1-A2150-EMP, 3G3M1-A2185-EMP | 50°C | - |
| 3G3M1-A4004-EMP, 3G3M1-A4007-EMP, 3G3M1-A4015-EMP 3G3M1-A4055-EMP, 3G3M1-A4075-EMP, 3G3M1-A4110-EMP, 3G3M1-A4150-EMP, 3G3M1-A4185-EMP, 3G3M1-A4220-EMP, 3G3M1-AB002-EMP | 50°C | 40°C |
| 3G3M1-AB037-EMP | 50°C | - |

| Inverter Type | HHD | HND/HD/ND |
|---|---|---|
| 3G3M1-A2022-EMP, 3G3M1-A2037-EMP 3G3M1-A4022-EMP, 3G3M1-A4030-EMP, 3G3M1-A4040-EMP 3G3M1-AB004-EMP, 3G3M1-AB007-EMP, 3G3M1-AB015-EMP, 3G3M1- AB022-EMP | 50°C | 40°C |

- Set motor (electronic thermal) protection levels using parameters F010 to F012. (For details, refer to *6-3-3 Motor Electronic Thermal Function* on page 6-18.)
- Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electric Code and any additional local codes.
  The inverter does not have motor overheat protection built in.

## Main Circuit Terminal Block Screw Sizes, Tightening Torque and Wire Sizes

| Power supply system | Standard applicable motor (kW) | Inverter Model | HHD/HD/HND/ND modes | Tightening torque lb-in (N・m) | | | Wire size AWG (mm²) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Main circuit copper wire | | | | | | ⏚G | |
| | | | | | | | L1/R, L2/S, L3/T | | | U, V, W | | | | |
| | | | | Main Terminal | Inverter's grounding | Control circuit auxiliary input | 60°C Cu Wire | 75°C Cu Wire | Remarks | 60°C Cu Wire | 75°C Cu Wire | Remarks | Inverter's grounding | Control circuit auxiliary input |
| Three phase 200V | 0.2 | 3G3M1-A2001-EMP | HND | 10.6 (1.2) | 15.9 (1.8) | - | 14 (2.1) | 14 (2.1) | *3 | 14 (2.1) | 14 (2.1) | *3 | 14 (2.1) | - |
| | | 3G3M1-A2002-EMP | HHD | | | | | | | | | | | |
| | 0.4 | 3G3M1-A2002-EMP | HND | | | | | | | | | | | |
| | | 3G3M1-A2004-EMP | HHD | | | | | | | | | | | |
| | 0.75 | 3G3M1-A2004-EMP | HND | | | | | | | | | | | |
| | | 3G3M1-A2007-EMP | HHD | | | | | | | | | | | |
| | 1.1 | 3G3M1-A2007-EMP | HND | | | | | | | | | | | |
| | 1.5 | 3G3M1-A2015-EMP | HHD | | | | | | | | | | | |
| | 2.2 | 3G3M1-A2015-EMP | HND | | | | | | | | | | 12 (3.3) | |
| | | 3G3M1-A2022-EMP | HHD | | | | | | | | | | | |
| | 3 | 3G3M1-A2022-EMP | HND | | | | | | | | | | | |

| Power supply system | Standard applicable motor (kW) | Inverter Model | HHD/HD/HND/ND modes | Tightening torque lb-in (N・m) | | | Wire size AWG (mm²) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Main circuit copper wire | | | | | | ⏚G | |
| | | | | | | | L1/R, L2/S, L3/T | | | U, V, W | | | | |
| | | | | Main Terminal | Inverter's grounding | Control circuit auxiliary input | 60°C Cu Wire | 75°C Cu Wire | Remarks | 60°C Cu Wire | 75°C Cu Wire | Remarks | Inverter's grounding | Control circuit auxiliary input |
| Three phase 200V | 3.7 | 3G3M1-A2037-EMP | HHD | 10.6 (1.2) | 15.9 (1.8) | - | 14 (2.1) | 14 (2.1) | *3 | 12 (3.3) | 12 (3.3) | *3 | 10 (5.3) | - |
| | 5.5 | 3G3M1-A2037-EMP | HND | | | | 10 (5.3) | 10 (5.3) | | | | | 8 (8.4) | |
| | | 3G3M1-A2055-EMP | HHD | 27 (3) | 27 (3) | | 8 (8.4) | 8 (8.4) | | 10 (5.3) | 10 (5.3) | | | |
| | 7.5 | 3G3M1-A2055-EMP | HND | | | | 6 (13.3) | | | | | | | |
| | | 3G3M1-A2075-EMP | HHD | | | | | | | 8 (8.4) | 8 (8.4) | | | |
| | 11 | 3G3M1-A2075-EMP | HND | | | | 4 (21.2) | 6 (13.3) | | | | | 6 (13.3) | |
| | | 3G3M1-A2110-EMP | HHD | 51.3 (5.8) | 51.3 (5.8) | | | | | 6 (13.3) | | | | |
| | 15 | 3G3M1-A2110-EMP | HND | | | | 3 (26.7) | 4 (21.2) | | 4 (21.2) | 6 (13.3) | | | |
| | | 3G3M1-A2150-EMP | HHD | | | | | | | | | | | |
| | 18.5 | 3G3M1-A2150-EMP | HND | | | | 1 (42.4) | 3 (26.7) | | | 4 (21.2) | | | |
| | | 3G3M1-A2185-EMP | HHD | | | 10.6 (1.2) | | | | 3 (26.7) | | | | 14 (2.1)* 1*2 |
| | 22 | 3G3M1-A2185-EMP | HND | | | | - | 2 (33.6) | *2, *3 | 2 (33.6) | 3 (26.7) | | | |

| Power supply system | Standard applicable motor (kW) | Inverter Model | HHD/HD/HND/ND modes | Tightening torque lb-in (N・m) | | | Wire size AWG (mm²) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Main circuit copper wire | | | | | | ⏚G | |
| | | | | | | | L1/R, L2/S, L3/T | | | U, V, W | | | | |
| | | | | Main Terminal | Inverter's grounding | Control circuit auxiliary input | 60°C Cu Wire | 75°C Cu Wire | Remarks | 60°C Cu Wire | 75°C Cu Wire | Remarks | Inverter's grounding | Control circuit auxiliary input |
| Three phase 400V | 0.4 | 3G3M1-A4004-EMP | HHD | 10.6 (1.2) | 15.9 (1.8) | - | 14 (2.1) | 14 (2.1) | *3 | 14 (2.1) | 14 (2.1) | *3 | 14 (2.1) | - |
| | 0.75 | 3G3M1-A4004-EMP | HD/ HND | | | | | | | | | | | |
| | | 3G3M1-A4004-EMP | ND | | | | | | | | | | | |
| | | 3G3M1-A4007-EMP | HHD | | | | | | | | | | | |
| | 1.1 | 3G3M1-A4007-EMP | HD/ HND | | | | | | | | | | | |
| | 1.5 | 3G3M1-A4007-EMP | ND | | | | | | | | | | | |
| | | 3G3M1-A4015-EMP | HHD | | | | | | | | | | | |
| | 2.2 | 3G3M1-A4015-EMP | HD/ HND | | | | | | | | | | 12 (3.3) | |
| | | 3G3M1-A4015-EMP | ND | | | | | | | | | | | |
| | | 3G3M1-A4022-EMP | HHD | | | | | | | | | | | |
| | 3 | 3G3M1-A4022-EMP | ND | | | | | | | | | | | |
| | | 3G3M1-A4022-EMP | HD/ HND | | | | | | | | | | | |
| | | 3G3M1-A4030-EMP | HHD | | | | | | | | | | | |
| | 4 | 3G3M1-A4030-EMP | N D / H D / HND | | | | | | | | | | 10 (5.3) | |
| | | 3G3M1-A4040-EMP | HHD | | | | | | | | | | | |

| Power supply system | Standard applicable motor (kW) | Inverter Model | HHD/HD/HND/ND modes | Tightening torque lb-in (N・m) | | | Wire size AWG (mm²) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Main circuit copper wire | | | | | | ⏚G | |
| | | | | | | | L1/R, L2/S, L3/T | | | U, V, W | | | | |
| | | | | Main Terminal | Inverter's grounding | Control circuit auxiliary input | 60°C Cu Wire | 75°C Cu Wire | Remarks | 60°C Cu Wire | 75°C Cu Wire | Remarks | Inverter's grounding | Control circuit auxiliary input |
| Three phase 400V | 5.5 | 3G3M1-A4040-EMP | ND | 10.6 (1.2) | 15.9 (1.8) | - | 12 (3.3) | 12 (3.3) | *3 | 14 (2.1) | 14 (2.1) | *3 | 10 (5.3) | - |
| | | 3G3M1-A4040-EMP | HD/HND | | | | | | | | | | | |
| | | 3G3M1-A4055-EMP | HHD | 27 (3) | 27 (3) | | | | | | | | | |
| | 7.5 | 3G3M1-A4055-EMP | HD/HND | 27 (3) | 27 (3) | - | 10 (5.3) | 10 (5.3) | *3 | 12 (3.3) | 12 (3.3) | *3 | 10 (5.3) | - |
| | | 3G3M1-A4075-EMP | HHD | | | | | | | | | | | |
| | 11 | 3G3M1-A4055-EMP | ND | | | | 8 (8.4) | 8 (8.4) | | 10 (5.3) | 10 (5.3) | | 8 (8.4) | |
| | | 3G3M1-A4075-EMP | HD/HND | | | | | | | | | | | |
| | | 3G3M1-A4110-EMP | HHD | 51.3 (5.8) | 51.3 (5.8) | | | | | | | | | |
| | 15 | 3G3M1-A4075-EMP | ND | 27 (3) | 27 (3) | | 6 (13.3) | | | | | | | |
| | | 3G3M1-A4110-EMP | HD/HND | 51.3 (5.8) | 51.3 (5.8) | | | | | 8 (8.4) | 8 (8.4) | | | |
| | | 3G3M1-A4150-EMP | HHD | | | | | | | | | | | |
| | 18.5 | 3G3M1-A4110-EMP | ND | | | | | 6 (13.3) | | 6 (13.3) | | | 6 (13.3) | 14 (2.1) *1*2 |
| | | 3G3M1-A4150-EMP | HD/HND | | | | | | | | | | | |
| | | 3G3M1-A4185-EMP | HHD | | | 10.6 (1.2) | | | | | 6 (13.3) | | | |

| Power supply system | Standard applicable motor (kW) | Inverter Model | HHD/HD/HND/ND modes | Tightening torque lb-in (N・m) | | | Wire size AWG (mm²) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Main circuit copper wire | | | | | | ⏚G | |
| | | | | | | | L1/R, L2/S, L3/T | | | U, V, W | | | | |
| | | | | Main Terminal | Inverter's grounding | Control circuit auxiliary input | 60°C Cu Wire | 75°C Cu Wire | Remarks | 60°C Cu Wire | 75°C Cu Wire | Remarks | Inverter's grounding | Control circuit auxiliary input |
| Three phase 400V | 22 | 3G3M1-A4150-EMP | ND | 51.3 (5.8) | 51.3 (5.8) | 10.6 (1.2) | 4 (21.2) | 6 (13.3) | *3 | 6 (13.3) | 6 (13.3) | *3 | 6 (13.3) | 14 (2.1)*1*2 |
| | | 3G3M1-A4185-EMP | HD/HND | | | | | | | | | | | |
| | | 3G3M1-A4220-EMP | HHD | | | | | | | | | | | |
| | 30 | 3G3M1-A4185-EMP | ND | | | | 3 (26.7) | 4 (21.2) | | 4 (21.2) | | | | |
| | | 3G3M1-A4220-EMP | HD/HND | | | | | | | | | | | |
| | 37 | 3G3M1-A4220-EMP | ND | | | | 2 (33.6) | 3 (26.7) | | 3 (26.7) | 4 (21.2) | | | |
| Single Phase 200V | 0.2 | 3G3M1-AB001-EMP | HND | 7.1 (0.8) | 10.6 (1.2) | - | 14 (2.1) | 14 (2.1) | *3 | 14 (2.1) | 14 (2.1) | *3 | 14 (2.1) | - |
| | | 3G3M1-AB002-EMP | HHD | | | | | | | | | | | |
| | 0.4 | 3G3M1-AB002-EMP | HND | | | | | | | | | | | |
| | | 3G3M1-AB004-EMP | HHD | | | | | | | | | | | |
| | 0.75 | 3G3M1-AB004-EMP | HND | | | | | | | | | | 12 (3.3) | |
| | | 3G3M1-AB007-EMP | HHD | | | | | | | | | | | |
| | 1.1 | 3G3M1-AB007-EMP | HND | | | | | | | | | | 10 (5.3) | |

| Power supply system | Standard applicable motor (kW) | Inverter Model | HHD/HD/HND/ND modes | Tightening torque lb-in (N・m) | | | Wire size AWG (mm²) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Main circuit copper wire | | | | | | ⏚G | |
| | | | | | | | L1/R, L2/S, L3/T | | | U, V, W | | | | |
| | | | | Main Terminal | Inverter's grounding | Control circuit auxiliary input | 60°C Cu Wire | 75°C Cu Wire | Remarks | 60°C Cu Wire | 75°C Cu Wire | Remarks | Inverter's grounding | Control circuit auxiliary input |
| Single Phase 200V | 1.5 | 3G3M1-AB015-EMP | HHD | 10.6 (1.2) | 15.9 (1.8) | - | 12 (3.3) | 12 (3.3) | *3 | 14 (2.1) | 14 (2.1) | *3 | 10 (5.3) | - |
| | 2.2 | 3G3M1-AB015-EMP | HND | | | | 10 (5.3) | 10 (5.3) | | | | | | |
| | | 3G3M1-AB022-EMP | HHD | | | | | | | | | | | |
| | 3 | 3G3M1-AB022-EMP | HND | | | | | | | | | | | |
| | 3.7 | 3G3M1-AB037-EMP | HHD | 27 (3) | 27 (3) | | 6 (13.3) | 8 (8.4) | | 12 (3.3) | 12 (3.3) | | 8 (8.4) | |

*1. Wires can be connected without any terminal treatment.

*2. Only 75°C (167°F) Cu wiring can be used.

*3. Shows common wiring sizes for UL Open Type and Enclosed Type. Please contact us separately if dedicated UL Open Type wiring sizes are required.

## Fuse Size for Semiconductor type

| Power supply voltage | Standard applicable motor (kW) | Inverter model | HHD/HD HND/ND modes | Semiconductor fuse reference, manufacturer: Mersen / Bussmann (Eaton) SCCR=100kA |
|---|---|---|---|---|
| Three-phase 200V | 0.2 | 3G3M1-A2001-EMP | HND | |
| | | 3G3M1-A2002-EMP | HHD | PC30UD69V50□/170M3458 |
| | 0.4 | 3G3M1-A2002-EMP | HND | |
| | | 3G3M1-A2004-EMP | HHD | PC30UD69V50□/170M3458 |
| | 0.75 | 3G3M1-A2004-EMP | HND | |
| | | 3G3M1-A2007-EMP | HHD | PC30UD69V50□/170M3460 |
| | 1.1 | 3G3M1-A2007-EMP | HND | |
| | 1.5 | 3G3M1-A2015-EMP | HHD | PC30UD69V80□/170M3462 |
| | 2.2 | 3G3M1-A2015-EMP | HND | |
| | | 3G3M1-A2022-EMP | HHD | PC30UD69V125□/170M3462 |
| | 3 | 3G3M1-A2022-EMP | HND | |
| | 3.7 | 3G3M1-A2037-EMP | HHD | PC30UD69V125□/170M3463 |
| | 5.5 | 3G3M1-A2037-EMP | HND | |
| | | 3G3M1-A2055-EMP | HHD | PC30UD69V160□/170M3464 |
| | 7.5 | 3G3M1-A2055-EMP | HND | |
| | | 3G3M1-A2075-EMP | HHD | PC30UD69V200□/170M3465 |
| | 11 | 3G3M1-A2075-EMP | HND | |
| | | 3G3M1-A2110-EMP | HHD | PC30UD69V200□/170M3465 |
| | 15 | 3G3M1-A2110-EMP | HND | |
| | | 3G3M1-A2150-EMP | HHD | PC30UD69V250□/170M3466 |
| | 18.5 | 3G3M1-A2150-EMP | HND | |
| | | 3G3M1-A2185-EMP | HHD | PC30UD69V250□/170M3466 |
| | 22 | 3G3M1-A2185-EMP | HND | |

| Power supply voltage | Standard applicable motor (kW) | Inverter model | HHD/HD HND/ND modes | Semiconductor fuse reference, manufacturer: Mersen / Bussmann (Eaton) SCCR=100kA |
|---|---|---|---|---|
| Three-phase 400V | 0.4 | 3G3M1-A4004-EMP | HHD | PC30UD69V50□/170M3458 |
| | 0.75 | 3G3M1-A4004-EMP | HD/HND | |
| | | 3G3M1-A4004-EMP | ND | |
| | | 3G3M1-A4007-EMP | HHD | PC30UD69V50□/170M3458 |
| | 1.1 | 3G3M1-A4007-EMP | HD/HND | |
| | 1.5 | 3G3M1-A4007-EMP | ND | |
| | | 3G3M1-A4015-EMP | HHD | PC30UD69V50□/170M3459 |
| | 2.2 | 3G3M1-A4015-EMP | HD/HND | |
| | | 3G3M1-A4015-EMP | ND | |
| | | 3G3M1-A4022-EMP | HHD | PC30UD69V63□/170M3460 |
| | 3 | 3G3M1-A4022-EMP | HD/HND | |
| | | 3G3M1-A4022-EMP | ND | |
| | | 3G3M1-A4030-EMP | HHD | PC30UD69V63□/170M3461 |
| | 3.7 | 3G3M1-A4030-EMP | HD/HND/ND | |
| | | 3G3M1-A4040-EMP | HHD | PC30UD69V63□/170M3461 |
| | 5.5 | 3G3M1-A4040-EMP | HD/HND | |
| | | 3G3M1-A4040-EMP | ND | |
| | | 3G3M1-A4055-EMP | HHD | PC30UD69V100□/170M3462 |
| | 7.5 | 3G3M1-A4055-EMP | HD/HND | |
| | | 3G3M1-A4075-EMP | HHD | PC30UD69V100□/170M3462 |
| | 11 | 3G3M1-A4075-EMP | ND | PC30UD69V100□/170M3462 |
| | | 3G3M1-A4075-EMP | HD/HND | PC30UD69V100□/170M3462 |
| | | 3G3M1-A4110-EMP | HHD | PC30UD69V125□/170M3463 |
| | 15 | 3G3M1-A4075-EMP | ND | PC30UD69V100□/170M3462 |
| | | 3G3M1-A4110-EMP | HD/HND | PC30UD69V125□/170M3463 |
| | | 3G3M1-A4150-EMP | HHD | PC30UD69V160□/170M3464 |
| | 18.5 | 3G3M1-A4110-EMP | ND | PC30UD69V125□/170M3463 |
| | | 3G3M1-A4150-EMP | HD/HND | PC30UD69V160□/170M3464 |
| | | 3G3M1-A4185-EMP | HHD | PC30UD69V160□/170M3464 |
| | 22 | 3G3M1-A4150-EMP | ND | PC30UD69V160□/170M3464 |
| | | 3G3M1-A4185-EMP | HD/HND | PC30UD69V160□/170M3464 |
| | | 3G3M1-A4220-EMP | HHD | PC30UD69V200□/170M3465 |
| | 30 | 3G3M1-A4185-EMP | ND | PC30UD69V160□/170M3464 |
| | | 3G3M1-A4220-EMP | HD/HND | PC30UD69V200□/170M3465 |
| | 37 | 3G3M1-A4220-EMP | ND | |

| Power supply voltage | Standard applicable motor (kW) | Inverter model | HHD/HD HND/ND modes | Semiconductor fuse reference, manufacturer: Mersen / Bussmann (Eaton) SCCR=100kA |
|---|---|---|---|---|
| Single-phase 200V | 0.2 | 3G3M1-AB002-EMP | HHD | PC30UD69V50□/170M3458 |
| | 0.4 | 3G3M1-AB002-EMP | HND | |
| | | 3G3M1-AB004-EMP | HHD | PC30UD69V50□/170M3458 |
| | 0.75 | 3G3M1-AB004-EMP | HND | |
| | | 3G3M1-AB007-EMP | HHD | PC30UD69V50□/170M3460 |
| | 1.1 | 3G3M1-AB007-EMP | HND | |
| | 1.5 | 3G3M1-AB015-EMP | HHD | PC30UD69V125□/170M3462 |
| | 2.2 | 3G3M1-AB015-EMP | HND | |
| | | 3G3M1-AB022-EMP | HHD | PC30UD69V125□/170M3463 |
| | 3 | 3G3M1-AB022-EMP | HND | |
| | 3.7 | 3G3M1-AB037-EMP | HHD | PC30UD69V160□/170M3464 |

## Fuse size for Class CC, J or T types

| Power supply voltage | Standard applicable motor (kW) | Inverter model | HHD/HD HND/ND modes | Class CC, J or T fuse rating [Max. A] SCCR=100kA |
|---|---|---|---|---|
| Three-phase 200V | 0.2 | 3G3M1-A2002-EMP | HHD | 6A (min 600Vac) |
| | 0.4 | 3G3M1-A2002-EMP | HND | 6A (min 600Vac) |
| | | 3G3M1-A2004-EMP | HHD | 10A (min 600Vac) |
| | 0.75 | 3G3M1-A2004-EMP | HND | 10A (min 600Vac) |
| | | 3G3M1-A2007-EMP | HHD | 15A (min 600Vac) |
| | 1.1 | 3G3M1-A2007-EMP | HND | 15A (min 600Vac) |
| | 1.5 | 3G3M1-A2015-EMP | HHD | 20A (min 600Vac) |
| | 2.2 | 3G3M1-A2015-EMP | HND | 20A (min 600Vac) |
| | | 3G3M1-A2022-EMP | HHD | 30A (min 600Vac) |
| | 3 | 3G3M1-A2022-EMP | HND | 30A (min 600Vac) |
| | 3.7 | 3G3M1-A2037-EMP | HHD | 40A (min 600Vac) |
| | 5.5 | 3G3M1-A2037-EMP | HND | 50A (min 600Vac) |
| | | 3G3M1-A2055-EMP | HHD | 60A (min 600Vac) |
| | 7.5 | 3G3M1-A2055-EMP | HND | 80A (min 600Vac) |
| | | 3G3M1-A2075-EMP | HHD | 80A (min 600Vac) |
| | 11 | 3G3M1-A2075-EMP | HND | 100A (min 600Vac) |
| | | 3G3M1-A2110-EMP | HHD | 100A (min 600Vac) |
| | 15 | 3G3M1-A2110-EMP | HND | 150A (min 600Vac) |
| | | 3G3M1-A2150-EMP | HHD | 150A (min 600Vac) |
| | 18.5 | 3G3M1-A2150-EMP | HND | 175A (min 600Vac) |
| | | 3G3M1-A2185-EMP | HHD | 175A (min 600Vac) |
| | 22 | 3G3M1-A2185-EMP | HND | 200A (min 600Vac) |

| Power supply voltage | Standard applicable motor (kW) | Inverter model | HHD/HD HND/ND modes | Class CC, J or T fuse rating [Max. A] SCCR=100kA |
|---|---|---|---|---|
| Three phase 400V | 0.4 | 3G3M1-A4004-EMP | HHD | 3A (min 600Vac) |
| | 0.75 | 3G3M1-A4004-EMP | HD/HND | 6A (min 600Vac) |
| | | 3G3M1-A4004-EMP | ND | 6A (min 600Vac) |
| | | 3G3M1-A4007-EMP | HHD | 6A (min 600Vac) |
| | 1.1 | 3G3M1-A4007-EMP | HD/HND | 10A (min 600Vac) |
| | 1.5 | 3G3M1-A4007-EMP | ND | 10A (min 600Vac) |
| | | 3G3M1-A4015-EMP | HHD | 10A (min 600Vac) |
| | 2.2 | 3G3M1-A4015-EMP | HD/HND | 15A (min 600Vac) |
| | | 3G3M1-A4015-EMP | ND | 15A (min 600Vac) |
| | | 3G3M1-A4022-EMP | HHD | 20A (min 600Vac) |
| | 3 | 3G3M1-A4022-EMP | HD/HND/ND | 20A (min 600Vac) |
| | | 3G3M1-A4030-EMP | HHD | 20A (min 600Vac) |
| | 3.7 | 3G3M1-A4030-EMP | HD/HND/ND | 30A (min 600Vac) |
| | | 3G3M1-A4040-EMP | HHD | 30A (min 600Vac) |
| | 5.5 | 3G3M1-A4040-EMP | HD/HND/ND | 30A (min 600Vac) |
| | | 3G3M1-A4055-EMP | HHD | 30A (min 600Vac) |
| | 7.5 | 3G3M1-A4055-EMP | HD/HND | 40A (min 600Vac) |
| | | 3G3M1-A4055-EMP | ND | 60A (min 600Vac) |
| | | 3G3M1-A4075-EMP | HHD | 60A (min 600Vac) |
| | 11 | 3G3M1-A4075-EMP | HD/HND | 60A (min 600Vac) |
| | | 3G3M1-A4075-EMP | ND | 70A (min 600Vac) |
| | | 3G3M1-A4110-EMP | HHD | 60A (min 600Vac) |
| | 15 | 3G3M1-A4075-EMP | ND | 70A (min 600Vac) |
| | | 3G3M1-A4110-EMP | HD/HND | 70A (min 600Vac) |
| | | 3G3M1-A4150-EMP | HHD | 90A (min 600Vac) |
| | 18.5 | 3G3M1-A4110-EMP | ND | 90A (min 600Vac) |
| | | 3G3M1-A4150-EMP | HD/HND | 90A (min 600Vac) |
| | | 3G3M1-A4185-EMP | HHD | 90A (min 600Vac) |
| | 22 | 3G3M1-A4150-EMP | ND | 100A (min 600Vac) |
| | | 3G3M1-A4185-EMP | HD/HND | 100A (min 600Vac) |
| | | 3G3M1-A4220-EMP | HHD | 100A (min 600Vac) |
| | 30 | 3G3M1-A4185-EMP | ND | 125A (min 600Vac) |
| | | 3G3M1-A4220-EMP | HD/HND | 125A (min 600Vac) |
| | 37 | 3G3M1-A4220-EMP | ND | 175A (min 600Vac) |

| Power supply voltage | Standard applicable motor (kW) | Inverter model | HHD/HD HND/ND modes | Class CC, J or T fuse rating [Max. A] SCCR=100kA |
|---|---|---|---|---|
| Single phase 200V | 0.2 | 3G3M1-AB001-EMP | HND | 10A (min 600Vac) |
| | | 3G3M1-AB002-EMP | HHD | 6A (min 600Vac) |
| | 0.4 | 3G3M1-AB002-EMP | HND | 10A (min 600Vac) |
| | | 3G3M1-AB004-EMP | HHD | 10A (min 600Vac) |
| | 0.75 | 3G3M1-AB004-EMP | HND | 15A (min 600Vac) |
| | | 3G3M1-AB007-EMP | HHD | 20A (min 600Vac) |
| | 1.1 | 3G3M1-AB007-EMP | HND | 30A (min 600Vac) |
| | 1.5 | 3G3M1-AB015-EMP | HHD | 30A (min 600Vac) |
| | 2.2 | 3G3M1-AB015-EMP | HND | 40A (min 600Vac) |
| | | 3G3M1-AB022-EMP | HHD | 50A (min 600Vac) |
| | 3 | 3G3M1-AB022-EMP | HND | 60A (min 600Vac) |
| | 3.7 | 3G3M1-AB037-EMP | HHD | 80A (min 600Vac) |

## Size for Inverse Time Circuit Breaker type

| Power supply voltage | Standard applicable motor (kW) | Inverter model | HHD/HD HND/ND modes | Inverse time circuit breaker rating [Max. A] SCCR=100kA |
|---|---|---|---|---|
| Three phase 200V | 0.2 | 3G3M1-A2001-EMP | HND | 15A (min 240Vac) |
| | | 3G3M1-A2002-EMP | HHD | 15A (min 240Vac) |
| | 0.4 | 3G3M1-A2002-EMP | HND | 15A (min 240Vac) |
| | | 3G3M1-A2004-EMP | HHD | 15A (min 240Vac) |
| | 0.75 | 3G3M1-A2004-EMP | HND | 15A (min 240Vac) |
| | | 3G3M1-A2007-EMP | HHD | 15A (min 240Vac) |
| | 1.1 | 3G3M1-A2007-EMP | HND | 15A (min 240Vac) |
| | 1.5 | 3G3M1-A2015-EMP | HHD | 20A (min 240Vac) |
| | 2.2 | 3G3M1-A2015-EMP | HND | 20A (min 240Vac) |
| | | 3G3M1-A2022-EMP | HHD | 30A (min 240Vac) |
| | 3 | 3G3M1-A2022-EMP | HND | 30A (min 240Vac) |
| | 3.7 | 3G3M1-A2037-EMP | HHD | 50A (min 240Vac) |
| | 5.5 | 3G3M1-A2037-EMP | HND | 50A (min 240Vac) |
| | | 3G3M1-A2055-EMP | HHD | 80A (min 240Vac) |
| | 7.5 | 3G3M1-A2055-EMP | HND | 80A (min 240Vac) |
| | | 3G3M1-A2075-EMP | HHD | 100A (min 240Vac) |
| | 11 | 3G3M1-A2075-EMP | HND | 100A (min 240Vac) |
| | | 3G3M1-A2110-EMP | HHD | 125A (min 240Vac) |
| | 15 | 3G3M1-A2110-EMP | HND | 125A (min 240Vac) |
| | | 3G3M1-A2150-EMP | HHD | 150A (min 240Vac) |
| | 18.5 | 3G3M1-A2150-EMP | HND | 150A (min 240Vac) |
| | | 3G3M1-A2185-EMP | HHD | 175A (min 240Vac) |
| | 22 | 3G3M1-A2185-EMP | HND | 175A (min 240Vac) |

| Power supply voltage | Standard applicable motor (kW) | Inverter model | HHD/HD HND/ND modes | Inverse time circuit breaker rating [Max. A] SCCR=100kA |
|---|---|---|---|---|
| Three phase 400V | 0.4 | 3G3M1-A4004-EMP | HHD | 15A (min 480Vac) |
| | 0.75 | 3G3M1-A4004-EMP | HD/HND | 15A (min 480Vac) |
| | | 3G3M1-A4004-EMP | ND | 15A (min 480Vac) |
| | | 3G3M1-A4007-EMP | HHD | 15A (min 480Vac) |
| | 1.1 | 3G3M1-A4007-EMP | HD/HND | 15A (min 480Vac) |
| | 1.5 | 3G3M1-A4007-EMP | ND | 15A (min 480Vac) |
| | | 3G3M1-A4015-EMP | HHD | 15A (min 480Vac) |
| | 2.2 | 3G3M1-A4015-EMP | HD/HND | 15A (min 480Vac) |
| | | 3G3M1-A4015-EMP | ND | 15A (min 480Vac) |
| | | 3G3M1-A4022-EMP | HHD | 20A (min 480Vac) |
| | 3 | 3G3M1-A4022-EMP | HD/HND/ND | 20A (min 480Vac) |
| | | 3G3M1-A4030-EMP | HHD | 30A (min 480Vac) |
| | 3.7 | 3G3M1-A4030-EMP | HD/HND/ND | 30A (min 480Vac) |
| | | 3G3M1-A4040-EMP | HHD | 30A (min 480Vac) |
| | 5.5 | 3G3M1-A4040-EMP | HD/HND/ND | 30A (min 480Vac) |
| | | 3G3M1-A4055-EMP | HHD | 50A (min 480Vac) |
| | 7.5 | 3G3M1-A4055-EMP | HD/HND | 50A (min 480Vac) |
| | | 3G3M1-A4055-EMP | ND | 50A (min 480Vac) |
| | | 3G3M1-A4075-EMP | HHD | 70A (min 480Vac) |
| | 11 | 3G3M1-A4075-EMP | HD/HND | 70A (min 480Vac) |
| | | 3G3M1-A4075-EMP | ND | 70A (min 480Vac) |
| | | 3G3M1-A4110-EMP | HHD | 80A (min 480Vac) |
| | 15 | 3G3M1-A4075-EMP | ND | 70A (min 480Vac) |
| | | 3G3M1-A4110-EMP | HD/HND | 80A (min 480Vac) |
| | | 3G3M1-A4150-EMP | HHD | 100A (min 480Vac) |
| | 18.5 | 3G3M1-A4110-EMP | ND | 80A (min 480Vac) |
| | | 3G3M1-A4150-EMP | HD/HND | 100A (min 480Vac) |
| | | 3G3M1-A4185-EMP | HHD | 125A (min 480Vac) |
| | 22 | 3G3M1-A4150-EMP | ND | 100A (min 480Vac) |
| | | 3G3M1-A4185-EMP | HD/HND | 125A (min 480Vac) |
| | | 3G3M1-A4220-EMP | HHD | 150A (min 480Vac) |
| | 30 | 3G3M1-A4185-EMP | ND | 125A (min 480Vac) |
| | | 3G3M1-A4220-EMP | HD/HND | 150A (min 480Vac) |
| | 37 | 3G3M1-A4220-EMP | ND | 150A (min 480Vac) |

| Power supply voltage | Standard applicable motor (kW) | Inverter model | HHD/HD HND/ND modes | Inverse time circuit breaker rating [Max. A] SCCR=100kA |
|---|---|---|---|---|
| Single phase 200V | 0.2 | 3G3M1-AB001-EMP | HND | 15A (min 240Vac) |
| | | 3G3M1-AB002-EMP | HHD | 15A (min 240Vac) |
| | 0.4 | 3G3M1-AB002-EMP | HND | 15A (min 240Vac) |
| | | 3G3M1-AB004-EMP | HHD | 15A (min 240Vac) |
| | 0.75 | 3G3M1-AB004-EMP | HND | 15A (min 240Vac) |
| | | 3G3M1-AB007-EMP | HHD | 30A (min 240Vac) |
| | 1.1 | 3G3M1-AB007-EMP | HND | 30A (min 240Vac) |
| | 1.5 | 3G3M1-AB015-EMP | HHD | 40A (min 240Vac) |
| | 2.2 | 3G3M1-AB015-EMP | HND | 40A (min 240Vac) |
| | | 3G3M1-AB022-EMP | HHD | 40A (min 240Vac) |
| | 3 | 3G3M1-AB022-EMP | HND | 40A (min 240Vac) |
| | 3.7 | 3G3M1-AB037-EMP | HHD | 70A (min 240Vac) |

# 3

# Ethernet Communications



M1-EMP is a Ethernet multiprotocol slave. It supports Modbus TCP, EtherNet/IP and ProfiNet This section explains Ethernet communications for the inverter connected to a Machine Automation Controller or PLC. The M1-EMP, can connect to a master device (PLC, PC for industrial use, etc.) with Ethernet and control the inverter as an communications adapter (Modbus TCP naming convention), a server (EtherNet/IP) or a device (PROFINET) using run commands, frequency commands, function code access, etc.

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# 3-1 Industrial Ethernet communications



Ethernet is a widely used communication standard originally developed for office and commercial data networks. It defines how digital information is packaged, transmitted, and received across wired or wireless systems. Ethernet enables fast and reliable data exchange using standardized physical cabling, network architecture, and communication protocols. Its broad adoption, scalability, and interoperability make it a foundation for modern networked devices.

## 3-1-1 Industrial EtherNet

Industrial Ethernet refers to the adaptation of traditional Ethernet technology for use in industrial automation and control systems. Unlike conventional office EtherNet, Industrial Ethernet is designed to handle real-time data exchange, high electromagnetic interference environments, long cable distances, and deterministic network performance. It supports multiple industrial communication protocols, allowing equipment such as controllers, variable frequency drives (VFDs), sensors, and human–machine interfaces (HMIs) to communicate efficiently over a common network infrastructure.

Common Industrial Ethernet protocols supported by M1-EMP include:

- PROFINET® IO + PROFIdrive® profile
- Modbus® TCP
- EtherNet/IP™

## 3-1-2 Common Ethernet specifications

| Item | Description |
|---|---|
| Connector type | RJ-45 connector with shielding,<br>CAT5e or higher level categories, UTP or STP cable |
| Ethernet cable | For details, refer to the following website.<br>ODVA (Open DeviceNet Vendor Association, Inc.) https://www.odva.org<br>PROFIBUS & PROFINET International (PI) https://www.profibus.com/ |
| Physical layer type | IEEE 802.3 |
| Port | 2 Ports (Built-in switching function excluding PROFINET protocol) |
| Communication speed | 10Mbps/100Mbps (Automatic detection) |
| Duplex | Half-duplex/Full-duplex (Automatic detection) |
| Auto MDI-X | Supported (Automatic recognition of straight/cross cables) |
| Auto Polarity | Supported (Automatic polarity recognition) |
| Cable length | Maximum 100m (328 ft) per segment |
| IP Address | Static(Specified with the inverter function codes), Hardware switch.<br>DHCP (Other than PROFINET), DCP (PROFINET) |
| MAC Address | Configured |

Common

Communications bandwidth between Ethernet port and drive

# 3-2 Protocol Selection

The protocol and basic network configuration is selected by parameter.

## 3-2-1 Protocol selection parameters

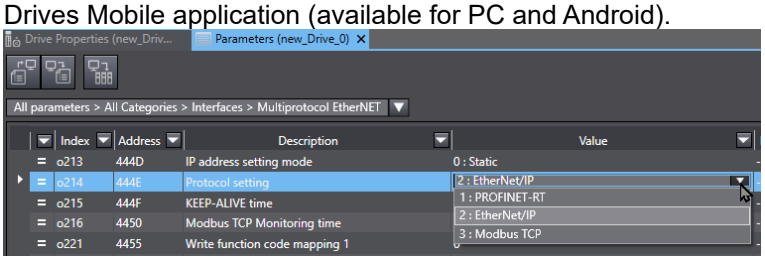
Protocol selection parameter.

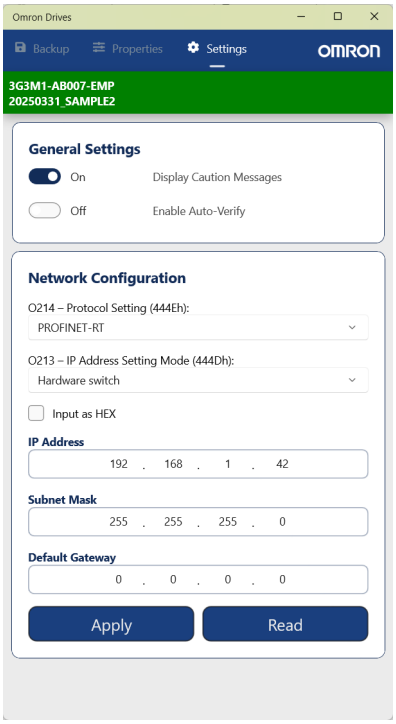
| param | Function name | Range | Def. data |
|---|---|---|---|
| o214 | Protocol setting | 1 to 3<br>1:PROFINET-RT<br>2:EtherNet/IP<br>3:Modbus TCP | 2 |

After setting the protocol, the inverter must soft-reboot (by parameter o299) or power cycle for the protocol and the modified settings to become effective.

| param | Function name | Range | Def. data |
|---|---|---|---|
| o299 | Apply Ethernet settings | 0 to 1 | 0 |

As the M1-EMP does not have operator panel ,this setting has to be done by Sysmac Studio or Omron Drives Mobile application (available for PC and Android).

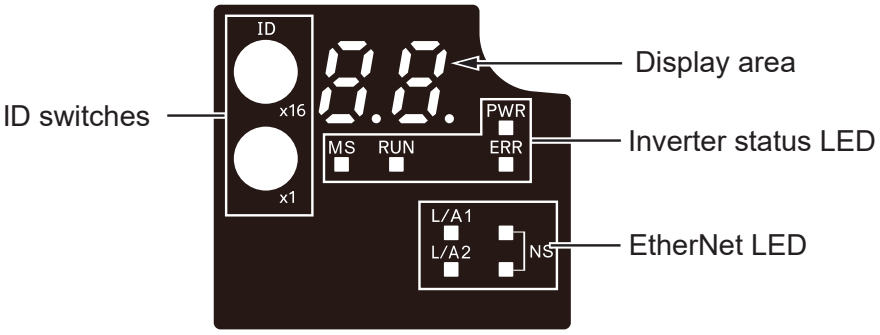



After any settings change, soft Network reboot by parameter o299 or power re-cycle are required for the settings to become effective. By using the Omron Drives App, this is automatic when selecting "Apply"

# 3-3 Display Area and settings

This section explains the indicators and switches located on the front of the inverter.

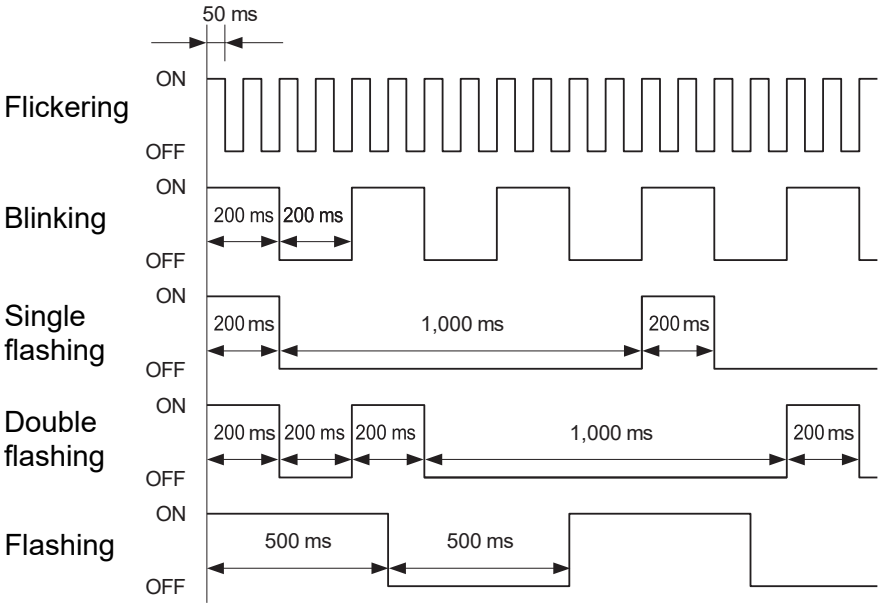



## 3-3-1 Status Indicators in LED operation panel

The following table shows the status indicators and their meaning. Network status indicators will present small differences for each protocol.

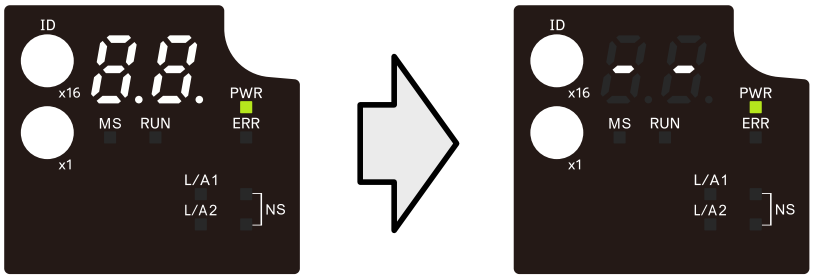
| Name | | Function | Color | Status | Description |
|---|---|---|---|---|---|
| PWR | | POWER | Green | OFF | Control power supply OFF |
| | | | | ON | Control power supply ON |
| ERR | | ERROR | Red | OFF | No error |
| | | | | ON | Error |
| | | | | Flashing | Warning |
| RUN | | RUN | Green | OFF | Stopped |
| | | | | ON | Running |
| MS | | MODULE STATUS | Green/Red | By each Network Specification. Check corresponding section. | |
| NS | | NETWORK STATUS | Green/Red | | |
| L/A1 | | PORT1 Link Active | Green | | |
| L/A2 | | PORT2 Link Active | Green | | |
| ID | X16 | Rotary switch | - | ID setting (Hex) | |
| | X1 | | - | | |

See the following diagram for the keyword of all the possible status of the indicators.



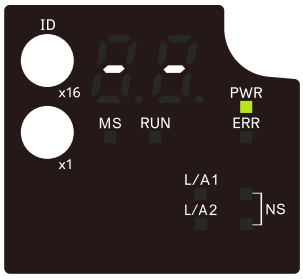

## Startup

After all segments are on, the center bar will be displayed for both digits. Other LEDs: Perform LED self-check for approximate 1.5 s.




## STOP

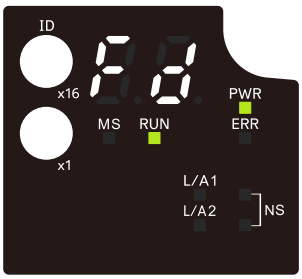
The center bar will be displayed for both digits.

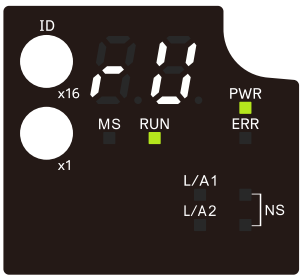



## During Motor Operation

Forward Operation

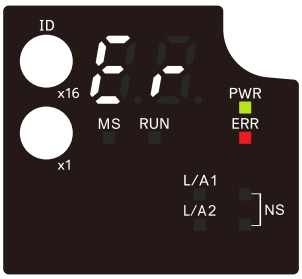
Reverse Operation

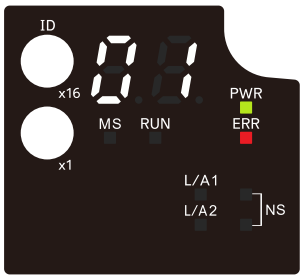


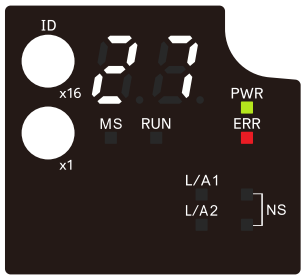



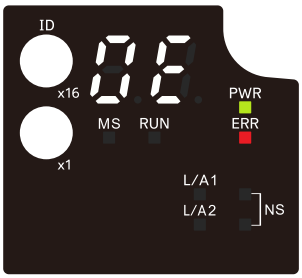

## Alarm

The alarm code and sub code blink in sequence. ERR LED: Steady ON



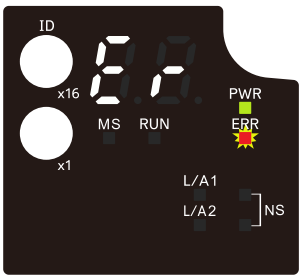



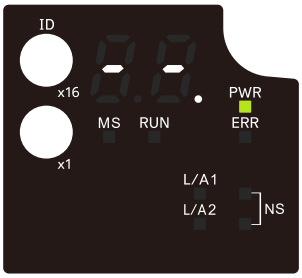

## Warning

The alarm code and sub code blink in sequence. (Same as in alarm) Sub code is fixed to “0”.
ERR LED: Blinking



## Low Voltage

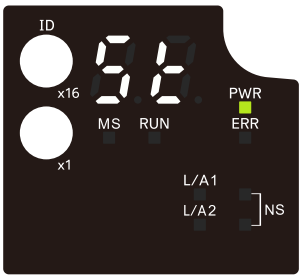
Dot on lower digit (right side) turns ON.



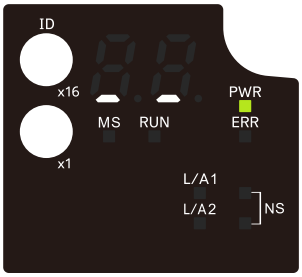

## STO

Blinking “St”

* Priority : Alarm > Warning > STO




## Measuring main capacitor



# 3-4 Ethernet common settings

## 3-4-1 Node Address Setting

M1-EMP provides different methods to set its IP address in the network. In a short form, these are the available methods, selectable by parameter o213

| param | Function name | Range | Def. data |
|---|---|---|---|
| o213 | IP address setting mode | 0 to 3<br>0:Static<br>1:Hardware switch<br>2:DHCP<br>3:DCP | 0 |

According to o213 setting, the final IP address will be composed as follows.

| o213 mode | IP Adress Octet 1 | IP Adress Octet 2 | IP Adress Octet 3 | IP Adress Octet 4 |
|---|---|---|---|---|
| 0 – Static | o201 | o202 | o203 | o204 |
| 1 – Hardware switch | o201 | o202 | o203 | Rotary switch |
| 2 – DHCP | DHCP | DHCP | DHCP | DHCP |
| 3 – DCP | DCP | DCP | DCP | DCP |

### Static IP Address defined by parameters only by o213=0

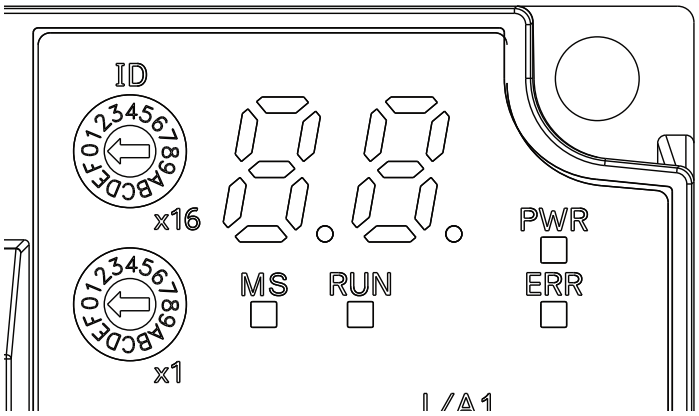
If o213 is set to Static, the network address will be defined completely by parameters

| param | Function name | Range | Def. data |
|---|---|---|---|
| o201 | IP address setting 1 | 0 to 255 | 192 |
| o202 | IP address setting 2 | 0 to 255 | 168 |
| o203 | IP address setting 3 | 0 to 255 | 0 |
| o204 | IP address setting 4 | 0 to 255 | 10 |
| o205 | Subnet mask setting 1 | 0 to 255 | 255 |
| o206 | Subnet mask setting 2 | 0 to 255 | 255 |
| o207 | Subnet mask setting 3 | 0 to 255 | 255 |
| o208 | Subnet mask setting 4 | 0 to 255 | 0 |
| o209 | Default gateway setting 1 | 0 to 255 | 0 |
| o210 | Default gateway setting 2 | 0 to 255 | 0 |
| o211 | Default gateway setting 3 | 0 to 255 | 0 |
| o212 | Default gateway setting 4 | 0 to 255 | 0 |

o213 is set to 2:DHCP or 3:DCP, the master controller and M1-EMP have special functionality for IP node address automatic setting.

## Static IP Address by parameters and rotary switch by o213=1

Use the ID switches located in the display area to set the Ethernet last node octet of the IP address (in Hexadecimal) when parameter o213 is set to 1 (hardware switch mode)




## DHCP (Dynamic Host Configuration Protocol) by o213=2

DHCP is a network service that automatically assigns IP addresses to devices when they power up.

- The device sends a request to a DHCP server on the network. The device sends a request to a DHCP server on the network. The device sends a request to a DHCP server on the network.
- The server provides an IP address, subnet mask, gateway, and optionally DNS information. The device sends a request to a DHCP server on the network. The device sends a request to a DHCP server on the network. The device sends a request to a DHCP server on the network.
- Useful when the network needs centralized, flexible IP management.
- The address may change unless a reservation is configured on the server.

## DCP (Discovery and Configuration Protocol) by o213=3

DCP is a protocol used mainly in PROFINET and some industrial Ethernet environments to assign fixed IP settings without requiring a DHCP server.

A controller or engineering tool sends a DCP “Set” command directly to the device.

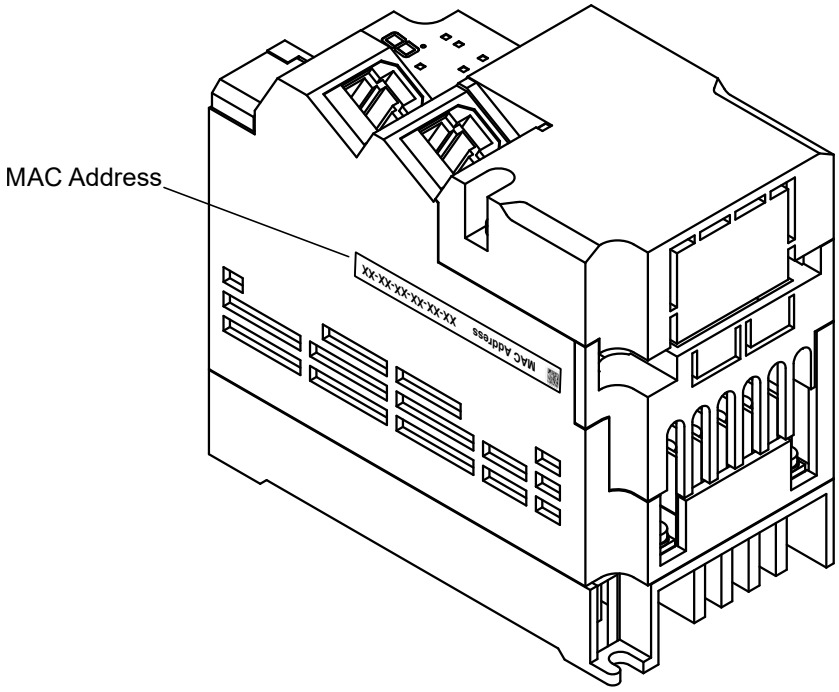
- The device stores the assigned IP address and uses it on every startup.
- Useful for simple setups or isolated networks where no DHCP server exists.
- Provides static, deterministic addressing.

# 3-4-2 MAC address of M1-EMP

In case of DHCP (common method for IP assignation that can bind MAC and IP if desired) and specially DCP in PROFINET (where MAC address are the fundamental slave identification method) it can be of interest to identify the MAC address of the particular device.

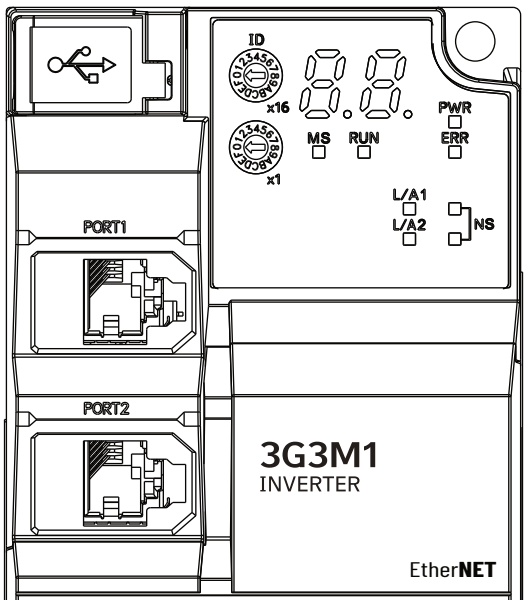
For this purpose, the M1-EMP adds a label with the MAC address information attached to the right side of the inverter. The label has this shape and content including a QR code to easily scan the MAC address.

MAC Label position in the drives is in the side of the unit.



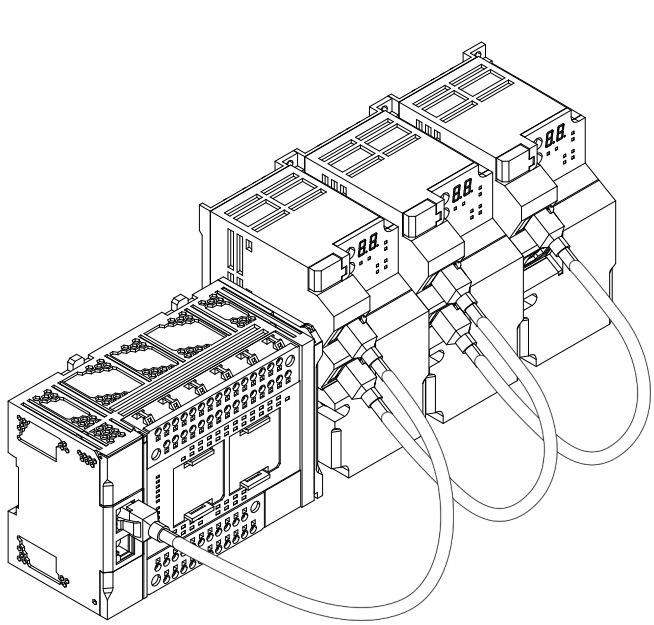

## 3-4-3 Ethernet ports and available topoloogies

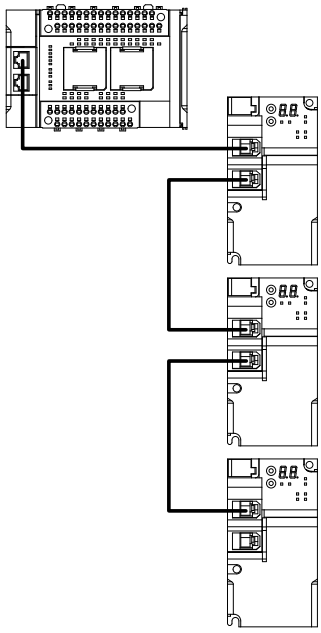
M1-EMP has 2 Ethernet ports with certain topology possibilities that differ by protocol.



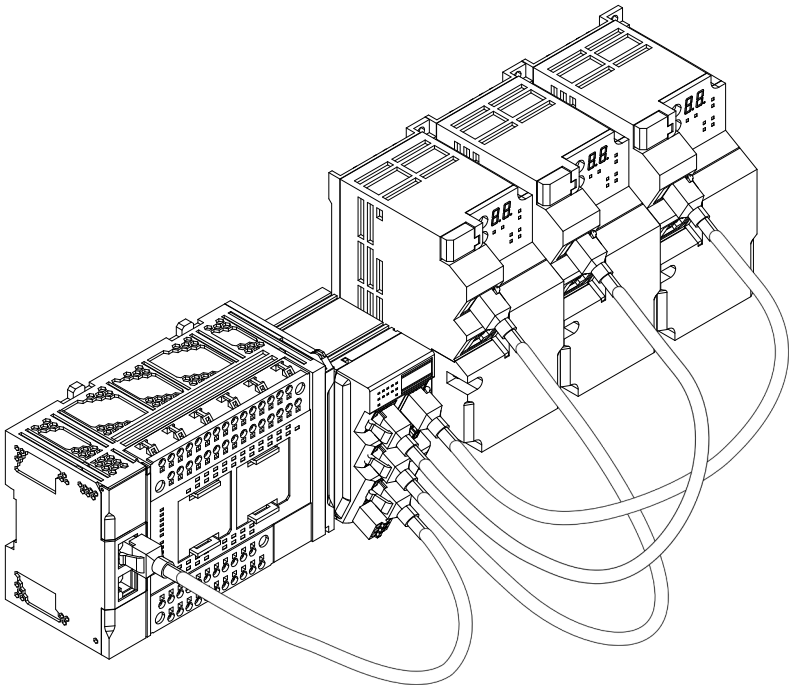
| Protocol | Ethernet Port | | Network Topology | | |
|---|---|---|---|---|---|
| | Port1 | Port2 | Star / Switch connection | linear / Daisy chain | Redundant Ring |
| **EtherNet/IP** | Supported | Supported | Supported | Supported | N/A |
| **PROFINET** | Supported | N/A | Supported | N/A | N /A |
| **Modbus TCP** | Supported | Supported | Supported | Supported | N /A |

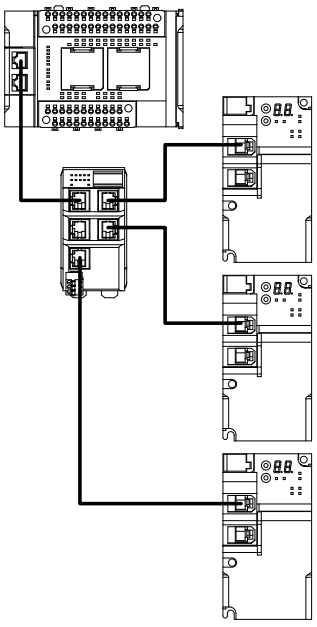
Daisy chain or Linear connection is possible for the EtherNet/IP and Modbus TCP protocols. This is ok for a limited number of units. Each drive acts like a "soft-switch". The drawback is that delays are added and network response timing is affected.





Hardware Switch Ethernet distribution (common method in IT infrastructure for stability), is supported by all protocols. Most hardware switches will work for PROFINET frames exchange, but make sure they are of industrial grade (such as the Omron W4S1_05D) with hardware switching in OSI layer 2 to comply with RT requirements. If PROFINET specific capabilities are required (multicast, network diagnostics, etc), a PROFINET-aware switch would be required.





## 3-4-4 Ethernet Recommended communication cables

To connect M1-EMP to the Ethernet industrial network, quality cables are recommended for connection.

| Ethernet Cable Specification | |
|---|---|
| Category | Cat 5e standard |
| Compliance | 100BASE-TX compliant |
| Wiring type | STP cable (straight / crosscable) |
| EMC | Shielded cable |

Following table lists the Ethernet cables supplied by omron that can be used for the purpose.

| Item | Appearance | Cable length (m) | Model |
|---|---|---|---|
| • Compact RJ45 connectors reduce in-panel cable routing space<br>• Enhanced wiring flexibility (*F) Cable sheath material: PUR<br>• Double-shielded for use in hostile, noisy environment<br>• Cable colors include blue (B), yellow (Y), or green.(G) |  | 0.3 | XS6W-6PUR8SS30CM-YF |
| | | 0.5 | XS6W-6PUR8SS50CM-YF |
| | | 1 | XS6W-6PUR8SS100CM-YF |
| | | 2 | XS6W-6PUR8SS200CM-YF |
| | | 3 | XS6W-6PUR8SS300CM-YF |
| | | 5 | XS6W-6PUR8SS500CM-YF |
| • RJ45 connectors with tough latch structure.<br>• Rugged cable.<br>• Better vibration immunity.<br>• Double-shielded for use in hostile, noisy environments |  | 0.3 | XS5W-T421-AMD-K |
| | | 0.5 | XS5W-T421-BMD-K |
| | | 1 | XS5W-T421-CMD-K |
| | | 2 | XS5W-T421-DMD-K |
| | | 5 | XS5W-T421-GMD-K |
| | | 10 | XS5W-T421-JMD-K |

## 3-4-5 External 24Vdc backup for communications

The 24Vdc backup is available to keep communications operation in the event of main power loss. The P24 terminal is insulated from the +24 terminal. The supply spec is 24 VDC (22 to 26 V) 500 mA max.

The power supply backup coverage is basically to maintain communications alive. The protection function, motor operation, STO, each I/O terminal, fan, braking transistor and inrush current protection circuit do not operate.

## 3-4-6 External backup supply for Control (>18.5kW)

Control power supply auxiliary input R0 an T0, in power terminal section, is available for Three-phase 400V and Single-phase 200V models of capacity 18.5 kW or more.

Backup power supply for control circuit/ communication function. The P24 terminal is insulated from the +24 terminal.

The protection function, motor operation, FSoE (STO), each I/O terminal, fan, braking transistor and inrush current protection circuit do not operate.

## 3-4-7 Custom Forced Operation Command Function

In stablished Ethernet based protocols, the protocol defines the way how the customer can take control of the drive. Normally through the pre-defined objects associated with drive control RUN and frequency command in the particular protocol including additional control bits for enabling the control from the network.

However, when we use assemblies or PDOs without mapping digital input control, and EXT (External Trip) or STOP (from 3 wire control) are present, they will prevent the inverter to run even if the physical inputs are closed (because they require AND combination with S006:

| Data NO/NC | Description | Comm. Function |
|---|---|---|
| 1009 / 9 | EXT: External trip | AND |
| 1030 / 30 | STOP: Force to stop (30 = Active OFF; 1030 = Active ON) | AND |

It is recommended to use y092 only for those cases. We can use new y092 as a permanent parameter (unlike S006, the value remains when saved) to enable the AND function for those inputs like if S006 was mapped and controlled from network.

In this way, the physical input is operative and not blocked even if S006 is not mapped.

**IMPORTANT NOTE:**

Although it could be used to force-close any other digital input, it is not recommended, as the digital input becomes unusable from either physical input or network.

### y092 bit pattern (same as S006)

| Parameter | Name | Setting Data | Def. Setting | Change during RUN | Data Format | Remark |
|---|---|---|---|---|---|---|
| y092 (New) | Forced Operation Command | 0000 to FFFF Hex<br><br>Bit15: RS<br>Bit14: DI7<br>Bit13: DI6<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: ---<br>Bit7: ---<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: RV<br>Bit0: FW | 0 | Y | 14 | • Stored in non-volatile memory as like other setting parameters<br>• Data will remain when H003=5 (initialization except I/O and communications related parameters). |
| S006 | Operation command | | | Y | | • Not stored in non-volatile memory |
| W042 | Communications Input Signal Monitor | | | N | | • Read-only parameter for monitoring |

## Operation combination example:

| | bit 15 | bit 14 | bit 13 | bit 12 | bit 11 | bit 10 | bit 9 | bit 8 | bit 7 | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S006 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| Y092 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| Final command (W042) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |

This has a special impact in EtherNet/IP. If using y092>0, ODVA certification will be lost (because it forces a clear meaning of the source of control defined from the Network control itself. Customer can decide if this is convenient for the application or he prefers to conform to ODVA specified usage way.

## 3-4-8 Inverter response to network timeout

We can select the inverter reaction in case of Fieldbus communications issue by setting parameters H489 and H490 to define the reaction of a communications timeout

| H489 | H490 | Inverter Response when a Timeout Occurs |
|---|---|---|
| 0, 4 to 9 | - | Immediately coast to a stop and er5 trip |
| 1 | 0.0s to 60.0s | After the time specified by H490, coast to a stop and er5. |
| 2 | 0.0s to 60.0s | If the communication link is restored within the time specified by H490, ignore the communication error.<br>After the timeout, coast to a stop and er5. |
| 3, 13 to 15 | - | Maintains present operation, ignoring the communication error. No Er5 trip. |
| 10 | - | Immediate forced deceleration according to the time set in parameter H056.<br>Er5 trip after stopping. |
| 11 | 0.0s to 60.0s | After the time specified by H490, forced deceleration. Er5 trip after stopping. |
| 12 | 0.0s to 60.0s | If the communication link is restored within the time specified by H490, ignore the communication error.<br>After the timeout, forced deceleration and er5 trip. |
| 13 | | Coast to a stop |
| 14 | | Deceleration stop |

## Clearing communication errors

It is possible to clear communication errors separately from the other inverter errors by parameter y095

| param | Function name | Range | Def. data |
|---|---|---|---|
| y095 | Data Clear Processing for Communications Error | 0 to 3<br>0: Do not clear the data of parameters S when a communications error occurs. (compatible with the conventional inverters)<br>1: Clear the data of parameters S001, S005, and S019 when a communications error occurs<br>2: Clear the run command assigned bit of parameter S006 when a communications error occurs<br>3: Clear both data 1 and 2 above | 0 |

## 3-4-9 Free Mapping for Cyclic R/W in EtherNet/IP and PROFINET

Both EtherNet/IP and PROFINET support a free mapping function that defines which inverter parameters are exchanged in the cyclic process (PDO type). The free mapping function is available in some of the custom Omron specific assemblies with a variable amount of assignations depending on the assembly.

Check the Appendix for more information on each assembly

You select the parameters by specifying their Modbus addresses as 16bit segments. Check parameter tables in section 6 for both 16bit and 32bit parameters.

| param | Function name | Range | Def. data | R/W | Eth/IP a0x01 16bit | Eth/IP a0x02 32bit LSW MSW | Data format 16bit 32bit |
|---|---|---|---|---|---|---|---|
| F006 | 1st Rated Voltage at Maximum Output Frequency | 80 to 240 V (200 V class series)<br>160 to 500 V (400 V class series) | 200V | R/W | 3006h | ---<br>--- | 1<br>--- |
| F007 | 1st Acceleration Time 1 | 0.00 to 6000.00 s | 6.00s | R/W | --- | 1103h<br>1102h | ---<br>6 |

The selected parameters are transmitted each network cycle as:

- Assembly data (EtherNet/IP), or
- PDO/user-configured I/O data (PROFINET).
- Modbus TCP does not support cyclic mapping, but supports free mapping for optimization.

Data size limits:

- PROFINET: Up to 32out/32in Free mapping words in and out can be exchanged in each cycle
- EtherNet/IP: Up to 14out/20in Free mapping words by assemblies 121(0x71) and 166(0xA6)
- Modbus TCP can address a maximum of 125 read registers and 123 write registers in a single communications message (multiple register access types).

### Free Mapping selection parameters

o221 until o252 define the parameters for writing onto the drive.

o253 until 0284 define the parameters for reading from the drive.

They are used to define the Ethernet/IP and PROFINET cyclic communication mapping. All of them are used by PROFINET (32out/32in), and EtherNet/IP only uses o221 to o234 and o253 to o266 (20in/14out)

| param | Function name | Range | Def. data | R/W | Set in RUN | Eth/IP a0x01 16bit | Eth/IP a0x02 32bit LSW MSW | Data format 16bit 32bit |
|---|---|---|---|---|---|---|---|---|
| o221 | Write function code mapping 1 | 0 to FFFFh | 0 | R/W | • | 4455h | ---<br>--- | 1<br>--- |
| o222 | Write function code mapping 2 | 0 to FFFFh | 0 | R/W | • | 4456h | ---<br>--- | 1<br>--- |
| ⋮<br>⋮ | ⋮<br>⋮ | ⋮<br>⋮ | ⋮<br>⋮ | ⋮<br>⋮ | ⋮<br>⋮ | ⋮<br>⋮ | ⋮<br>⋮ | ⋮<br>⋮ |
| o251 | Write function code mapping 31 | 0 to FFFFh | 0 | R/W | • | 4473h | ---<br>--- | 1<br>--- |
| o252 | Write function code mapping 32 | 0 to FFFFh | 0 | R/W | • | 4474h | ---<br>--- | 1<br>--- |
| o253 | Read function code mapping 1 | 0 to FFFFh | 0 | R/W | • | 4475h | ---<br>--- | 1<br>--- |
| o254 | Read function code mapping 2 | 0 to FFFFh | 0 | R/W | • | 4476h | ---<br>--- | 1<br>--- |
| ⋮<br>⋮ | ⋮<br>⋮ | ⋮<br>⋮ | ⋮<br>⋮ | ⋮<br>⋮ | ⋮<br>⋮ | ⋮<br>⋮ | ⋮<br>⋮ | ⋮<br>⋮ |
| o283 | Read function code mapping 31 | 0 to FFFFh | 0 | R/W | • | 4493h | ---<br>--- | 1<br>--- |
| o284 | Read function code mapping 32 | 0 to FFFFh | 0 | R/W | • | 4494h | ---<br>--- | 1<br>--- |

Limitations apply to the free mapped parameters, see Limitations of Free Mapping Section next.

## 3-4-10 Free Mapping for Indirect Parameter Access in Modbus TCP

In Modbus TCP, free mapping parameters allow the grouping of several parameters by using fake mirrored addresses for access. It works like a "look-up table" and allows access by grouping parameters in single Modbus message calls, even if their original addresses are far away from each other.

In o221 until o252 we select the parameters that we want to group in a Modbus multiple holding registers Write Function Code (0x06) or Multiple Read/Write (0x17). With a single message, we can write them all through the indirect addresses from 0x8000 until 0x801F

In o253 until o284, we select the paramters that we want to group in a Modbus multiple holding registers Read Function Code (0x03) or Multiple Read/Write (0x17). We can read them all by using the indirect addresses (0x8020 until 0x803F).

| Write Mapping parameter | Mapped Address | Content Write Address | Read Mapping parameter | Mapped Address | Content Read Address |
|---|---|---|---|---|---|
| **o221** | 4455h | 8000h | **o253** | 4475h | 8020h |
| **o222** | 4456h | 8001h | **o254** | 4476h | 8021h |
| **o223** | 4457h | 8002h | **o255** | 4477h | 8022h |
| **o224** | 4458h | 8003h | **o256** | 4478h | 8023h |
| **o225** | 4459h | 8004h | **o257** | 4479h | 8024h |
| **o226** | 445Ah | 8005h | **o258** | 447Ah | 8025h |
| **o227** | 445Bh | 8006h | **o259** | 447Bh | 8026h |
| **o228** | 445Ch | 8007h | **o260** | 447Ch | 8027h |
| **o229** | 445Dh | 8008h | **o261** | 447Dh | 8028h |
| **o230** | 445Eh | 8009h | **o262** | 447Eh | 8029h |
| **o231** | 445Fh | 800Ah | **o263** | 447Fh | 802Ah |
| **o232** | 4460h | 800Bh | **o264** | 4480h | 802Bh |
| **o233** | 4461h | 800Ch | **o265** | 4481h | 802Ch |
| **o234** | 4462h | 800Dh | **o266** | 4482h | 802Dh |
| **o235** | 4463h | 800Eh | **o267** | 4483h | 802Eh |
| **o236** | 4464h | 800Fh | **o268** | 4484h | 802Fh |
| **o237** | 4465h | 8010h | **o269** | 4485h | 8030h |
| **o238** | 4466h | 8011h | **o270** | 4486h | 8031h |
| **o239** | 4467h | 8012h | **o271** | 4487h | 8032h |
| **o240** | 4468h | 8013h | **o272** | 4488h | 8033h |
| **o241** | 4469h | 8014h | **o273** | 4489h | 8034h |
| **o242** | 446Ah | 8015h | **o274** | 448Ah | 8035h |
| **o243** | 446Bh | 8016h | **o275** | 448Bh | 8036h |
| **o244** | 446Ch | 8017h | **o276** | 448Ch | 8037h |
| **o245** | 446Dh | 8018h | **o277** | 448Dh | 8038h |
| **o246** | 446Eh | 8019h | **o278** | 448Eh | 8039h |
| **o247** | 446Fh | 801Ah | **o279** | 448Fh | 803Ah |
| **o248** | 4470h | 801Bh | **o280** | 4490h | 803Bh |
| **o249** | 4471h | 801Ch | **o281** | 4491h | 803Ch |
| **o250** | 4472h | 801Dh | **o282** | 4492h | 803Dh |
| **o251** | 4473h | 801Eh | **o283** | 4493h | 803Eh |
| **o252** | 4474h | 801Fh | **o284** | 4494h | 803Fh |

**Example:**

Writing o221=2103h (LSW of E010), o222=2104h (MSW of E010), o223=1103h (LSW of F007), o224=1104h (MSW of F007), and writing with command 0x10 to 8020h until 8023h will actually modify E010 and F007 parameters in RAM with a single message, even if they addresses are not consecutive.

## 3-4-11 Limitations of Free Mapping

- Values written using free mapping will be lost when the power is turned off.
- If you want to save the value, execute y097=2 (save from temporary memory to nonvolatile memory).

| param | Function name | Range | Def. data |
|---|---|---|---|
| y097 | Communication Data Storage Selection | 0 to 2<br>0: Store into nonvolatile memory (Rewritable times are limited)<br>1: Write into temporary memory (Rewritable times are unlimited)<br>2: Save all data from temporary memory to nonvolatile memory (After all data is saved, return to Data 1) | 1 |

### Limitations of Free Mapping Write

The following parameters cannot be assigned to writes:

- Read only parameter (M-parameter, W-parameter etc)
- EEPROM access (H003, H193, y097)
- Password (H099, H198, H199)
- Maintenance (H042, H043, H044, H047, H048, H077, H094, A051, A052)
- Ethernet parameter (o201 to o299)

If we want to access limited parameters, they should be accessed by their original addresses directly.

### Duplicated parameters access

- If the same parameter is assigned multiple times to the write parameter assignment, only the parameter with the smallest assignment number will be valid.
- On the other hand, when the same parameter is assigned multiple times to the read parameter assignment, all of them are valid.
- In order to avoid conflicts of the same signal, do not assign parameter with the same meaning to the write function code assignment.
  Example : Frequency commands S001, S005, and S019. Same meaning, different units. Mapping them at the same time
- When the operation command S006 is assigned to the write parameter, do not use control bits that confiict with other protocol-specific operation commands (e.g. Do not use Forward/Reverse or Jog control bits while PROFINET is controlling the inverter with PROFIdrive or EtherNet/IP is using assemblies with equivalent control bits.

## 3-4-12 Access to 32bit parameters

- When mapping a 4-byte parameter (e.g. 32-bit), you must assign two consecutive addresses (upper word-MSW → lower word-LSW). M1-EMP adopts higher word first order.
- If o221 to o284, which set the 4-byte function code, are not consecutive numbers, or if they are not set in the order of upper address before lower address in EtherNet/IP or PROFINET, the setting will be invalid. If invalid, writing is not possible, and the read value will be 0. Modbus TCP is not affected and 32bit integrity will depend on how 16bit portions are grouped. Modbus does not understand 32bit, but the M1 will ensure integrity of MSW and LSW registers that are read in the same message.

An example of setting F007 and the invalid settings results is in this table:

| Parameter setting | Y : Valid<br>N : Invalid | Remark |
|---|---|---|
| o222 = 1102h (Upper)<br>o223 = 1103h (Lower) | Y | The settings are correct. |
| o222 = 1102h (Upper)<br>o224 = 1103h (Lower) | N | o222 and o224 are not consecutive numbers. |
| o222 = 1103h (Lower)<br>o223 = 1102h (Upper) | N | The upper and lower addresses are reversed. |
| o252 = 1102h (Upper)<br>o253 = 1103h (Lower) | EIP:N<br>PROFI:N<br>Modbus:Y | PROFINET and EtherNet/IP are invalid because they span the write function code assignment and read function code assignment. It is not possible to use o252 (write group) and o253 (read group) at the same time in EtherNet/IP or PROFINET for the same parameter. |

Some parameters are automatically treated as 32bits in the o2xx mapping. Those are the following in this list, in this case referring them only with MSW is ok.

| param LSW MSW | Function name | Range | R/W | Set in RUN | 32bit LSW MSW | Data format 16bit 32bit |
|---|---|---|---|---|---|---|
| d224<br>d223 | Detection Level of Excessive Positioning Deviation | 0 to 2147483647<br>(MSW: 0 to 32767,<br>LSW: 0 to 65535) | R/W | • | 4158h<br>4157h | ---<br>1 |
| d226<br>d225 | Software Overtravel Detection Position in the Positive Direction | −2147483648 to 2147483647<br>(MSW: -32768 to 32767,<br>LSW: 0 to 65535) | R/W | | 415Ah<br>4159h | ---<br>2 |
| d228<br>d227 | Software Overtravel Detection Position in the Negative Direction | | R/W | | 415Ch<br>415Bh | ---<br>2 |
| d241<br>d240 | Preset Position | | R/W | • | 1660h<br>165Fh | ---<br>2 |
| d243<br>d242 | Homing Offset | 0 to 2147483647<br>(MSW: 0 to 32767,<br>LSW: 0 to 65535) | R/W | • | 416Bh<br>416Ah | ---<br>1 |
| d245<br>d244 | Positioning Data 1 | −2147483648 to 2147483647<br>(MSW: -32768 to 32767,<br>LSW: 0 to 65535) | R/W | • | 163Eh<br>163Dh | ---<br>2 |
| d247<br>d246 | Positioning Data 2 | | R/W | • | 1640h<br>163Fh | ---<br>2 |
| d249<br>d248 | Positioning Data 3 | | R/W | • | 1642h<br>1641h | ---<br>2 |
| d251<br>d250 | Positioning Data 4 | | R/W | • | 1644h<br>1643h | ---<br>2 |
| d253<br>d252 | Positioning Data 5 | | R/W | • | 1646h<br>1645h | ---<br>2 |
| d255<br>d254 | Positioning Data 6 | | R/W | • | 1648h<br>1647h | ---<br>2 |
| d257<br>d256 | Positioning Data 7 | | R/W | • | 164Ah<br>1649h | ---<br>2 |
| d259<br>d258 | Positioning Data 8 | | R/W | • | 164Ch<br>164Bh | ---<br>2 |
| d297<br>d296 | Current Reference Position Monitor | | RO | | 1036h<br>1035h | ---<br>2 |
| d299<br>d298 | Current Feedback Position Monitor | | RO | | 1038h<br>1037h | ---<br>2 |
| S021<br>S020 | Positioning Data via Communication | | R/W | • | 5016h<br>5015h | ---<br>2 |
| W143<br>W142 | Feedback Current Position Monitor | | RO | | 532Ch<br>532Bh | ---<br>2 |
| W145<br>W144 | Target Position Monitor | | RO | | 532Eh<br>532Dh | ---<br>2 |
| W147<br>W146 | Position Deviation Monitor | | RO | | 5330h<br>532Fh | ---<br>2 |
| W149<br>W148 | Touch Probe 1 Positive Edge | | RO | | 5332h<br>5331h | ---<br>2 |
| W151<br>W150 | Touch Probe 2 Positive Edge | | RO | | 5334h<br>5333h | ---<br>2 |
| W174<br>W173 | Set Target Position Monitor | | RO | | 534Bh<br>534Ah | ---<br>2 |

## Big assembly performance

If the assembly is big, please consider that the actual update performance to the inverter is 8 parameters/second (16 or 32bit parameters), so more than one inverter cycle may be required for the complete assembly transfer, regardless of the message grouping in the Ethernet side.

# 3-5 EtherNet/IP Protocol

EtherNet/IP (Ethernet Industrial Protocol) is an open, widely adopted industrial networking technology that uses standard Ethernet for real-time control and data exchange. Based on the CIP™ (Common Industrial Protocol), EtherNet/IP enables seamless integration with PLCs, HMIs, and other automation devices through common object models and services. In M1-EMP inverter, EtherNet/IP provides high-speed cyclic I/O communication for real-time control, along with explicit messaging for configuration and diagnostics, ensuring reliable and efficient connectivity within modern industrial automation systems.

- EtherNet/IP uses standard Ethernet (IEEE 802.3) for Physical layer (Layer 1) and Data Link layer (Layer 2).
- It uses IP for Network layer (Layer 3) and TCP/UDP for Transport layer (Layer 4).
- For the upper layers (Session/Presentation/Application, Layers 5-7), the protocol uses the Common Industrial Protocol (CIP) framework.

| OSI Layer | Layer Name | Implementation |
|---|---|---|
| 7 | Application | CIP Drive Profile (AC Drive Profile)<br>• Control Word / Status Word<br>• Speed, torque, position semantics<br>• Standard & vendor-specific assemblies |
| 6 | Presentation | CIP data representation & scaling |
| 5 | Session | CIP connections (Class 1 / Class 3) |
| 4 | Transport | TCP – Explicit Messaging (Class 3)<br>UDP – Implicit I/O Messaging (Class 1) |
| 3 | Network | IP (IPv4) |
| 2 | Data Link | Ethernet MAC (IEEE 802.3) |
| 1 | Physical | Ethernet PHY (100BASE-TX) |

## 3-5-1 EtherNet/IP Specifications

| Item | Description |
|---|---|
| Conformance Tested | ODVA EtherNet/IP Declaration of Conformity (CT21) (*4) |
| Vendor ID | 319 (Fuji Electric Group) |
| Product Code | Refer to “Product Code List” |
| Product Type Code | 2 (AC Drive) |
| UCMM | Supported |
| Class 3 (Explicit) Messaging | Supported |
| Class 1 (Implicit I/O) Messaging | Supported |
| Class 1 Unicast T→O | Supported |
| Class 1 Multicast T→O | Supported |
| Number of Connections | Class1:8, Class3:8 |
| Requested Packet Interval (RPI) | Min 4ms |
| I/O Input Size | Max 14 input words, user configurable (*1) |
| I/O Output Size | Max 14 output words, user configurable (*1) |
| Generic (User Configurable) Assembly Instances | 101, 115, 116, 117, 118, 119, 120, 121,<br>151, 155, 166, 167, 168, 169, 170, 171 (*3) |
| AC/DC Drive Profile Assembly Instances | 20, 21, 22, 23, 70, 71, 72, 73(*3) |
| Device Level Ring (DLR) | N/A |
| Class 1 UDP Port | 2222.0 |
| Explicit Messaging Port | 44818(0xAF12) |
| LLDP | Supported |
| Address Collision detection (ACD) | Supported |
| Communication Profile Object (*2) | AC Drive Profile Objects<br>- Identity Object (Class Code 1)<br>- Assembly Object (Class Code 4)<br>- Connection Manager Object (Class Code 6)<br>- Motor data Object (Class Code 40)<br>- Control Supervisor Object (Class Code 41)<br>- AC/DC Drive Object (Class Code 42)<br>- Vendor Specific Object (Class Code 162)<br>- TCP/IP Interface Object (Class Code 245)<br>- Ethernet Link Object (Class Code 246)<br>- LLDP Management Object(Class Code 265)<br>- LLDP Data Table Object(Class Code 266) |

(*1) The change of assignment does not reflect immediately. Please reboot after changing settings.

(*2) Vendor object specifications may not completely match MX2/Q2V

(*3) Refer to Appendix

(*4) If F002/E102 are set to “Ethernet”, the conformance test will not pass. This is done in order to allow local control even with assemblies without override bits assigned. This improves compatibility with previous Omron drives such as Q2V and MX2.

## 3-5-2 EtherNet/IP product code list

As EtherNet/IP EDS files contains the definition of the inverter parameters for all the models and KVA, it is required to have product codes for each size in order to be able to apply the proper parameter table with it's particular default settings. This mainly refers to values that change by voltage range or KVA power rating. The advantage is that parameters can be edited in master controllers other than omron, with the proper values for each KVA model.

M1-EMP List of product codes

| Product code | Model | Product code | Model |
|---|---|---|---|
| 0x2433 | 3G3M1-A2002-EMP | 0x2442 | 3G3M1-A4030-EMP |
| 0x2434 | 3G3M1-A2004-EMP | 0x2443 | 3G3M1-A4040-EMP |
| 0x2435 | 3G3M1-A2007-EMP | 0x2444 | 3G3M1-A4055-EMP |
| 0x2436 | 3G3M1-A2015-EMP | 0x2445 | 3G3M1-A4075-EMP |
| 0x2437 | 3G3M1-A2022-EMP | 0x2446 | 3G3M1-A4110-EMP |
| 0x2438 | 3G3M1-A2037-EMP | 0x2447 | 3G3M1-A4150-EMP |
| 0x2439 | 3G3M1-A2055-EMP | 0x2448 | 3G3M1-A4185-EMP |
| 0x243A | 3G3M1-A2075-EMP | 0x2449 | 3G3M1-A4220-EMP |
| 0x243B | 3G3M1-A2110-EMP | 0x244A | 3G3M1-AB002-EMP |
| 0x243C | 3G3M1-A2150-EMP | 0x244B | 3G3M1-AB004-EMP |
| 0x243D | 3G3M1-A2185-EMP | 0x244C | 3G3M1-AB007-EMP |
| 0x243E | 3G3M1-A4004-EMP | 0x244D | 3G3M1-AB015-EMP |
| 0x243F | 3G3M1-A4007-EMP | 0x244E | 3G3M1-AB022-EMP |
| 0x2440 | 3G3M1-A4015-EMP | 0x244F | 3G3M1-AB037-EMP |
| 0x2441 | 3G3M1-A4022-EMP | | |

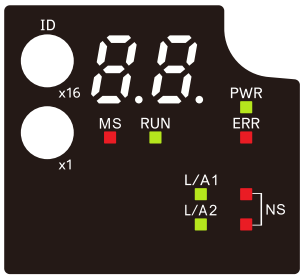
## 3-5-3 EtherNet/IP performance

EtherNet/IP can transmit large assemblies (see Appendix) within a single Ethernet frame. However, the drive requires multiple internal cycles to process this data, as the transfer to the inverter must be segmented. This distinction is important for understanding the effective performance in real applications. Developers should size the assemblies appropriately to meet their performance requirements.

| Access | Bandwidth | Remarks |
|---|---|---|
| Cyclic message | Max. 4 parameters* / 500µs | Same as M1-ECT 2nd ver. (V1.1) |
| Non cyclic message | Max.1 parameter* / 500µs | |

* Parameters can be either 16 or 32bit

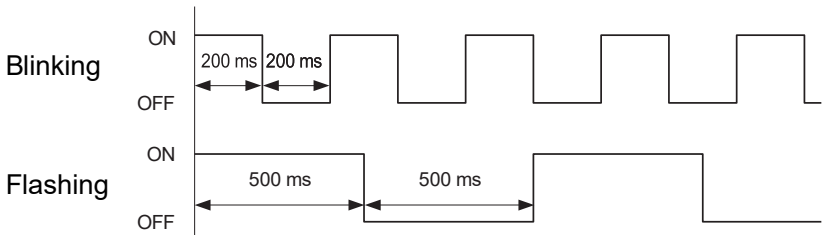
## 3-5-4 EtherNet/IP Status in LED operation panel




Specific EtherNet/IP status indicators

| Name | Color | LED status | Description |
|---|---|---|---|
| MS (MODULE STATUS) | Green/ Red | OFF | Power OFF |
| | Green | Flashing | IP address is not set when DHCP is used. |
| | | ON | Operating normally |
| | Red | OFF | No failure |
| | | Flashing | Minor failure (recoverable) |
| | | ON | Hardware failure (unrecoverable) |
| NS (NETWORK STATUS) | Green | OFF | Connection with scanner not established (IP address is not set) |
| | | Flashing | Waiting for connection establishment with scanner (IP address is set) |
| | | ON | Normally communicating with the scanner |
| | Red | OFF | Normally communicating with the scanner |
| | | Flashing | A timeout occurred during communication with the scanner. |
| | | ON | Duplicate IP address |
| L/A1 (Link/Activity1) | Green | OFF | Not connected |
| | | Blinking | Linking (in communication) |
| | | ON | Linking (not in communication) |
| L/A2 (Link/Activity2) | Green | same as L/A1 | |

See the following diagram for the meaning of the status of the indicators.



# 3-6 PROFINET® IO and PROFIdrive®

PROFINET® IO is an open industrial Ethernet communication standard designed for high-speed data exchange between automation devices. It enables real-time control, device diagnostics, and seamless system integration within distributed industrial networks. In this inverter, PROFINET® IO supports cyclic data communication for control and monitoring, as well as acyclic communication for configuration and diagnostic functions, ensuring reliable performance in complex automation environments.

- PROFINET is based on Ethernet and uses IEEE 802.3 at Layers 1 and 2.
- Layer 3 (Network) uses IP for non-real-time communications; Layers 4 (Transport) uses TCP/UDP for non-real-time.
- For real-time (and isochronous) data, PROFINET can bypass some of the higher OSI layers and even use Layer 2 frames directly for fast I/O.

| OSI Layer | Layer Name | M1-EMP PROFINET / PROFIdrive Implementation |
|---|---|---|
| 7 | Application | PROFIDrive Profile (AC1 – Standard Drives)<br>• STW1 / ZSW1<br>• NSOLL / NIST<br>• Drive state machine |
| 6 | Presentation | PROFIdrive data formatting & normalization |
| 5 | Session | PROFIdrive connection context |
| 4 | Transport | PROFINET RT protocol (not UDP) cyclic |
| 3 | Network | IP (acyclic services only) |
| 2 | Data Link | Ethernet MAC (IEEE 802.3) |
| 1 | Physical | Ethernet PHY (100BASE-TX) |

## 3-6-1 PROFINET® IO and PROFIdrive® Specifications

| Item | Description |
|---|---|
| Conformance Tested | PROFINET V2.43 Certificate PROFIDrive V4.2 Certificate |
| Vendor ID | 0x0015 (Fuji) |
| Device ID | 0x2433 |
| Device Type | PROFINET IO Device |
| Device Name | Unassigned (Factory default setting) |
| Protocol Level | RT (Real-Time) |
| RT Conformance Class | Class B (CC-B) |
| Netload Class | I |
| I/O Cycle Time | Min 4ms |
| I/O Input Size | Max 32 input words, user configurable |
| I/O Output Size | Max 32 output words, user configurable |
| Media Redundancy Protocol (MRP) | N/A |
| DCP | Supported |
| LLDP | Supported |
| I&M | I&M0 to I&M3 |
| Communication Profile | PROFIDrive Application Class 1: Standard Drives<br>- Standard Telegram 1<br>- Telegram 100<br>- Telegram 101 |

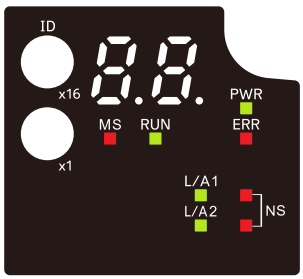
## 3-6-2 PROFINET® IO performance

PROFINET® IO can exchange large data records (see Appendix) within a single Ethernet frame. However, the drive still processes this information over multiple internal update cycles, since the transfer to the inverter must be segmented. Understanding this behaviour is important when assessing real-world performance. Developers should select data record sizes that align with their application’s performance requirements.

| Access | Bandwidth | Remarks |
|---|---|---|
| Cyclic message | Max. 4 parameters* / 500µs | Same as M1-ECT 2nd ver. (V1.1) |
| Noncyclic message | Max.1 parameter* / 500µs | |

* Parameters are either 16 or 32bits.

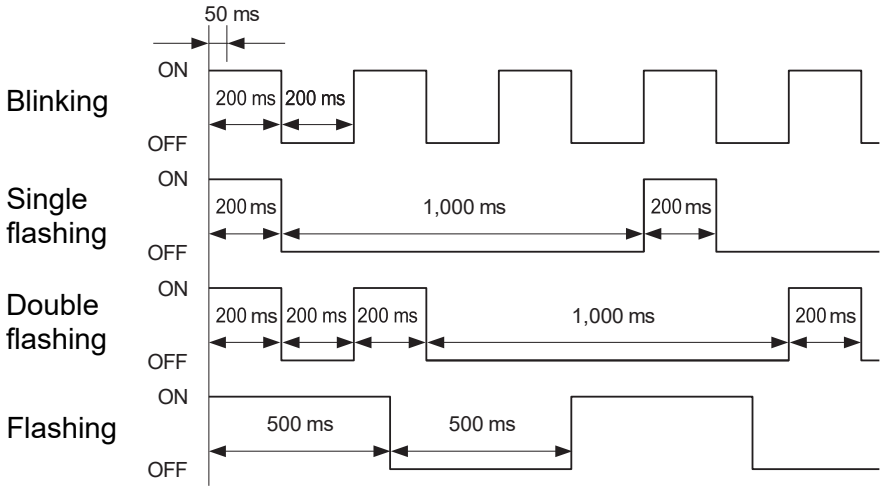
## 3-6-3 PROFINET Status in LED operation panel




Specific PROFINET status indicators

| Name | Color | LED status | Description |
|---|---|---|---|
| MS (MODULE STATUS) | Green/ Red | OFF | Power OFF |
| | Green | Flashing | IP address is not set when DHCP is used. |
| | | ON | Operating normally |
| | Red | OFF | Operating normally |
| | | Flashing | MAC address error |
| | | ON | Hardware failure (unrecoverable) |
| NS (NETWORK STATUS) | Green | OFF | Connection with master not established. (Ethernet is off-line) |
| | | Flashing | Identifying the device.<br>(The LED test with diagnostic tool) |
| | | Single Flashing | Waiting for connection establishment with master. |
| | | ON | Normally communicating with the master. |
| | Red | OFF | Normally communicating with the master. |
| | | Single | Device Name is not registered. |
| | | Double Flashing | IP address is not registered. |
| L/A1<br>(Link/Activity1) | Green | OFF | Not connected |
| | | Blinking | Linking (in communication) |
| | | ON | Linking (not in communication) |
| L/A2<br>(Link/Activity2) | Green | Not used | |

See the following diagram for the meaning of the status of the indicators.




## 3-6-4 Access to 32bit parameters

In PROFINET there is no particular word order check, as PROFINET does not really understand 32bit parameters. Because of this, the 32bit parameter may be split depending on the parameter grouping and sort order. There is no compulsory word order understanding in PROFINET, but there is a convention that, particularly in PROFIdrive, the High word is the first, and Low word is second.

e.g. for F007 (Acceleration time)
High word (1102h) → first
Low word (1103h) → second

For 32bit consistency, M1-EMP applies an internal method, similar of that used in M1-ECT 2nd version (V1.1) to guarantee that the 2 words of a 32bit register in the same network side communications cycle are consistent to each other, in order to avoid mismatch of MSW/LSW pairs and parameters belonging to the same communications message.

# 3-7 Modbus TCP

Modbus TCP is a widely used open industrial communication protocol that use standard Ethernet networking for master-slave data exchange. Known for its simplicity and interoperability, Modbus TCP enables efficient communication between controllers, inverters, sensors, and SCADA systems.

In M1-EMP, Modbus TCP provides register-based access for control, monitoring, and parameter configuration over TCP/IP networks.

- Modbus is strictly the Application layer (Layer 7) in the OSI model.
- The lower layers (Physical, Data Link, Network, Transport) are those of Ethernet TCP/IP.
- ModbusTCP protocol does not have particular requirements compared to any Ethernet connection.

| OSI Layer | Layer Name | M1-EMP MODBUS TCP Implementation |
|---|---|---|
| 7 | Application | MODBUS Application Protocol<br>• Holding Registers (parameters, monitors)<br>• Coils / Discrete Inputs (control/status bits) |
| 6 | Presentation | MODBUS data formatting (16-bit registers, scaling) |
| 5 | Session | MODBUS transaction context (Transaction ID) |
| 4 | Transport | TCP |
| 3 | Network | IP (IPv4) |
| 2 | Data Link | Ethernet MAC (IEEE 802.3) |
| 1 | Physical | Ethernet PHY (100BASE-TX) |

## 3-7-1 Modbus TCP Specifications

| Item | Description |
|---|---|
| Class | 1 (extended) |
| Number of Connections | 8 |
| Max Read Register Size | 125 registers for 3G3M1 series |
| Max Write Register Size | 123 registers for 3G3M1 series |
| Register Data Type | 16bit integer |
| Unit (Slave) ID | Ignored, echoed in response |
| TCP Port | 502 |

## Modbus TCP supported Function codes

| Function Code | Command |
|---|---|
| 1 (0x01) | Read Coil |
| 3 (0x03) | Read Holding Registers |
| 5 (0x05) | Write Single Coil |
| 6 (0x06) | Write Single Register |
| 15 (0x0F) | Write Multiple Coils |
| 16 (0x10) | Write Multiple registers |
| 23 (0x17) | Read/Write Multiple Registers |

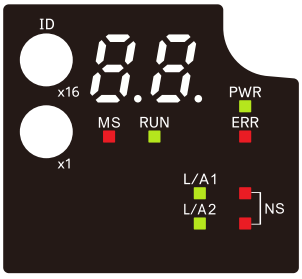
For details of the messaging frames for each Function Code, please refer to the Appendix
(*) Modbus addresses are used to access R/W registers.
The consistency (e.g. 32bit position data) is guaranteed same as 3G3M1-ECT 2nd version. (V1.1)

## 3-7-2 Modbus TCP performance

Modbus communications accept up to 125 registers in a message, however to transfer them to the drive takes some time as the transfer has to be split in several communications. This helps understanding effective performance for applications. Developer should adjust the frame size according to the application performance target.

| Access | Bandwidth |
|---|---|
| Free mapping register | Max. 4 parameters / 500µs |
| Normal register | Max.1 parameter / 500µs |

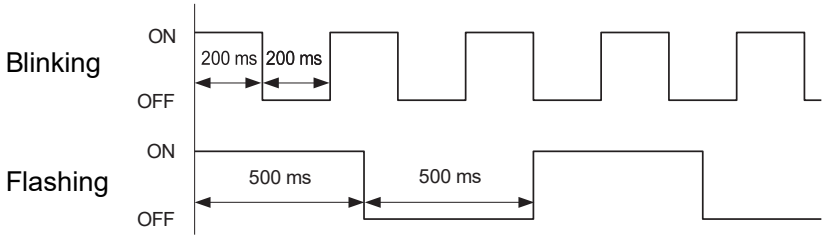
## 3-7-3 Modbus TCP Status in LED operation panel




Specific Modbus TCP status indicators

| Name | Color | LED status | Description |
|---|---|---|---|
| MS (MODULE STATUS) | Green/ Red | OFF | Power OFF |
| | Green | Flashing | IP address is not set when DHCP is used. |
| | | ON | Operating normally |
| | Red | OFF | No failure |
| | | Flashing | Minor failure (recoverable) |
| | | ON | Hardware failure (unrecoverable) |
| NS (NETWORK STATUS) | Green | Not used | |
| | Red | | |
| L/A1 (Link/Activity1) | Green | OFF | Not connected |
| | | Blinking | Linking (in communication) |
| | | ON | Linking (not in communication) |
| L/A2 (Link/Activity2) | Green | same as L/A1 | |

See the following diagram for the meaning of the status of the indicators.




## 3-7-4 Access to 32bit parameters

In Modbus TCP there is no particular word order check, as Modbus does not really understand 32bit parameters. Because of this, the 32bit parameter may be split depending on the parameter grouping and sort order. There is no compulsory word order understanding in ModbusTCP.

M1-EMP applies an internal method to guarantee that the 2 words of a 32bit register in the same network side communications cycle are consistent to each other, in order to avoid mismatch of MSW/LSW pairs and parameters belonging to the same communications message.

| Address (Byte) | Name | Data length (Byte) | Remark |
|---|---|---|---|
| 0 | Error Code | 1 | 0x97 |
| 1 | Extension Code | 1 | 0x03: Number of registers is incorrect (0 or over).<br>Byte count is incorrect.<br>The size of the request message is smaller than the required size. |

# 4

# Drive Control and Test Run

M1-EMP supports EtherNet/IP and PROFINET drive profiles as defined by corresponding standards. ODVA or SIEMENS. These profiles allow interoperable control for the basic functions of the device type. In this case, Run/Stop, frequency reference, inverter error state and others are defined in a standard way that allows control of the Variable Frequency Drive regardless of the brand.



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# 4-1 EtherNet/IP Drive Control

## 4-1-1 EtherNet/IP CIP profile for VFD control

In EtherNet/IP there are standardized I/O instances and object models specifically intended for variable-frequency drives (VFDs), defined by ODVA. M1-EMP implements these standards

EtherNet/IP standardizes drive behavior through the AC Drive Profile, which defines:

- Standard CIP objects for drives
- Standard Assembly Instances for cyclic I/O
- A consistent control/status model across vendors

This allows PLCs to control drives in a vendor-independent way. M1-EMP declares as:

### Device Type = 2 (AC Drive)

This value identifies the device as an AC motor drive according to the EtherNet/IP (CIP) standard. It allows PLCs and engineering tools to automatically recognize the device as a variable-frequency drive and apply the correct control model (Run/Stop, speed reference, status, faults). In short, the controller knows it is talking to a drive, not a generic I/O device.

### UCMM + Class 1 I/O supported

This indicates that the drive supports both EtherNet/IP communication types:

- UCMM (Unconnected Message Manager). Used for explicit messaging, such as parameter read/write, configuration, diagnostics
- Class 1 I/O messaging. Used for cyclic, real-time data exchange, such as Run/Stop commands, speed or torque references, status and feedback data

In short, it means that the drive can be fully configured via parameters and also controlled in real time using cyclic I/O.

### AC Drive Profile compliant

This means the drive follows the ODVA-defined AC Drive Profile, which standardizes:

- Control and status behavior
- Data meaning for common drive functions
- Standard I/O Assembly formats



NOTE:

AC Drive Profile compliance does NOT mean that every possible drive function is supported. PLCs can control the drive using generic EtherNet/IP drive instructions without vendor-specific programming for basic functions (Run/Stop, speed operation, general error flagging).

There are Omron vendor specific assemblies that provide advanced diagnostics, special control modes, extended I/O, and are more compatible with previous inverters MX2 and Q2V with EtherNet/IP option board. Even so, there are still differences if accessing parameters out of the assembly definitions

- Error alarm signal codes and available alarms
- Bit patterns for command, status, alarm and error flags.
- Dynamic Input and output register addresses

## 4-1-2 Standard CIP objects used for VFD control

| CIP Object | Class | Purpose |
|---|---|---|
| Identity Object | 0x01 | Device identification |
| Assembly Object | 0x04 | Cyclic I/O data |
| Control Supervisor Object | 0x29 (41) | Run/Stop, direction, state machine |
| AC/DC Drive Object | 0x2A (42) | Speed, torque, limits, scaling |
| Motor Data Object | 0x28 (40) | Rated motor data |
| Connection Manager | 0x06 | I/O connections |

For details of control and parameter access through assemblies and about the address and format of each parameter and monitor, please refer to Assemblies details in Appendix and to Parameter list details in Section 5.

## 4-1-3 Standard EtherNet/IP Drive Assembly Instances

ODVA defines well-known I/O Assembly instance numbers for AC drives. The M1-EMP supports these standard instances directly.

| Function name | Output Instance (PLC → Drive) | Input Instance (Drive → PLC) | Capability summary |
|---|---|---|---|
| Basic Speed Control | 20 (0x14) | 70 (0x46) | Provides basic Run/Stop control and speed reference with minimal status feedback. Suitable for simple speed control applications. |
| Extended Speed Control | 21 (0x15) | 71 (0x47) | Adds network command and reference source control, better drive status reporting for more robust speed control. |
| Speed and Torque Control | 22 (0x16) | 72 (0x48) | Supports both speed reference and torque reference/limit, enabling torque-limited or torque-controlled operation with the simplest status feedback. |
| Extended Speed and Torque Control | 23 (0x17) | 73 (0x49) | Combines speed and torque control with extended status feedback information and network control indication. |

For details of the instances content and register meaning and units, please refer to the Appendix.

## 4-1-4 Omron Specific EtherNet/IP Drive Assembly Instances

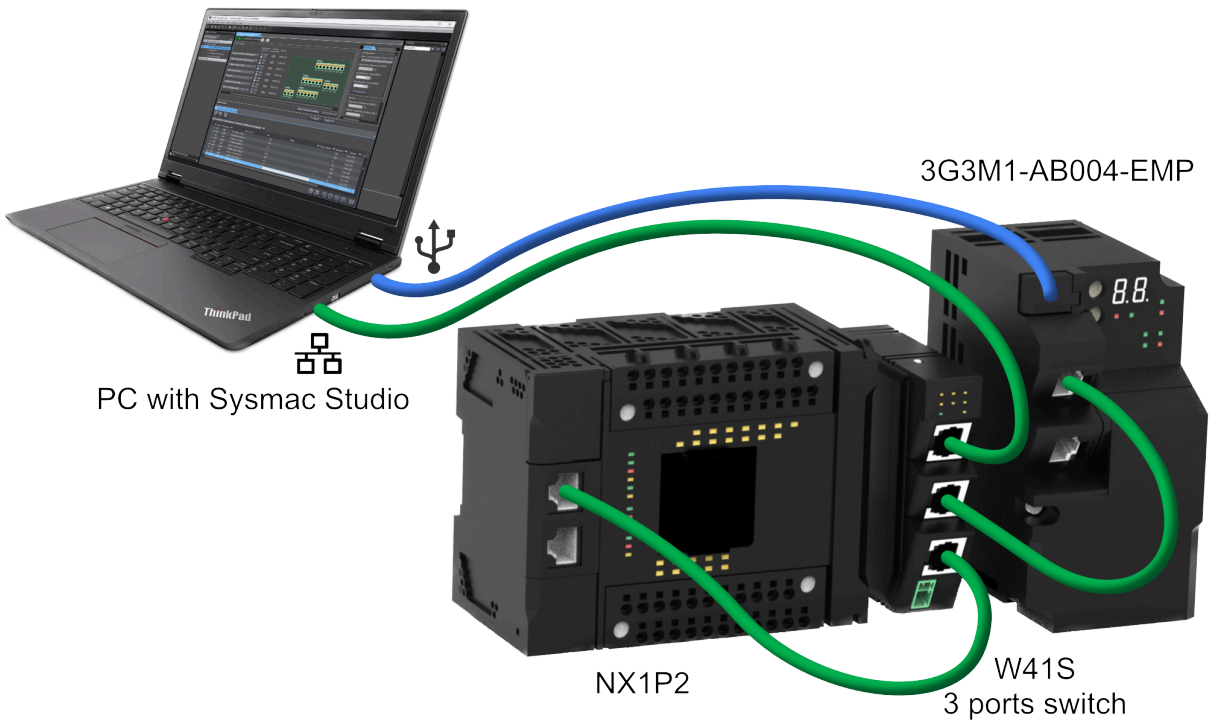
Omron Assemblies are defined to provided extended and flexible control of up to 16 arbitrary parameters

| Omron Function name | Output Instance (PLC → Drive) | Input Instance (Drive → PLC) | Capability summary |
|---|---|---|---|
| Speed/ Torque Control | 101 (0x65) | 151 (0x97) | Adds terminal I/O control, fault handling, and extended speed/torque monitoring. |
| Extended Speed/ Torque Control | 115 (0x73) | 155 (0x9B) | Provides extended monitoring data such as current, DC voltage, frequency commands, and alarm information. |
| High Speed/ Torque Control | 116 (0x74) | 166 (0xA6) | High-bandwidth I/O with extensive status, diagnostics, and dynamic input/output mapping for advanced applications. |
| 8-Byte Dynamic I/O | 117 (0x75) | 167 (0xA7) | Compact dynamic I/O with free parameter mapping; suitable when limited I/O size is required. |
| 12-Byte Dynamic I/O | 118 (0x76) | 168 (0xA8) | Medium-size dynamic I/O with multiple freely assignable parameters. |
| 18-Byte Dynamic I/O | 119 (0x77) | 169 (0xA9) | Expanded dynamic I/O for additional mapped parameters and monitoring signals. |
| 24-Byte Dynamic I/O | 120 (0x78) | 170 (0xAA) | Large dynamic I/O allowing extensive parameter mapping and feedback. |
| 32-Byte Dynamic I/O | 121 (0x79) | 171 (0xAB) | Maximum-size dynamic I/O, supporting the highest number of user-assignable parameters and signals. |

For details of the instances content and register meaning and units, please refer to the Appendix.

# 4-2 EtherNet/IP with Sysmac PLC

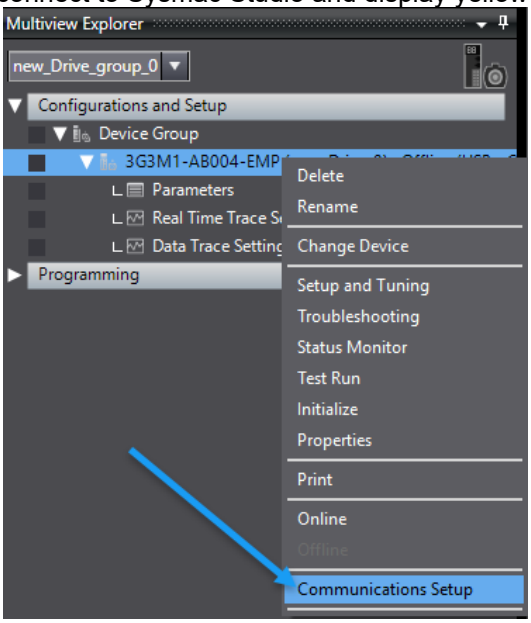
Step by step configuration example of NX1P2 controller with M1-EMP and Omron Ethernet switch.

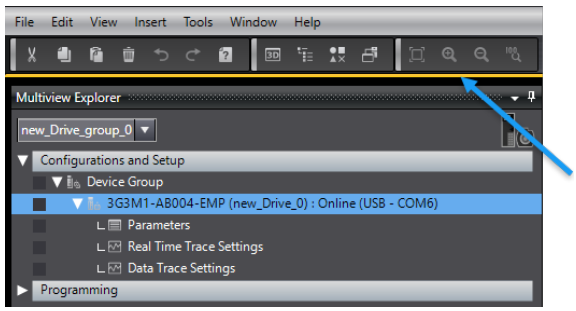



## 4-2-1 Basic drive configuration for network operation

Configure the device by USB connection. It is not yet possible to configure the drives through the Ether-Net/IP network.

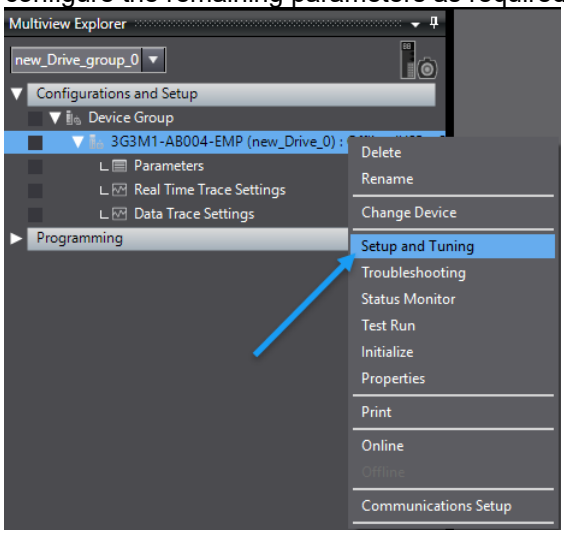
Right-click the device and connect by selecting Online. If the configuration is correct, the device will connect to Sysmac Studio and display yellow in the status bar.

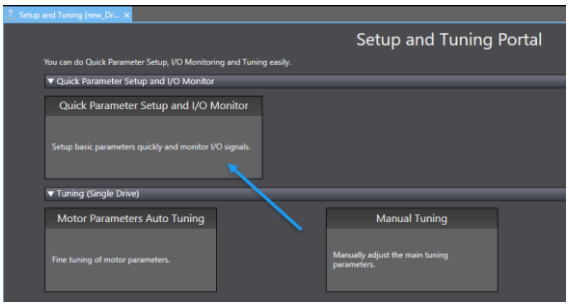


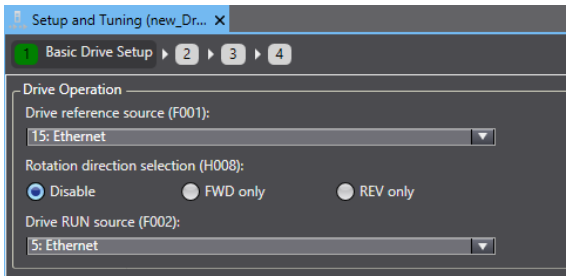



Network-based control can be enabled using the configuration wizard. Right-click the device and select Setup and Tuning, then choose Quick Configuration of Settings and Input/Output Monitoring.

Configure the drive to receive the frequency setpoint and Run command via Ethernet communication, and configure the remaining parameters as required by the application.




Or by direct parameter settings:

| Parameter | Description | Value |
|---|---|---|
| F001 | Setpoint Source | 15: Ethernet* |
| F002 | Command Source | 5: Ethernet* |

## 4-2-2 Protocol selection and IP address parameter settings

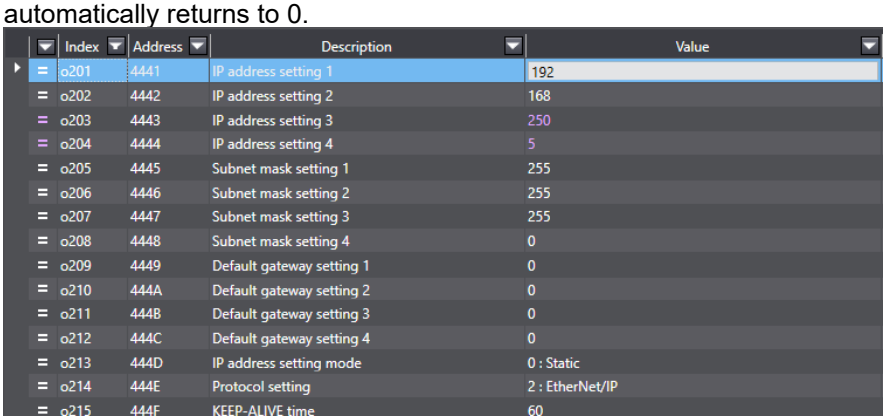
Configure the M1-EMP to operate using EtherNet/IP, and set the IP address using parameter settings through the Sysmac Studio editor or the Omron Drives mobile app. Communication-related settings are defined by the parameter group beginning with o201.

If you prefer to use the front rotary switches to define the IP address, set parameter o213 to 1. Each rotary switch can be set from 0 to F, and together they define the final octet of the IP address as a hexadecimal value, up to FFh (255)..

This example sets **IP:** 192.168.0.10 **Mask:** 255.255.255.0, Gateway is optionally left blank.

| Parameter | Description | Value | Default setting |
|---|---|---|---|
| o214 | Protocol Selection | 1:PROFINET-RT<br>2:EtherNet/IP<br>3:Modbus TCP | 2 (EtherNet/IP) |
| o213 | IP Address Setting Mode | 0: Static<br>1: Hardware Switch<br>2: DHCP<br>3: DCP | 0 (Static) |
| o201 | IP Address Setting 1 | 0 to 255 | 192 |
| o202 | IP Address Setting 2 | 0 to 255 | 168 |
| o203 | IP Address Setting 3 | 0 to 255 | 250 |
| o204 | IP Address Setting 4 | 0 to 255 | 5 |
| o205 | Subnet Mask Setting 1 | 0 to 255 | 255 |
| o206 | Subnet Mask Setting 2 | 0 to 255 | 255 |
| o207 | Subnet Mask Setting 3 | 0 to 255 | 255 |
| o208 | Subnet Mask Setting 4 | 0 to 255 | 0 |
| o209 | Default Gateway Setting 1 | 0 to 255 | 0 |
| o210 | Default Gateway Setting 2 | 0 to 255 | 0 |
| o211 | Default Gateway Setting 3 | 0 to 255 | 0 |
| o212 | Default Gateway Setting 4 | 0 to 255 | 0 |

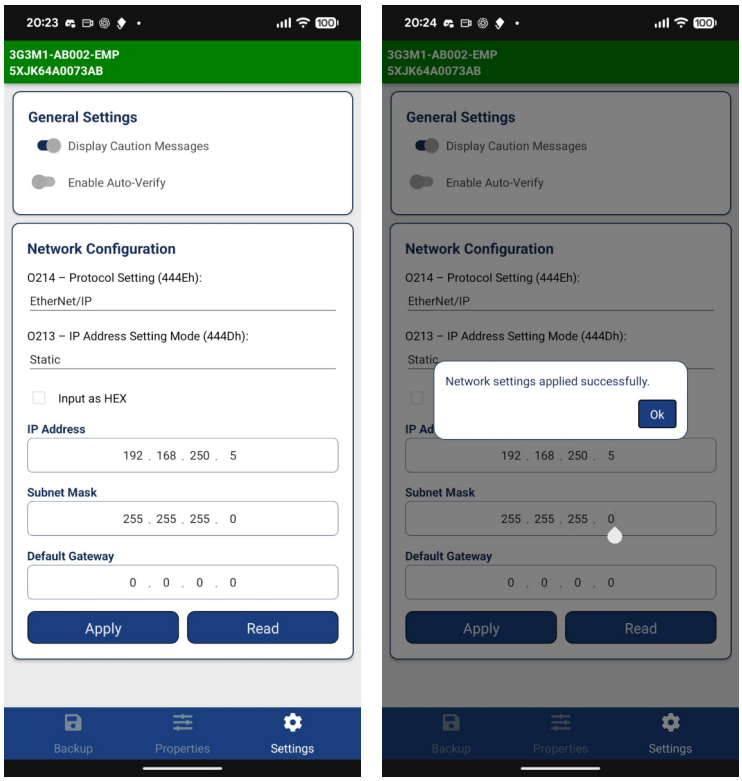
For the parameter changes to take effect, power cycle the inverter or perform a soft reset by setting parameter o299 to 1 using Sysmac Studio or Omron Drives. After the network reset is complete, the parameter automatically returns to 0.



| Index | Address | Description | Value |
|---|---|---|---|
| o201 | 4441 | IP address setting 1 | 192 |
| o202 | 4442 | IP address setting 2 | 168 |
| o203 | 4443 | IP address setting 3 | 250 |
| o204 | 4444 | IP address setting 4 | 5 |
| o205 | 4445 | Subnet mask setting 1 | 255 |
| o206 | 4446 | Subnet mask setting 2 | 255 |
| o207 | 4447 | Subnet mask setting 3 | 255 |
| o208 | 4448 | Subnet mask setting 4 | 0 |
| o209 | 4449 | Default gateway setting 1 | 0 |
| o210 | 444A | Default gateway setting 2 | 0 |
| o211 | 444B | Default gateway setting 3 | 0 |
| o212 | 444C | Default gateway setting 4 | 0 |
| o213 | 444D | IP address setting mode | 0 : Static |
| o214 | 444E | Protocol setting | 2 : EtherNet/IP |
| o215 | 444F | KEEP-ALIVE time | 60 |

| Parameter | Description | Value | Default setting |
|---|---|---|---|
| o299 | Apply Ethernet Setting | 0 to 1 | 0: Nothing 1: Apply Setting |

It is also possible to apply the configuration by tapping "Apply" button in Omron Drives app.







Omron Drives app is only available for Android and Microsoft as wired USB connection is required.

## 4-2-3 Assemblies selection and configuration in drive

Like other EIP-based drives, the M1-EMP supports multiple INPUT/OUTPUT data groups. These groups are described in this section of the manual and in the Appendix. Referred to as Assemblies, each data group has a defined size in bytes, ranging from a basic 4-byte configuration to flexible configurations of up to 32 bytes.

In this example, an 8-byte configuration is used: Assembly 117 for Output data (written from the PLC to the drive) and Assembly 167 for Input data (read from the drive by the PLC). These assemblies were selected because, despite their relatively small size, they support dynamic mapping. This allows additional 16-bit objects (Actual Torque and Current) and a 32-bit object (Acceleration Time) to be mapped.

### Output Assembly - Write from PLC to Drive

8-Byte Dynamic Output – 117 (0x75)

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 117 | 0 | DI6 | DI5 | DI4 | DI3 | DI2 | DI1 | Run Rev | Run Fwd |
| | 1 | - | - | DO1 | - | - | - | Fault Reset | External Fault |
| | 2 | Speed Reference/Speed Limit (Low Byte) | | | | | | | |
| | 3 | Speed Reference/Speed Limit (High Byte) | | | | | | | |
| | 4-5 | Dynamic Output 1 specified by parameter o221 | | | | | | | |
| | 6-7 | Dynamic Output 2 specified by parameter o222 | | | | | | | |

In this example, the acceleration time will be written from the PLC using parameter F007 (1st Acceleration Time) of 32 bits, occupying 4 Bytes. In this example, F007 will be mapped to bytes 4, 5, 6 and 7

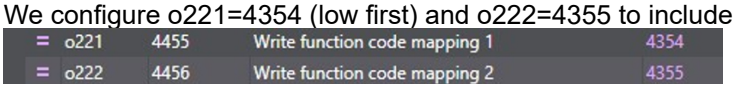
| Parameter | Name | Address | Range | Default |
|---|---|---|---|---|
| F007 | 1st acceleration time | 1102h = 4354<br>1103h = 4355 | 0.00 to 6000.00s | 6.00s |

Example: F007 = 20.00s = 2000 = 0000 07D0 hex

Address 1102h (4354d, Low Word) = 07D0h

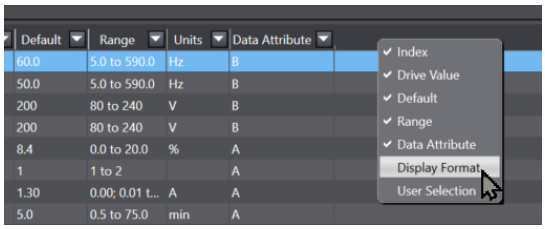
Address 1103h (4355d, High Word) = 0

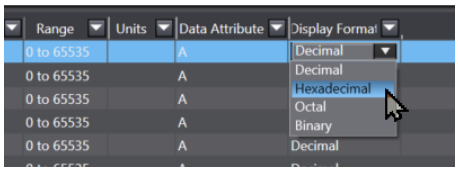
We configure o221=4354 (low first) and o222=4355 to include in the cyclic writing.



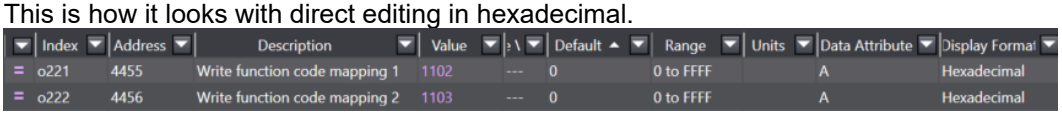

**Tip**

Instead of translating addresses to decimal, it is possible to temporary set the parameter visualization in Sysmac studio to hexadecimal. In the parameter editor, make sure that display format column is visible (right click in empty area of the header row and enable, it is not visible by default), then you can select visualization format for each parameter separately.




This is how it looks with direct editing in hexadecimal.




## Input Assembly - Reading from Drive to PLC

8-Byte Dynamic Input – 167 (0xA7)

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 167 | 0 | Fault | Alarm | Ready | Speed Agree | Fault Reset | Running2 | ZSP | Running |
| | 1 | ZSV | - | - | - | DO1 | LOCAL/ REMOTE | UV | - |
| | 2 | Output Frequency (Low Byte) | | | | | | | |
| | 3 | Output Frequency (High Byte) | | | | | | | |
| | 4-5 | Dynamic Input 1 specified by parameter o253 | | | | | | | |
| | 6-7 | Dynamic Input 2 specified by parameter o254 | | | | | | | |

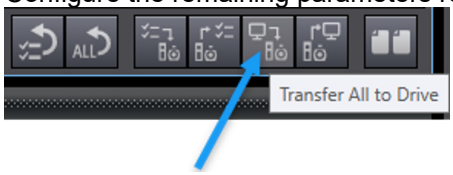
Monitoring Actual Torque parameter M007 and the Output Current in % M011. Those are of data size of 16 bits. In this example, M007 will be mapped to bytes (4-5) and M011 to bytes (6-7).

| Parameter | Name | Address | Range | Default |
|---|---|---|---|---|
| M007 | Torque Value | 50C8h = 20680 (Decimal) | -327.68 to 327.67% | 0 |
| M011 | Output Current Monitor | 50CDh = 20685 (Decimal) | 0.00 to 399.99% | 0 |

Example: If we want to read actual torque (M007) and Output Current Monitor (M011),
M007 address is 50C8h (20680) and M011 address is 50CDh (20685)
So o253=505Bh (20680) and o254=50CDh (20685) to include it in the cyclic reading.

| Index | Address | Description | Value | Default | Range | Units | Data Attribute | Display Format |
|---|---|---|---|---|---|---|---|---|
| o253 | 4475 | Read function code mapping 1 | 50C8 | 0 | 0 to FFFF | | A | Hexadecimal |
| o254 | 4476 | Read function code mapping 2 | 50CD | 0 | 0 to FFFF | | A | Hexadecimal |

Configure the remaining parameters required for the application and transfer the changes to the drive.

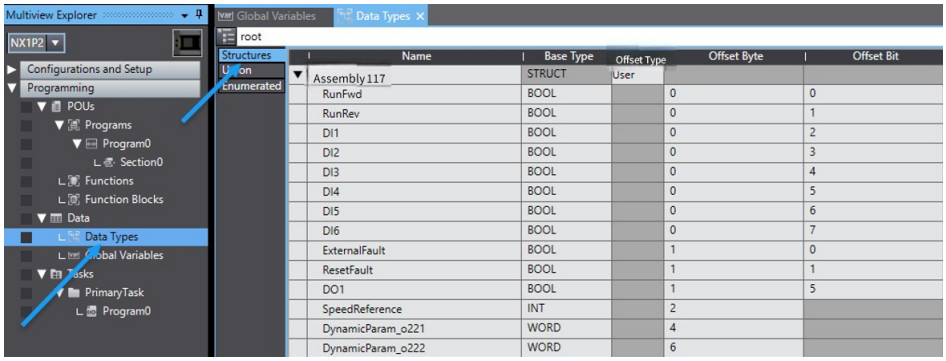



## 4-2-4 Sysmac PLC configuration

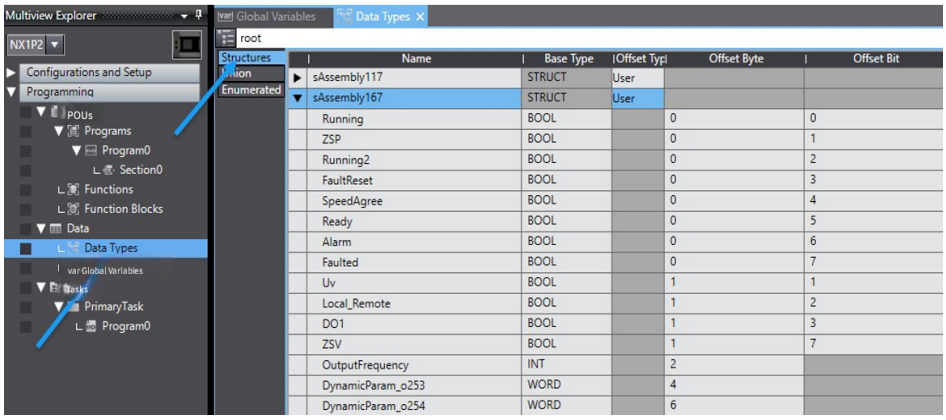
In the example, NX1P2 is used, but the process is same for all SYSMAC PLCs with EtherNet/IP port

### Data types definition for easy assembly handling

In the PLC project, create assembly structures for easy handling of the read/write information (they are not automatically generated). In the screeshots Assembly 117 and 167 that we are going to use are shown.
Assembly 117 has a size of BYTE[8], following the assembly information in Appendix, the structures are created according to the defined offsets between bytes and bits, with a total size of 8 bytes. In this way, the read and write registers become easy to handle in the PLC program.

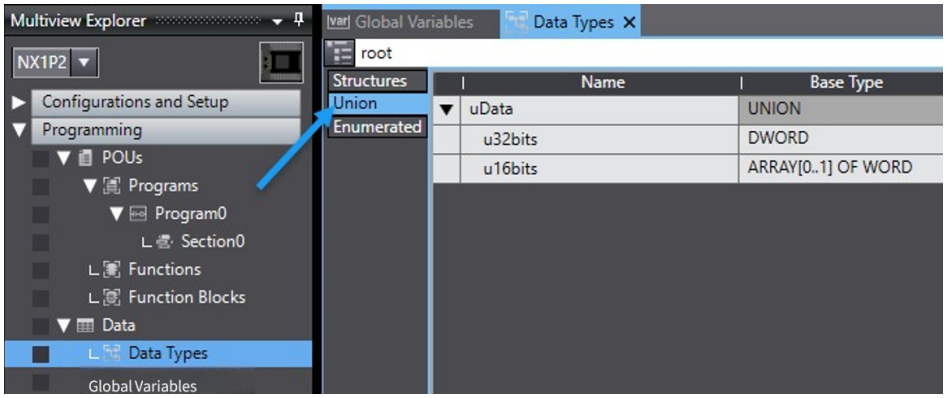


The data structure for Assembly 167 must be created in the same manner, with a total size of 8 bytes

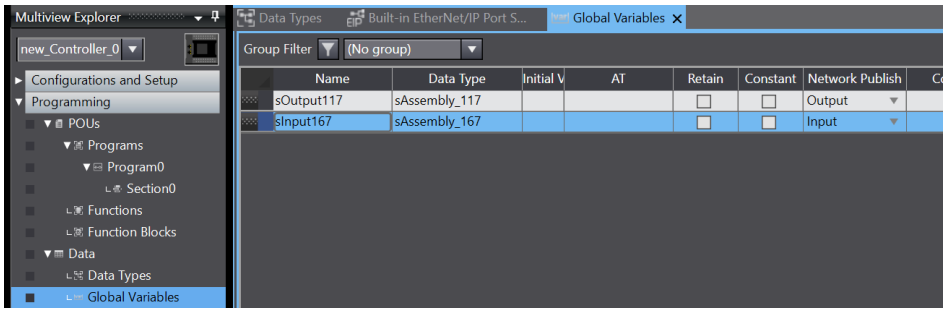



## Define Unions for the 32bit handling

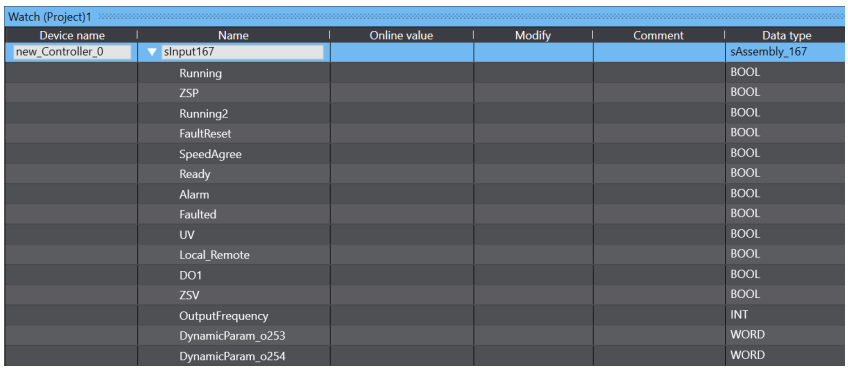
To enable writing and monitoring of 32bit parameters, a union data type is created to facilitate decomposition from 32 bits to 16 bits as managed by M1 EMP.




Network input and output variable tags are created using the newly defined Structured data types.

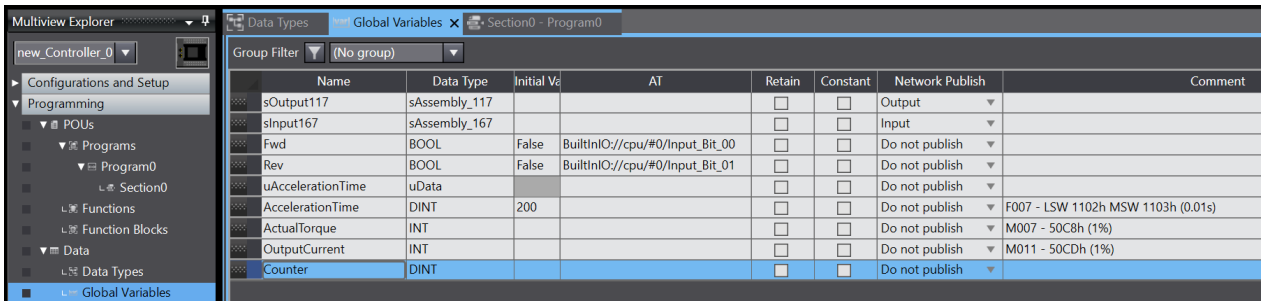



Now, the variables and all the contents of the I/O communications is easy to access and monitor.

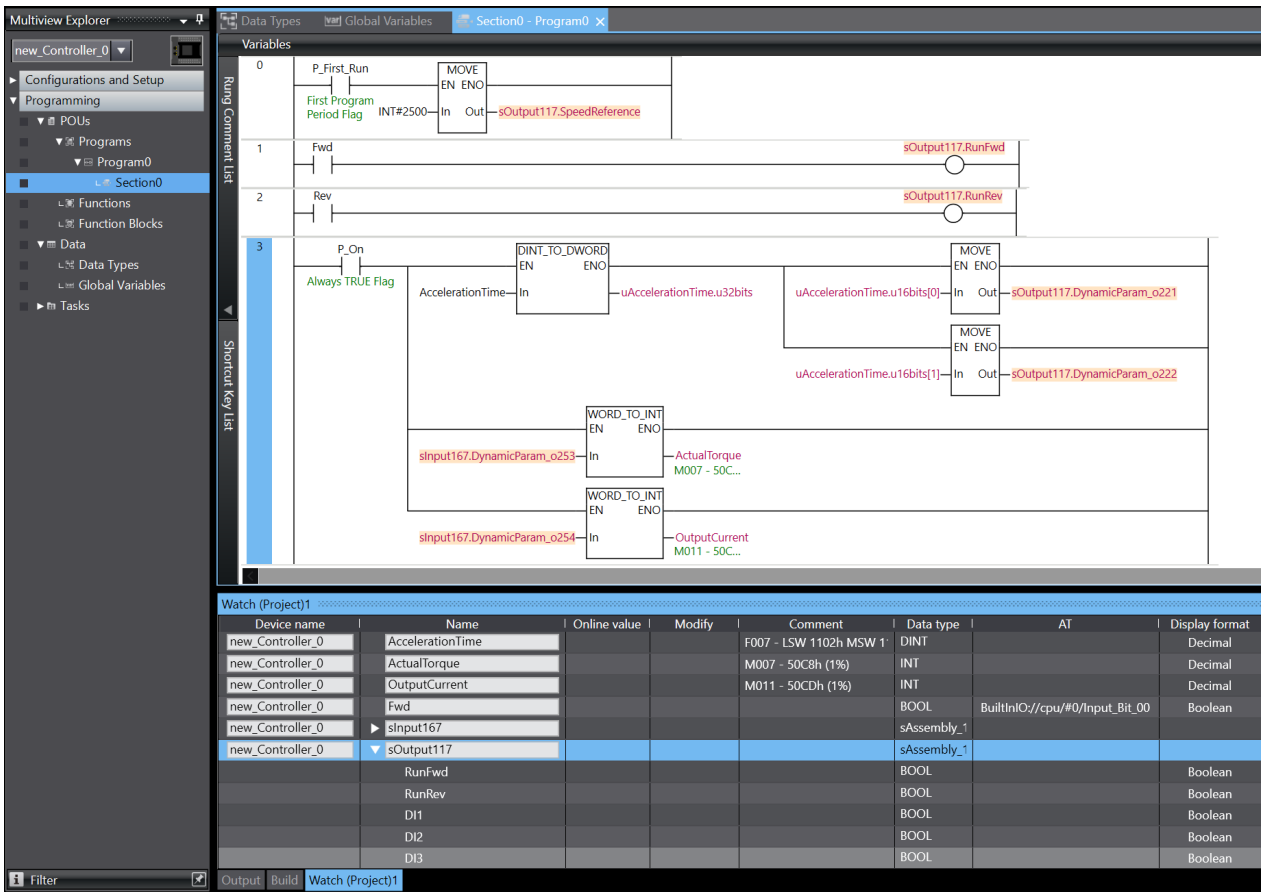


# Easy to understand PLC program

Now we can define the program variables that access PLC I/O and the intermediate unions for simpler 32bit parameter management (e.g. Acceleration time in this case)

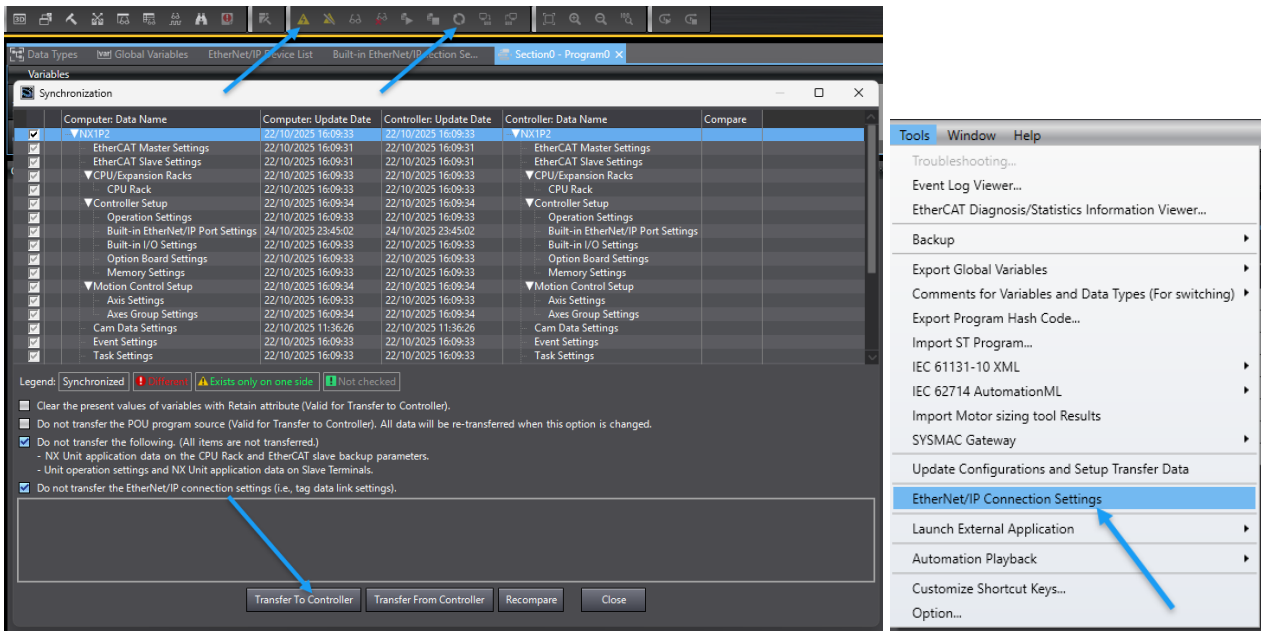



A sample program to make it all work:

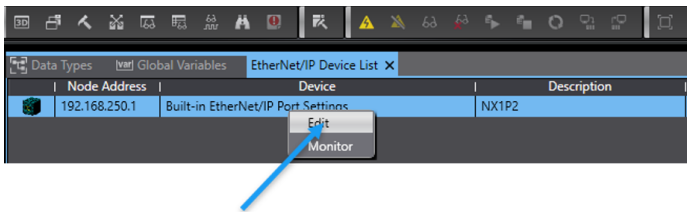


## Link all tags to the network I/O

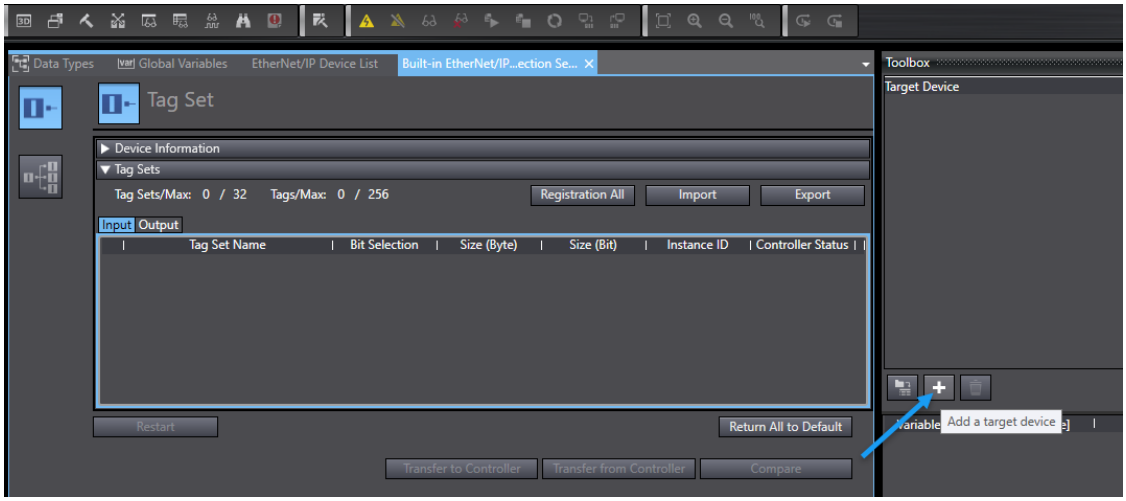
Connect the CPU Online, synchronize, and transfer the program to the Controller.
In the Tools tab, select the menu: EtherNet/IP Connection Settings

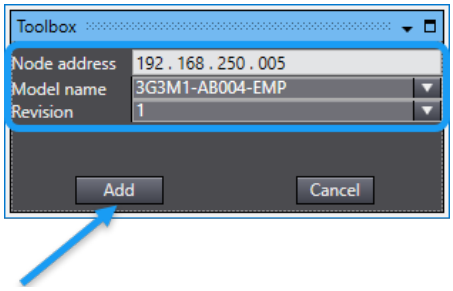



Select the port you will use to communicate with the M1 EMP.
In this case, NX1P2 has only one port; right-click and select Edit.

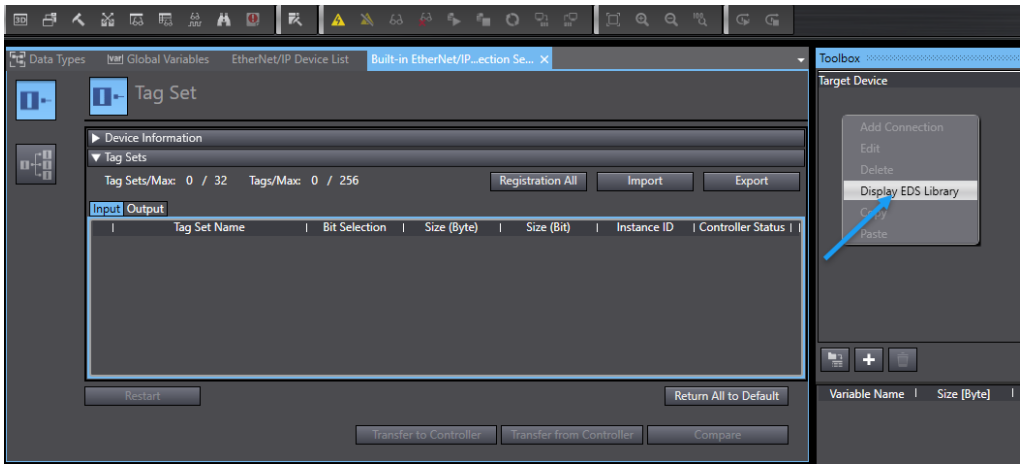


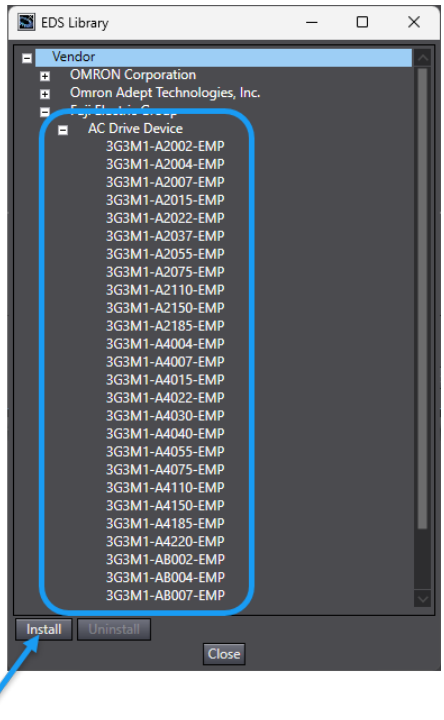

If the EDS files (EtherNet/IP definition files) for M1-EMP are installed (included from Sysmac Studio V1.64), the device can be added directly by pressing the add button and selecting model names.



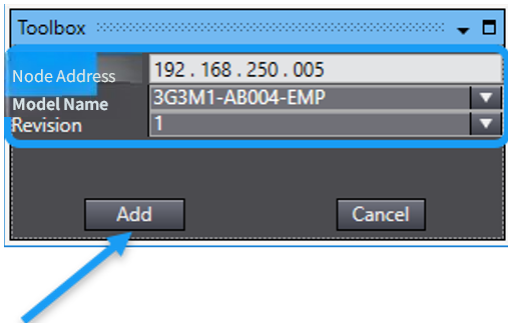



If the model names for M1-EMP don't appear, this means that the EDS files have to be installed by using the EDS Library utility.

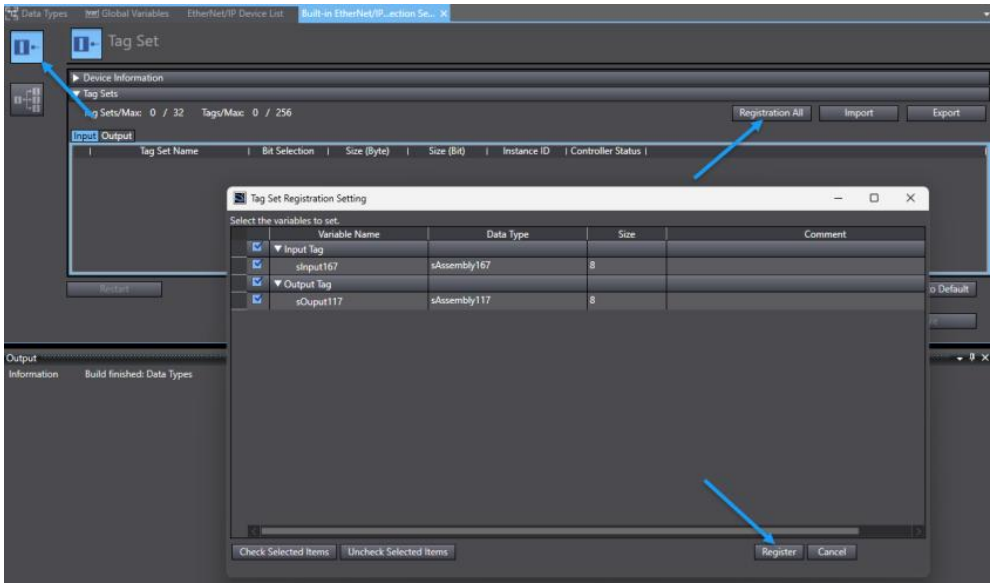


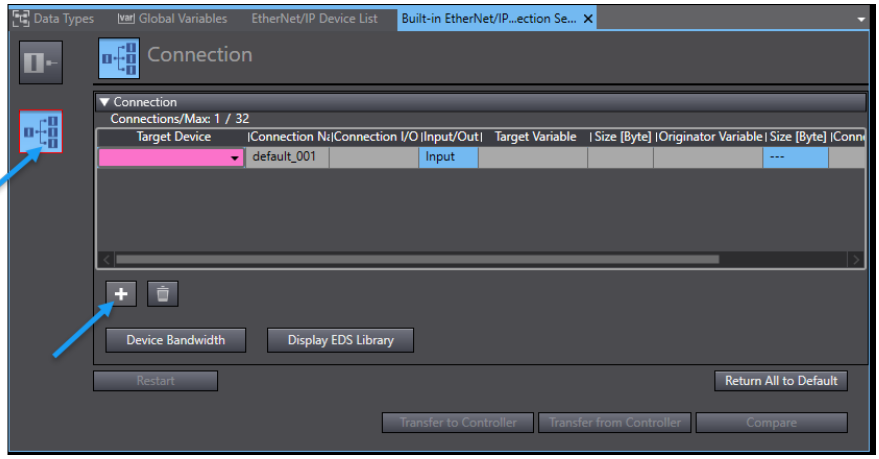
When ready, select the device exact model, IP address, model, EDS version, and click Add.



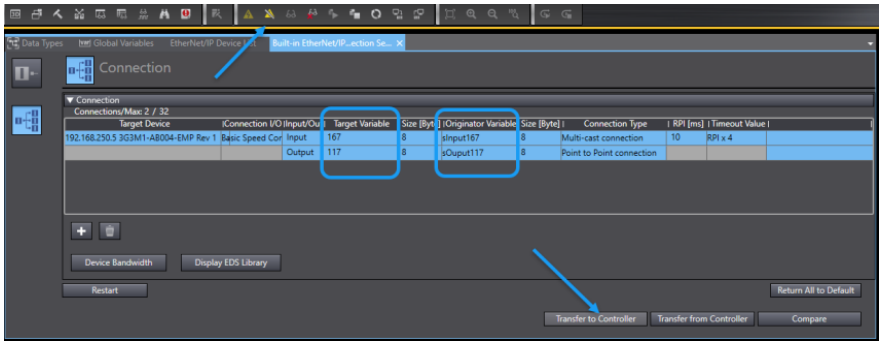

In the central window, using the Tag Settings menu, click Register All. The previously configured network variables (those selected for publishing as Input and Output) will be displayed. Then click Register.

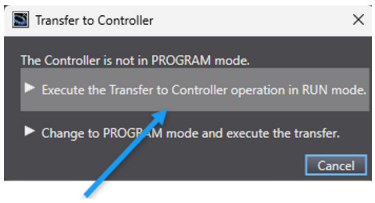



In the central window under the Connection menu, add the target device or drag the one displayed in the tool window.

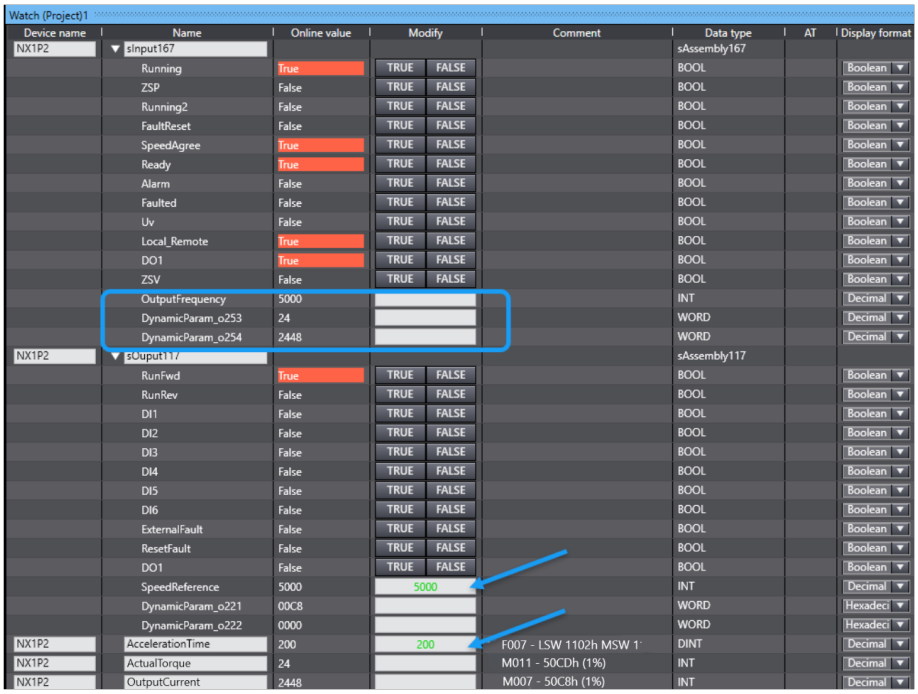



Assign the network variables to the corresponding Assemblies; the size in Bytes must match. In this case, an RPI of 10 ms was set, with a minimum of 4 ms for M1-EMP. Transfer to Controller




Once transferred and with the CPU in RUN, open a watch window to write and monitor the program variables to test that the communications have been stablished.



# 4-3 PROFIdrive Drive Control

## 4-3-1 PROFIdrive Drive Control (PROFINET)

In PROFIdrive, the drive is controlled using a standardized state machine.

The controller commands state transitions using Control Word 1 (STW1), while the drive reports its current state using Status Word 1 (ZSW1).

The 3G3M1-EMP implements PROFIDrive Application Class 1 (Standard Drives) and follows the Siemens/SINAMICS state model.

PROFIdrive Control and Status Words are used to drive and monitor the PROFInet state machine

Control Word (STW1)

| bit15 | bit14 | bit13 | bit12 | bit11 | bit10 | bit9 | bit8 | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DI4 | DI3 | DI2 | DI1 | Direction | Control By PLC | - | - | Reset | Enable Setpoint | Freeze Ramp | Enable Ramp | Enable Operation | ON3/OFF3 | ON2/OFF2 | ON/OFF1 |

bit0 (ON/OFF1) - Main run enable. 0 = controlled stop (ramp stop). 1 = run permitted.

bit1 (ON/OFF2) - Coast stop control. 0 = torque removed immediately (coast). 1 = normal operation.

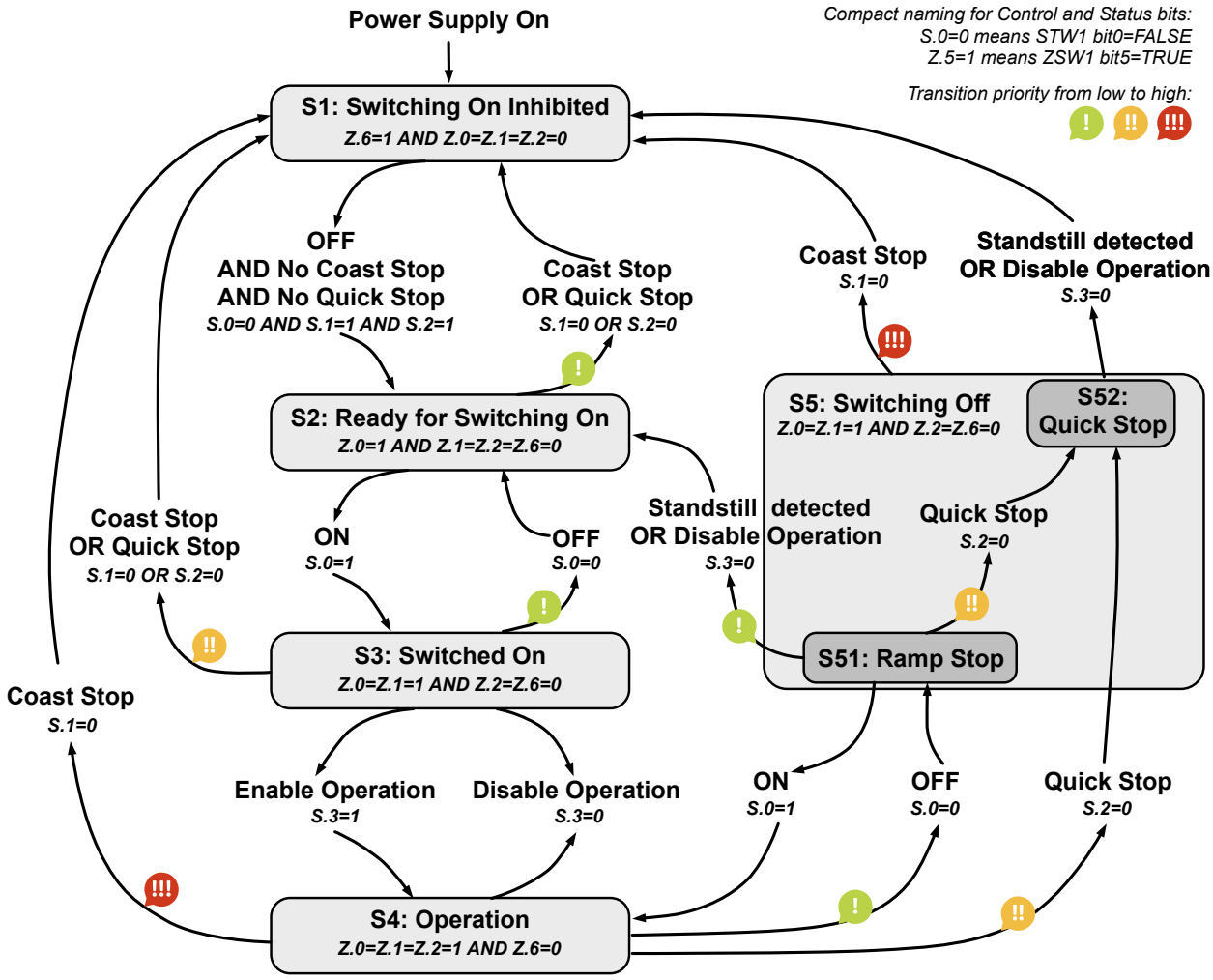
bit2 (ON/OFF3) - Quick stop control. 0 = quick stop ramp. 1 = quick stop inactive.

Status Word (ZSW1)

| bit15 | bit14 | bit13 | bit12 | bit11 | bit10 | bit9 | bit8 | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Direction | - | - | - | - | AT Setpoint | Remote | Speed Error | Warning | Switch On | Quick Stop | Coast Stop | Fault | Operation Enabled | Ready to Operation | Ready to Switch On |

### PROFIdrive State diagram:

| State | Name (PROFIdrive) | Description |
|---|---|---|
| S0 | Switch-On Inhibited | Drive not ready (power-up, fault, inhibit) |
| S1 | Ready to Switch On | Drive initialized, waiting for enable |
| S2 | Ready for Operation | Preconditions fulfilled |
| S3 | Operation Enabled | Drive can run |
| S4 | Fault | Drive stopped due to fault |
| S5 | Quick Stop Active | Fast stop in progress |
| S6 | Coast Stop Active | Output disabled immediately |



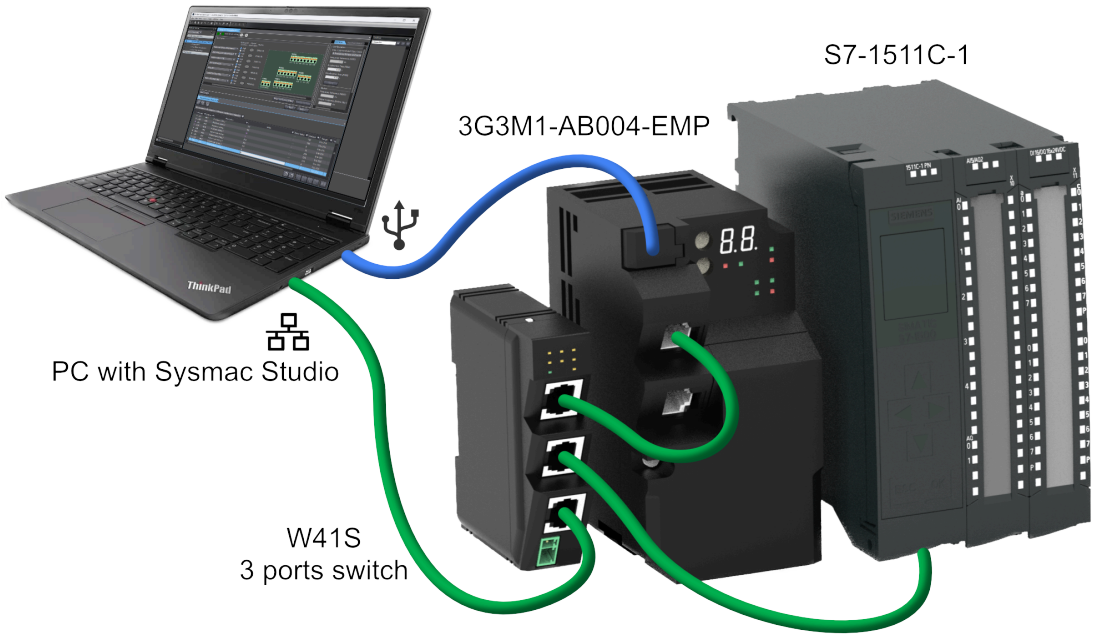

PROFIdrive Command Word STW1 "quick run" test sequence

| Step | STW1 bits | Meaning |
|---|---|---|
| 1 | 0,1,2 = 1 | Switch on + voltage enable |
| 2 | 3 = 1 | Enable operation |
| 3 | 4 = 1 | Enable ramp |
| 4 | 6 = 1 | Enable setpoint |
| 5 | 10 = 1 | Control by PLC |
| 6 | 11 = 0/1 | Forward / Reverse |

Write the speed setpoint to NSOLL_A (Speed setpoint), with +32768=Max speed
and read back actual speed with NIST_A (Speed actual)
For proper run sequence programming, the sequence should check ZSW1 status bits
to validate and confirm all transitions and generate sequence errors in case of mismatch.

# 4-4 PROFINET with SIEMENS PLC

Step by step configuration example of SIEMENS S7-1511C controller with M1-EMP and Omron Ethernet switch. PROFINET does not require IP addresses as it is working at a lower layer.




Sysmac Studio version 1.64 or higher is required to configure the parameters of the 3G3M1.

For configuring communication parameters such as protocol and IP address, the Omron Drives App (Windows and Android) may also be utilized.

The Omron Drives App is available free of charge from the Microsoft Store or Google Play Store. It is only available in android as it requires wired connection.

## 4-4-1 Basic drive configuration for network operation

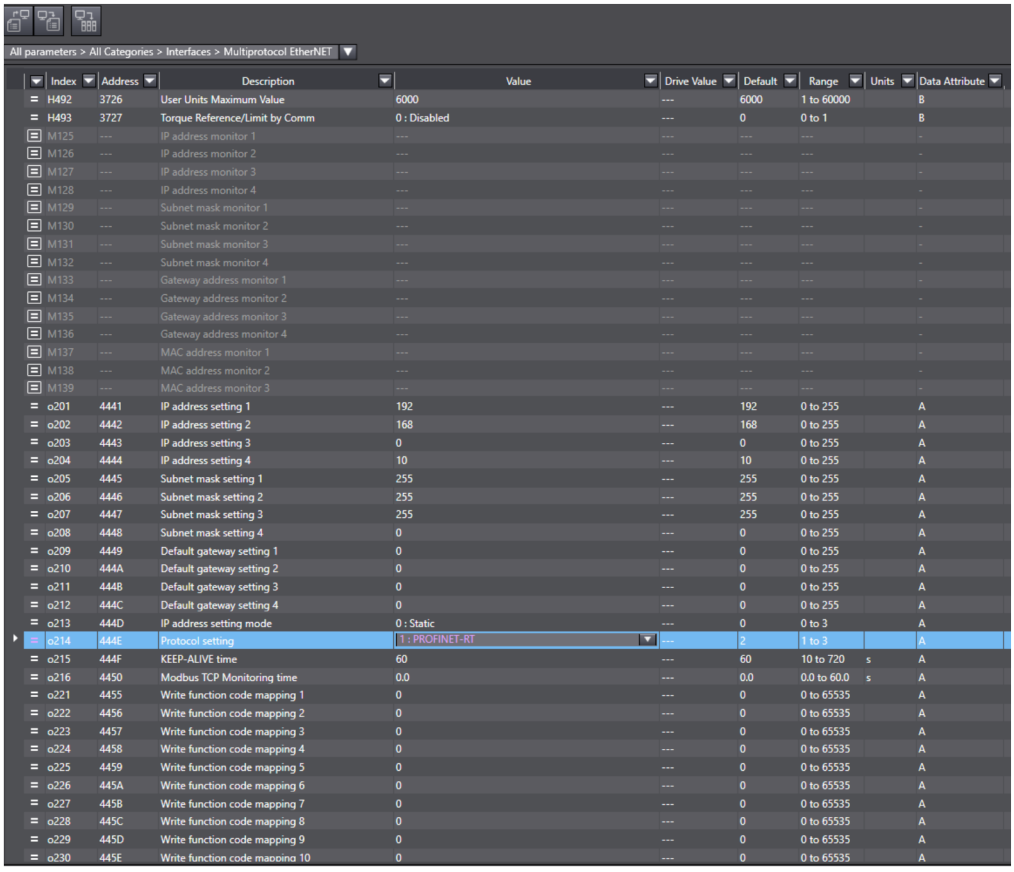
Settings for the Multiprotocol Ethernet interface can be configured via Sysmac Studio or Omron Drives mobile app. For PROFINET control, minimum settings are shown in this table.

| Parameter | Description | Value |
|---|---|---|
| F001 | Setpoint Source | 15: Ethernet* |
| F002 | Command Source | 5: Ethernet* |

## 4-4-2 Protocol selection and IP address parameter settings

| Parameter | Description | Value | Default setting |
|---|---|---|---|
| o214 | Protocol Selection | 1:PROFINET-RT<br>2:EtherNet/IP<br>3:Modbus TCP | 1:PROFINET-RT |
| o213 | IP Address Setting Mode | 0: Static<br>1: Hardware Switch<br>2: DHCP<br>3: DCP | 2: DHCP |
| o201 | IP Address Setting 1 | 0 to 255 | 192 |
| o202 | IP Address Setting 2 | 0 to 255 | 168 |
| o203 | IP Address Setting 3 | 0 to 255 | 0 |
| o204 | IP Address Setting 4 | 0 to 255 | 10 |
| o205 | Subnet Mask Setting 1 | 0 to 255 | 255 |
| o206 | Subnet Mask Setting 2 | 0 to 255 | 255 |
| o207 | Subnet Mask Setting 3 | 0 to 255 | 255 |
| o208 | Subnet Mask Setting 4 | 0 to 255 | 0 |
| o209 | Default Gateway Setting 1 | 0 to 255 | 0 |
| o210 | Default Gateway Setting 2 | 0 to 255 | 0 |
| o211 | Default Gateway Setting 3 | 0 to 255 | 0 |
| o212 | Default Gateway Setting 4 | 0 to 255 | 0 |

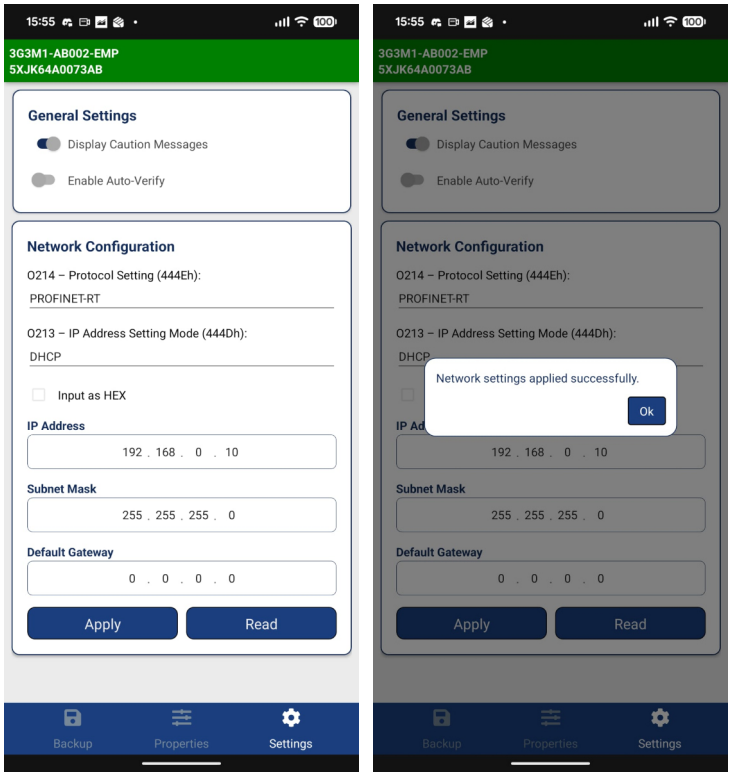
This parameters can be set by Sysmac Studio parameter editor



For the parameter changes to take effect, power cycle the inverter or perform a soft reset by setting parameter o299 to 1 using Sysmac Studio or Omron Drives. After the network reset is complete, the parameter automatically returns to 0.

| Parameter | Description | Value | Default setting |
|---|---|---|---|
| o299 | Apply Ethernet Setting | 0 to 1 | 0: Nothing 1: Apply Setting |

It is also possible to apply the configuration by tapping "Apply" button in Omron Drives app.
Omron Drives App is available as a light weight free tool available for Windows PCs or Android devices.





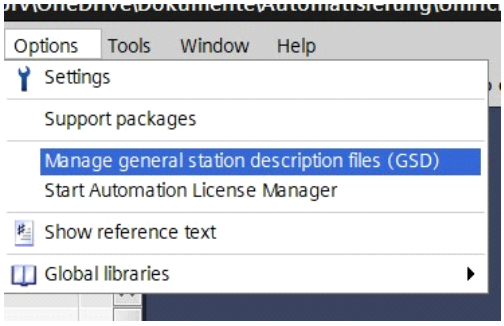


## 4-4-3 SIEMENS PLC TIA Portal Configuration

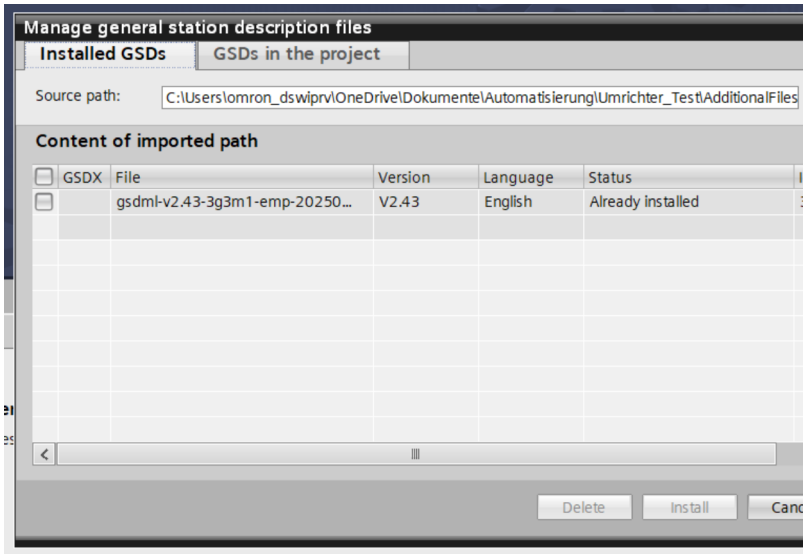
Once in TIA portal, we need to do install the M1-EMP information in our installation if it is the first time that we configure M1-EMP

## Importing M1 EMP GSD files into TIA Portal.

To enable the Siemens controller to recognize the 3G3M1 as a device on the PROFINET network, the GSD file must be installed in advance. To do this, open the GSD management menu in the Siemens TIA Portal under 'Options'.

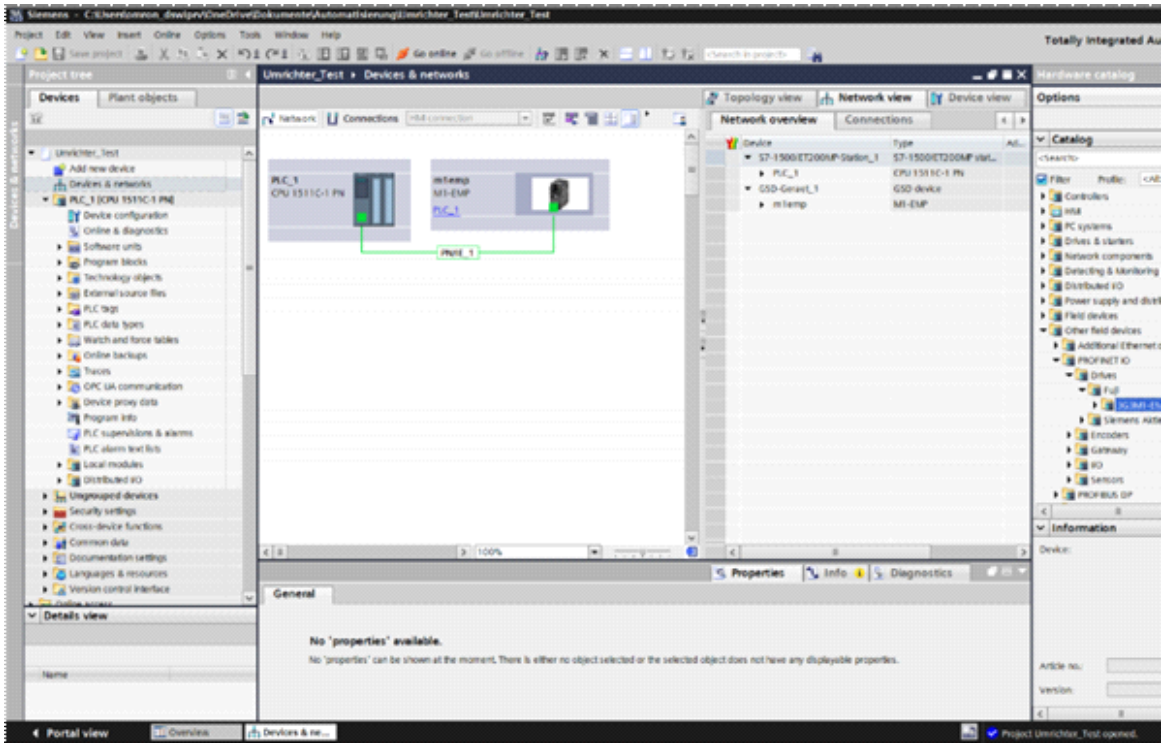



Then install the corresponding GSD file for the 3G3M1 via 'Install'.




## Adding the M1 to PROFINET

In the 'Devices & Networks' configuration, the 3G3M1 can now be added as a participant. To do this, select the drive under 'Additional Field Devices' -> 'PROFINET IO' -> 'Drives' -> 'Fuji'->'3G3M1-EMP':

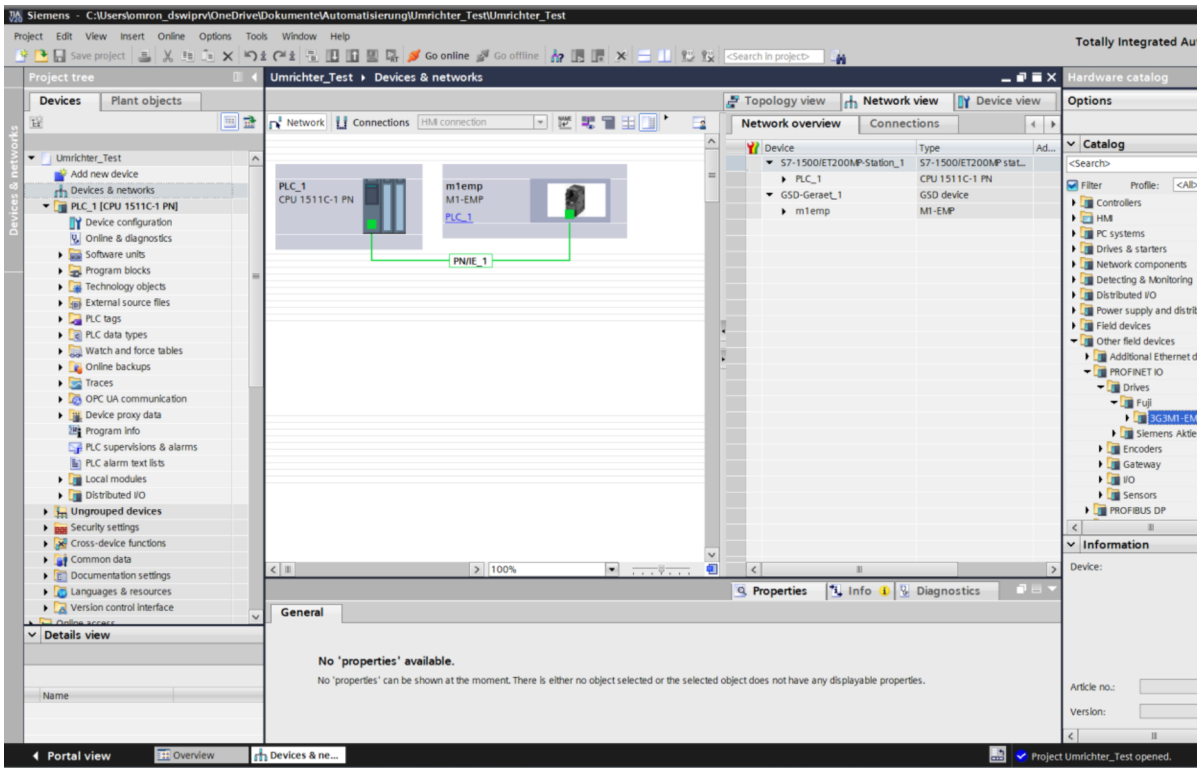


## Configuring the IP Address in TIA Portal

The IP address can now be assigned in the 'Devices & networks' settings.

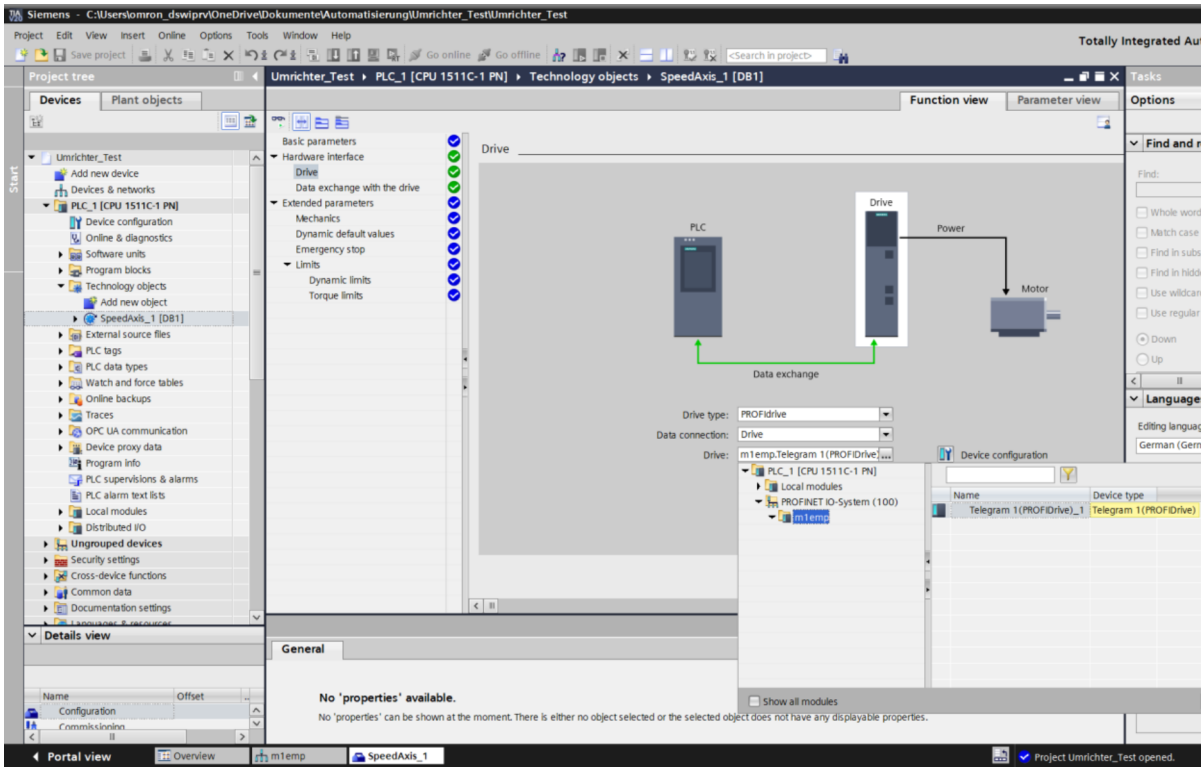
**Note**

For the IP address to be configured via the PROFINET master, DHCP must be enabled on the frequency inverter. To do this, set parameter o213 IP address setting mode to 2: DHCP.

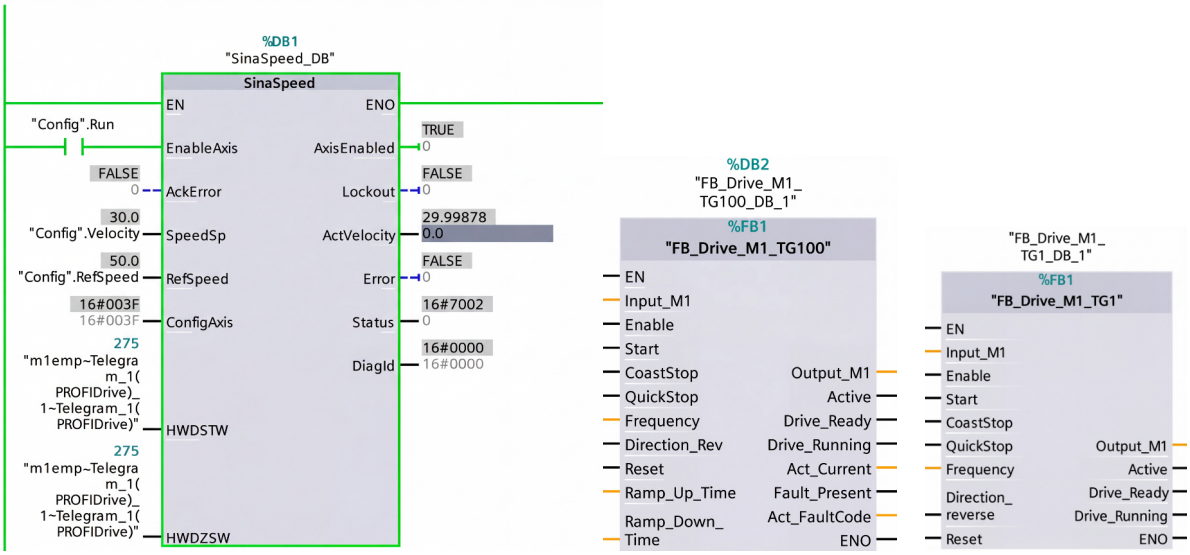


# Integration of the 3G3M1 Using the PROFIdrive Profile

The 3G3M1 supports control via the PROFIdrive Profile and is, by default, controlled using Telegram 1. For this purpose, a new technology object of type SpeedAxis must be added to the controller within the TIA Portal project. In the Hardware Interface -> Drive section, Telegram 1 of the 3G3M1-EMP can now be assigned.




The drive can now be controlled either via the 'Commissioning' function or through an appropriate user program in the controller, using SINASPEED FB or Omron M1 specific FBs.



# 4-5 Modbus TCP control of M1-EMP

Modbus TCP is far simpler compared to EtherCAT, Ethernet/IP and PROFINET. Not having a cyclic communications layer and no timing compliance requirements, it behaves same as a classical Modbus. It works by polling Modbus equivalent structured messages packed in the EtherNet layer.

In this sense, in order to control M1-EMP inverter from a Modbus TCP, the same messaging and control / monitoring parameters used with RS-485 wired Modbus RTU have to be used.
With read/write commands, we have access to the full map of inverter parameters, controls and monitors. The overview of the register address map is in this table. For details of each parameter address and format, check Section 5: Parameter Lists.

| Address | Description | Remark |
|---|---|---|
| 0x0000 to 0x57FF | Parameter | Refer to parameter list |
| 0x8000 to 0x803F | Free mapped data (o221 to o284) | |

## 4-5-1 Basic drive configuration for network operation

Settings for the Multiprotocol Ethernet interface can be configured via Sysmac Studio or Omron Drives mobile app. For Modbus TCP control, minimum settings are shown in this table.

| Parameter | Description | Value |
|---|---|---|
| F001 | Setpoint Source | 15: Ethernet* |
| F002 | Command Source | 5: Ethernet* |

## 4-5-2 ModbusTCP protocol selection and IP settings

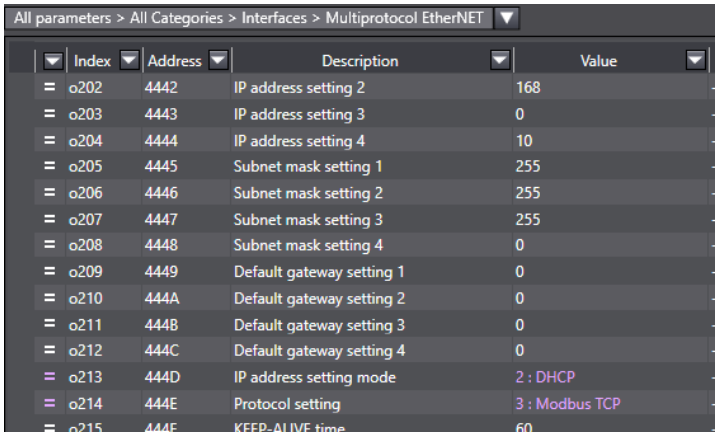
Configure the M1-EMP to operate using ModbusTCP, and set the IP address using parameter settings through the Sysmac Studio editor or the Omron Drives mobile app.

with o213=1, rotary switches define the last octet of IP address as a hexadecimal value, up to FFh (255)..

This example sets **IP:** 192.168.0.10 **Mask:** 255.255.255.0, Gateway is optionally left blank.

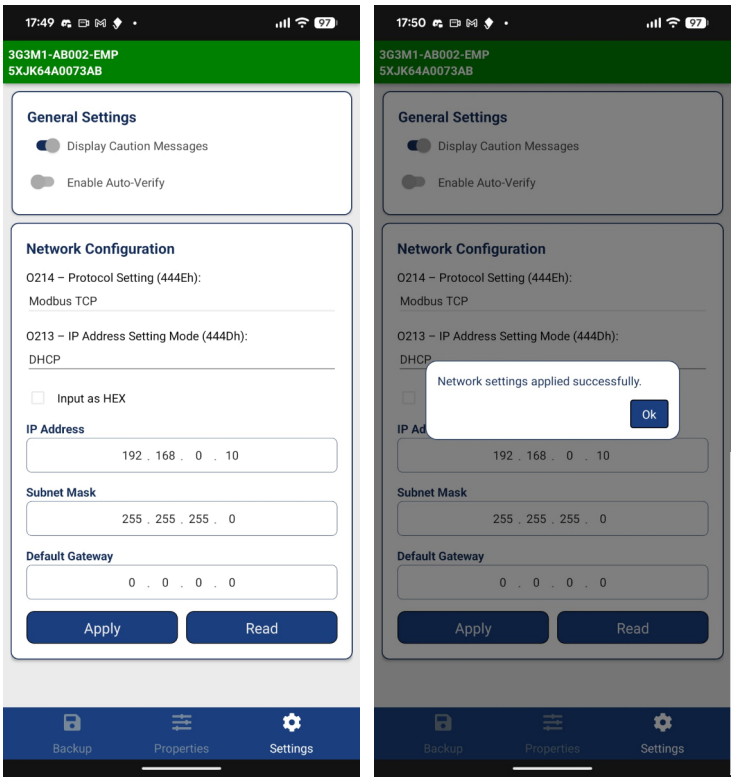
| Parameter | Description | Value | Default setting |
|---|---|---|---|
| o214 | Protocol Selection | 1:PROFINET-RT<br>2:EtherNet/IP<br>3:Modbus TCP | 3:Modbus TCP |
| o213 | IP Address Setting Mode | 0: Static<br>1: Hardware Switch<br>2: DHCP<br>3: DCP | 2: DHCP |
| o201 | IP Address Setting 1 | 0 to 255 | 192 |
| o202 | IP Address Setting 2 | 0 to 255 | 168 |
| o203 | IP Address Setting 3 | 0 to 255 | 0 |
| o204 | IP Address Setting 4 | 0 to 255 | 10 |
| o205 | Subnet Mask Setting 1 | 0 to 255 | 255 |
| o206 | Subnet Mask Setting 2 | 0 to 255 | 255 |
| o207 | Subnet Mask Setting 3 | 0 to 255 | 255 |
| o208 | Subnet Mask Setting 4 | 0 to 255 | 0 |
| o209 | Default Gateway Setting 1 | 0 to 255 | 0 |
| o210 | Default Gateway Setting 2 | 0 to 255 | 0 |
| o211 | Default Gateway Setting 3 | 0 to 255 | 0 |
| o212 | Default Gateway Setting 4 | 0 to 255 | 0 |

For the parameter changes to take effect, power cycle the inverter or perform a soft reset by setting parameter o299 to 1 using Sysmac Studio or Omron Drives. After the network reset is complete, the parameter automatically returns to 0.



| Parameter | Description | Value | Default setting |
|---|---|---|---|
| o299 | Apply Ethernet Setting | 0 to 1 | 0: Nothing 1: Apply Setting |

It is also possible to apply the configuration by tapping "Apply" button in Omron Drives app.







Omron drives app is only available for Android and Microsoft as wired USB connection is required.

## 4-5-3 ModbusTCP fundamental concept for M1 EMP control

Minimum set of Modbus Registers for M1-EMP control. Most important real time control parameters are in the S group, and key status monitoring is available in M menu

| Word control codes | Command |
|---|---|
| 3 (0x03) | Read Holding Registers |
| 6 (0x06) | Write Single Register |
| 16 (0x10) | Write Multiple registers |
| 23 (0x17) | Read/Write Multiple Registers |

Numeric registers. Some like S005 serve as our speed command, while M005 monitors actual output.

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | For-mat 16bit 32bit | R/W |
|---|---|---|---|---|---|---|
| S005 | 5006h 5005h | Frequency Refer-ence | 0.00 to 655.35 Hz | 0.00Hz | --- 5 | R/W |
| M005 | 50C6h 50C5h | Frequency Refer-ence at Final | 0.00 to 655.35 | 0.00Hz | --- 5 | RO |

Bit control and monitor registers can trigger inverter actions and monitor states.

| param | Address 16/32bit LSW MSW | Function name | Range |
|---|---|---|---|
| S006 | 5007h --- | Operation command | 0000 to FFFFh<br>Bit15: RS<br>Bit14: DI7<br>Bit13: DI6<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: ---<br>Bit7: ---<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: RV<br>Bit0: FW |

| param | Address 16/32bit LSW MSW | Function name | Range |
|---|---|---|---|
| M014 | 50D0h --- | Operation Status 1 Monitor | 0000 to FFFFh<br>Bit15: BUSY (During parameter data writing)<br>Bit14: -<br>Bit13: -<br>Bit12: RL (Communications effective)<br>Bit11: ALM (Alarm relay)<br>Bit10: DEC (During deceleration)<br>Bit9: ACC (During acceleration)<br>Bit8: IL (During current limiting)<br>Bit7: VL (During voltage limiting)<br>Bit6: TL (Torque limiting)<br>Bit5: NUV (Main circuit DC voltage established)<br>Bit4: BRK (During braking)<br>Bit3: INT (Inverter shut down)<br>Bit2: EXT (During DC braking or during pre-exciting)<br>Bit1: REV (During reverse opera-tion)<br>Bit0: FWD (During forward oper-ation) |

Apart from the 16bit registers (that can be accessed by word access commands), the bit control and monitor words can also be accessed with Modbus coil read/write commands.
For 32bit parameters, low word is first (check details in *"Access to 32bit parameters", on page 3-33*

| Coil control codes | Command |
|---|---|
| 1 (0x01) | Read Coil |
| 5 (0x05) | Write Single Coil |
| 15 (0x0F) | Write Multiple Coils |

| Register | Coil | Coil Name | Short Explanation |
|---|---|---|---|
| S006 | 1 | FWD | Forward run command |
| | 2 | REV | Reverse run command |
| | 3 | DI1 | Digital input 1 |
| | 4 | DI2 | Digital input 2 |
| | 5 | DI3 | Digital input 3 |
| | 6 | DI4 | Digital input 4 |
| | 7 | DI5 | Digital input 5 |
| | 14 | DI6 | Digital input 6 |
| | 15 | DI7 | Digital input 7 |
| | 16 | RST | Fault reset |

| Register | Coil | Coil Name | Short Explanation |
|---|---|---|---|
| M014 | 17 | FWD | Forward run command |
| | 18 | REV | Reverse run command |
| | 19 | EXT | External trip |
| | 20 | INT | Internal trip |
| | 21 | BRK | Braking command |
| | 22 | NUV | DC undervoltage |
| | 23 | TL | Torque limit |
| | 24 | VL | Voltage low |
| | 25 | IL | Current limit |
| | 26 | ACC | Acceleration active |
| | 27 | DEC | Deceleration active |
| | 28 | ALM | Alarm active |
| | 29 | RL | Run latch |
| | 32 | BUSY | Inverter busy |

## 4-5-4 ModbusTCP optimization by Modbus mapping function

If we want something similar to a cyclic communication with M1-EMP without having to use multiple messages due to the parameter addresses of our intereset are scattered and not grouped, we can use indirect Modbus mapping, by using the same set of parameters used for the cyclic PDOs of the other protocols.

The parameters set in o221 to o284 can be accessed at register addresses 0x8000 to 0x803Fh. As those registers are consecutive, it is possible to read/write them in a single modbus TCP message even if their original addresses are scattered all over the map. So writing in o221 to o284 an unsorted list of parameter addresses, we will then be able to access them in the 8000h mirrored area.

| Mapping Parameter | Modbus Target Address Pointer | Mirrored parameter Modbus Address |
|---|---|---|
| o221 | 4455h | 8000h |
| o222 | 4456h | 8001h |
| … | | … |
| o284 | 4494h | 803Fh |

For details and a complete list of direct register correspondence, mapping rules, 32bit parameter access and exceptions, check Modbus TCP free mapping details in *“Free Mapping for Indirect Parameter Access in Modbus TCP”, on page 3-17*.

# 5

# Parameter List



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# 5-1 Parameter Table Structure

## 5-1-1 Parameter table interpretation

The parameter table has following formatting, grouping the most information in a compact format. The meaning of each information field is described below.

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| Pxxx | XXXXh<br>YYYYh | Parameter name | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Control modes, min-max and options | def | ● | ● | ● | ---<br>--- | R/W | n. |

| Item | Description |
|---|---|
| param | Parameter number in the M1 parameter structure (e.g. Pxxx). Common across all M1 models. |
| Address 16/32bit LSW MSW | Modbus TCP register address in hexadecimal. For 16-bit parameters, only the LSW address is used. For 32-bit parameters, LSW and MSW form a consecutive register pair. |
| Function name | Common parameter name. Identical for all M1 models. |
| Range | Valid setting range, control modes, or selectable options for the parameter. Monitoring range is also shown for monitor-only items. |
| Def. data | Default value set before shipment. |
| Set in RUN | Indicates whether the parameter can be written while the inverter is running or only in STOP condition. ● = allowed writing during RUN |
| KVA diff | Indicates whether the default value or range depends on inverter voltage rating or capacity (kVA). ● = capacity-dependent. |
| EMP Map | Indicates whether the parameter is accessible via mapping to cyclic communications. ● = supported. |
| Format 16bit / 32bit | Data format used by Modbus communication. 32-bit format uses two consecutive registers; 16-bit format may use compact encoding. |
| R/W | Modbus access permission. RO = read only, R/W = read and write. |
| Page | Reference page for detailed explanation in another section of this manual. |

Control modes icons.

| Symbol | Control method (F042/A014) |
|---|---|
| V/f | 0:IM V/f control |
| DTV | 1:IM Dynamictorque vector control |
| PG V/f | 3:IM V/f control with speed sensor |
| PG DTV | 4:IM Dynamictorque vector control with speed sensor |
| SLV | 5:IM Vector control without speed sensor |
| PGV | 6:IM Vector control with speed sensor |
| PM SLV | 15:PM Vector control without speed and ABZ encoder |
| PM PGV | 16:PM Vector control with speed and ABZ encoder |

V/f = Enabled / V/f = Disabled in that mode

## 5-1-2 Modbus coil address list

This is the list of available coils in Modbus protocol and their meaning

| Register | Coil | Coil Name | Short Explanation | Long Explanation |
|---|---|---|---|---|
| S006 | 1 | FWD | Forward run command | Starts the inverter in forward direction when this command is active. |
| | 2 | REV | Reverse run command | Starts the inverter in reverse direction when this command is active. |
| | 3 | DI1 | Digital input 1 | Simulation of digital input terminal 1. |
| | 4 | DI2 | Digital input 2 | Simulation of digital input terminal 2. |
| | 5 | DI3 | Digital input 3 | Simulation of digital input terminal 3. |
| | 6 | DI4 | Digital input 4 | Simulation of digital input terminal 4. |
| | 7 | DI5 | Digital input 5 | Simulation of digital input terminal 5. |
| | 14 | DI6 | Digital input 6 | Simulation of digital input terminal 6. |
| | 15 | DI7 | Digital input 7 | Simulation of digital input terminal 7. |
| | 16 | RST | Fault reset | Resets active alarms and fault conditions when triggered. |
| M014 | 17 | FWD | Forward run command | Monitors forward direction when this command is active. |
| | 18 | REV | Reverse run command | Monitors reverse direction when this command is active. |
| | 19 | EXT | External trip | Indicates an externally triggered trip condition. |
| | 20 | INT | Internal trip | Indicates inverter internal protection trip. |
| | 21 | BRK | Braking command | Indicates braking control is active. |
| | 22 | NUV | DC undervoltage | Indicates DC link voltage is below allowable range. |
| | 23 | TL | Torque limit | Indicates torque is being limited by control function. |
| | 24 | VL | Voltage low | Undervoltage detection signal from DC bus. |
| | 25 | IL | Current limit | Indicates output current is being limited by protection control. |
| | 26 | ACC | Acceleration active | Indicates inverter is actively accelerating the motor. |
| | 27 | DEC | Deceleration active | Indicates inverter is actively decelerating the motor. |
| | 28 | ALM | Alarm active | Indicates that an alarm condition is currently active. |
| | 29 | RL | Run latch | Indicates run condition is internally latched. |
| | 32 | BUSY | Inverter busy | Indicates the inverter is processing a command or switching states. |

The list continues ...

... the list continues

| Register | Coil | Coil Name | Short Explanation | Long Explanation |
|---|---|---|---|---|
| M070 | 33 | FA1 | Frequency arrival 1 | Indicates output frequency has reached preset level 1. |
| | 34 | FA2 | Frequency arrival 2 | Indicates output frequency has reached preset level 2. |
| | 35 | IRDY | Inverter ready | Indicates inverter is powered and ready for operation. |
| | 36 | SETM | Second control mode | Indicates second control parameter set is active. |
| | 37 | IPF | Input phase failure | Indicates loss of one or more input phases. |
| | 38 | THM | Thermal warning | Indicates inverter thermal warning condition. |
| | 40 | FAN | Cooling fan status | Indicates cooling fan operation status. |
| | 41 | TRY | Retry active | Indicates inverter is executing an automatic restart sequence. |
| | 42 | OHF | Heatsink overheat | Indicates cooling fin or heatsink overtemperature. |
| | 43 | LIFE | Life alarm | Indicates lifespan limit has been reached for a monitored component. |
| | 44 | OLP | Overload pre-alarm | Early-stage overload detection prior to trip. |
| | 45 | OL2 | Second overload | Indicates second-stage overload condition. |
| | 46 | LOC | Low current | Indicates abnormally low output current state. |
| | 47 | OL | Overload warning | Indicates motor overload condition warning. |
| M013 | 49 | FWD | Forward run command | Monitors forward direction when this bit is active. |
| | 50 | REV | Reverse run command | Monitors reverse direction when this bit is active. |
| | 51 | DI1 | Digital input 1 | Status feedback of digital input terminal 1. |
| | 52 | DI2 | Digital input 2 | Status feedback of digital input terminal 2. |
| | 53 | DI3 | Digital input 3 | Status feedback of digital input terminal 3. |
| | 54 | DI4 | Digital input 4 | Status feedback of digital input terminal 4. |
| | 55 | DI5 | Digital input 5 | Status feedback of digital input terminal 5. |
| | 60 | EN | Enable | Enables inverter operation when active. |
| | 62 | DI6 | Digital input 6 | Status feedback of digital input terminal 6. |
| | 63 | DI7 | Digital input 7 | Status feedback of digital input terminal 7. |
| | 64 | RST | Fault reset | Resets active alarms and fault conditions when triggered. |
| M015 | 65 | DO1 | Digital output 1 | Status of digital output terminal 1. |
| | 73 | RO | Relay output | Status of internal relay output contact. |

# 5-2 Modbus Register Data Formats

This section describes the communication data format for accessing drive parameters in the different protocols. Modbus addressing is used to identify parameters. for cyclic flexible mapping or acyclic communications.

## 5-2-1 Data Format Specifications

All data in the data field of a communications frame is represented as 16-bit binary data as shown below.

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | |
| 16-bit binary data | | | | | | | | | | | | | | | |

For convenience of description, 16-bit data is divided into the upper byte (8 bits from 15 to 8) and the lower byte (8 bits from 7 to 0) and represented in hexadecimal.

For example, the following data is 1234h in hexadecimal representation and is described as

| 12h | 34h |
|---|---|

| 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

### Data Format [1] Integer Data (Positive), Resolution 1

Example: **1st Rated Voltage at Base Frequency** (F005) = 200 V

200 = 00C8h → | 00h | C8h |

### Data Format [2]: Integer Data (Positive/Negative), Resolution 1

Example: -20

-20 = FFECh → | FFh | ECh |

### Data Format [3]: Decimal Point Data (Positive), Resolution 0.1

Example: **1st Maximum Output Frequency** (F003) = 70.0 Hz

70.0 × 10 = 700 = 02BCh → | 02h | BCh |

### Data Format [4]: Decimal Point Data (Positive/Negative), Resolution 0.1

Example: **Input Terminal [AI1] Offset** (C031) = -5.0%

-5.0 × 10 = -50 = FFCEh → | FFh | CEh |

### Data Format [5]: Decimal Point Data (Positive), Resolution 0.01

Example: **Multi-step Frequency Reference 1** (C005) = 50.25 Hz

50.25 × 100 = 5,025 = 13A1h → | 13h | A1h |

## Data Format [6]: Decimal Point Data (Pos/Neg), Resolution 0.01

Example: **Torque Value** (M007) = -85.38%
-85.38 × 100 = -8,538 = DEA6h → DEh | A6h

## Data Format [7]: Decimal Point Data (Positive), Resolution 0.001

Example: **Electronic Thermal for Braking Resistor Allowable Average Loss** (3004h-34) = 0.105 kW
0.105 × 1,000 = 105 = 0069h → 00h | 69h

## Data Format [10]: Alarm Code

| Code | Description | | Code | Description | |
|---|---|---|---|---|---|
| 0 | No alarm | --- | 37 | Tuning Error | er7 |
| 1 | Overcurrent Protection (During Acceleration) | 0c1 | 42 | Step-out Detection/Magnetic Pole Position Detection Error during Startup | erd |
| 2 | Overcurrent Protection (During Deceleration) | 0c2 | 46 | Output Phase Loss Error | 0pl |
| 3 | Overcurrent Protection (During Constant Speed) | 0c3 | 47 | Speed Mismatch or Excessive Speed Deviation | ere |
| 6 | Overvoltage Protection (During Acceleration) | 0u1 | 50 | Magnetic Pole Position Detection Error | erc |
| 7 | Overvoltage Protection (During Deceleration) | 0u2 | 51 | Data Save Error during Undervoltage | erf |
| 8 | Overvoltage Protection (During Constant Speed) | 0u3 | 52 | Excessive Position Deviation Error | d0 |
| 10 | Undervoltage | lu | 53 | RS-485 Communication Error | erp |
| 11 | Input Phase Loss Error | lin | 54 | Hardware Error | erh |
| 16 | Inrush Current Prevention Circuit Error | pbf | 56 | Positioning Control Error | ero |
| 17 | Cooling Fin Overheat Error | 0h1 | 57 | Enable Circuit Failure | ecf |
| 18 | External Trip | 0h2 | 58 | Terminal [Ai2]AII Current Input Wire Break Detection | cof |
| 19 | Inverter Overheat Error | 0h3 | 59 | Breaking Transistor Error | dba |
| 20 | Thermistor Error | 0h4 | 65 | Customizable Logic Abnormality | ecl |
| 22 | Braking Resistor Overheat Error | dbh | 70 | Inrush Current Prevention Resistor Overheat | 0h6 |
| 23 | 1st Motor Overload Protection | 0l1 | 101 | Motor Overload Warning | 0l |
| 24 | 2nd Motor Overload Protection | 0l2 | 102 | Cooling Fin Overheat Warning | 0h |
| 25 | Inverter Overload Protection | 0lu | 103 | Life Warning | lif |
| 27 | Overspeed | 0s | 104 | Analog Input Reference Command Loss Detected | ref |
| 28 | Abnormal Setting Related to the PG Option Card | pg | 105 | PID Warning Output | pid |
| 31 | EEPROM Error | er1 | 106 | Low Torque Detected | uTl |
| 32 | Operator Communications Error | er2 | 107 | PTC thermistor activated | pTc |
| 33 | CPU Error | er3 | 108 | Motor Run Time Over | rTe |
| 34 | Option Timeout | er4 | 109 | Number of Startups Over | cnT |
| 35 | Option Error | er5 | 253 | Locked by Password | lok |
| 36 | Operation Error | er6 | 254 | Mock Alarm | err |

Example: Overvoltage Protection (During Acceleration) (0u1) 6 = 0006h → 00h | 06h

## Data Format [11]: Capacity Code (in kW)

The data is in a scale 1=10W as shown in the table below.

| Capacity (kW) | Data |
|---|---|
| 0.1 | 10 |
| 0.2 | 20 |
| 0.4 | 40 |
| 0.75 | 75 |
| 1.5 | 150 |
| 2.2 | 220 |
| 3.7 | 370 |
| 5.5 | 550 |
| 7.5 | 750 |
| 11 | 1,100 |
| 15 | 1,500 |
| 18.5 | 1,850 |
| 22 | 2,200 |

Example: 2.2 kW

2.20 ×100 = 220 = 00DCh →

| 00h | DCh |
|---|---|

## Data Format [12]: Floating Point Data (Acc/Dec Time, PID Conversion Coefficient

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 0 | 0 | | | | | | | | | | | | |
| Polarity | Not used | | | Exponent part | | Mantisa part | | | | | | | | | |

Polarity: 0 → Positive (+), 1 → Negative (-), Exponent part: 0 to 3, Mantissa part: 1 to 999

Value represented in this format = (Polarity) mantissa part × 10 to the power of (exponent part - 2)

| Value | Mantissa part | Exponent part | 10 to the power of (exponent part - 2) |
|---|---|---|---|
| 0.01 to 9.99 | 1 to 999 | 0 | 0.01 |
| 10.0 to 99.9 | 100 to 999 | 1 | 0.1 |
| 100 to 999 | 100 to 999 | 2 | 1 |
| 1,000 to 9,990 | 100 to 999 | 3 | 10 |

Example: **PID Control Maximum Scale** (J106) = 80.00

80.0 = 800 × 0.1 → 0000 0100 1100 $1000_b$ = 0720h →

| 07h | 20h |
|---|---|

## Data Format [14]: Operation Command

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RST | DI7 | DI6 | 0 | 0 | 0 | 0 | 0 | 0 | DI5 | DI4 | DI3 | DI2 | DI1 | REV | FWD |
| inputs | | | Not used | | | | | | inputs | | | | | | |

RST: Alarm reset
FWD: Forward command REV: Reverse command
(All bits are ON with 1 regardless of the positive/negative logic setting.)
Example: **Operation command** (S006) = FWD, DI1 = ON
$0000\ 0000\ 0000\ 0101_b$ = 0005h → 00h | 05h

## Data Format [15]: General-purpose Output Terminal

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | RO | 0 | 0 | 0 | 0 | 0 | DO2 | DO1 |
| Not used | | | | | | | | out | Not used | | | | | outputs | |

RO: Relay output
(All bits are ON with 1 regardless of the positive/negative logic setting.)
Example: **Output Terminal Monitor** (M015) DO1 = ON
$0000\ 0000\ 0000\ 0001_b$ = 0001h → 00h | 01h

## Data Format [16]: Operation Status

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BUSY | 0 | 0 | RL | ALM | DEC | ACC | IL | VL | TL | NUV | BRK | INT | EXT | REV | FWD |
| | Not used | | Operation Status | | | | | | | | | | | | |

Operation status meaning

| Bit | Symbol | Description | Bit | Symbol | Description |
|---|---|---|---|---|---|
| 0 | FWD | During forward operation | 8 | IL | During current limiting |
| 1 | REV | During reverse operation | 9 | ACC | During acceleration |
| 2 | EXT | Direct DC braking (or during pre-excitation) | 10 | DEC | During deceleration |
| 3 | INT | Inverter shut down | 11 | ALM | Alarm relay |
| 4 | BRK | During braking | 12 | RL | Communications effective |
| 5 | NUV | Main circuit DC voltage established (Undervoltage with 0) | 13 | 0 | --- |
| 6 | TL | Torque limiting | 14 | 0 | --- |
| 7 | VL | During voltage limiting | 15 | BUSY | During parameter code data writing |

Example: **Operation Status 1 Monitor** (M014) = During forward operation and during acceleration 0000 0010 0000 0001$_b$ = 0401h → | 04h | 01h |

## Data Format [17]: Voltage Class Code

FF12h (65298) (1ph 200V)
FF13h (65299) (3ph 200V)
FF14h (65300) (3ph 400V)

## Data Format [19]: Current Value

A current value is decimal point data (positive), resolution 0.01.
Example: **1st Motor Electronic Thermal Level** (F011) = 3.60 A
3.60 ×100 = 360 = 0168h → | 00h | 01h |

## Data Format [20]: Communications Error Code

| Code | Description |
|---|---|
| 1 | Non-existent object (parameter number) specified |
| 2 | Non-existent object (parameter number) specified |
| 3 | Improper data (Range error) |
| 7 | NAK (Link priority, no right, write disabled) |
| 71 | Checksum error, CRC error |
| 72 | Parity error |
| 73 | Framing error, overrun error, buffer full |

Example: Improper address
2 = 0002h → | 00h | 02h |

## Data Format [21]: Auto Tuning

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | REV | FW | | | | | | | | |
| Not used | | | | | | Rotation Direction | | Data part | | | | | | | |

(Data part)
0: Disable
1: Tune the motor parameters while stopped
2: Tune the motor parameters while rotating
4: Tune the PM motor magnetic pole position offset while rotating
5: Tune the motor %R1 and %X while stopped
Example: **1st Auto Tuning Function Selection** (P004) = 2: Tune the motor parameters while rotating, forward operation
2 = 0102h → 01h | 02h

## Data Format [22]: Frequency Data

Decimal point data (positive), resolution 0.01 Hz
Example: **Multi-step Frequency Reference 1** (C005) = 50.25 Hz
50.25 × 100 = 5,025 = 13A1h → 13h | A1h

## Data Format [24]: Floating Point Data

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Exponent part | | | | | | | | Mantissa part | | | | | | | |

Exponent part: 0 to 3, Mantissa part: 1 to 9,999
Value represented in this format = Mantissa part × 10 to the power of (exponent part - 2)

| Value | Mantissa part | Exponent part | 10 to the power of (exponent part - 2) |
|---|---|---|---|
| 0.00 to 99.99 | 0 to 9,999 | 0 | 0.01 |
| 100.0 to 999.9 | 1,000 to 9,999 | 1 | 0.1 |
| 1,000 to 9,999 | 1,000 to 9,999 | 2 | 1 |
| 10,000 to 99,990 | 1,000 to 9,999 | 3 | 10 |

Example: **Power Consumption Monitor** (W021) = 10.02 kW
10.02 = Mantissa part: 1,002 (3EAh), Exponent part: 0 = 03EAh → 03h | EAh

Example: **Power Consumption Monitor** (W021) = 100.2 kW
100.2 = Mantissa part: 1,002 (3EAh), Exponent part: 1 = 43EAh → 43h | EAh

Example: **Power Consumption Monitor** (W021) = 9,999 kW
100.2 = Mantissa part: 9,999 (270Fh), Exponent part: 2 = 670Fh → 67h | 0Fh

## Data Format [29]: Positive/Negative Data with ±20,000 as ±100%

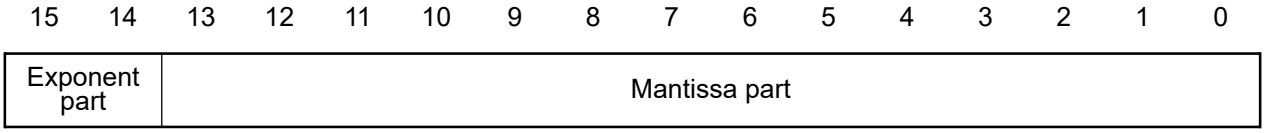
Example: **Frequency Reference** (S001) = -20,000 (= -100% = Maximum output frequency)
-20,000 = B1E0h → B1h | E0h

Example: **Frequency Reference** (S001) = 20,000 (= 100% = Maximum output frequency)
20,000 = 4E20h → 4Eh | 20h

## Data Format [35]: ROM Version

Setting range: 0 to 59,999
Example: **ROM Version** (M025) = 0064h
00h | 64h → 0064h = 100

## Data Format [37]: Floating Point Data (Load Shaft Speed, etc.)




Exponent part: 0 to 3, Mantissa part: 1 to 9,999
Value represented in this format = Mantissa part × 10 to the power of (exponent part - 2)

| Value | Mantissa part | Exponent part | 10 to the power of (exponent part - 2) |
|---|---|---|---|
| 0.00 to 99.99 | 0 to 9,999 | 0 | 0.01 |
| 100.0 to 999.9 | 1,000 to 9,999 | 1 | 0.1 |
| 1,000 to 9,999 | 1,000 to 9,999 | 2 | 1 |
| 10,000 to 99,990 | 1,000 to 9,999 | 3 | 10 |

Example: **Rotate Speed Monitor** (W008) = 99,990 r/min
99,990 = Mantissa part: 9,999 (270Fh), Exponent part: 3 = E70Fh → E7h | 0Fh
Example: **Rotate Speed Monitor** (W008) = 9,999 r/min
9,999 = Mantissa part: 9,999 (270Fh), Exponent part: 2 = A70Fh → A7h | 0Fh
Example: **Rotate Speed Monitor** (W008) = 9.999 r/min
999.9 = Mantissa part: 9,999 (270Fh), Exponent part: 1 = 670Fh → 67h | 0Fh
Example: **Rotate Speed Monitor** (W008) = 99.99 r/min
99.99 = Mantissa part: 9,999 (270Fh), Exponent part: 0 = 270Fh → 27h | 0Fh

## Data Format [41]: Alarm History

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of consecutive occurrences of the same alarm | | | | | | | | Alarm Code (*1) | | | | | | | |

*1 For alarm codes, refer to “Data Format [10]: Alarm Code” in this section.

This gives the contents of the alarm that occurred and the number of consecutive occurrences of the alarm.

Example: **Last Alarm History/Number of Consecutive Same Alarms** (X005) = 021Bh | 02h | 1Bh | →

Number of consecutive occurrences of the same alarm: 2

Alarm code: 1Bh = 27 OS (Overspeed)

## Data Format [43]: Operation Command (for I/O Check)

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | EN2 | EN1 | 0 | 0 | 0 | 0 | DI5 | DI4 | DI3 | DI2 | DI1 | DI7 | DI6 |
| Not used | | | EN input | | Not used | | | | General-purpose Inputs | | | | | | |

(All bits are ON with 1)

Example: **Input Terminal Monitor** (W040) = 0061h

| 00h | 61h | → 0000 0000 0110 0001$_b$ = DI4, DI5, and DI6 are ON

## Data Format [44]: Operation Status 2

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | OL | LOC | OL2 | OLP | LIFE | OHF | TRY | FAN | REF | THM | IPF | SETM | IDRY | FDT1 | FAR1 |
| Not used | Operation Status | | | | | | | | | | | | | | |

All bits are ON or active with 1

| Bit | Symbol | Description | Bit | Symbol | Description |
|---|---|---|---|---|---|
| 0 | FAR1 | Constant speed arrival | 8 | TRY | During retry |
| 1 | FDT1 | Over set Frequency arrival | 9 | OHF | Fin Overheat warning |
| 2 | IRDY | Operation ready | 10 | LIFE | Life warning |
| 3 | SETM | 2nd motor selection | 11 | OLP | During active drive |
| 4 | IPF | During restart after instantaneous power failure | 12 | OL2 | Overload warning 2 |
| 5 | THM | Thermal warning | 13 | LOC | Light load detection |
| 6 | REF | RUN command source | 14 | OL | Overload warning |
| 7 | FAN | Fan operation signal | 15 | 0 | --- |

Example: **Running Status 3 Monitor** (M070) = 0281h

| 02h | 81h |
|---|---|

→ 0000 0010 1000 0001$_b$ = FAR1, FAN, and OHF are ON

## Data Format [45]: Floating Point Data

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Exponent part | | | | Mantissa part | | | | | | | | | | | |

Exponent part: 0 to 3, Mantissa part: 0 to 9,999

Value represented in this format = Mantissa part × 10 to the power of (exponent part - 3)

| Value | Mantissa part | Exponent part | 10 to the power of (exponent part - 3) |
|---|---|---|---|
| 0.000 to 9.999 | 0 to 9,999 | 0 | 0.001 |
| 10.00 to 99.99 | 1,000 to 9,999 | 1 | 0.01 |
| 100.0 to 999.9 | 1,000 to 9,999 | 2 | 0.1 |
| 1,000 to 9,999 | 1,000 to 9,999 | 3 | 1 |

Example: **Data Used Integrating Electric Power** (W082) =
9,999kW, 9,999 = Mantissa part: 9,999 (270Fh), Exponent part: 2 = A70Fh →

| A7h | 0Fh |
|---|---|

Example: **Data Used Integrating Electric Power** (W082) = 999.9 kW
999.9 = Mantissa part: 9,999 (270Fh), Exponent part: 1 = 670Fh →

| 67h | 0Fh |
|---|---|

Example: **Data Used Integrating Electric Power** (W082) = 99.99 kW
99.99 = Mantissa part: 9,999 (270Fh), Exponent part: 0 = 270Fh →

| 27h | 0Fh |
|---|---|

## Data Format [67]: RUN Command Source Monitor

| Code | Description | Remarks |
|---|---|---|
| 0 | Digital Operator positive direction terminal | Same as the selection for RUN Command Selection (F002 / E102) |
| 1 | Terminal command (FW or RV) | |
| 2 | Digital Operator forward rotation | |
| 3 | Digital Operator reverse rotation | |
| 4 to 20 | Reserved | |
| 21 | RS-485 communications | |
| 22 | Fieldbus (Reserved) | |
| 23 | Support Tool | |

Example: **RUN Command Source Monitor** (W028) = 0001h

| 00h | 01h |
|---|---|

→ 1 = Terminal command (FW or RV)

## Data Format [68]: Frequency Reference Source Code

| Code | Description | Remarks |
|---|---|---|
| 0 | Digital Operator (Increment/Decrement key) (No output frequency takeover) | Same as the selection for Frequency Reference Selection (F001/C030) |
| 1 | Analog voltage input (terminal [AI1])(F001 / C030) | |
| 2 | Analog current input (terminal [AI2] (AII)) | |
| 3 | Analog voltage input (terminal [AI1]) + analog current input (terminal [AI2] (AII)) | |
| 5 | Analog voltage input (terminal AI2 (AIV)) | |
| 7 | UP/DOWN control | |
| 8 | Digital Operator (Increment/Decrement key) (Output frequency takeover) | |
| 10 | Pattern operation | |
| 13 | Pulse train input or Frequency calculation | |
| 21 | RS-485 communications | |
| 22 | Fieldbus (Reserved) | |
| 23 | Support Tool | |
| 24 | Multi-step Frequency | |
| 25 | Jogging Frequency | |
| 30 | PID Control Operator Process | |
| 31 | PID Control Analog Process | |
| 33 | PID Control UP/DOWN control | |
| 34 | PID Control Communication Process | |
| 36 | PID Control Multi-Step Terminal Process | |
| 255 | Not Selected | |

Example: **Frequency and PID Command Source Monitor** (W029) = 000Ah

| 00h | 0Ah |
|---|---|

→ 10 = Pattern operation

## Data Format [74]: Integer Data (Positive), in 10 Hours

Example: **1st Remaining Time before the Next Motor Maintenance** (M081) = 12,340 h
12340 ÷ 10 = 04D2 $_h$ → 04h | D2h

## Data Format [76]: Operation Status 2

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Drive motor type | Not used | | | | | | | During Speed Control | Not used | Selected motor | | Control method | | | |

Example: **Running Status 2 Monitor** (M074) = 0003h
00h | 03h → 0000 0000 0000 0011$_b$ = IM V/f control with speed sensor, 1st motor, indication motor

| Signal name | Description |
|---|---|
| Control method | Indicates the final control method including set value, terminal status, etc.<br>0: IM V/f control<br>1: IM Dynamic torque vector control without speed sensor<br>3: IM V/f control with speed sensor<br>4: IM Dynamic torque vector control with speed sensor<br>5: IM Vector control without speed sensor<br>6: IM Vector control with speed sensor<br>15: PM Vector control without speed and pole position sensor<br>16: PM Vector control with speed and pole position sensor Others: Reserved |
| Selected motor | Indicates the selected motor number.<br>00b: 1st motor<br>01b: 2nd motor |
| During speed control | 1 during control |
| Drive motor type | 0: Induction motor<br>1: Synchronous motor |

## Data Format [84]: Pattern Operation

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rotation direction | Not used | Acceleration/ Deceleration time selection | | Minimum unit of operation time | | Data part of operation time | | | | | | | | | |

| Item | Description |
|---|---|
| Rotation direction | 0: Forward, 1: Reverse |
| Acceleration/Deceleration time selection | 0: 1st Acceleration Time 1 (F007)/1st Deceleration Time 1 (F008)<br>1: 2nd Acceleration Time 1 (E010)/2nd Deceleration Time 1 (E011)<br>2: 1st Acceleration Time 2 (E012)/1st Deceleration Time 2 (E013)<br>3: 2nd Acceleration Time 2 (E014)/2nd Deceleration Time 2 (E015) |
| Minimum unit of operation time | 0: 0.01<br>1: 0.1<br>2: 1<br>3: 10 |
| Data part of operation time | Exponent part 0: 000 to 999<br>Exponent part not 0: 100 to 999 |

Example: **Pattern Operation Stage 1 Operation Setting** (C022) = Reverse, 2nd Acceleration/ Deceleration Time, and 10.0 s

Rotation direction: Reverse (8000h)

Acceleration/Deceleration time: 2nd Acceleration/Deceleration Time (1000h)

Operation time: 10.0 s = 0.1 × 100 (0400h + 0064h). Therefore, the set value is

8000h + 1000h + 0400h + 0064h = 9464h → 94h | 64h

## Data Format [93]: Floating Point Data

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | |
| Exponent part | | | | | | | Mantissa part | | | | | | | | |

Exponent part: 0 to 3, Mantissa part: 0 to 9,999

Value represented in this format = Mantissa part × 10 to the power of (exponent part - 1)

| Value | Mantissa part | Exponent part | 10 to the power of (exponent part - 1) |
|---|---|---|---|
| 0.0 to 999.9 | 0 to 9,999 | 0 | 0.1 |
| 1,000 to 9,999 | 1,000 to 9,999 | 1 | 1 |
| 10,000 to 99,990 | 1,000 to 9,999 | 2 | 10 |
| 100,000 to 999,900 | 1,000 to 9,999 | 3 | 100 |

Example: **Integrated Power Monitor** (W081) = 12,340

12,340 = Mantissa part: 1,234 (04D2h), Exponent part: 2 = C4D2h → C4h | D2h

Example: **Integrated Power Monitor** (W081) = 567.8
567.8 = Mantissa part: 5,678 (162Eh), Exponent part: 0 = 162Eh →

| 16h | 2Eh |
|---|---|

## Data Format [99]: Base Model Code

This base model code can be checked in monitor M123 (Model Code 2)

- M123 = 0121h (289) → 3G3M1-STD
- M123 = 0141h (321) → 3G3M1-ECT
- M123 = 0171h (369) → 3G3M1-EMP

# 5-3 Lists of Inverter Monitors

The following tables list the parameters that allow monitoring of Inverter status.

## 5-3-1 Monitor parameters M (Monitor 1)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M001 | 50C1h<br>--- | Frequency Reference at Final | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767<br>+20000 or -20000 = maximum output frequency | 0 | • | 29<br>--- | RO | |
| M002 | 50C2h<br>--- | Torque Reference Monitor at Last | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 | 0.00% | • | 6<br>--- | RO | |
| M003 | 50C3h<br>--- | Torque Current Command at Final | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 | 0.00% | • | 6<br>--- | RO | |
| M004 | 50C4h<br>--- | Magnetic Flux Command Value | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 | 0.00% | • | 6<br>--- | RO | |
| M005 | 50C6h<br>50C5h | Frequency Reference at Final | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 | 0.00Hz | • | ---<br>5 | RO | |
| M006 | 50C7h<br>--- | Output Frequency 1 without Slip Compensation | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767<br>+20000 or -20000 = maximum output frequency | 0 | • | 29<br>--- | RO | |
| M007 | 50C8h<br>--- | Torque Value | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 | 0.00% | • | 6<br>--- | RO | |
| M008 | 50C9h<br>--- | Torque Current Value | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 | 0.00% | • | 6<br>--- | RO | |
| M009 | 50CBh<br>50CAh | Output Frequency without Slip Compensation | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 Hz | 0.00Hz | • | ---<br>5 | RO | |
| M010 | 50CCh<br>--- | Input Power | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 399.99 % | 0.00% | • | 5<br>--- | RO | |
| M011 | 50CDh<br>--- | Output Current Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 399.99 % | 0.00% | • | 5<br>--- | RO | |
| M012 | 50CEh<br>--- | Output Voltage Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 1000.0 V | 0.0V | • | 3<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M013 | 50CFh<br>--- | Operation Command at Final | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: RST<br>Bit14: DI7<br>Bit13: DI6<br>Bit12: -<br>Bit11: EN<br>Bit10: -<br>Bit9: -<br>Bit8: -<br>Bit7: -<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: REV<br>Bit0: FWD | 0 | • | 14<br>--- | RO | |
| M014 | 50D0h<br>--- | Operation Status 1 Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: BUSY (During parameter data writing)<br>Bit14: -<br>Bit13: -<br>Bit12: RL (Communications effective)<br>Bit11: ALM (Alarm relay)<br>Bit10: DEC (During deceleration)<br>Bit9: ACC (During acceleration)<br>Bit8: IL (During current limiting)<br>Bit7: VL (During voltage limiting)<br>Bit6: TL (Torque limiting)<br>Bit5: NUV (Main circuit DC voltage established)<br>Bit4: BRK (During braking)<br>Bit3: INT (Inverter shut down)<br>Bit2: EXT (During DC braking or during pre-exciting)<br>Bit1: REV (During reverse operation)<br>Bit0: FWD (During forward operation) | 0 | • | 16<br>--- | RO | |
| M015 | 50D1h<br>--- | Output Terminal Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: RO<br>Bit7: ---<br>Bit6: ---<br>Bit5: ---<br>Bit4: ---<br>Bit3: ---<br>Bit2: ---<br>Bit1: DO2<br>Bit0: DO1 | 0 | • | 15<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M016 | 0011h<br>--- | Latest Alarm Contents | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 254 (00 to FFh)<br>0 (00h): No alarm<br>1 (01h): OC1 Overcurrent protection (during acceleration)<br>2 (02h): OC2 Overcurrent protection (during deceleration)<br>3 (03h): OC3 Overcurrent protection (during constant speed operation)<br>6 (06h): OU1 Overvoltage protection (during acceleration)<br>7 (07h): OU2 Overvoltage protection (during deceleration)<br>8 (08h): OU3 Overvoltage protection (during constant speed operation or stopping)<br>10 ( 0Ah): LU Undervoltage protection<br>11 (0Bh): Lin Input phase loss protection<br>16 (10h): PbF Inrush Current Prevention Circuit Error<br>17 (11h): OH1 Heat sink overheat<br>18 (12h): OH2 External alarm input<br>19 (13h): OH3 Inverter internal overheat<br>20 (14h): OH4 Motor protection (PTC thermistor)<br>22 (16h): dbH Braking resistor overheat<br>23 (17h): OL1 1st Motor Overload Protection<br>24 (18h): OL2 2nd Motor Overload Protection<br>25 (19h): OLU Inverter overload<br>27 (1Bh): OS Over speed protection<br>28 (1Ch): Pg PG disconnection<br>31 (1Fh): Er1 Memory error<br>32 (20h): Reserved<br>33 (21h): Er3 CPU error<br>34 (22h): Reserved<br>35 (23h): Er5 Ethernet board error<br>36 (24h): Er6 Operation protection<br>37 (25h): Er7 Tuning error<br>42 (2Ah): Erd Detection of step-out<br>46 (2Eh): OPL Output phase loss protection<br>47 (2Fh): ErE Following error (excessive speed deviation)<br>50 (32h): ErC Magnetic pole position detection error<br>51 (33h): ErF Data save error in case of undervoltage<br>52 (34h): d0 Excessive positioning deviation<br>53 (35h): Reserved<br>56 (38h): Ero Position control error<br>57 (39h): ECF Safety circuit failure<br>58 (3Ah): Reserved<br>59 (3Bh): dbA DB transistor trouble<br>65 (41h): Reserved<br>68 (44h): ErU Support tool communication disconnection<br>70 (46h): OH6 Inrush Current Prevention Resistor Overheat<br>121 (79h): CA1 Drive App Alarm 1<br>122 (7Ah): CA2 Drive App Alarm 2<br>123 (7Bh): CA3 Drive App Alarm 3<br>124 (7Ch): CA4 Drive App Alarm 4<br>125 (7Dh): CA5 Drive App Alarm 5<br>130 (82h): EnF SF terminal OFF<br>252 (FCh): Fod Fire mode activated<br>253 (FDh): Lok Locked by password<br>254 (FEh): Err Mock alarm (Subcode = 9998) | 0 | • | 10<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M017 | 001Bh<br>--- | Last Alarm Contents | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 254 (00 to FFh)<br>0 (00h): No alarm<br>1 (01h): OC1 Overcurrent protection (during acceleration)<br>2 (02h): OC2 Overcurrent protection (during deceleration)<br>3 (03h): OC3 Overcurrent protection (during constant speed operation)<br>6 (06h): OU1 Overvoltage protection (during acceleration)<br>7 (07h): OU2 Overvoltage protection (during deceleration)<br>8 (08h): OU3 Overvoltage protection (during constant speed operation or stopping)<br>10 ( 0Ah): LU Undervoltage protection<br>11 (0Bh): Lin Input phase loss protection<br>16 (10h): PbF Inrush Current Prevention Circuit Error<br>17 (11h): OH1 Heat sink overheat<br>18 (12h): OH2 External alarm input<br>19 (13h): OH3 Inverter internal overheat<br>20 (14h): OH4 Motor protection (PTC thermistor)<br>22 (16h): dbH Braking resistor overheat<br>23 (17h): OL1 1st Motor Overload Protection<br>24 (18h): OL2 2nd Motor Overload Protection<br>25 (19h): OLU Inverter overload<br>27 (1Bh): OS Over speed protection<br>28 (1Ch): Pg PG disconnection<br>31 (1Fh): Er1 Memory error<br>32 (20h): Reserved<br>33 (21h): Er3 CPU error<br>34 (22h): Reserved<br>35 (23h): Er5 Ethernet board error<br>36 (24h): Er6 Operation protection<br>37 (25h): Er7 Tuning error<br>42 (2Ah): Erd Detection of step-out<br>46 (2Eh): OPL Output phase loss protection<br>47 (2Fh): ErE Following error (excessive speed deviation)<br>50 (32h): ErC Magnetic pole position detection error<br>51 (33h): ErF Data save error in case of undervoltage<br>52 (34h): d0 Excessive positioning deviation<br>53 (35h): Reserved<br>56 (38h): Ero Position control error<br>57 (39h): ECF Safety circuit failure<br>58 (3Ah): Reserved<br>59 (3Bh): dbA DB transistor trouble<br>65 (41h): Reserved<br>68 (44h): ErU Support tool communication disconnection<br>70 (46h): OH6 Inrush Current Prevention Resistor Overheat<br>121 (79h): CA1 Drive App Alarm 1<br>122 (7Ah): CA2 Drive App Alarm 2<br>123 (7Bh): CA3 Drive App Alarm 3<br>124 (7Ch): CA4 Drive App Alarm 4<br>125 (7Dh): CA5 Drive App Alarm 5<br>130 (82h): EnF SF terminal OFF<br>252 (FCh): Fod Fire mode activated<br>253 (FDh): Lok Locked by password<br>254 (FEh): Err Mock alarm (Subcode = 9998) | 0 | • | 10<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M018 | 0025h<br>--- | Second Last Alarm Contents | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 254 (00 to FFh)<br>0 (00h): No alarm<br>1 (01h): OC1 Overcurrent protection (during acceleration)<br>2 (02h): OC2 Overcurrent protection (during deceleration)<br>3 (03h): OC3 Overcurrent protection (during constant speed operation)<br>6 (06h): OU1 Overvoltage protection (during acceleration)<br>7 (07h): OU2 Overvoltage protection (during deceleration)<br>8 (08h): OU3 Overvoltage protection (during constant speed operation or stopping)<br>10 ( 0Ah): LU Undervoltage protection<br>11 (0Bh): Lin Input phase loss protection<br>16 (10h): PbF Inrush Current Prevention Circuit Error<br>17 (11h): OH1 Heat sink overheat<br>18 (12h): OH2 External alarm input<br>19 (13h): OH3 Inverter internal overheat<br>20 (14h): OH4 Motor protection (PTC thermistor)<br>22 (16h): dbH Braking resistor overheat<br>23 (17h): OL1 1st Motor Overload Protection<br>24 (18h): OL2 2nd Motor Overload Protection<br>25 (19h): OLU Inverter overload<br>27 (1Bh): OS Over speed protection<br>28 (1Ch): Pg PG disconnection<br>31 (1Fh): Er1 Memory error<br>32 (20h): Reserved<br>33 (21h): Er3 CPU error<br>34 (22h): Reserved<br>35 (23h): Er5 Ethernet board error<br>36 (24h): Er6 Operation protection<br>37 (25h): Er7 Tuning error<br>42 (2Ah): Erd Detection of step-out<br>46 (2Eh): OPL Output phase loss protection<br>47 (2Fh): ErE Following error (excessive speed deviation)<br>50 (32h): ErC Magnetic pole position detection error<br>51 (33h): ErF Data save error in case of undervoltage<br>52 (34h): d0 Excessive positioning deviation<br>53 (35h): Reserved<br>56 (38h): Ero Position control error<br>57 (39h): ECF Safety circuit failure<br>58 (3Ah): Reserved<br>59 (3Bh): dbA DB transistor trouble<br>65 (41h): Reserved<br>68 (44h): ErU Support tool communication disconnection<br>70 (46h): OH6 Inrush Current Prevention Resistor Overheat<br>121 (79h): CA1 Drive App Alarm 1<br>122 (7Ah): CA2 Drive App Alarm 2<br>123 (7Bh): CA3 Drive App Alarm 3<br>124 (7Ch): CA4 Drive App Alarm 4<br>125 (7Dh): CA5 Drive App Alarm 5<br>130 (82h): EnF SF terminal OFF<br>252 (FCh): Fod Fire mode activated<br>253 (FDh): Lok Locked by password<br>254 (FEh): Err Mock alarm (Subcode = 9998) | 0 | • | 10<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M019 | 002Fh<br>--- | Third Last Alarm Contents | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 254 (00 to FFh)<br>0 (00h): No alarm<br>1 (01h): OC1 Overcurrent protection (during acceleration)<br>2 (02h): OC2 Overcurrent protection (during deceleration)<br>3 (03h): OC3 Overcurrent protection (during constant speed operation)<br>6 (06h): OU1 Overvoltage protection (during acceleration)<br>7 (07h): OU2 Overvoltage protection (during deceleration)<br>8 (08h): OU3 Overvoltage protection (during constant speed operation or stopping)<br>10 ( 0Ah): LU Undervoltage protection<br>11 (0Bh): Lin Input phase loss protection<br>16 (10h): PbF Inrush Current Prevention Circuit Error<br>17 (11h): OH1 Heat sink overheat<br>18 (12h): OH2 External alarm input<br>19 (13h): OH3 Inverter internal overheat<br>20 (14h): OH4 Motor protection (PTC thermistor)<br>22 (16h): dbH Braking resistor overheat<br>23 (17h): OL1 1st Motor Overload Protection<br>24 (18h): OL2 2nd Motor Overload Protection<br>25 (19h): OLU Inverter overload<br>27 (1Bh): OS Over speed protection<br>28 (1Ch): Pg PG disconnection<br>31 (1Fh): Er1 Memory error<br>32 (20h): Reserved<br>33 (21h): Er3 CPU error<br>34 (22h): Reserved<br>35 (23h): Er5 Ethernet board error<br>36 (24h): Er6 Operation protection<br>37 (25h): Er7 Tuning error<br>42 (2Ah): Erd Detection of step-out<br>46 (2Eh): OPL Output phase loss protection<br>47 (2Fh): ErE Following error (excessive speed deviation)<br>50 (32h): ErC Magnetic pole position detection error<br>51 (33h): ErF Data save error in case of undervoltage<br>52 (34h): d0 Excessive positioning deviation<br>53 (35h): Reserved<br>56 (38h): Ero Position control error<br>57 (39h): ECF Safety circuit failure<br>58 (3Ah): Reserved<br>59 (3Bh): dbA DB transistor trouble<br>65 (41h): Reserved<br>68 (44h): ErU Support tool communication disconnection<br>70 (46h): OH6 Inrush Current Prevention Resistor Overheat<br>121 (79h): CA1 Drive App Alarm 1<br>122 (7Ah): CA2 Drive App Alarm 2<br>123 (7Bh): CA3 Drive App Alarm 3<br>124 (7Ch): CA4 Drive App Alarm 4<br>125 (7Dh): CA5 Drive App Alarm 5<br>130 (82h): EnF SF terminal OFF<br>252 (FCh): Fod Fire mode activated<br>253 (FDh): Lok Locked by password<br>254 (FEh): Err Mock alarm (Subcode = 9998) | 0 | • | 10<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M020 | 50D7h<br>50D6h | Cumulative Operation Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655350 hour | 0h | ● | ---<br>1 | RO | |
| M021 | 50D8h<br>--- | Main Circuit DC Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1000 V | 0V | ● | 1<br>--- | RO | |
| M023 | 50DAh<br>--- | Model code | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | ● | 17<br>--- | RO | |
| M024 | 50DBh<br>--- | Capacity code | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.10 to 22.00 | 5.50 | ● | 11<br>--- | RO | |
| M025 | 50DCh<br>--- | ROM Version | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 59999 | 101 | ● | 35<br>--- | RO | |
| M026 | 50DDh<br>--- | Transmission Error Transaction Code for Operator Comm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 127<br>1: Improper FC (Non-existent parameter block specified) [RTU]<br>2: Improper address (Non-existent parameter number specified) [RTU]<br>3: Improper data (Range error) [RTU]<br>7: NAK (Link priority, no right, write disabled) [RTU]<br>71: Checksum error, CRC error<br>72: Parity error<br>73: Framing error, overrun error, buffer full | 0 | ● | 20<br>--- | RO | |
| M027 | 50DEh<br>--- | Final Frequency Reference Monitor on Alarm Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767<br>+20000 or -20000 = maximum output frequency | 0 | ● | 29<br>--- | RO | |
| M028 | 50DFh<br>--- | Final Torque Command Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 | 0.00% | ● | 6<br>--- | RO | |
| M029 | 50E0h<br>--- | Final Torque Current Command Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 | 0.00% | ● | 6<br>--- | RO | |
| M030 | 50E1h<br>--- | Final Magnetic flux command Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 | 0.00% | ● | 6<br>--- | RO | |
| M031 | 50E3h<br>50E2h | Final Frequency Reference Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 | 0.00Hz | ● | ---<br>5 | RO | |
| M032 | 50E4h<br>--- | Output Frequency Monitor on Alarm without Slip Compensation | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767<br>+20000 or -20000 = maximum output frequency | 0 | ● | 29<br>--- | RO | |
| M033 | 50E5h<br>--- | Output Torque Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 | 0.00% | ● | 6<br>--- | RO | |
| M034 | 50E6h<br>--- | Torque Current Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 | 0.00% | ● | 6<br>--- | RO | |
| M035 | 50E8h<br>50E7h | Output Frequency Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 Hz | 0.00Hz | ● | ---<br>5 | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M036 | 50E9h<br>--- | Input Power Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 399.99 % | 0.00% | • | 5<br>--- | RO | |
| M037 | 50EAh<br>--- | Output Current Effective Value Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 399.99 % | 0.00% | • | 5<br>--- | RO | |
| M038 | 50EBh<br>--- | Output Voltage Effective Value Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 1000.0 V | 0.0V | • | 3<br>--- | RO | |
| M039 | 50ECh<br>--- | Operation Command Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: RST<br>Bit14: DI7<br>Bit13: DI6<br>Bit12: -<br>Bit11: EN<br>Bit10: -<br>Bit9: -<br>Bit8: -<br>Bit7: -<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: REV<br>Bit0: FWD | 0 | • | 14<br>--- | RO | |
| M040 | 50EDh<br>--- | Operation Status 1 Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: BUSY (During parameter data writing)<br>Bit14: -<br>Bit13: -<br>Bit12: RL (Communications effective)<br>Bit11: ALM (Alarm relay)<br>Bit10: DEC (During deceleration)<br>Bit9: ACC (During acceleration)<br>Bit8: IL (During current limiting)<br>Bit7: VL (During voltage limiting)<br>Bit6: TL (Torque limiting)<br>Bit5: NUV (Main circuit DC voltage established)<br>Bit4: BRK (During braking)<br>Bit3: INT (Inverter shut down)<br>Bit2: EXT (During DC braking or during pre-exciting)<br>Bit1: REV (During reverse operation)<br>Bit0: FWD (During forward operation) | 0 | • | 16<br>--- | RO | |
| M041 | 50EEh<br>--- | Latest Output Terminal Information Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: RO<br>Bit7: ---<br>Bit6: ---<br>Bit5: ---<br>Bit4: ---<br>Bit3: ---<br>Bit2: ---<br>Bit1: DO2<br>Bit0: DO1 | 0 | • | 15<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M042 | 5124h<br>5123h | Cumulative Operation Time Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655,350 hour | 0h | • | ---<br>1 | RO | |
| M043 | 50F0h<br>--- | Main Circuit DC Voltage Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1,000 V | 0V | • | 1<br>--- | RO | |
| M044 | 50F1h<br>--- | Inverter Internal Air Temperature Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0degC | • | 2<br>--- | RO | |
| M045 | 50F2h<br>--- | Heat Sink Temperature Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0degC | • | 2<br>--- | RO | |
| M046 | 50F3h<br>--- | Life of Main Circuit Capacitor Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 100.0 | 0.0% | • | 3<br>--- | RO | |
| M047 | 50F4h<br>--- | Life of PC Board Electrolytic Capacitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 (in 10 hours) | 0x10h | • | 74<br>--- | RO | |
| M048 | 50F5h<br>--- | Life of Cooling Fan | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 (in 10 hours) | 0x10h | • | 74<br>--- | RO | |
| M049 | 50F6h<br>--- | Input Terminal [AI1] Input Voltage Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767<br>20000: 10 V | 0 | • | 29<br>--- | RO | |
| M056 | 50FDh<br>--- | Input Terminal [PTC] Input Voltage Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767<br>20000: 10 V | 32767 | • | 29<br>--- | RO | |
| M057 | 50FEh<br>--- | Electric pole angle | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 359.9º | 0.0deg | • | 3<br>--- | RO | |
| M058 | 50FFh<br>--- | Mechanical pole angle | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 359.9º | 0.0deg | • | 3<br>--- | RO | |
| M059 | 5100h<br>--- | Motor Electronic Thermal Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 100% | 0% | • | 1<br>--- | RO | |
| M061 | 5102h<br>--- | Inverter Internal Air Temperature Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-3276.8 to 3276.7 | 0.0degC | • | 4<br>--- | RO | |
| M062 | 1018h<br>--- | Fin Temperature Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-3276.8 to 3276.7 | 0.0degC | • | 4<br>--- | RO | |
| M063 | 5104h<br>--- | Load Factor Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 | 0.00% | • | 6<br>--- | RO | |
| M064 | 5105h<br>--- | Motor Output Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67<br>% of rated power | 0.00% | • | 6<br>--- | RO | |
| M065 | 5106h<br>--- | Motor Output Monitor on Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0 | • | 29<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M066 | 5107h<br>--- | Speed Detection Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0 | • | 29<br>--- | RO | |
| M067 | 5108h<br>--- | Transmission Error Transaction Code for RS485 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 127<br>1: Improper FC (Non-existent parameter block specified) [RTU]<br>2: Improper address (Non-existent parameter number specified) [RTU]<br>3: Improper data (Range error) [RTU]<br>7: NAK (Link priority, no right, write disabled) [RTU]<br>71: Checksum error, CRC error<br>72: Parity error<br>73: Framing error, overrun error, buffer full | 0 | • | 20<br>--- | RO | |
| M068 | 5109h<br>--- | PID Final Command | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767<br>-20000 = -100% ; +20000 = +100% | 0 | • | 29<br>--- | RO | |
| M069 | 510Ah<br>--- | Inverter Rated Current | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 A | 0.00A | • | 19<br>--- | RO | |
| M070 | 510Bh<br>--- | Running Status 3 Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: OL (Overload warning)<br>Bit13: LOC (Light load detection)<br>Bit12: OL2 (Overload warning 2)<br>Bit11: OLP (During active drive)<br>Bit10: LIFE (Life warning)<br>Bit9: OHF (Fin Overheat warning)<br>Bit8: TRY (During retry)<br>Bit7: FAN (Fan operation signal)<br>Bit6: Reserved<br>Bit5: THM (Thermal warning)<br>Bit4: IPF (During restart after instantaneous power failure)<br>Bit3: SETM (2nd motor selection)<br>Bit2: IRDY (Operation ready)<br>Bit1: FA2 (Over set Frequency arrival)<br>Bit0: FA1 (Constant speed arrival) | 0 | • | 44<br>--- | RO | |
| M071 | 510Ch<br>--- | Input Terminal Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: RST<br>Bit14: DI7<br>Bit13: DI6<br>Bit12: -<br>Bit11: EN<br>Bit10: -<br>Bit9: -<br>Bit8: -<br>Bit7: -<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: REV<br>Bit0: FWD | 0 | • | 14<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M072 | 510Dh<br>--- | PID Feedback Value Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0 | ● | 29<br>--- | RO | |
| M073 | 510Eh<br>--- | PID Output Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767<br>-20000 = -100%, 20000 = 100% | 0 | ● | 29<br>--- | RO | |
| M074 | 510Fh<br>--- | Running Status 2 Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: Motor type<br>0: Induction motor<br>1: PM motor<br>Bit14: Reserved<br>Bit7: During speed limit<br>0: Inactive<br>1: During speed limit<br>Bit5 to 4: Selected motor<br>00: 1st motor<br>01: 2nd motor<br>10: Reserved<br>11: Reserved<br>Bit3 to 0: Control method<br>0000: V/f control without slip compensation<br>0001: Dynamic torque vector control<br>0010: V/f control with slip compensation<br>0011: V/f control with speed sensor<br>0100: Dynamic torque vector control with speed sensor<br>0101: Vector control without speed sensor<br>0110: Vector control with speed sensor<br>0111: Torque control (Vector control without speed sensor)<br>1000: Torque control (Vector control with speed sensor) | 0 | ● | 76<br>--- | RO | |
| M076 | 5111h<br>--- | Service Life of Main Circuit Capacitor Elapsed Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 (in 10 hours) | 0x10h | ● | 74<br>--- | RO | |
| M077 | 5112h<br>--- | Service Life of Main Circuit Capacitor Remaining Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 (in 10 hours) | 0x10h | ● | 74<br>--- | RO | |
| M078 | 5113h<br>--- | Rotation Speed Command Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0r/min | ● | 2<br>--- | RO | |
| M079 | 5115h<br>5114h | Rotation Speed Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0r/min | ● | ---<br>2 | RO | |
| M081 | 5117h<br>--- | 1st Remaining Time before the Next Motor Maintenance | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 (in 10 hours) | 0x10h | ● | 74<br>--- | RO | |
| M084 | 100Ch<br>--- | Torque Command at Final | **V/f DTV PG V/f PG DTV**<br>SLV PGV PM SLV PM PGV<br>-327 to 327 | 0% | ● | 2<br>--- | RO | |
| M085 | 511Bh<br>--- | 1st Remaining Startup Times before the Next Motor Maintenance | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | 1<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M086 | 511Ch<br>--- | Latest Light Alarm Factor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 254 (00 to FFh)<br>0 (0x00h): No alarm<br>17 (0x11h): OH1 Heat sink overheat<br>18 (0x12h): OH2 External alarm input<br>19 (0x13h): OH3 Inverter internal overheat<br>22 (0x16h): dbH Braking resistor overheat<br>23 (0x17h): OL1 Motor 1 overload<br>24 (0x18h): OL2 Motor 2 overload<br>34 (0x22h): Er4 Option card communications error<br>35 (0x23h): Er5 Ethernet card error<br>47 (0x2Fh): ErE Following error (excessive speed deviation)<br>53 (0x35h): ErP RS-485 communications error (Option card)<br>56 (0x38h): Ero Position control error<br>58 (0x3Ah): CoF PID feedback disconnection detected<br>101 (0x65h): OL Motor overload early warning<br>102 (0x66h): OH Heat sink overheat early warning<br>103 (0x67h): LiF Lifetime alarm<br>104 (0x68h): rEF Reference loss<br>105 (0x69h): Pid PID alarm<br>106 (0x6Ah): UTL Low output torque detection<br>107 (0x6Bh): PTC PTC thermistor activated<br>108 (0x6Ch): rTE Inverter life (Cumulative run time)<br>109 (0x6Dh): CnT (Inverter life, Number of startups)<br>111 (0x6Fh): CW1 Drive App Warning 1<br>112 (0x70h): CW2 Drive App Warning 2<br>113 (0x71h): CW3 Drive App Warning 3<br>114 (0x72h): CW4 Drive App Warning 4<br>115 (0x73h): CW5 Drive App Warning 5<br>130 (0x82h): EnF SF terminal OFF | 0 | • | 41<br>--- | RO | |
| M087 | 511Dh<br>--- | Light Alarm Factor Last | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 254 (00 to FFh)<br>0 (0x00h): No alarm<br>17 (0x11h): OH1 Heat sink overheat<br>18 (0x12h): OH2 External alarm input<br>19 (0x13h): OH3 Inverter internal overheat<br>22 (0x16h): dbH Braking resistor overheat<br>23 (0x17h): OL1 Motor 1 overload<br>24 (0x18h): OL2 Motor 2 overload<br>34 (0x22h): Er4 Option card communications error<br>35 (0x23h): Er5 Ethernet card error<br>47 (0x2Fh): ErE Following error (excessive speed deviation)<br>53 (0x35h): ErP RS-485 communications error (Option card)<br>56 (0x38h): Ero Position control error<br>58 (0x3Ah): CoF PID feedback disconnection detected<br>101 (0x65h): OL Motor overload early warning<br>102 (0x66h): OH Heat sink overheat early warning<br>103 (0x67h): LiF Lifetime alarm<br>104 (0x68h): rEF Reference loss<br>105 (0x69h): Pid PID alarm<br>106 (0x6Ah): UTL Low output torque detection<br>107 (0x6Bh): PTC PTC thermistor activated<br>108 (0x6Ch): rTE Inverter life (Cumulative run time)<br>109 (0x6Dh): CnT (Inverter life, Number of startups)<br>111 (0x6Fh): CW1 Drive App Warning 1<br>112 (0x70h): CW2 Drive App Warning 2<br>113 (0x71h): CW3 Drive App Warning 3<br>114 (0x72h): CW4 Drive App Warning 4<br>115 (0x73h): CW5 Drive App Warning 5<br>130 (0x82h): EnF SF terminal OFF | 0 | • | 41<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M088 | 511Eh<br>--- | Light Alarm Factor 2nd Last | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 254 (00 to FFh)<br>0 (0x00h): No alarm<br>17 (0x11h): OH1 Heat sink overheat<br>18 (0x12h): OH2 External alarm input<br>19 (0x13h): OH3 Inverter internal overheat<br>22 (0x16h): dbH Braking resistor overheat<br>23 (0x17h): OL1 Motor 1 overload<br>24 (0x18h): OL2 Motor 2 overload<br>34 (0x22h): Er4 Option card communications error<br>35 (0x23h): Er5 Ethernet card error<br>47 (0x2Fh): ErE Following error (excessive speed deviation)<br>53 (0x35h): ErP RS-485 communications error (Option card)<br>56 (0x38h): Ero Position control error<br>58 (0x3Ah): CoF PID feedback disconnection detected<br>101 (0x65h): OL Motor overload early warning<br>102 (0x66h): OH Heat sink overheat early warning<br>103 (0x67h): LiF Lifetime alarm<br>104 (0x68h): rEF Reference loss<br>105 (0x69h): Pid PID alarm<br>106 (0x6Ah): UTL Low output torque detection<br>107 (0x6Bh): PTC PTC thermistor activated<br>108 (0x6Ch): rTE Inverter life (Cumulative run time)<br>109 (0x6Dh): CnT (Inverter life, Number of startups)<br>111 (0x6Fh): CW1 Drive App Warning 1<br>112 (0x70h): CW2 Drive App Warning 2<br>113 (0x71h): CW3 Drive App Warning 3<br>114 (0x72h): CW4 Drive App Warning 4<br>115 (0x73h): CW5 Drive App Warning 5<br>130 (0x82h): EnF SF terminal OFF | 0 | • | 41<br>--- | RO | |
| M089 | 511Fh<br>--- | Light Alarm Factor 3rd Last | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 254 (00 to FFh)<br>0 (0x00h): No alarm<br>17 (0x11h): OH1 Heat sink overheat<br>18 (0x12h): OH2 External alarm input<br>19 (0x13h): OH3 Inverter internal overheat<br>22 (0x16h): dbH Braking resistor overheat<br>23 (0x17h): OL1 Motor 1 overload<br>24 (0x18h): OL2 Motor 2 overload<br>34 (0x22h): Er4 Option card communications error<br>35 (0x23h): Er5 Ethernet card error<br>47 (0x2Fh): ErE Following error (excessive speed deviation)<br>53 (0x35h): ErP RS-485 communications error (Option card)<br>56 (0x38h): Ero Position control error<br>58 (0x3Ah): CoF PID feedback disconnection detected<br>101 (0x65h): OL Motor overload early warning<br>102 (0x66h): OH Heat sink overheat early warning<br>103 (0x67h): LiF Lifetime alarm<br>104 (0x68h): rEF Reference loss<br>105 (0x69h): Pid PID alarm<br>106 (0x6Ah): UTL Low output torque detection<br>107 (0x6Bh): PTC PTC thermistor activated<br>108 (0x6Ch): rTE Inverter life (Cumulative run time)<br>109 (0x6Dh): CnT (Inverter life, Number of startups)<br>111 (0x6Fh): CW1 Drive App Warning 1<br>112 (0x70h): CW2 Drive App Warning 2<br>113 (0x71h): CW3 Drive App Warning 3<br>114 (0x72h): CW4 Drive App Warning 4<br>115 (0x73h): CW5 Drive App Warning 5<br>130 (0x82h): EnF SF terminal OFF | 0 | • | 41<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M095 | 5126h<br>5125h | Cumulative Running Time at Tripping | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655350 h | 0h | • | ---<br>1 | RO | |
| M096 | 0039h<br>--- | Fourth Last Alarm Con-tents | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 254 (00 to FFh)<br>0 (00h): No alarm<br>1 (01h): OC1 Overcurrent protection (during acceleration)<br>2 (02h): OC2 Overcurrent protection (during deceleration)<br>3 (03h): OC3 Overcurrent protection (during constant speed operation)<br>6 (06h): OU1 Overvoltage protection (during acceleration)<br>7 (07h): OU2 Overvoltage protection (during deceleration)<br>8 (08h): OU3 Overvoltage protection (during constant speed operation or stopping)<br>10 ( 0Ah): LU Undervoltage protection<br>11 (0Bh): Lin Input phase loss protection<br>16 (10h): PbF Inrush Current Prevention Circuit Error<br>17 (11h): OH1 Heat sink overheat<br>18 (12h): OH2 External alarm input<br>19 (13h): OH3 Inverter internal overheat<br>20 (14h): OH4 Motor protection (PTC thermistor)<br>22 (16h): dbH Braking resistor overheat<br>23 (17h): OL1 1st Motor Overload Protection<br>24 (18h): OL2 2nd Motor Overload Protection<br>25 (19h): OLU Inverter overload<br>27 (1Bh): OS Over speed protection<br>28 (1Ch): Pg PG disconnection<br>31 (1Fh): Er1 Memory error<br>32 (20h): Reserved<br>33 (21h): Er3 CPU error<br>34 (22h): Reserved<br>35 (23h): Er5 Ethernet board error<br>36 (24h): Er6 Operation protection<br>37 (25h): Er7 Tuning error<br>42 (2Ah): Erd Detection of step-out<br>46 (2Eh): OPL Output phase loss protection<br>47 (2Fh): ErE Following error (excessive speed deviation)<br>50 (32h): ErC Magnetic pole position detection error<br>51 (33h): ErF Data save error in case of undervoltage<br>52 (34h): d0 Excessive positioning deviation<br>53 (35h): Reserved<br>56 (38h): Ero Position control error<br>57 (39h): ECF Safety circuit failure<br>58 (3Ah): Reserved<br>59 (3Bh): dbA DB transistor trouble<br>65 (41h): Reserved<br>68 (44h): ErU Support tool communication disconnection<br>70 (46h): OH6 Inrush Current Prevention Resistor Overheat<br>121 (79h): CA1 Drive App Alarm 1<br>122 (7Ah): CA2 Drive App Alarm 2<br>123 (7Bh): CA3 Drive App Alarm 3<br>124 (7Ch): CA4 Drive App Alarm 4<br>125 (7Dh): CA5 Drive App Alarm 5<br>130 (82h): EnF SF terminal OFF<br>252 (FCh): Fod Fire mode activated<br>253 (FDh): Lok Locked by password<br>254 (FEh): Err Mock alarm (Subcode = 9998) | 0 | • | 10<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M097 | 0043h<br>--- | Fifth Last Alarm Contents | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 254 (00 to FFh)<br>0 (00h): No alarm<br>1 (01h): OC1 Overcurrent protection (during acceleration)<br>2 (02h): OC2 Overcurrent protection (during deceleration)<br>3 (03h): OC3 Overcurrent protection (during constant speed operation)<br>6 (06h): OU1 Overvoltage protection (during acceleration)<br>7 (07h): OU2 Overvoltage protection (during deceleration)<br>8 (08h): OU3 Overvoltage protection (during constant speed operation or stopping)<br>10 ( 0Ah): LU Undervoltage protection<br>11 (0Bh): Lin Input phase loss protection<br>16 (10h): PbF Inrush Current Prevention Circuit Error<br>17 (11h): OH1 Heat sink overheat<br>18 (12h): OH2 External alarm input<br>19 (13h): OH3 Inverter internal overheat<br>20 (14h): OH4 Motor protection (PTC thermistor)<br>22 (16h): dbH Braking resistor overheat<br>23 (17h): OL1 1st Motor Overload Protection<br>24 (18h): OL2 2nd Motor Overload Protection<br>25 (19h): OLU Inverter overload<br>27 (1Bh): OS Over speed protection<br>28 (1Ch): Pg PG disconnection<br>31 (1Fh): Er1 Memory error<br>32 (20h): Reserved<br>33 (21h): Er3 CPU error<br>34 (22h): Reserved<br>35 (23h): Er5 Ethernet board error<br>36 (24h): Er6 Operation protection<br>37 (25h): Er7 Tuning error<br>42 (2Ah): Erd Detection of step-out<br>46 (2Eh): OPL Output phase loss protection<br>47 (2Fh): ErE Following error (excessive speed deviation)<br>50 (32h): ErC Magnetic pole position detection error<br>51 (33h): ErF Data save error in case of undervoltage<br>52 (34h): d0 Excessive positioning deviation<br>53 (35h): Reserved<br>56 (38h): Ero Position control error<br>57 (39h): ECF Safety circuit failure<br>58 (3Ah): Reserved<br>59 (3Bh): dbA DB transistor trouble<br>65 (41h): Reserved<br>68 (44h): ErU Support tool communication disconnection<br>70 (46h): OH6 Inrush Current Prevention Resistor Overheat<br>121 (79h): CA1 Drive App Alarm 1<br>122 (7Ah): CA2 Drive App Alarm 2<br>123 (7Bh): CA3 Drive App Alarm 3<br>124 (7Ch): CA4 Drive App Alarm 4<br>125 (7Dh): CA5 Drive App Alarm 5<br>130 (82h): EnF SF terminal OFF<br>252 (FCh): Fod Fire mode activated<br>253 (FDh): Lok Locked by password<br>254 (FEh): Err Mock alarm (Subcode = 9998) | 0 | • | 10<br>--- | RO | |
| M098 | 5129h<br>--- | Warning status monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0 : Warning not occurred<br>1 : Warning occurring | 0 | • | 1<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M114 | 519Ch<br>519Bh | PID Feedback Value (no filter) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-9990.00 to 9990.00 | 0.00 | • | ---<br>6 | RO | |
| M115 | 519Dh<br>--- | PID Output (no filter) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-150.0 to 150.0 | 0.0% | • | 4<br>--- | RO | |
| M123 | 51A6h<br>--- | Model code 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>0121h (289) (3G3M1-STD)<br>0141h (321) (3G3M1-ECT)<br>0171h (369) (3G3M1-EMP) | 0 | • | 99<br>--- | RO | |
| M125 | 51A8h<br>--- | IP address monitor 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | • | 1<br>--- | RO | |
| M126 | 51A9h<br>--- | IP address monitor 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | • | 1<br>--- | RO | |
| M127 | 51AAh<br>--- | IP address monitor 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | • | 1<br>--- | RO | |
| M128 | 51ABh<br>--- | IP address monitor 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | • | 1<br>--- | RO | |
| M129 | 51ACh<br>--- | Subnet mask monitor 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | • | 1<br>--- | RO | |
| M130 | 51ADh<br>--- | Subnet mask monitor 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | • | 1<br>--- | RO | |
| M131 | 51AEh<br>--- | Subnet mask monitor 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | • | 1<br>--- | RO | |
| M132 | 51AFh<br>--- | Subnet mask monitor 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | • | 1<br>--- | RO | |
| M133 | 51B0h<br>--- | Gateway address monitor 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | • | 1<br>--- | RO | |
| M134 | 51B1h<br>--- | Gateway address monitor 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | • | 1<br>--- | RO | |
| M135 | 51B2h<br>--- | Gateway address monitor 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | • | 1<br>--- | RO | |
| M136 | 51B3h<br>--- | Gateway address monitor 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | • | 1<br>--- | RO | |
| M137 | 51B4h<br>--- | MAC address monitor 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |
| M138 | 51B5h<br>--- | MAC address monitor 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |
| M139 | 51B6h<br>--- | MAC address monitor 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| M140 | 51B7h<br>--- | Mechanical rotor angle | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 359.9º | 0.0deg | ● | 3<br>--- | RO | |
| M151 | 51C3h<br>51C2h | Load Shaft Speed | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 | 0.00r/min | ● | ---<br>5 | RO | |
| M152 | 51C5h<br>51C4h | PID Process Command | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-9990.00 to 9990.00 | 0.00 | ● | ---<br>6 | RO | |
| M153 | 51C7h<br>51C6h | Motor Speed Set Value | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 | 0.00r/min | ● | ---<br>5 | RO | |
| M154 | 51C9h<br>51C8h | Load Shaft Set Value | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 | 0.00r/min | ● | ---<br>5 | RO | |
| M155 | 51CBh<br>51CAh | Feed Speed Set Value | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 | 0.00m/min | ● | ---<br>5 | RO | |
| M156 | 51CDh<br>51CCh | Transport Time Set Value for Specified Length | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 min | 999.90min | ● | ---<br>5 | RO | |
| M157 | 51CFh<br>51CEh | Transport Time for Specified Length | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 min | 999.90min | ● | ---<br>5 | RO | |
| M158 | 51D1h<br>51D0h | Power Consumption Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 9999 kW | 0.00kW | ● | ---<br>5 | RO | |
| M159 | 51D3h<br>51D2h | Motor Output Power Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 9999 kW | 0.00kW | ● | ---<br>5 | RO | |
| M160 | 51D5h<br>51D4h | Analog Input Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-9990.00 to 9990.00 | 0.00 | ● | ---<br>6 | RO | |
| M161 | 51D7h<br>51D6h | Motor Speed | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 r/min | 0.00r/min | ● | ---<br>5 | RO | |
| M162 | 51D9h<br>51D8h | Load Shaft Speed | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 r/min | 0.00r/min | ● | ---<br>5 | RO | |
| M163 | 51DBh<br>51DAh | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0.00 | ● | ---<br>6 | RO | |
| M164 | 51DDh<br>51DCh | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0.00 | ● | ---<br>6 | RO | |
| M165 | 51DFh<br>51DEh | Latest Alarm Info. Input Power | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 9999 kW | 0.00kW | ● | ---<br>5 | RO | |

## 5-3-2 Monitor parameters W (Monitor 2)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| W001 | 1003h<br>--- | Running Status 1 Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: BUSY (During parameter data writing)<br>Bit14: -<br>Bit13: -<br>Bit12: RL (Communications effective)<br>Bit11: ALM (Alarm relay)<br>Bit10: DEC (During deceleration)<br>Bit9: ACC (During acceleration)<br>Bit8: IL (During current limiting)<br>Bit7: VL (During voltage limiting)<br>Bit6: TL (Torque limiting)<br>Bit5: NUV (Main circuit DC voltage established)<br>Bit4: BRK (During braking)<br>Bit3: INT (Inverter shut down)<br>Bit2: EXT (During DC braking or during pre-exciting)<br>Bit1: REV (During reverse operation)<br>Bit0: FWD (During forward operation) | 0 | ● | 16<br>--- | RO | |
| W002 | 5243h<br>5242h | Frequency Reference Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 Hz | 0.00Hz | ● | ---<br>5 | RO | |
| W003 | 5245h<br>5244h | Output Frequency Monitor before Slip Compensation | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 Hz | 0.00Hz | ● | ---<br>5 | RO | |
| W004 | 5247h<br>5246h | Output Frequency after Slip Compensation | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 | 0.00Hz | ● | ---<br>5 | RO | |
| W005 | 1002h<br>--- | Output Current Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 A | 0.00A | ● | 19<br>--- | RO | |
| W006 | 1010h<br>--- | Output Voltage Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 1000.0 V | 0.0V | ● | 3<br>--- | RO | |
| W007 | 100Fh<br>--- | Output Torque Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999 to 999 | 0% | ● | 2<br>--- | RO | |
| W008 | 524Ch<br>524Bh | Rotate Speed Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 | 0.00r/min | ● | ---<br>5 | RO | |
| W009 | 524Dh<br>--- | Load Shaft Speed | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 | 0.00r/min | ● | 37<br>--- | RO | |
| W010 | 524Fh<br>524Eh | Feed Speed | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 | 0.00m/min | ● | ---<br>5 | RO | |
| W011 | 5250h<br>--- | PID Process Command | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-9990.00 to 9990.00 | 0.00 | ● | 12<br>--- | RO | |
| W012 | 1005h<br>1004h | PID Feedback Value Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-9990.00 to 9990.00 | 0.00 | ● | ---<br>6 | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| W013 | 5253h<br>--- | Analog Torque Limit Value Mon-itor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-300 to 300 % | 300% | ● | 2<br>--- | RO | |
| W014 | 5254h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 300% | ● | 2<br>--- | RO | |
| W015 | 5255h<br>--- | Ratio value Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 200.00 | 0.00% | ● | 5<br>--- | RO | |
| W016 | 5256h<br>--- | Motor Speed Set Value | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 | 0.00r/min | ● | 37<br>--- | RO | |
| W017 | 5257h<br>--- | Load Shaft Set Value | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 | 0.00r/min | ● | 37<br>--- | RO | |
| W018 | 5258h<br>--- | Feed Speed Set Value | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 | 0.00m/min | ● | 37<br>--- | RO | |
| W019 | 5259h<br>--- | Transport Time Set Value for Specified Length | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 min | 999.90min | ● | 37<br>--- | RO | |
| W020 | 525Ah<br>--- | Transport Time for Specified Length | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 min | 999.90min | ● | 37<br>--- | RO | |
| W021 | 525Bh<br>--- | Power Consumption Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 9999 kW | 0.00kW | ● | 24<br>--- | RO | |
| W022 | 525Ch<br>--- | Motor Output Power Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 9999kW | 0.00kW | ● | 24<br>--- | RO | |
| W023 | 525Dh<br>--- | Load Rate Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999 to 999 | 0% | ● | 2<br>--- | RO | |
| W024 | 525Eh<br>--- | Torque Current Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999 to 999 | 0% | ● | 2<br>--- | RO | |
| W025 | 525Fh<br>--- | Output Current Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 3276.7 A | 0.0A | ● | 3<br>--- | RO | |
| W026 | 5260h<br>--- | Magnetic Flux Command Value | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999 to 999 | 0% | ● | 2<br>--- | RO | |
| W027 | 5261h<br>--- | Timed Operation Remaining Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 s | 0s | ● | 1<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| W028 | 1059h<br>--- | RUN Command Source Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255<br>0: Reserved<br>1: Terminal command FW or RV<br>2: Reserved<br>3: Reserved<br>4: Reserved<br>5: Reserved<br>6: Reserved<br>7: Reserved<br>8: Reserved<br>9: Reserved<br>10: Reserved<br>11: Reserved<br>12: Reserved<br>13: Reserved<br>14: Reserved<br>15: Reserved<br>16: Reserved<br>17: Reserved<br>18: Reserved<br>19: Reserved<br>20: Reserved<br>21: Reserved<br>22: Ethernet<br>23: Support Tool<br>255: Not Selected | 0 | • | 67<br>--- | RO | |
| W029 | 1058h<br>--- | Frequency and PID Command Source Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255<br>0: Reserved<br>1: Analog Voltage Input (Input Terminal[AI1])<br>2: Reserved<br>3: Reserved<br>4: Reserved<br>5: Reserved<br>6: Reserved<br>7: UP/DOWN control<br>8: Reserved<br>9: Reserved<br>10: Pattern operation<br>11: Reserved<br>12: Reserved<br>13: Pulse train input or Frequency calculation<br>14: Reserved<br>15: Reserved<br>16: Reserved<br>17: Reserved<br>18: Reserved<br>19: Reserved<br>20: Reserved<br>21: Reserved<br>22: Ethernet<br>23: Support Tool<br>24: Multi-step Frequency<br>25: Jogging Frequency<br>26: Reserved<br>27: Reserved<br>28: Reserved<br>29: Reserved<br>30: PID Control Operator Process<br>31: PID Control Analog Process<br>32: Reserved<br>33: PID Control UP/DOWN control<br>34: PID Control Communication Process<br>35: Reserved<br>36: PID Control Multi-Step Terminal Process<br>255: Not Selected | 0 | • | 68<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| W030 | 5264h<br>--- | Speed in Percentage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 100.00 | 0.00% | ● | 5<br>--- | RO | |
| W031 | 5265h<br>--- | Speed Set Value in Percentage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 100.00 | 0.00% | ● | 5<br>--- | RO | |
| W032 | 10B2h<br>10B1h | PID Output Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-150.00 to 150.00 | 0.00% | ● | ---<br>6 | RO | |
| W033 | 5267h<br>--- | Analog Input Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-9990 to 9990 | 0.00 | ● | 12<br>--- | RO | |
| W040 | 1006h<br>--- | Input Terminal Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: SF2<br>Bit11: SF1<br>Bit10: ---<br>Bit9: ---<br>Bit8: ---<br>Bit7: ---<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: DI7<br>Bit0: DI6 | 0 | ● | 43<br>--- | RO | |
| W041 | 1007h<br>--- | Output Signal Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: RO<br>Bit7: ---<br>Bit6: ---<br>Bit5: ---<br>Bit4: ---<br>Bit3: ---<br>Bit2: ---<br>Bit1: DO2<br>Bit0: DO1 | 0 | ● | 15<br>--- | RO | |
| W042 | 5270h<br>--- | Communications Input Signal Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: RS<br>Bit14: DI7<br>Bit13: DI6<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: ---<br>Bit7: ---<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: RV<br>Bit0: FW | 0 | ● | 14<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| W043 | 5271h<br>--- | Communications Control Output Signal Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: RO<br>Bit7: ---<br>Bit6: ---<br>Bit5: ---<br>Bit4: ---<br>Bit3: ---<br>Bit2: ---<br>Bit1: DO2<br>Bit0: DO1 | 0 | • | 15<br>--- | RO | |
| W044 | 5272h<br>--- | Input Terminal [AI1] Input Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-12.0 to 12.0 V | 0.0V | • | 4<br>--- | RO | |
| W055 | 527Dh<br>--- | Pulse Input (A/B Phase [PI-A][PIB]) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 kp/s | 0.00kp/s | • | 6<br>--- | RO | |
| W056 | 527Eh<br>--- | Pulse Input (Z Phase [PIZ]) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 16000 p/s | 0p/s | • | 1<br>--- | RO | |
| W067 | 5289h<br>--- | Cumulative Run Time of Capacitors on Printed Circuit Boards | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 (in 10 hours) | 0x10h | • | 74<br>--- | RO | |
| W068 | 528Ah<br>--- | Cumulative Run Time of Cooling Fan | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 (in 10 hours) | 0x10h | • | 74<br>--- | RO | |
| W070 | 528Dh<br>528Ch | Total Power ON Time Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655350 hour | 0h | • | ---<br>1 | RO | |
| W071 | 1025h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0.0V | • | 3<br>--- | RO | |
| W072 | 528Fh<br>--- | Internal Air Highest Temperature | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0degC | • | 2<br>--- | RO | |
| W073 | 5290h<br>--- | Heat Sink Maximum Temperature | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0degC | • | 2<br>--- | RO | |
| W074 | 5291h<br>--- | Maximum Effective Current Value | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 A | 0.00A | • | 19<br>--- | RO | |
| W075 | 5292h<br>--- | Main Circuit Capacitor's Capacitor Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 100.0 | 0.0% | • | 3<br>--- | RO | |
| W076 | 1017h<br>1016h | Cumulative Run Time of Electrolytic Capacitors on PC Board | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 hour | 0h | • | ---<br>1 | RO | |
| W077 | 5296h<br>5295h | Cumulative Run Time of Cooling Fan | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 hour | 0h | • | ---<br>1 | RO | |
| W078 | 5297h<br>--- | Number of Startups | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | 1<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| W079 | 5299h<br>5298h | Cumulative Operation Time of Motor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 hour | 0h | ● | ---<br>1 | RO | |
| W081 | 529Ch<br>529Bh | Integrated Power Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 999900.0 | 0.0kWh | ● | ---<br>3 | RO | |
| W082 | 1013h<br>1012h | Data Used Integrating Electric Power | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 9999 | 0.0 | ● | ---<br>3 | RO | |
| W087 | 52A3h<br>--- | Inverter ROM Version 1 Main | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 59999 | 0 | ● | 1<br>--- | RO | |
| W088 | 52A4h<br>--- | Inverter ROM Version 2 Sub | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 59999 | 0 | ● | 1<br>--- | RO | |
| W089 | 52A5h<br>--- | ROM Version Operator | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0 | ● | 1<br>--- | RO | |
| W090 | 52A6h<br>--- | ROM Version (OPC) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0 | ● | 1<br>--- | RO | |
| W095 | 52ABh<br>--- | Number of OPC errors | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0 | ● | 1<br>--- | RO | |
| W096 | 52ACh<br>--- | Contents of OPC error | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0 | ● | 1<br>--- | RO | |
| W110 | 530Ah<br>--- | Motor Speed | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 r/min | 0.00r/min | ● | 37<br>--- | RO | |
| W111 | 530Ch<br>--- | Load Shaft Speed | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 r/min | 0.00r/min | ● | 37<br>--- | RO | |
| W115 | 5314h<br>--- | Output Frequency After Slip Compensation | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 Hz | 0.00Hz | ● | 22<br>--- | RO | |
| W116 | 5316h<br>--- | PG Feedback Value | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 Hz | 0.00Hz | ● | 22<br>--- | RO | |
| W118 | 100Dh<br>--- | Torque Bias Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999 to 999 | 0% | ● | 2<br>--- | RO | |
| W131 | 10AEh<br>10ADh | PID Control PID Deviation | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-9990.00 to 9990.00 | 0.00 | ● | ---<br>6 | RO | |
| W132 | 5321h<br>--- | PID Control PID Deviation | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767<br>-20000 = -100%<br>+20000 = +100% | 0 | ● | 29<br>--- | RO | |
| W135 | 1011h<br>--- | Input Power Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 6553.5 kW | 0.0kW | ● | 3<br>--- | RO | |
| W136 | 108Dh<br>--- | Input Terminal [AI1] Input Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-1024 to 1023<br>(1023 = 10.9 V) | 0 | ● | 2<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| W079 | 5299h<br>5298h | Cumulative Operation Time of Motor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 hour | 0h | • | ---<br>1 | RO | |
| W081 | 529Ch<br>529Bh | Integrated Power Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 999900.0 | 0.0kWh | • | ---<br>3 | RO | |
| W082 | 1013h<br>1012h | Data Used Integrating Electric Power | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 9999 | 0.0 | • | ---<br>3 | RO | |
| W087 | 52A3h<br>--- | Inverter ROM Version 1 Main | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 59999 | 0 | • | 1<br>--- | RO | |
| W088 | 52A4h<br>--- | Inverter ROM Version 2 Sub | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 59999 | 0 | • | 1<br>--- | RO | |
| W089 | 52A5h<br>--- | ROM Version Operator | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0 | • | 1<br>--- | RO | |
| W090 | 52A6h<br>--- | ROM Version (OPC) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0 | • | 1<br>--- | RO | |
| W095 | 52ABh<br>--- | Number of OPC errors | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0 | • | 1<br>--- | RO | |
| W096 | 52ACh<br>--- | Contents of OPC error | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0 | • | 1<br>--- | RO | |
| W110 | 530Ah<br>--- | Motor Speed | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 r/min | 0.00r/min | • | 37<br>--- | RO | |
| W111 | 530Ch<br>--- | Load Shaft Speed | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99990 r/min | 0.00r/min | • | 37<br>--- | RO | |
| W115 | 5314h<br>--- | Output Frequency After Slip Compensation | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 Hz | 0.00Hz | • | 22<br>--- | RO | |
| W116 | 5316h<br>--- | PG Feedback Value | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 Hz | 0.00Hz | • | 22<br>--- | RO | |
| W118 | 100Dh<br>--- | Torque Bias Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999 to 999 | 0% | • | 2<br>--- | RO | |
| W131 | 10AEh<br>10ADh | PID Control PID Deviation | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-9990.00 to 9990.00 | 0.00 | • | ---<br>6 | RO | |
| W132 | 5321h<br>--- | PID Control PID Deviation | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767<br>-20000 = -100%<br>+20000 = +100% | 0 | • | 29<br>--- | RO | |
| W135 | 1011h<br>--- | Input Power Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 6553.5 kW | 0.0kW | • | 3<br>--- | RO | |
| W136 | 108Dh<br>--- | Input Terminal [AI1] Input Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-1024 to 1023<br>(1023 = 10.9 V) | 0 | • | 2<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| W139 | 1090h<br>--- | Pulse Train Frequency Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-163.84 to 163.83 % | 0.00% | • | 6<br>--- | RO | |
| W143<br>W142 | 532Ch<br>532Bh | Feedback Current Position Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | ---<br>2 | RO | |
| W145<br>W144 | 532Eh<br>532Dh | Target Position Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | ---<br>2 | RO | |
| W147<br>W146 | 5330h<br>532Fh | Position Deviation Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | ---<br>2 | RO | |
| W149<br>W148 | 5332h<br>5331h | Touch Probe 1 Positive Edge | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | ---<br>2 | RO | |
| W151<br>W150 | 5334h<br>5333h | Touch Probe 2 Positive Edge | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | ---<br>2 | RO | |
| W152 | 5335h<br>--- | Touch Probe Status | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: Touch probe 2 PLc<br>Bit8: Touch probe 2 Enb<br>Bit7: ---<br>Bit6: ---<br>Bit5: ---<br>Bit4: ---<br>Bit3: ---<br>Bit2: ---<br>Bit1: Touch probe 1 PLc<br>Bit0: Touch probe 1 Enb | 0 | • | 1<br>--- | RO | |
| W153 | 5336h<br>--- | Pulse Input Rate for A/B Phase of Reference Side | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 | 0.00kp/s | • | 6<br>--- | RO | |
| W154 | 5337h<br>--- | Pulse Input Rate for Z Phase of Reference Side | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 16000 | 0p/s | • | 1<br>--- | RO | |
| W155 | 5338h<br>--- | Pulse Input Rate for A/B Phase of Feedback Side | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 | 0.00kp/s | • | 6<br>--- | RO | |
| W156 | 5339h<br>--- | Pulse Input Rate for Z Phase of Feedback Side | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 16000 | 0p/s | • | 1<br>--- | RO | |
| W161 | 533Eh<br>--- | Braking Resistor Thermal Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 100.0% | 0.0% | • | 3<br>--- | RO | |
| W174<br>W173 | 534Bh<br>534Ah | Set Target Position Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | ---<br>2 | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| W178 | 534Fh<br>--- | Number of Startups | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35<br>(1.00 = 10000 times) | 0.00 | • | 5<br>--- | RO | |
| W179 | 1015h<br>1014h | Total RUN Time Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655350 hour | 0h | • | ---<br>1 | RO | |
| W180 | 5351h<br>--- | Tuning Progress | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 100 % | 0% | • | 1<br>--- | RO | |
| W202 | 53C2h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0.00 | • | 12<br>--- | RO | |
| W203 | 53C3h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0.00 | • | 12<br>--- | RO | |
| W220 | 5438h<br>--- | Password protection status 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |
| W221 | 5439h<br>--- | Password protection status 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |
| W250 | 5456h<br>--- | Model name 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |
| W251 | 5457h<br>--- | Model name 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |
| W252 | 5458h<br>--- | Model name 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |
| W253 | 5459h<br>--- | Model name 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |
| W254 | 545Ah<br>--- | Model name 5 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |
| W255 | 545Bh<br>--- | Model name 6 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |
| W256 | 545Ch<br>--- | Model name 7 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |
| W257 | 545Dh<br>--- | Model name 8 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |
| W258 | 545Eh<br>--- | Model name 9 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |
| W259 | 545Fh<br>--- | Model name 10 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |
| W260 | 5460h<br>--- | Model name 11 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |
| W261 | 5461h<br>--- | Model name 12 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 1<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| W262 | 5462h<br>--- | Serial number 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | ● | 1<br>--- | RO | |
| W263 | 5463h<br>--- | Serial number 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | ● | 1<br>--- | RO | |
| W264 | 5464h<br>--- | Serial number 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | ● | 1<br>--- | RO | |
| W265 | 5465h<br>--- | Serial number 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | ● | 1<br>--- | RO | |
| W266 | 5466h<br>--- | Serial number 5 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | ● | 1<br>--- | RO | |
| W267 | 5467h<br>--- | Serial number 6 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | ● | 1<br>--- | RO | |
| W268 | 5468h<br>--- | Serial number 7 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | ● | 1<br>--- | RO | |
| W269 | 5469h<br>--- | Serial number 8 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | ● | 1<br>--- | RO | |
| W270 | 546Bh<br>546Ah | Drive App monitor 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-2147483648 to 2147483647 | 0 | ● | ---<br>2 | RO | |
| W271 | 546Dh<br>546Ch | Drive App monitor 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-2147483648 to 2147483647 | 0 | ● | ---<br>2 | RO | |
| W272 | 546Fh<br>546Eh | Drive App monitor 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-2147483648 to 2147483647 | 0 | ● | ---<br>2 | RO | |
| W273 | 5471h<br>5470h | Drive App monitor 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-2147483648 to 2147483647 | 0 | ● | ---<br>2 | RO | |
| W274 | 5473h<br>5472h | Drive App monitor 5 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-2147483648 to 2147483647 | 0 | ● | ---<br>2 | RO | |
| W275 | 5475h<br>5474h | Drive App monitor 6 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-2147483648 to 2147483647 | 0 | ● | ---<br>2 | RO | |
| W276 | 5477h<br>5476h | Drive App monitor 7 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-2147483648 to 2147483647 | 0 | ● | ---<br>2 | RO | |
| W277 | 5479h<br>5478h | Drive App monitor 8 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-2147483648 to 2147483647 | 0 | ● | ---<br>2 | RO | |
| W278 | 547Bh<br>547Ah | Drive App monitor 9 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-2147483648 to 2147483647 | 0 | ● | ---<br>2 | RO | |
| W279 | 547Dh<br>547Ch | Drive App monitor 10 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-2147483648 to 2147483647 | 0 | ● | ---<br>2 | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| W280 | 547Fh<br>547Eh | Frequency Reference via In monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-590.00 to 590.00Hz | 0.00Hz | • | ---<br>6 | RO | |
| W281 | 5481h<br>5480h | Frequency Reference via Out monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-590.00 to 590.00Hz | 0.00Hz | • | ---<br>6 | RO | |
| W282 | 5483h<br>5482h | ASR input via In monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-590.00 to 590.00Hz | 0.00Hz | • | ---<br>6 | RO | |
| W283 | 5485h<br>5484h | ASR input via Out monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-590.00 to 590.00Hz | 0.00Hz | • | ---<br>6 | RO | |
| W284 | 5486h<br>--- | Torque reference via In monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67% | 0.00% | • | 6<br>--- | RO | |
| W285 | 5487h<br>--- | Torque reference via Out monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67% | 0.00% | • | 6<br>--- | RO | |
| W286 | 5488h<br>--- | PID set point via In monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67% | 0.00% | • | 6<br>--- | RO | |
| W287 | 5489h<br>--- | PID set point via Out monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67% | 0.00% | • | 6<br>--- | RO | |
| W288 | 548Ah<br>--- | PID present value via In monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67% | 0.00% | • | 6<br>--- | RO | |
| W289 | 548Bh<br>--- | PID present value via Out monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67% | 0.00% | • | 6<br>--- | RO | |
| W290 | 548Ch<br>--- | PID error via In monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67% | 0.00% | • | 6<br>--- | RO | |
| W291 | 548Dh<br>--- | PID error via Out monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67% | 0.00% | • | 6<br>--- | RO | |
| W292 | 548Eh<br>--- | RUN command via In monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1 | 0 | • | 1<br>--- | RO | |
| W293 | 548Fh<br>--- | RUN command via Out monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1 | 0 | • | 1<br>--- | RO | |
| W294 | 5490h<br>--- | Driving direction via In monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1 | 0 | • | 1<br>--- | RO | |
| W295 | 5491h<br>--- | Driving direction via Out monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1 | 0 | • | 1<br>--- | RO | |
| W296 | 5492h<br>--- | Unique application ID | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | 1<br>--- | RO | |

## 5-3-3 Monitor parameters Z (Alarm Information 1)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| Z000 | 0028h<br>0027h | Second Last Alarm Info. Output Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 Hz | 0.00Hz | ● | ---<br>5 | RO | |
| Z001 | 0029h<br>--- | Second Last Alarm Info. Output Current | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 A | 0.00A | ● | 19<br>--- | RO | |
| Z002 | 5783h<br>--- | Second Last Alarm Info. Output Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1000 V | 0V | ● | 1<br>--- | RO | |
| Z003 | 5784h<br>--- | Second Last Alarm Info. Torque Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999 to 999 | 0% | ● | 2<br>--- | RO | |
| Z004 | 5786h<br>5785h | Second Last Alarm Info. Frequency Command | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 | 0.00Hz | ● | ---<br>5 | RO | |
| Z005 | 0026h<br>--- | Second Last Alarm Info. Running Status | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: BUSY (During parameter data writing)<br>Bit14: -<br>Bit13: -<br>Bit12: RL (Communications effective)<br>Bit11: ALM (Alarm relay)<br>Bit10: DEC (During deceleration)<br>Bit9: ACC (During acceleration)<br>Bit8: IL (During current limiting)<br>Bit7: VL (During voltage limiting)<br>Bit6: TL (Torque limiting)<br>Bit5: NUV (Main circuit DC voltage established)<br>Bit4: BRK (During braking)<br>Bit3: INT (Inverter shut down)<br>Bit2: EXT (During DC braking or during pre-exciting)<br>Bit1: REV (During reverse operation)<br>Bit0: FWD (During forward operation) | 0 | ● | 16<br>--- | RO | |
| Z006 | 002Eh<br>002Dh | Second Last Alarm Info. Cumulative Ope. Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655,350 hour | 0h | ● | ---<br>1 | RO | |
| Z007 | 578Ah<br>--- | Second Last Alarm Info. Number of Startups | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | 1<br>--- | RO | |
| Z008 | 002Ah<br>--- | Second Last Alarm Info. Main Circuit DC Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 1000.0 V | 0.0V | ● | 3<br>--- | RO | |
| Z009 | 578Ch<br>--- | Second Last Alarm Info. Internal Air Temperature | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0degC | ● | 2<br>--- | RO | |
| Z010 | 578Dh<br>--- | Second Last Alarm Info. Heat Sink Temperature | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0degC | ● | 2<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| Z011 | 578Eh<br>--- | Second Last Alarm Info. Input Terminal | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: SF2<br>Bit11: SF1<br>Bit10: ---<br>Bit9: ---<br>Bit8: ---<br>Bit7: ---<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: DI7<br>Bit0: DI6 | 0 | • | 43<br>--- | RO | |
| Z012 | 578Fh<br>--- | Second Last Alarm Info. Output Terminal | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: RO<br>Bit7: ---<br>Bit6: ---<br>Bit5: ---<br>Bit4: ---<br>Bit3: ---<br>Bit2: ---<br>Bit1: DO2<br>Bit0: DO1 | 0 | • | 15<br>--- | RO | |
| Z013 | 5790h<br>--- | Second Last Alarm Info. Input Terminal via Communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: RS<br>Bit14: DI7<br>Bit13: DI6<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: ---<br>Bit7: ---<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: RV<br>Bit0: FW | 0 | • | 14<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| Z014 | 5791h<br>--- | Second Last Alarm Info. Output Terminal via Communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: RO<br>Bit7: ---<br>Bit6: ---<br>Bit5: ---<br>Bit4: ---<br>Bit3: ---<br>Bit2: ---<br>Bit1: DO2<br>Bit0: DO1 | 0 | • | 15<br>--- | RO | |
| Z016 | 5793h<br>--- | Second Last Alarm Info. Running Status 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: Motor type<br>0: Induction motor<br>1: PM motor<br>Bit14: Reserved<br>Bit7: During speed limit<br>0: Inactive<br>1: During speed limit<br>Bit5 to 4: Selected motor<br>00: 1st motor<br>01: 2nd motor<br>10: Reserved<br>11: Reserved<br>Bit3 to 0: Control method<br>0000: V/f control without slip compensation<br>0001: Dynamic torque vector control<br>0010: V/f control with slip compensation<br>0011: V/f control with speed sensor<br>0100: Dynamic torque vector control with speed sensor<br>0101: Vector control without speed sensor<br>0110: Vector control with speed sensor<br>0111: Torque control (Vector control without speed sensor)<br>1000: Torque control (Vector control with speed sensor) | 0 | • | 76<br>--- | RO | |
| Z017 | 5794h<br>--- | Second Last Alarm Info. Speed Detection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0 | • | 29<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| Z018 | 5795h<br>--- | Second Last Alarm Info. Running Status 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: OL (Overload warning)<br>Bit13: LOC (Light load detection)<br>Bit12: OL2 (Overload warning 2)<br>Bit11: OLP (During active drive)<br>Bit10: LIFE (Life warning)<br>Bit9: OHF (Fin Overheat warning)<br>Bit8: TRY (During retry)<br>Bit7: FAN (Fan operation signal)<br>Bit6: REF (RUN command source)<br>Bit5: THM (Thermal warning)<br>Bit4: IPF (During restart after instantaneous power failure)<br>Bit3: SETM (2nd motor selection)<br>Bit2: IRDY (Operation ready)<br>Bit1: FA2 (Over set Frequency arrival)<br>Bit0: FA1 (Constant speed arrival) | 0 | • | 44<br>--- | RO | |
| Z040 | 57ADh<br>--- | 1st Cumulative Run Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 (in 10 hours) | 0x10h | • | 74<br>--- | RO | |
| Z041 | 57AEh<br>--- | 2nd Cumulative Run Time of motor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 (in 10 hours) | 0x10h | • | 74<br>--- | RO | |
| Z044 | 57AFh<br>--- | 2nd Number of Start-ups | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | 1<br>--- | RO | |
| Z050 | 0032h<br>0031h | Third Last Alarm Info. Output Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 Hz | 0.00Hz | • | ---<br>5 | RO | |
| Z051 | 0033h<br>--- | Third Last Alarm Info. Output Current | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 A | 0.00A | • | 19<br>--- | RO | |
| Z052 | 57B8h<br>--- | Third Last Alarm Info. Output Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1000 V | 0V | • | 1<br>--- | RO | |
| Z053 | 57B9h<br>--- | Third Last Alarm Info. Torque Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999 to 999 | 0% | • | 2<br>--- | RO | |
| Z054 | 57BBh<br>57BAh | Third Last Alarm Info. Frequency Command | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 | 0.00Hz | • | ---<br>5 | RO | |
| Z055 | 0030h<br>--- | Third Last Alarm Info. Running Status | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: BUSY (During parameter data writing)<br>Bit14: -<br>Bit13: -<br>Bit12: RL (Communications effective)<br>Bit11: ALM (Alarm relay)<br>Bit10: DEC (During deceleration)<br>Bit9: ACC (During acceleration)<br>Bit8: IL (During current limiting)<br>Bit7: VL (During voltage limiting)<br>Bit6: TL (Torque limiting)<br>Bit5: NUV (Main circuit DC voltage established)<br>Bit4: BRK (During braking)<br>Bit3: INT (Inverter shut down)<br>Bit2: EXT (During DC braking or during pre-exciting)<br>Bit1: REV (During reverse operation)<br>Bit0: FWD (During forward operation) | 0 | • | 16<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| Z056 | 0038h<br>0037h | Third Last Alarm Info. Cumulative Ope. Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655350 hour | 0h | • | ---<br>1 | RO | |
| Z057 | 57BFh<br>--- | Third Last Alarm Info. Number of Startups | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | 1<br>--- | RO | |
| Z058 | 0034h<br>--- | Third Last Alarm Info. Main Circuit DC Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 1000.0 V | 0.0V | • | 3<br>--- | RO | |
| Z059 | 57C1h<br>--- | Third Last Alarm Info. Internal Air Temper-ature | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0degC | • | 2<br>--- | RO | |
| Z060 | 57C2h<br>--- | Third Last Alarm Info. Heat Sink Temperature | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0degC | • | 2<br>--- | RO | |
| Z061 | 57C3h<br>--- | Third Last Alarm Info. Input Terminal | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: SF2<br>Bit11: SF1<br>Bit10: ---<br>Bit9: ---<br>Bit8: ---<br>Bit7: ---<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: DI7<br>Bit0: DI6 | 0 | • | 43<br>--- | RO | |
| Z062 | 57C4h<br>--- | Third Last Alarm Info. Output Terminal | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: RO<br>Bit7: ---<br>Bit6: ---<br>Bit5: ---<br>Bit4: ---<br>Bit3: ---<br>Bit2: ---<br>Bit1: DO2<br>Bit0: DO1 | 0 | • | 15<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| Z063 | 57C5h<br>--- | Third Last Alarm Info. Input Terminal via Communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: RS<br>Bit14: DI7<br>Bit13: DI6<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: ---<br>Bit7: ---<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: RV<br>Bit0: FW | 0 | • | 14<br>--- | RO | |
| Z064 | 57C6h<br>--- | Third Last Alarm Info. Output Terminal via Communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: RO<br>Bit7: ---<br>Bit6: ---<br>Bit5: ---<br>Bit4: ---<br>Bit3: ---<br>Bit2: ---<br>Bit1: DO2<br>Bit0: DO1 | 0 | • | 15<br>--- | RO | |
| Z066 | 57C8h<br>--- | Third Last Alarm Info. Running Status 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: Motor type<br>0: Induction motor<br>1: PM motor<br>Bit14: Reserved<br>Bit7: During speed limit<br>0: Inactive<br>1: During speed limit<br>Bit5 to 4: Selected motor<br>00: 1st motor<br>01: 2nd motor<br>10: Reserved<br>11: Reserved<br>Bit3 to 0: Control method<br>0000: V/f control without slip compensation<br>0001: Dynamic torque vector control<br>0010: V/f control with slip compensation<br>0011: V/f control with speed sensor<br>0100: Dynamic torque vector control with speed sensor<br>0101: Vector control without speed sensor<br>0110: Vector control with speed sensor<br>0111: Torque control (Vector control without speed sensor)<br>1000: Torque control (Vector control with speed sensor) | 0 | • | 76<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| Z067 | 57C9h<br>--- | Third Last Alarm Info. Speed Detection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0 | • | 29<br>--- | RO | |
| Z068 | 57CAh<br>--- | Third Last Alarm Info. Running Status 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: OL (Overload warning)<br>Bit13: LOC (Light load detection)<br>Bit12: OL2 (Overload warning 2)<br>Bit11: OLP (During active drive)<br>Bit10: LIFE (Life warning)<br>Bit9: OHF (Fin Overheat warning)<br>Bit8: TRY (During retry)<br>Bit7: FAN (Fan operation signal)<br>Bit6: REF (RUN command source)<br>Bit5: THM (Thermal warning)<br>Bit4: IPF (During restart after instantaneous power failure)<br>Bit3: SETM (2nd motor selection)<br>Bit2: IRDY (Operation ready)<br>Bit1: FA2 (Over set Frequency arrival)<br>Bit0: FA1 (Constant speed arrival) | 0 | • | 44<br>--- | RO | |
| Z084 | 57DAh<br>--- | Output Current Mon-itor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 A | 0.00A | • | 19<br>--- | RO | |

## 5-3-4 Monitor parameters X (Alarm Information 2)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| X000 | 5540h<br>--- | Latest Alarm History/ Number of Consecutive Same Alarms | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>(MSB: 00 to FF h, LSB:00 to FEh)<br>MSB: Number of alarm ("00 h")<br><br>LSB: 00 to FEh<br>00h (0) : No alarm<br>01h (1) : OC1 Overcurrent protection (during acceleration)<br>02h (2) : OC2 Overcurrent protection (during deceleration)<br>03h (3) : OC3 Overcurrent protection (during constant speed operation)<br>06h (4) : OU1 Overvoltage protection (during acceleration)<br>07h (7) : OU2 Overvoltage protection (during deceleration)<br>08h (8) : OU3 Overvoltage protection (during constant speed operation or stopping)<br>0Ah (10) : LU Undervoltage protection<br>0Bh (11) : Lin Input phase loss protection<br>10h (16) : PbF Inrush current avoidance circuit error<br>11h (17) : OH1 Heat sink overheat<br>12h (18) : OH2 External alarm input<br>13h (19) : OH3 Inverter internal overheat<br>14h (20) : OH4 Motor protection (PTC thermistor)<br>16h (22) : dbH Braking resistor overheat<br>17h (23) : OL1 Motor 1 overload<br>18h (24) : OL2 Motor 2 overload<br>19h (25) : OLU Inverter overload<br>1Bh (27) : OS Over speed protection<br>1Ch (28) : Pg PG disconnection<br>1Fh (31) : Er1 Memory error<br>20h (32) : Er2 Operator communications<br>21h (33) : Er3 CPU error<br>22h (34) : Er4 Option card communications error<br>23h (35) : Er5 Ethernet card error<br>24h (36) : Er6 Operation protection<br>25h (37) : Er7 Tuning error<br>2Ah (42) : Erd Detection of step-out<br>2Eh (46) : OPL Output phase loss protection<br>2Fh (47) : ErE Following error (excessive speed deviation)<br>32h (50) : ErC Magnetic pole position detection error<br>33h (51) : ErF Data save error in case of undervoltage<br>34h (52) : d0 Excessive positioning deviation<br>35h (53) : ErP (RS-485 communications error, Option card)<br>38h (56) : Ero Position control error<br>39h (57) : ECF Safety circuit failure<br>3Ah (58) : CoF PID feedback disconnection detected<br>3Bh (59) : dbA Braking resistor overheat<br>44h (68) : ErU Support tool communication disconnection<br>46h (70) : OH6 Inrush current prevention resistor overheat<br>79h (121) : CA1 Drive App Alarm Fault 1<br>7Ah (122) : CA2 Drive App Alarm Fault 2<br>7Bh (123) : CA3 Drive App Alarm Fault 3<br>7Ch (124) : CA4 Drive App Alarm Fault 4<br>7Dh (125) : CA5 Drive App Alarm Fault 5<br>82h (130) : EnF SF terminal OFF<br>FCh (252) : Fod Fire mode activated<br>FDh (253) : Lok Locked by password<br>FEh (254) : Err Mock alarm (Subcode = 9998) | 0 | • | 41<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| X001 | 5541h<br>--- | Latest Multiple Alarm1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 10<br>--- | RO | |
| X002 | 5542h<br>--- | Latest Multiple Alarm2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 10<br>--- | RO | |
| X003 | 5543h<br>--- | Latest Alarm Sub Code 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0 | • | 1<br>--- | RO | |
| X004 | 5544h<br>--- | Latest Multiple Alarm Sub Code 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0 | • | 1<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| X005 | 5545h<br>--- | Last Alarm History/ Number of Consecutive Same Alarms | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>(MSB: 00 to FF h, LSB:00 to FEh)<br>MSB: Number of alarm<br><br>LSB: 00 to FEh<br>00h (0) : No alarm<br>01h (1) : OC1 Overcurrent protection (during acceleration)<br>02h (2) : OC2 Overcurrent protection (during deceleration)<br>03h (3) : OC3 Overcurrent protection (during constant speed operation)<br>06h (4) : OU1 Overvoltage protection (during acceleration)<br>07h (7) : OU2 Overvoltage protection (during deceleration)<br>08h (8) : OU3 Overvoltage protection (during constant speed operation or stopping)<br>0Ah (10) : LU Undervoltage protection<br>0Bh (11) : Lin Input phase loss protection<br>10h (16) : PbF Inrush current avoidance circuit error<br>11h (17) : OH1 Heat sink overheat<br>12h (18) : OH2 External alarm input<br>13h (19) : OH3 Inverter internal overheat<br>14h (20) : OH4 Motor protection (PTC thermistor)<br>16h (22) : dbH Braking resistor overheat<br>17h (23) : OL1 Motor 1 overload<br>18h (24) : OL2 Motor 2 overload<br>19h (25) : OLU Inverter overload<br>1Bh (27) : OS Over speed protection<br>1Ch (28) : Pg PG disconnection<br>1Fh (31) : Er1 Memory error<br>20h (32) : Er2 Operator communications<br>21h (33) : Er3 CPU error<br>22h (34) : Er4 Option card communications error<br>23h (35) : Er5 Ethernet card error<br>24h (36) : Er6 Operation protection<br>25h (37) : Er7 Tuning error<br>2Ah (42) : Erd Detection of step-out<br>2Eh (46) : OPL Output phase loss protection<br>2Fh (47) : ErE Following error (excessive speed deviation)<br>32h (50) : ErC Magnetic pole position detection error<br>33h (51) : ErF Data save error in case of undervoltage<br>34h (52) : d0 Excessive positioning deviation<br>35h (53) : ErP (RS-485 communications error, Option card)<br>38h (56) : Ero Position control error<br>39h (57) : ECF Safety circuit failure<br>3Ah (58) : CoF PID feedback disconnection detected<br>3Bh (59) : dbA Braking resistor overheat<br>44h (68) : ErU Support tool communication disconnection<br>46h (70) : OH6 Inrush current prevention resistor overheat<br>79h (121) : CA1 Drive App Alarm Fault 1<br>7Ah (122) : CA2 Drive App Alarm Fault 2<br>7Bh (123) : CA3 Drive App Alarm Fault 3<br>7Ch (124) : CA4 Drive App Alarm Fault 4<br>7Dh (125) : CA5 Drive App Alarm Fault 5<br>82h (130) : EnF SF terminal OFF<br>FCh (252) : Fod Fire mode activated<br>FDh (253) : Lok Locked by password<br>FEh (254) : Err Mock alarm (Subcode = 9998) | 0 | • | 41<br>--- | RO | |
| X006 | 5546h<br>--- | Last Multiple Alarm 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 10<br>--- | RO | |
| X007 | 5547h<br>--- | Last Multiple Alarm 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 10<br>--- | RO | |
| X008 | 5548h<br>--- | Last Alarm Sub Code 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0 | • | 1<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| X009 | 5549h<br>--- | Last Multiple Alarm Sub Code | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0 | • | 1<br>--- | RO | |
| X010 | 554Ah<br>--- | Second Last Alarm History/ Number of Consecutive Same Alarms | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>(MSB: 00 to FF h, LSB:00 to FEh)<br>MSB: Number of alarm<br><br>LSB: 00 to FEh<br>00h (0) : No alarm<br>01h (1) : OC1 Overcurrent protection (during acceleration)<br>02h (2) : OC2 Overcurrent protection (during deceleration)<br>03h (3) : OC3 Overcurrent protection (during constant speed operation)<br>06h (4) : OU1 Overvoltage protection (during acceleration)<br>07h (7) : OU2 Overvoltage protection (during deceleration)<br>08h (8) : OU3 Overvoltage protection (during constant speed operation or stopping)<br>0Ah (10) : LU Undervoltage protection<br>0Bh (11) : Lin Input phase loss protection<br>10h (16) : PbF Inrush current avoidance circuit error<br>11h (17) : OH1 Heat sink overheat<br>12h (18) : OH2 External alarm input<br>13h (19) : OH3 Inverter internal overheat<br>14h (20) : OH4 Motor protection (PTC thermistor)<br>16h (22) : dbH Braking resistor overheat<br>17h (23) : OL1 Motor 1 overload<br>18h (24) : OL2 Motor 2 overload<br>19h (25) : OLU Inverter overload<br>1Bh (27) : OS Over speed protection<br>1Ch (28) : Pg PG disconnection<br>1Fh (31) : Er1 Memory error<br>20h (32) : Er2 Operator communications<br>21h (33) : Er3 CPU error<br>22h (34) : Er4 Option card communications error<br>23h (35) : Er5 Ethernet card error<br>24h (36) : Er6 Operation protection<br>25h (37) : Er7 Tuning error<br>2Ah (42) : Erd Detection of step-out<br>2Eh (46) : OPL Output phase loss protection<br>2Fh (47) : ErE Following error (excessive speed deviation)<br>32h (50) : ErC Magnetic pole position detection error<br>33h (51) : ErF Data save error in case of undervoltage<br>34h (52) : d0 Excessive positioning deviation<br>35h (53) : ErP (RS-485 communications error, Option card)<br>38h (56) : Ero Position control error<br>39h (57) : ECF Safety circuit failure<br>3Ah (58) : CoF PID feedback disconnection detected<br>3Bh (59) : dbA Braking resistor overheat<br>44h (68) : ErU Support tool communication disconnection<br>46h (70) : OH6 Inrush current prevention resistor overheat<br>79h (121) : CA1 Drive App Alarm Fault 1<br>7Ah (122) : CA2 Drive App Alarm Fault 2<br>7Bh (123) : CA3 Drive App Alarm Fault 3<br>7Ch (124) : CA4 Drive App Alarm Fault 4<br>7Dh (125) : CA5 Drive App Alarm Fault 5<br>82h (130) : EnF SF terminal OFF<br>FCh (252) : Fod Fire mode activated<br>FDh (253) : Lok Locked by password<br>FEh (254) : Err Mock alarm (Subcode = 9998) | 0 | • | 41<br>--- | RO | |
| X011 | 554Bh<br>--- | Second last Multiple Alarm2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 10<br>--- | RO | |
| X012 | 554Ch<br>--- | Second Last Multiple Alarm3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 10<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| X013 | 554Dh<br>--- | Second Last Alarm Sub Code | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0 | • | 1<br>--- | RO | |
| X014 | 554Eh<br>--- | Second Last Multiple Alarm Sub Code | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0 | • | 1<br>--- | RO | |
| X015 | 554Fh<br>--- | Third Last Alarm History/ Number of Consecutive Same Alarms | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>(MSB: 00 to FFh, LSB:00 to FEh)<br>MSB: Number of alarm<br><br>LSB: 00 to FEh<br>00h (0) : No alarm<br>01h (1) : OC1 Overcurrent protection (during acceleration)<br>02h (2) : OC2 Overcurrent protection (during deceleration)<br>03h (3) : OC3 Overcurrent protection (during constant speed operation)<br>06h (4) : OU1 Overvoltage protection (during acceleration)<br>07h (7) : OU2 Overvoltage protection (during deceleration)<br>08h (8) : OU3 Overvoltage protection (during constant speed operation or stopping)<br>0Ah (10) : LU Undervoltage protection<br>0Bh (11) : Lin Input phase loss protection<br>10h (16) : PbF Inrush current avoidance circuit error<br>11h (17) : OH1 Heat sink overheat<br>12h (18) : OH2 External alarm input<br>13h (19) : OH3 Inverter internal overheat<br>14h (20) : OH4 Motor protection (PTC thermistor)<br>16h (22) : dbH Braking resistor overheat<br>17h (23) : OL1 Motor 1 overload<br>18h (24) : OL2 Motor 2 overload<br>19h (25) : OLU Inverter overload<br>1Bh (27) : OS Over speed protection<br>1Ch (28) : Pg PG disconnection<br>1Fh (31) : Er1 Memory error<br>20h (32) : Er2 Operator communications<br>21h (33) : Er3 CPU error<br>22h (34) : Er4 Option card communications error<br>23h (35) : Er5 Ethernet card error<br>24h (36) : Er6 Operation protection<br>25h (37) : Er7 Tuning error<br>2Ah (42) : Erd Detection of step-out<br>2Eh (46) : OPL Output phase loss protection<br>2Fh (47) : ErE Following error (excessive speed deviation)<br>32h (50) : ErC Magnetic pole position detection error<br>33h (51) : ErF Data save error in case of undervoltage<br>34h (52) : d0 Excessive positioning deviation<br>35h (53) : ErP (RS-485 communications error, Option card)<br>38h (56) : Ero Position control error<br>39h (57) : ECF Safety circuit failure<br>3Ah (58) : CoF PID feedback disconnection detected<br>3Bh (59) : dbA Braking resistor overheat<br>44h (68) : ErU Support tool communication disconnection<br>46h (70) : OH6 Inrush current prevention resistor overheat<br>79h (121) : CA1 Drive App Alarm Fault 1<br>7Ah (122) : CA2 Drive App Alarm Fault 2<br>7Bh (123) : CA3 Drive App Alarm Fault 3<br>7Ch (124) : CA4 Drive App Alarm Fault 4<br>7Dh (125) : CA5 Drive App Alarm Fault 5<br>82h (130) : EnF SF terminal OFF<br>FCh (252) : Fod Fire mode activated<br>FDh (253) : Lok Locked by password<br>FEh (254) : Err Mock alarm (Subcode = 9998) | 0 | • | 41<br>--- | RO | |
| X016 | 5550h<br>--- | Third Last Multiple Alarm 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | • | 10<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| X017 | 5551h<br>--- | Third Last Multiple Alarm 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | ● | 10<br>--- | RO | |
| X018 | 5552h<br>--- | Third Last Alarm Sub Code 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0 | ● | 1<br>--- | RO | |
| X019 | 5553h<br>--- | Third Last Multiple Alarm Sub Code 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0 | ● | 1<br>--- | RO | |
| X020 | 0014h<br>0013h | Latest Alarm Info. Output Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 Hz | 0.00Hz | ● | ---<br>5 | RO | |
| X021 | 0015h<br>--- | Latest Alarm Info. Output Current | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 A | 0.00A | ● | 19<br>--- | RO | |
| X022 | 5557h<br>--- | Latest Alarm Info. Output Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1000 A | 0V | ● | 1<br>--- | RO | |
| X023 | 5558h<br>--- | Latest Alarm Info. Torque Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999 to 999 | 0% | ● | 2<br>--- | RO | |
| X024 | 555Ah<br>5559h | Latest Alarm Info. Frequency Command | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 | 0.00Hz | ● | ---<br>5 | RO | |
| X025 | 0012h<br>--- | Latest Alarm Info. Running Status 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: BUSY (During parameter data writing)<br>Bit14: -<br>Bit13: -<br>Bit12: RL (Communications effective)<br>Bit11: ALM (Alarm relay)<br>Bit10: DEC (During deceleration)<br>Bit9: ACC (During acceleration)<br>Bit8: IL (During current limiting)<br>Bit7: VL (During voltage limiting)<br>Bit6: TL (Torque limiting)<br>Bit5: NUV (Main circuit DC voltage established)<br>Bit4: BRK (During braking)<br>Bit3: INT (Inverter shut down)<br>Bit2: EXT (During DC braking or during pre-exciting)<br>Bit1: REV (During reverse operation)<br>Bit0: FWD (During forward operation) | 0 | ● | 16<br>--- | RO | |
| X026 | 001Ah<br>0019h | Latest Alarm Info. Cumulative Ope. time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655350 hour | 0h | ● | ---<br>1 | RO | |
| X027 | 555Dh<br>--- | Latest Alarm Info. Number of Startups | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | 1<br>--- | RO | |
| X028 | 0016h<br>--- | Latest Alarm Info. Main Circuit DC Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 1000.0 V | 0.0V | ● | 3<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| X029 | 555Fh<br>--- | Latest Alarm Info. Internal Air Temperature | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0degC | • | 2<br>--- | RO | |
| X030 | 5560h<br>--- | Latest Alarm Info. Heat Sink Temperature | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0degC | • | 2<br>--- | RO | |
| X031 | 5561h<br>--- | Latest Alarm Info. Input Terminal | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: SF2<br>Bit11: SF1<br>Bit10: ---<br>Bit9: ---<br>Bit8: ---<br>Bit7: ---<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: DI7<br>Bit0: DI6 | 0 | • | 43<br>--- | RO | |
| X032 | 5562h<br>--- | Latest Alarm Info. Output Terminal | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: RO<br>Bit7: ---<br>Bit6: ---<br>Bit5: ---<br>Bit4: ---<br>Bit3: ---<br>Bit2: ---<br>Bit1: DO2<br>Bit0: DO1 | 0 | • | 15<br>--- | RO | |
| X033 | 5563h<br>--- | Latest Alarm Info. Input Terminal via Communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: RS<br>Bit14: DI7<br>Bit13: DI6<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: ---<br>Bit7: ---<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: RV<br>Bit0: FW | 0 | • | 14<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| X034 | 5564h<br>--- | Latest Alarm Info. Output Terminal via Communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: RO<br>Bit7: ---<br>Bit6: ---<br>Bit5: ---<br>Bit4: ---<br>Bit3: ---<br>Bit2: ---<br>Bit1: DO2<br>Bit0: DO1 | 0 | • | 15<br>--- | RO | |
| X035 | 5565h<br>--- | Latest Alarm Info. Input Power | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 9999 kW | 0.00kW | • | 24<br>--- | RO | |
| X036 | 5566h<br>--- | Latest Alarm Info. Running Status 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: Motor type<br>0: Induction motor<br>1: PM motor<br>Bit14: Reserved<br>Bit7: During speed limit<br>0: Inactive<br>1: During speed limit<br>Bit5 to 4: Selected motor<br>00: 1st motor<br>01: 2nd motor<br>10: Reserved<br>11: Reserved<br>Bit3 to 0: Control method<br>0000: V/f control without slip compensation<br>0001: Dynamic torque vector control<br>0010: V/f control with slip compensation<br>0011: V/f control with speed sensor<br>0100: Dynamic torque vector control with speed sensor<br>0101: Vector control without speed sensor<br>0110: Vector control with speed sensor<br>0111: Torque control (Vector control without speed sensor)<br>1000: Torque control (Vector control with speed sensor) | 0 | • | 76<br>--- | RO | |
| X037 | 5567h<br>--- | Latest Alarm Info. Speed Detection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0 | • | 29<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| X038 | 5568h<br>--- | Latest Alarm Info. Running Status 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: OL (Overload warning)<br>Bit13: LOC (Light load detection)<br>Bit12: OL2 (Overload warning 2)<br>Bit11: OLP (During active drive)<br>Bit10: LIFE (Life warning)<br>Bit9: OHF (Fin Overheat warning)<br>Bit8: TRY (During retry)<br>Bit7: FAN (Fan operation signal)<br>Bit6: REF (RUN command source)<br>Bit5: THM (Thermal warning)<br>Bit4: IPF (During restart after instantaneous power failure)<br>Bit3: SETM (2nd motor selection)<br>Bit2: IRDY (Operation ready)<br>Bit1: FA2 (Over set Frequency arrival)<br>Bit0: FA1 (Constant speed arrival) | 0 | • | 44<br>--- | RO | |
| X049 | 5573h<br>--- | Fault Counter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | 1<br>--- | RO | |
| X060 | 001Eh<br>001Dh | Last Info. Alarm Info. Output Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 Hz | 0.00Hz | • | ---<br>5 | RO | |
| X061 | 001Fh<br>--- | Last Alarm Info. Output Current | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 A | 0.00A | • | 19<br>--- | RO | |
| X062 | 5581h<br>--- | Last Alarm Info. Output Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1000 V | 0V | • | 1<br>--- | RO | |
| X063 | 5582h<br>--- | Last Alarm Info. Torque Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999 to 999 | 0% | • | 2<br>--- | RO | |
| X064 | 5584h<br>5583h | Last Alarm Info. Frequency Command | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 | 0.00Hz | • | ---<br>5 | RO | |
| X065 | 001Ch<br>--- | Last Alarm Info. Running Status | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: BUSY (During parameter data writing)<br>Bit14: -<br>Bit13: -<br>Bit12: RL (Communications effective)<br>Bit11: ALM (Alarm relay)<br>Bit10: DEC (During deceleration)<br>Bit9: ACC (During acceleration)<br>Bit8: IL (During current limiting)<br>Bit7: VL (During voltage limiting)<br>Bit6: TL (Torque limiting)<br>Bit5: NUV (Main circuit DC voltage established)<br>Bit4: BRK (During braking)<br>Bit3: INT (Inverter shut down)<br>Bit2: EXT (During DC braking or during pre-exciting)<br>Bit1: REV (During reverse operation)<br>Bit0: FWD (During forward operation) | 0 | • | 16<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| X066 | 0024h<br>0023h | Last Alarm Info. Cumulative Ope. Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655350 hour | 0h | • | ---<br>1 | RO | |
| X067 | 5587h<br>--- | Last Alarm Info. Number of Start-ups | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | 1<br>--- | RO | |
| X068 | 0020h<br>--- | Last Alarm Info. Main Circuit DC Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 1000.0 V | 0.0V | • | 3<br>--- | RO | |
| X069 | 5589h<br>--- | Last Alarm Info Internal Air Temperature | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0deg C | • | 2<br>--- | RO | |
| X070 | 558Ah<br>--- | Last Alarm Info. Heat Sink Temperature | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0deg C | • | 2<br>--- | RO | |
| X071 | 558Bh<br>--- | Last Alarm Info. Input Terminal | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: SF2<br>Bit11: SF1<br>Bit10: ---<br>Bit9: ---<br>Bit8: ---<br>Bit7: ---<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: DI7<br>Bit0: DI6 | 0 | • | 43<br>--- | RO | |
| X072 | 558Ch<br>--- | Last Alarm Info. Output Terminal | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: RO<br>Bit7: ---<br>Bit6: ---<br>Bit5: ---<br>Bit4: ---<br>Bit3: ---<br>Bit2: ---<br>Bit1: DO2<br>Bit0: DO1 | 0 | • | 15<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| X073 | 558Dh<br>--- | Last Alarm Info. Input Terminal via Communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: RS<br>Bit14: DI7<br>Bit13: DI6<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: ---<br>Bit7: ---<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: RV<br>Bit0: FW | 0 | • | 14<br>--- | RO | |
| X074 | 558Eh<br>--- | Last Alarm Info. Output Terminal via Communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: RO<br>Bit7: ---<br>Bit6: ---<br>Bit5: ---<br>Bit4: ---<br>Bit3: ---<br>Bit2: ---<br>Bit1: DO2<br>Bit0: DO1 | 0 | • | 15<br>--- | RO | |
| X076 | 5590h<br>--- | Last Alarm Info. Running Status 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: Motor type<br>0: Induction motor<br>1: PM motor<br>Bit14: Reserved<br>Bit7: During speed limit<br>0: Inactive<br>1: During speed limit<br>Bit5 to 4: Selected motor<br>00: 1st motor<br>01: 2nd motor<br>10: Reserved<br>11: Reserved<br>Bit3 to 0: Control method<br>0000: V/f control without slip compensation<br>0001: Dynamic torque vector control<br>0010: V/f control with slip compensation<br>0011: V/f control with speed sensor<br>0100: Dynamic torque vector control with speed sensor<br>0101: Vector control without speed sensor<br>0110: Vector control with speed sensor<br>0111: Torque control (Vector control without speed sensor)<br>1000: Torque control (Vector control with speed sensor) | 0 | • | 76<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| X077 | 5591h<br>--- | Last Alarm Info. Speed Detection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0 | • | 29<br>--- | RO | |
| X078 | 5592h<br>--- | Last Alarm Info. Running Status 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: OL (Overload warning)<br>Bit13: LOC (Light load detection)<br>Bit12: OL2 (Overload warning 2)<br>Bit11: OLP (During active drive)<br>Bit10: LIFE (Life warning)<br>Bit9: OHF (Fin Overheat warning)<br>Bit8: TRY (During retry)<br>Bit7: FAN (Fan operation signal)<br>Bit6: REF (RUN command source)<br>Bit5: THM (Thermal warning)<br>Bit4: IPF (During restart after instantaneous power failure)<br>Bit3: SETM (2nd motor selection)<br>Bit2: IRDY (Operation ready)<br>Bit1: FA2 (Over set Frequency arrival)<br>Bit0: FA1 (Constant speed arrival) | 0 | • | 44<br>--- | RO | |
| X097 | 55A5h<br>--- | Input Input Terminal [PTC] Input Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-0.0 to 12.0 ; 999 | 3276<br>7.0V | • | 4<br>--- | RO | |
| X108 | 0018h<br>0017h | Latest Alarm Info. Cumu-lative Running Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655350 hour | 0h | • | ---<br>1 | RO | |
| X118 | 0022h<br>0021h | Last Alarm Info. Cumu-lative Running Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655350 hour | 0h | • | ---<br>1 | RO | |
| X128 | 002Ch<br>002Bh | Second last Alarm Info. Cumulative Running Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655350 hour | 0h | • | ---<br>1 | RO | |
| X138 | 0036h<br>0035h | Third last Alarm Info. Cumulative Running Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655350 hour | 0h | • | ---<br>1 | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| X140 | 5628h<br>--- | 4th last Alarm History/ Number of Consecutive Same Alarms | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>(MSB: 00 to FFh, LSB:00 to FEh)<br>MSB: Number of alarm<br><br>LSB: 00 to FEh<br>00h (0) : No alarm<br>01h (1) : OC1 Overcurrent protection (during acceleration)<br>02h (2) : OC2 Overcurrent protection (during deceleration)<br>03h (3) : OC3 Overcurrent protection (during constant speed operation)<br>06h (4) : OU1 Overvoltage protection (during acceleration)<br>07h (7) : OU2 Overvoltage protection (during deceleration)<br>08h (8) : OU3 Overvoltage protection (during constant speed operation or stopping)<br>0Ah (10) : LU Undervoltage protection<br>0Bh (11) : Lin Input phase loss protection<br>10h (16) : PbF Inrush current avoidance circuit error<br>11h (17) : OH1 Heat sink overheat<br>12h (18) : OH2 External alarm input<br>13h (19) : OH3 Inverter internal overheat<br>14h (20) : OH4 Motor protection (PTC thermistor)<br>16h (22) : dbH Braking resistor overheat<br>17h (23) : OL1 Motor 1 overload<br>18h (24) : OL2 Motor 2 overload<br>19h (25) : OLU Inverter overload<br>1Bh (27) : OS Over speed protection<br>1Ch (28) : Pg PG disconnection<br>1Fh (31) : Er1 Memory error<br>20h (32) : Er2 Operator communications<br>21h (33) : Er3 CPU error<br>22h (34) : Er4 Option card communications error<br>23h (35) : Er5 Ethernet card error<br>24h (36) : Er6 Operation protection<br>25h (37) : Er7 Tuning error<br>2Ah (42) : Erd Detection of step-out<br>2Eh (46) : OPL Output phase loss protection<br>2Fh (47) : ErE Following error (excessive speed deviation)<br>32h (50) : ErC Magnetic pole position detection error<br>33h (51) : ErF Data save error in case of undervoltage<br>34h (52) : d0 Excessive positioning deviation<br>35h (53) : ErP (RS-485 communications error, Option card)<br>38h (56) : Ero Position control error<br>39h (57) : ECF Safety circuit failure<br>3Ah (58) : CoF PID feedback disconnection detected<br>3Bh (59) : dbA Braking resistor overheat<br>44h (68) : ErU Support tool communication disconnection<br>46h (70) : OH6 Inrush current prevention resistor overheat<br>79h (121) : CA1 Drive App Alarm Fault 1<br>7Ah (122) : CA2 Drive App Alarm Fault 2<br>7Bh (123) : CA3 Drive App Alarm Fault 3<br>7Ch (124) : CA4 Drive App Alarm Fault 4<br>7Dh (125) : CA5 Drive App Alarm Fault 5<br>82h (130) : EnF SF terminal OFF<br>FCh (252) : Fod Fire mode activated<br>FDh (253) : Lok Locked by password<br>FEh (254) : Err Mock alarm (Subcode = 9998) | 0 | • | 41<br>--- | RO | |
| X141 | 003Ch<br>003Bh | Fourth last Alarm Info. Output Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 Hz | 0.00 Hz | • | ---<br>5 | RO | |
| X142 | 003Dh<br>--- | Fourth last Alarm Info. Output Current | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 A | 0.00 A | • | 19<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| X143 | 0042h<br>0041h | Fourth Last Alarm Info. Cumulative Ope. time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655350 hour | 0h | • | ---<br>1 | RO | |
| X144 | 003Eh<br>--- | Fourth Last Alarm Info. Main Circuit DC Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 1000.0 V | 0.0V | • | 3<br>--- | RO | |
| X148 | 0040h<br>003Fh | Fourth Last Alarm Info. Cumulative Running Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655350 hour | 0h | • | ---<br>1 | RO | |
| X149 | 003Ah<br>--- | Fourth Last Alarm Info. Running Status | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: BUSY (During parameter data writing)<br>Bit14: -<br>Bit13: -<br>Bit12: RL (Communications effective)<br>Bit11: ALM (Alarm relay)<br>Bit10: DEC (During deceleration)<br>Bit9: ACC (During acceleration)<br>Bit8: IL (During current limiting)<br>Bit7: VL (During voltage limiting)<br>Bit6: TL (Torque limiting)<br>Bit5: NUV (Main circuit DC voltage established)<br>Bit4: BRK (During braking)<br>Bit3: INT (Inverter shut down)<br>Bit2: EXT (During DC braking or during pre-exciting)<br>Bit1: REV (During reverse operation)<br>Bit0: FWD (During forward operation) | 0 | • | 16<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| X150 | 5632h<br>--- | 5th last Alarm History/ Number of Consecutive Same Alarms | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>(MSB: 00 to FFh, LSB:00 to FEh)<br>MSB: Number of alarm<br><br>LSB: 00 to FEh<br>00h (0) : No alarm<br>01h (1) : OC1 Overcurrent protection (during acceleration)<br>02h (2) : OC2 Overcurrent protection (during deceleration)<br>03h (3) : OC3 Overcurrent protection (during constant speed operation)<br>06h (4) : OU1 Overvoltage protection (during acceleration)<br>07h (7) : OU2 Overvoltage protection (during deceleration)<br>08h (8) : OU3 Overvoltage protection (during constant speed operation or stopping)<br>0Ah (10) : LU Undervoltage protection<br>0Bh (11) : Lin Input phase loss protection<br>10h (16) : PbF Inrush current avoidance circuit error<br>11h (17) : OH1 Heat sink overheat<br>12h (18) : OH2 External alarm input<br>13h (19) : OH3 Inverter internal overheat<br>14h (20) : OH4 Motor protection (PTC thermistor)<br>16h (22) : dbH Braking resistor overheat<br>17h (23) : OL1 Motor 1 overload<br>18h (24) : OL2 Motor 2 overload<br>19h (25) : OLU Inverter overload<br>1Bh (27) : OS Over speed protection<br>1Ch (28) : Pg PG disconnection<br>1Fh (31) : Er1 Memory error<br>20h (32) : Er2 Operator communications<br>21h (33) : Er3 CPU error<br>22h (34) : Er4 Option card communications error<br>23h (35) : Er5 Ethernet card error<br>24h (36) : Er6 Operation protection<br>25h (37) : Er7 Tuning error<br>2Ah (42) : Erd Detection of step-out<br>2Eh (46) : OPL Output phase loss protection<br>2Fh (47) : ErE Following error (excessive speed deviation)<br>32h (50) : ErC Magnetic pole position detection error<br>33h (51) : ErF Data save error in case of undervoltage<br>34h (52) : d0 Excessive positioning deviation<br>35h (53) : ErP (RS-485 communications error, Option card)<br>38h (56) : Ero Position control error<br>39h (57) : ECF Safety circuit failure<br>3Ah (58) : CoF PID feedback disconnection detected<br>3Bh (59) : dbA Braking resistor overheat<br>44h (68) : ErU Support tool communication disconnection<br>46h (70) : OH6 Inrush current prevention resistor overheat<br>79h (121) : CA1 Drive App Alarm Fault 1<br>7Ah (122) : CA2 Drive App Alarm Fault 2<br>7Bh (123) : CA3 Drive App Alarm Fault 3<br>7Ch (124) : CA4 Drive App Alarm Fault 4<br>7Dh (125) : CA5 Drive App Alarm Fault 5<br>82h (130) : EnF SF terminal OFF<br>FCh (252) : Fod Fire mode activated<br>FDh (253) : Lok Locked by password<br>FEh (254) : Err Mock alarm (Subcode = 9998) | 0 | • | 41<br>--- | RO | |
| X151 | 0046h<br>0045h | Fifth Last Alarm Info. Output Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 Hz | 0.00 Hz | • | ---<br>5 | RO | |
| X152 | 0047h<br>--- | Fifth Last Alarm Info. Output Current | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 A | 0.00 A | • | 19<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| X153 | 004Ch<br>004Bh | Fifth Last Alarm Info. Cumulative Ope. Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655350 hour | 0h | • | ---<br>1 | RO | |
| X154 | 0048h<br>--- | Fifth last Alarm Info. Main Circuit DC Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 1000.0 V | 0.0V | • | 3<br>--- | RO | |
| X158 | 004Ah<br>0049h | Fifth last Alarm Info. Cumulative Running time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 655350 hour | 0h | • | ---<br>1 | RO | |
| X159 | 0044h<br>--- | Fifth Last Alarm Info. Running Status | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: BUSY (During parameter data writing)<br>Bit14: -<br>Bit13: -<br>Bit12: RL (Communications effective)<br>Bit11: ALM (Alarm relay)<br>Bit10: DEC (During deceleration)<br>Bit9: ACC (During acceleration)<br>Bit8: IL (During current limiting)<br>Bit7: VL (During voltage limiting)<br>Bit6: TL (Torque limiting)<br>Bit5: NUV (Main circuit DC voltage established)<br>Bit4: BRK (During braking)<br>Bit3: INT (Inverter shut down)<br>Bit2: EXT (During DC braking or during pre-exciting)<br>Bit1: REV (During reverse operation)<br>Bit0: FWD (During forward operation) | 0 | • | 16<br>--- | RO | |

## 5-3-5 Monitor parameters K (DriveApp Status Monitoring)

These monitors are related to customized functionality DriveApp installed in the inverter. Check with omron sales support for details about DriveApps.

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| K351 | F233h<br>--- | Debug Monitor Reset | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: no effect<br>1: Debug monitor reset | 0 | ● | 1<br>--- | R/W | |
| K352 | F234h<br>--- | CPU Load - Instant | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 100.00 % | 0.00% | ● | 5<br>--- | RO | |
| K353 | F235h<br>--- | CPU Load - Maximum | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 100.00 % | 0.00% | ● | 5<br>--- | RO | |
| K354 | F236h<br>--- | Execution Time 1ms Cycle - Instant | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 65.535 ms | 0.000ms | ● | 7<br>--- | RO | |
| K355 | F237h<br>--- | Execution Time 1ms Cylcle - Minimum | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 65.535 ms | 0.000ms | ● | 7<br>--- | RO | |
| K356 | F238h<br>--- | Execution Time 1ms Cylcle - Maximum | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 65.535 ms | 0.000ms | ● | 7<br>--- | RO | |
| K357 | F239h<br>--- | Execution Time 5ms Cylcle - Instant | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 65.535 ms | 0.000ms | ● | 7<br>--- | RO | |
| K358 | F23Ah<br>--- | Execution Time 5ms Cylcle - Minimum | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 65.535 ms | 0.000ms | ● | 7<br>--- | RO | |
| K359 | F23Bh<br>--- | Execution Time 5ms Cylcle - Maximum | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 65.535 ms | 0.000ms | ● | 7<br>--- | RO | |
| K360 | F23Ch<br>--- | Execution Time Main Loop - Instant | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 ms | 0.00ms | ● | 5<br>--- | RO | |
| K361 | F23Dh<br>--- | Execution Time Main Loop - Minimum | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 ms | 0.00ms | ● | 5<br>--- | RO | |
| K362 | F23Eh<br>--- | Execution Time Main Loop - Maximum | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 ms | 0.00ms | ● | 5<br>--- | RO | |
| K363 | F23Fh<br>--- | Stack Usage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 100.0 % | 0.0% | ● | 3<br>--- | RO | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|
| K364 | F241h<br>F240h | RAM Monitor 1 – Address | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>00000000 to FFFFFFFFh | 0 | • | ---<br>1 | R/W | |
| K366 | F243h<br>F242h | RAM Monitor 2 – Address | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>00000000 to FFFFFFFFh | 0 | • | ---<br>1 | R/W | |
| K368 | F245h<br>F244h | RAM Monitor 3 – Address | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>00000000 to FFFFFFFFh | 0 | • | ---<br>1 | R/W | |
| K370 | F247h<br>F246h | RAM Monitor 4 – Address | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>00000000 to FFFFFFFFh | 0 | • | ---<br>1 | R/W | |
| K372 | F249h<br>F248h | RAM Monitor 5 – Address | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>00000000 to FFFFFFFFh | 0 | • | ---<br>1 | R/W | |
| K374 | F24Ah<br>--- | RAM Monitor 5 – Data Type for Min/Max Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 5<br>0: 32bit Signed integer<br>1: 16bit Signed integer<br>2: 8bit Signed integer<br>3: 32bit Unsigned integer<br>4: 16bit Unsigned integer<br>5: 8bit Unsigned integer | 0 | • | 1<br>--- | R/W | |
| K376 | F24Dh<br>F24Ch | RAM Monitor 1 – Instant | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>80000000 to 7FFFFFFFh | 0 | • | ---<br>2 | RO | |
| K378 | F24Fh<br>F24Eh | RAM Monitor 2 – Instant | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>80000000 to 7FFFFFFFh | 0 | • | ---<br>2 | RO | |
| K380 | F251h<br>F250h | RAM Monitor 3 – Instant | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>80000000 to 7FFFFFFFh | 0 | • | ---<br>2 | RO | |
| K382 | F253h<br>F252h | RAM Monitor 4 – Instant | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>80000000 to 7FFFFFFFh | 0 | • | ---<br>2 | RO | |
| K384 | F255h<br>F254h | RAM Monitor 5 – Instant | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>80000000 to 7FFFFFFFh | 0 | • | ---<br>2 | RO | |
| K386 | F257h<br>F256h | RAM Monitor 5 – Minimum | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>80000000 to 7FFFFFFFh | 0 | • | ---<br>2 | RO | |
| K388 | F259h<br>F258h | RAM Monitor 5 – Maximum | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>80000000 to 7FFFFFFFh | 0 | • | ---<br>2 | RO | |

# 5-4 Lists of Inverter Parameters

The following table shows the parameters that allow programming all inverter functions

## 5-4-1 F Group Parameter List (Basic Functions)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| F000 | 3000h<br>--- | Operator Protection Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Disable parameter protection, enable Up/Down keys<br>1: Enable parameter protection, enable Up/Down keys<br>2: Disable parameter protection, disable Up/Down keys<br>3: Enable parameter protection, disable Up/Down keys | 0 | • | | • | 1<br>--- | R/W | |
| F001 | 3001h<br>--- | 1st Frequency Reference Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 15<br>0: Operator (UP and DOWN keys) (balancelessbumpless switching unavailable)<br>1: Analog Voltage Input (Input Terminal[AI1])<br>2: Analog Current Input (Input Terminal[AI2](AII))<br>3: Analog Voltage Input (Input Terminal[AI1]) + Analog Current Input (Input Terminal[AI2](AII))<br>5: Analog Voltage Input (Input Terminal[AI2](AIV))<br>7: UP/DOWN control<br>8: Operator (UP and DOWN keys) (balancelessbumpless switching available)<br>10: Pattern operation<br>12: Pulse train input<br>13: Calculation result<br>14: RS-485 communication<br>15: Fieldbus (Reserved) | 0 | | | • | 1<br>--- | R/W | |
| F002 | 1201h<br>--- | 1st RUN Command Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 5<br>0: Operator (Direction of rotation input: terminal block)<br>1: External signal (Digital input)<br>2: Operator (Forward rotation)<br>3: Operator (Reverse rotation)<br>4: RS-485 communication<br>5: Fieldbus (Reserved) | 2 | | | • | 1<br>--- | R/W | |
| F003 | 3003h<br>--- | 1st Maximum Output Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>5.0 to 590.0 Hz | 60.0Hz | | | • | 3<br>--- | R/W | |
| F004 | 3004h<br>--- | 1st Base Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>5.0 to 590.0 Hz | 50.0Hz | | | • | 3<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| F005 | 3005h<br>--- | 1st Rated Voltage at Base Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>80 to 240 V (200 V class series)<br>160 to 500 V (400 V class series) | 200V | | • | • | 1<br>--- | R/W | |
| F006 | 3006h<br>--- | 1st Rated Voltage at Maximum Output Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>80 to 240 V (200 V class series)<br>160 to 500 V (400 V class series) | 200V | | • | • | 1<br>--- | R/W | |
| F007 | 1103h<br>1102h | 1st Acceleration Time 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 6000.00 s | 6.00s | • | | • | ---<br>6 | R/W | |
| F008 | 1105h<br>1104h | 1st Deceleration Time 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 6000.00 s | 6.00s | • | | • | ---<br>6 | R/W | |
| F009 | 300Bh<br>--- | 1st Manual Torque Boost Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 20.0 %<br>Percentage of 1st Rated Voltage at Base Frequency(F05) | 1.9% | • | • | • | 3<br>--- | R/W | |
| F010 | 300Ch<br>--- | 1st Motor Electronic Thermal Characteristic Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 2<br>1: For a general-purpose motor with shaft-driven cooling fan<br>2: For an inverter-driven motor non-ventilated motor or motor with separately powered cooling fan | 1 | • | | • | 1<br>--- | R/W | |
| F011 | 300Dh<br>--- | 1st Motor Electronic Thermal Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 ; 0.01 to 118.8<br>0.00: Disable<br>0.01 to 118.8 A<br><br># Setting range from 1%(HHD) to 135%(ND) of the rated inverter current. | 21.00A | • | • | • | 19<br>--- | R/W | |
| F012 | 300Eh<br>--- | 1st Motor Electronic Thermal Time Constant | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.5 to 75.0 min | 5.0min | • | | • | 3<br>--- | R/W | |
| F014 | 3010h<br>--- | Power Interruption Restart Mode Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 6<br>0: Immediately trip(Free run stop)<br>1: Trip after a recovery from power failure(Free run stop)<br>2: Trip after decelerate-to-stop<br>3: Continue to run<br>4: Restart at the frequency selected by E152<br>6: Decelerate-to-stop(w/o trip) | 1 | • | | • | 1<br>--- | R/W | |
| F015 | 124Fh<br>124Eh | 1st Frequency Upper Limit | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 590.00 Hz<br>* Internal resolution is 0.1 steps. | 70.00Hz | • | | • | ---<br>5 | R/W | |
| F016 | 1251h<br>1250h | 1st Frequency Lower Limit | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 590.00 Hz<br>* Internal resolution is 0.1 steps. | 0.00Hz | • | | • | ---<br>5 | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| F018 | 3016h<br>--- | Input Terminal [AI1, AI2] Bias for 1st Frequency Command | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-100.00 to 100.00 % | 0.00% | • | | • | 6<br>--- | R/W | |
| F020 | 3018h<br>--- | 1st DC Injection Braking Start Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 60.0 Hz | 0.0Hz | • | | • | 3<br>--- | R/W | |
| F021 | 3019h<br>--- | 1st DC Injection Braking Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 100% (HHD mode)<br>0 to 80% (HND/HD mode)<br>0 to 60% (ND mode)<br>Based on inverter rated current | 0% | • | | • | 1<br>--- | R/W | |
| F022 | 301Ah<br>--- | 1st DC Injection Braking Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00: Disable<br>0.01 to 30.00 s | 0.00s | • | | • | 5<br>--- | R/W | |
| F023 | 301Bh<br>--- | 1st Starting Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 60.0 Hz | 0.5Hz | • | | • | 3<br>--- | R/W | |
| F024 | 301Ch<br>--- | 1st Starting Frequency 1 Holding Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 10.00 s | 0.00s | • | | • | 5<br>--- | R/W | |
| F025 | 301Dh<br>--- | 1st Stop Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 60.0 Hz | 0.2Hz | • | | • | 3<br>--- | R/W | |
| F026 | 301Eh<br>--- | Carrier Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 16<br>0: 0.75 kHz<br>1: 1 kHz<br>2: 2 kHz<br>3: 3 kHz<br>4: 4 kHz<br>5: 5 kHz<br>6: 6 kHz<br>7: 7 kHz<br>8: 8 kHz<br>9: 9 kHz<br>10: 10 kHz<br>11: 11 kHz<br>12: 12 kHz<br>13: 13 kHz<br>14: 14 kHz<br>15: 15 kHz<br>16: 16 kHz | 2kHz | • | | • | 1<br>--- | R/W | |
| F027 | 301Fh<br>--- | Motor Sound Tone | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Level 0 (Disable)<br>1: Level 1<br>2: Level 2<br>3: Level 3 | 0 | • | | • | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| F037 | 3029h<br>--- | 1st V/f Characteristics Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Variable torque load<br>1: Constant torque load | 1 | | | • | 1<br>--- | R/W | |
| F038 | 302Ah<br>--- | 1st Stop Frequency Detection Method Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Detected/Estimated speed<br>1: Reference speed | 0 | | | • | 1<br>--- | R/W | |
| F039 | 302Bh<br>--- | 1st Stop Frequency Holding Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 10.00 s | 0.00s | • | | • | 5<br>--- | R/W | |
| F040 | 132Ah<br>--- | Torque Limit 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 300 % | 300% | • | | • | 1<br>--- | R/W | |
| F041 | 132Bh<br>--- | Torque Limit 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 300 % | 300% | • | | • | 1<br>--- | R/W | |
| F042 | 302Eh<br>--- | 1st Drive Control Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 16<br>0: IM V/f control<br>1: IM Dynamic torque vector control<br>3: IM V/f control with speed sensor<br>4: IM Dynamic torque vector control with speed sensor<br>5: IM Vector control without speed sensor<br>6: IM Vector control with speed sensor<br>15: PM Vector control without speed and pole position sensor<br>16: PM Vector control with speed and pole position sensor | 0 | | | • | 1<br>--- | R/W | |
| F043 | 302Fh<br>--- | 1st Overload Protect Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2<br>0: Disable<br>1: Enable at constant speed<br>2: Enable during ACC/constant speed operation | 2 | • | | • | 1<br>--- | R/W | |
| F044 | 3030h<br>--- | 1st Overload Protect Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>20 to 200 %<br>100% = Rated output current of inverter<br>(Default: 180% for HHD mode and 130% for ND mode) | 180% | • | • | • | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| F050 | 3036h<br>--- | Braking resistor adiabatic power | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 9000kWs ; OFF (32767)<br>1 to 9,000 kWs<br>32,767: Disable | 32767kWs | • | | • | 1<br>--- | R/W | |
| F051 | 3037h<br>--- | Braking resistor rated power | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.001 to 99.99 kW | 0.001kW | • | | • | 45<br>--- | R/W | |
| F052 | 3038h<br>--- | Braking resistor resistance | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.01 to 999 Ω | 0.01ohm | • | | • | 12<br>--- | R/W | |
| F080 | 3054h<br>--- | Load Mode Se-lection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 4<br>0: HHD<br>1: HND<br>3: HD (only for 400 V)<br>4: ND (only for 400 V) | 0 | | | • | 1<br>--- | R/W | |

## 5-4-2 E Group Parameter List (Terminal Functions)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| E001 | 30C1h<br>--- | Input Terminal [DI1] Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 188 normally-open input, 1000 to 1188 normally-close input | 0 | | | • | 1<br>--- | R/W | |
| E002 | 30C2h<br>--- | Input Terminal [DI2] Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 188 normally-open input, 1000 to 1188 normally-close input | 1 | | | • | 1<br>--- | R/W | |
| E003 | 30C3h<br>--- | Input Terminal [DI3] Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 188 normally-open input, 1000 to 1188 normally-close input | 166 | | | • | 1<br>--- | R/W | |
| E004 | 30C4h<br>--- | Input Terminal [DI4] Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 188 normally-open input, 1000 to 1188 normally-close input | 7 | | | • | 1<br>--- | R/W | |
| E005 | 30C5h<br>--- | Input Terminal [DI5] Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 188 normally-open input, 1000 to 1188 normally-close input | 8 | | | • | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| E010 | 2103h 2102h | 2nd Acceleration Time 1 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 6000.00 s | 6.00s | ● | | ● | --- 6 | R/W | |
| E011 | 2105h 2104h | 2nd Decelera-tion Time 1 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 6000.00 s | 6.00s | ● | | ● | --- 6 | R/W | |
| E012 | 1274h 1273h | 1st Acceleration Time 2 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 6000.00 s | 6.00s | ● | | ● | --- 6 | R/W | |
| E013 | 1276h 1275h | 1st Deceleration Time 2 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 6000.00 s | 6.00s | ● | | ● | --- 6 | R/W | |
| E014 | 226Fh 226Eh | 2nd Acceleration Time 2 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 6000.00 s | 6.00s | ● | | ● | --- 6 | R/W | |
| E015 | 2271h 2270h | 2nd Decelera-tion Time 2 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 6000.00 s | 6.00s | ● | | ● | --- 6 | R/W | |
| E016 | 132Ch --- | Torque Limit 3 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0 to 300 % | 300% | ● | | ● | 1 --- | R/W | |
| E017 | 132Dh --- | Torque Limit 4 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0 to 300 % | 300% | ● | | ● | 1 --- | R/W | |
| E020 | 30DAh --- | Output Terminal [DO1] Function Selection | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0 to 241 normally-open output, 1000 to 1241 normally-close output Refer to the manual for the contents of function assignment. | 0 | | | ● | 1 --- | R/W | |
| E027 | 30E1h --- | Output Terminal [ROA, ROB] Function Selec-tion | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0 to 241 normally-open output, 1000 to 1241 normally-close output Refer to the manual for the contents of function assignment. | 99 | | | ● | 1 --- | R/W | |
| E029 | 30E3h --- | Frequency Ar-rival 2 ON Timer | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.01 to 10.00 s | 0.10s | ● | | ● | 5 --- | R/W | |
| E030 | 30E4h --- | Frequency Ar-rival Detection Width (FAR1/ FAR2/FAR3/F-DT3/FDT4) | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.0 to 10.0 Hz | 2.5Hz | ● | | ● | 3 --- | R/W | |
| E031 | 30E6h 30E5h | Frequency De-tection Level1 (FDT1/FDT3) | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.0 to 590.0 Hz | 60.0Hz | ● | | ● | --- 3 | R/W | |
| E032 | 30E8h 30E7h | Frequency De-tection Hyster-esis Width (FDT1/ FDT2) | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.0 to 590.0 Hz | 1.0Hz | ● | | ● | --- 3 | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| E034 | 30EAh<br>--- | Overload early warning 2 Level (OL2) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 ; 0.01 to 176.0<br>0.00: Disable<br>0.01 to 176.0 A<br><br># Setting range from 1%(HHD) to 200%(ND) of the rated inverter current. | 21.00A | ● | ● | ● | 19<br>--- | R/W | |
| E035 | 30EBh<br>--- | Overload early warning 2 Detection Timer (OL2) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.01 to 600.00 s | 10.00s | ● | | ● | 5<br>--- | R/W | |
| E036 | 30EDh<br>30ECh | Frequency Detection Level 2 (FDT2/FDT4) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 590.0 Hz | 60.0Hz | ● | | ● | ---<br>3 | R/W | |
| E037 | 30EEh<br>--- | 1st Overload Early Warning Detection Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 ; 0.01 to 176.0<br>0.00: Disable<br>0.01 to 176.0 A<br><br># Setting range from 1%(HHD) to 200%(ND) of the rated inverter current. | 21.00A | ● | ● | ● | 19<br>--- | R/W | |
| E038 | 30EFh<br>--- | 1st Overload Early Warning Detection Timer / Low Current detection level (OL, LOC) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.01 to 600.00 s | 10.00s | ● | | ● | 5<br>--- | R/W | |
| E039 | 30F0h<br>--- | Display Coefficient 1 for Transport Time / Auxiliary Display Coefficient 1 for Speed Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 9999 | 1.000 | ● | | ● | 45<br>--- | R/W | |
| E049 | 30FAh<br>--- | Torque Command Monitor Polarity Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Torque polarity<br>1: Plus for driving Minus for braking | 1 | ● | | ● | 1<br>--- | R/W | |
| E050 | 30FBh<br>--- | 1st Frequency Conversion Coefficient | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.01 to 600.00 | 30.00 | ● | | ● | 5<br>--- | R/W | |
| E051 | 30FCh<br>--- | Display Coefficient for Integrated Power | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 ; 0.001 to 9999<br>0.000: Cancel and reset<br>0.001 to 9999 | 0.010 | ● | | ● | 45<br>--- | R/W | |
| E055 | 3101h<br>--- | 2nd Overload Warning Detection Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 ; 0.01 to 176.0<br>0.00: Disable<br>0.01 to 176.0 A | 21.00A | ● | ● | ● | 19<br>--- | R/W | |
| E056 | 3102h<br>--- | 2nd Overload Early Warning Detection Timer | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.01 to 600.00 s | 10.00s | ● | | ● | 5<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
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| E061 | 3107h<br>--- | Input Terminal [AI1] Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 29<br>0: Frequency command<br>1: Auxiliary frequency setting 1<br>2: Auxiliary frequency setting 2<br>3: PID command<br>5: PID feedback<br>6: Ratio setting<br>7: Analog torque limiter<br>9: Torque bias<br>10: Torque command<br>11: Torque current command<br>17: Speed limit for forward rotation<br>18: Speed limit for reverse rotation<br>20: Analog signal input monitor<br>21: PID feed forward<br>24 : Drive App input 1<br>25 : Drive App input 2<br>26 : Drive App input 3<br>27 : Drive App input 4<br>28 : Drive App input 5<br>29 : Drive App input 6 | 0 | | | ● | 1<br>--- | R/W | |
| E065 | 310Bh<br>--- | Reference Loss Detection Operation Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 ; 20 to 120 % ; 999<br>0: Decelerate to stop<br>20 to 120 %: Continuous operation frequency ratio<br>999: Disable | 32767% | ● | | ● | 1<br>--- | R/W | |
| E076 | 3116h<br>--- | Main Circuit DC Voltage Low-voltage Detection Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>200 to 400V (200Vseries)<br>400 to 800V (400Vseries) | 235V | ● | ● | ● | 1<br>--- | R/W | |
| E078 | 3118h<br>--- | Overtorque/Undertorque Detection Level at Forward Power Running | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 300 % | 100% | ● | | ● | 1<br>--- | R/W | |
| E079 | 3119h<br>--- | Torque detection 1 Detection Timer | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.01 to 600.00 s | 10.00s | ● | | ● | 5<br>--- | R/W | |
| E080 | 311Ah<br>--- | Overtorque/Undertorque Detection Level at Reverse Regeneration | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 300 % | 100% | ● | | ● | 1<br>--- | R/W | |
| E098 | 312Ch<br>--- | Input Terminal [DI6] Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 188 normally-open input, 1000 to 1188 normally-close input | 98 | | | ● | 1<br>--- | R/W | |
| E099 | 312Dh<br>--- | Input Terminal [DI7] Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 188 normally-open input, 1000 to 1188 normally-close input | 99 | | | ● | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
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| E102 | 3182h<br>--- | 2nd RUN Command Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 5<br>0: Operator (Direction selected by Terminal)<br>1: Terminal command FW or RV<br>2: Operator (Forward direction)<br>3: Operator (Reverse direction)<br>4: RS-485 communication<br>5: Fieldbus (Reserved) | 2 | | | • | 1<br>--- | R/W | |
| E103 | 3184h<br>3183h | Acceleration Stop Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 ; 0.01 to 590.00<br>0.00: Disable<br>0.01 to 590.00 Hz | 0.00Hz | | | • | ---<br>5 | R/W | |
| E104 | 3186h<br>3185h | Acceleration Stop Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 ; 0.1 to 60.0<br>0.0: Disable<br>0.1 to 60.0 s | 0.0s | | | • | ---<br>3 | R/W | |
| E105 | 3188h<br>3187h | Deceleration Stop Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 ; 0.01 to 590.00<br>0.00: Disable<br>0.01 to 590.00 Hz | 0.00Hz | | | • | ---<br>5 | R/W | |
| E106 | 318Ah<br>3189h | Deceleration Stop Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 ; 0.1 to 60.0<br>0.0: Disable<br>0.1 to 60.0 s | 0.0s | | | • | ---<br>3 | R/W | |
| E107 | 318Bh<br>--- | Multi-step Frequency Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Binary (CF1 to CF4)<br>1: Bit (SF1 to SF7) | 0 | | | • | 1<br>--- | R/W | |
| E111 | 3191h<br>--- | Jogging Operation Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 5<br>0: Free run stop on jogging stop, disabled in operation<br>1: Deceleration stop on jogging stop, disabled in operation<br>2: DC injection braking on jogging stop, disabled in operation<br>3: Free run stop on jogging stop, enabled in operation<br>4: Deceleration stop on jogging stop, enabled in operation<br>5: DC injection braking on jogging stop, enabled in operation | 4 | | | • | 1<br>--- | R/W | |
| E112 | 3192h<br>--- | 1st Torque Boost Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Manual torque boost<br>1: Automatic torque boost | 1 | | | • | 1<br>--- | R/W | |
| E113 | 3193h<br>--- | 2nd Torque Boost Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Manual torque boost<br>1: Automatic torque boost | 1 | | | • | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| E125 | 31A1h<br>--- | 1st 2-step Acceleration / Deceleration switching Condition Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Switching by 2CH terminal<br>1: Switching by setting<br>2: Forward and reverse<br>3: Switching by RT1, RT2 terminals | 0 | | | ● | 1<br>--- | R/W | |
| E126 | 31A2h<br>--- | 2nd 2-step Acceleration/Deceleration Switching Condition Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Switching by 2CH terminal<br>1: Switching by setting<br>2: Forward and reverse<br>3: Switching by RT1, RT2 terminals | 0 | | | ● | 1<br>--- | R/W | |
| E127 | 31A4h<br>31A3h | 1st 2-step Acceleration Switching Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 590.00 Hz | 0.00Hz | | | ● | ---<br>5 | R/W | |
| E128 | 31A6h<br>31A5h | 2nd 2-step Acceleration Switching Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 590.00 Hz | 0.00Hz | | | ● | ---<br>5 | R/W | |
| E129 | 31A8h<br>31A7h | 1st 2-step Deceleration Switching Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 590.00 Hz | 0.00Hz | | | ● | ---<br>5 | R/W | |
| E130 | 31AAh<br>31A9h | 2nd 2-step Deceleration Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 590.00 Hz | 0.00Hz | | | ● | ---<br>5 | R/W | |
| E131 | 31ABh<br>--- | Frequency Calculation Operation Target 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 7<br>0: Up/Down keys on Operator<br>1: Voltage input to terminal [AI1]<br>2: Current input to terminal [AI2](AII)<br>3: Voltage input to terminal [AI2](AIV)<br>5: Pulse train input<br>6: RS-485 communication<br>7: Fieldbus (Reserved) | 1 | | | ● | 1<br>--- | R/W | |
| E132 | 31ACh<br>--- | Frequency Calculation Operation Target 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 7<br>0: Up/Down keys on Operator<br>1: Voltage input to terminal [AI1]<br>2: Current input to terminal [AI2](AII)<br>3: Voltage input to terminal [AI2](AIV)<br>5: Pulse train input<br>6: RS-485 communication<br>7: Fieldbus (Reserved) | 2 | | | ● | 1<br>--- | R/W | |
| E133 | 31ADh<br>--- | Frequency Calculation Operator Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2<br>0: Addition (E131 + E132)<br>1: Subtraction (E131 - E132)<br>2: Multiplication (E131 x E132) | 0 | | | ● | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| E134 | 31AFh<br>31AEh | Frequency Addition Amount | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 590.00 Hz | 0.00Hz | | | • | ---<br>5 | R/W | |
| E135 | 31B0h<br>--- | Frequency Addition Sign Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Frequency command + E134<br>1: Frequency command - E134 | 0 | | | • | 1<br>--- | R/W | |
| E139 | 31B5h<br>--- | Overvoltage/Overcurrent Restart Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 4<br>0: Trip immediately<br>4: Restart at the frequency selected by E152 | 0 | | | • | 1<br>--- | R/W | |
| E146 | 31BCh<br>--- | 2nd Overload Protect Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2<br>0: Disable<br>1: Enable at constant speed<br>2: Enable during ACC/constant speed operation | 2 | • | | • | 1<br>--- | R/W | |
| E147 | 31BDh<br>--- | 2nd Overload Protect Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>20 to 200 %<br>The data is interpreted as the rated output current of the inverter for 100%. | 180% | • | • | • | 1<br>--- | R/W | |
| E152 | 31C2h<br>--- | Starting Frequency Selection at Frequency Pull-in Restart | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Frequency at which the power failure occurred<br>1: Maximum output frequency<br>2: Reference frequency<br>3: Starting frequency | 3 | | | • | 1<br>--- | R/W | |
| E154 | 31C5h<br>31C4h | RUN Time Over (RNT)/ Power ON Time Over (ONT) Detection Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 0x10h | | | • | ---<br>1 | R/W | |
| E157 | 31C8h<br>--- | Analog Input [AI1] Detection Upper Limit Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 100 % | 100% | • | | • | 1<br>--- | R/W | |
| E158 | 31C9h<br>--- | Analog Input [AI1] Detection Lower Limit Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 100 % | 0% | • | | • | 1<br>--- | R/W | |
| E159 | 31CAh<br>--- | Analog Input [AI1] Level Detection Hysteresis Width | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 10 % | 0% | • | | • | 1<br>--- | R/W | |
| E163 | 31CEh<br>--- | Analog Operation Level at [AI1] Disconnection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-100 to 100 ; 999<br>-100 to 100 %<br>999: Disable | 32767% | | | • | 2<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
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| E165 | 31D0h<br>--- | Carrier Frequency Automatic Reduction Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Disable<br>1: Enable | 1 | | | • | 1<br>--- | R/W | |
| E166 | 31D1h<br>--- | Non-linear V/f Frequency 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 ; 0.1 to 590.0 Hz<br>0.0: Disable<br>0.1 to 590.0 Hz | 0.0Hz | | | • | 3<br>--- | R/W | |
| E167 | 31D2h<br>--- | Non-linear V/f Voltage 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 240 V (for 200 V class series)<br>0 to 500 V (for 400 V class series) | 0V | | | • | 1<br>--- | R/W | |
| E168 | 31D3h<br>--- | Non-linear V/f Frequency 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 ; 0.1 to 590.0 Hz<br>0.0: Disable<br>0.1 to 590.0 Hz | 0.0Hz | | | • | 3<br>--- | R/W | |
| E169 | 31D4h<br>--- | Non-linear V/f Voltage 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 240 V (for 200 V class series)<br>0 to 500 V (for 400 V class series) | 0V | | | • | 1<br>--- | R/W | |
| E170 | 31D5h<br>--- | Non-linear V/f Frequency 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 ; 0.1 to 590.0 Hz<br>0.0: Disable<br>0.1 to 590.0 Hz | 0.0Hz | | | • | 3<br>--- | R/W | |
| E171 | 31D6h<br>--- | Non-linear V/f Voltage 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 240 V (for 200 V class series)<br>0 to 500 V (for 400 V class series) | 0V | | | • | 1<br>--- | R/W | |
| E172 | 31D7h<br>--- | Non-linear V/f Frequency 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 ; 0.1 to 590.0 Hz<br>0.0: Disable<br>0.1 to 590.0 Hz | 0.0Hz | | | • | 3<br>--- | R/W | |
| E173 | 31D8h<br>--- | Non-linear V/f Voltage 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 240 V (for 200 V class series)<br>0 to 500 V (for 400 V class series) | 0V | | | • | 1<br>--- | R/W | |
| E174 | 31D9h<br>--- | Non-linear V/f Frequency 5 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 ; 0.1 to 590.0 Hz<br>0.0: Disable<br>0.1 to 590.0 Hz | 0.0Hz | | | • | 3<br>--- | R/W | |
| E175 | 31DAh<br>--- | Non-linear V/f Voltage 5 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 240 V (for 200 V class series)<br>0 to 500 V (for 400 V class series) | 0V | | | • | 1<br>--- | R/W | |
| E176 | 31DBh<br>--- | Non-linear V/f Frequency 6 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 ; 0.1 to 590.0 Hz<br>0.0: Disable<br>0.1 to 590.0 Hz | 0.0Hz | | | • | 3<br>--- | R/W | |
| E177 | 31DCh<br>--- | Non-linear V/f Voltage 6 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 240 V (for 200 V class series)<br>0 to 500 V (for 400 V class series) | 0V | | | • | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| E178 | 31DDh --- | Non-linear V/f Frequency 7 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0.0 ; 0.1 to 590.0 Hz<br>0.0: Disable<br>0.1 to 590.0 Hz | 0.0Hz | | | • | 3 --- | R/W | |
| E179 | 31DEh --- | Non-linear V/f Voltage 7 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0 to 240 V (for 200 V class series)<br>0 to 500 V (for 400 V class series) | 0V | | | • | 1 --- | R/W | |
| E181 | 31E0h --- | Acceleration Wait Time on Brake Control | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0.000 to 5.000 s | 0.000s | | | • | 7 --- | R/W | |
| E184 | 31E3h --- | Low Current Detection Condition Selection (LOC) | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Output during acceleration/deceleration and constant-speed operation<br>1: Output only during constant-speed operation | 1 | | | • | 1 --- | R/W | |
| E185 | 31E4h --- | Overload Warning Detection Condition Selection (OL1, OL2) | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Output during acceleration/deceleration and constant-speed operation<br>1: Output only during constant-speed operation | 1 | | | • | 1 --- | R/W | |
| E190 | 31E9h --- | STO Reaction Selection | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0 to 6<br>0: Only during RUN command is enabled, display "En"<br>1: Only during RUN command is enabled, warning "EnF"<br>2: Only during RUN command is enabled, alarm "EnF"<br>4: At all times, display "En"<br>5: At all times, warning "EnF"<br>6: At all times, alarm "EnF" | 0 | | | • | 1 --- | R/W | |
| E196 | 31F3h --- | Overtorque/Undertorque Detection Level Reverse Power Running | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0 to 300 % | 100% | | | • | 1 --- | R/W | |
| E197 | 31F4h --- | Overtorquee/Undertorque Detection Level Forward Regeneration | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0 to 300 % | 100% | | | • | 1 --- | R/W | |
| E198 | 31F5h --- | Overtorque/Undertorque Detection Condition Selection | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Output during acceleration/deceleration and constant-speed operation<br>1: Output only during constant-speed operation | 0 | | | • | 1 --- | R/W | |
| E199 | 31F6h --- | 0Hz Detection Output Detection Level (ZS) | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0.00 to 100.00 Hz | 0.00Hz | | | • | 5 --- | R/W | |

## 5-4-3 C Group Parameter List (Freq. Reference and Analog Input Functions)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| C001 | 3242h 3241h | Jump Frequency 1 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.0 to 590.0 Hz | 0.0Hz | ● | | ● | --- 3 | R/W | |
| C002 | 3244h 3243h | Jump Frequency 2 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.0 to 590.0 Hz | 0.0Hz | ● | | ● | --- 3 | R/W | |
| C003 | 3246h 3245h | Jump Frequency 3 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.0 to 590.0 Hz | 0.0Hz | ● | | ● | --- 3 | R/W | |
| C004 | 3247h --- | Jump Frequency Skip Width | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.0 to 30.0 Hz | 3.0Hz | ● | | ● | 3 --- | R/W | |
| C005 | 1218h 1217h | Multi-step Frequency Reference 1 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 590.00 Hz | 0.00Hz | ● | | ● | --- 5 | R/W | |
| C006 | 121Ah 1219h | Multi-step Frequency Reference 2 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 590.00 Hz | 0.00Hz | ● | | ● | --- 5 | R/W | |
| C007 | 121Ch 121Bh | Multi-step Frequency Reference 3 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 590.00 Hz | 0.00Hz | ● | | ● | --- 5 | R/W | |
| C008 | 121Eh 121Dh | Multi-step Frequency Reference 4 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 590.00 Hz | 0.00Hz | ● | | ● | --- 5 | R/W | |
| C009 | 1220h 121Fh | Multi-step Frequency Reference 5 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 590.00 Hz | 0.00Hz | ● | | ● | --- 5 | R/W | |
| C010 | 1222h 1221h | Multi-step Frequency Reference 6 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 590.00 Hz | 0.00Hz | ● | | ● | --- 5 | R/W | |
| C011 | 1224h 1223h | Multi-step Frequency Reference 7 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 590.00 Hz | 0.00Hz | ● | | ● | --- 5 | R/W | |
| C012 | 1226h 1225h | Multi-step Frequency Reference 8 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 590.00 Hz | 0.00Hz | ● | | ● | --- 5 | R/W | |
| C013 | 1228h 1227h | Multi-step Frequency Reference 9 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 590.00 Hz | 0.00Hz | ● | | ● | --- 5 | R/W | |
| C014 | 122Ah 1229h | Multi-step Frequency Reference 10 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 590.00 Hz | 0.00Hz | ● | | ● | --- 5 | R/W | |
| C015 | 122Ch 122Bh | Multi-step Frequency Reference 11 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 590.00 Hz | 0.00Hz | ● | | ● | --- 5 | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| C016 | 122Eh 122Dh | Multi-step Frequency Reference 12 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 590.00 Hz | 0.00Hz | ● | | ● | --- 5 | R/W | |
| C017 | 1230h 122Fh | Multi-step Frequency Reference 13 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 590.00 Hz | 0.00Hz | ● | | ● | --- 5 | R/W | |
| C018 | 1232h 1231h | Multi-step Frequency Reference 14 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 590.00 Hz | 0.00Hz | ● | | ● | --- 5 | R/W | |
| C019 | 1234h 1233h | Multi-step Frequency Reference 15 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 590.00 Hz | 0.00Hz | ● | | ● | --- 5 | R/W | |
| C020 | 1238h 1237h | Jogging Frequency | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 590.00 Hz | 0.00Hz | ● | | ● | --- 5 | R/W | |
| C021 | 3268h --- | Pattern Operation / Timed Operation Mode Selection | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0 to 3 0: 1 cycle operation (Pattern operation) 1: Repetition operation (Pattern operation) 2: Constant speed operation (Pattern operation) after 1 cycle operation 3: Timed operation | 0 | | | ● | 1 --- | R/W | |
| C022 | 3269h --- | Pattern Operation Stage 1 Operation Setting | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0000 to FFFFh Bit15: Operation direction selection 0: Forward 1: Reverse Bit14: Fixed to 0 (Not used) Bit13 to 12: Acceleration/Deceleration time selection 0: 1st Acceleration Time 1(F007)/1st Deceleration Time 1(F008) 1: 2nd Acceleration Time 1(E010)/2nd Deceleration Time 1(E011) 2: 1st Acceleration Time 2(E012)/1st Deceleration Time 2(E013) 3: 2nd Acceleration Time 2(E014)/2nd Deceleration Time 2(E015) Bit11 to 10: Minimum unit of operation time 0: 0.01 1: 0.1 2: 1 3: 10 Bit9 to 0: Data part of operation time 0000 to 03E7h (0.00 to 9.99) if Minimum unit is 0: 0.01 0064 to 03E7h (10.0 to 99.9) if Minimum unit is 1: 0.1 *1 0064 to 03E7h (100 to 999) if Minimum unit is 2: 1 *1 0064 to 0258h (1,000 to 6,000) if Minimum unit is 3: 10 *2 *1. 0000 to 0063h and 03E8 to 03FFh cannot be set. *2. 0000 to 0063h and 0259 to 03FFh cannot be set. | 0 | ● | | ● | 84 --- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| C023 | 326Ah<br>--- | Pattern Operation Stage 2 Operation Setting | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: Operation direction selection<br>0: Forward<br>1: Reverse<br>Bit14: Fixed to 0 (Not used)<br>Bit13 to 12: Acceleration/Deceleration time selection<br>0: 1st Acceleration Time 1(F007)/1st Deceleration Time 1(F008)<br>1: 2nd Acceleration Time 1(E010)/2nd Deceleration Time 1(E011)<br>2: 1st Acceleration Time 2(E012)/1st Deceleration Time 2(E013)<br>3: 2nd Acceleration Time 2(E014)/2nd Deceleration Time 2(E015)<br>Bit11 to 10: Minimum unit of operation time<br>0: 0.01<br>1: 0.1<br>2: 1<br>3: 10<br>Bit9 to 0: Data part of operation time<br>0000 to 03E7h (0.00 to 9.99) if Minimum unit is 0: 0.01<br>0064 to 03E7h (10.0 to 99.9) if Minimum unit is 1: 0.1 *1<br>0064 to 03E7h (100 to 999) if Minimum unit is 2: 1 *1<br>0064 to 0258h (1,000 to 6,000) if Minimum unit is 3: 10 *2<br>*1. 0000 to 0063h and 03E8 to 03FFh cannot be set.<br>*2. 0000 to 0063h and 0259 to 03FFh cannot be set. | 0 | • | | • | 84<br>--- | R/W | |
| C024 | 326Bh<br>--- | Pattern Operation Stage 3 Operation Setting | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: Operation direction selection<br>0: Forward<br>1: Reverse<br>Bit14: Fixed to 0 (Not used)<br>Bit13 to 12: Acceleration/Deceleration time selection<br>0: 1st Acceleration Time 1(F007)/1st Deceleration Time 1(F008)<br>1: 2nd Acceleration Time 1(E010)/2nd Deceleration Time 1(E011)<br>2: 1st Acceleration Time 2(E012)/1st Deceleration Time 2(E013)<br>3: 2nd Acceleration Time 2(E014)/2nd Deceleration Time 2(E015)<br>Bit11 to 10: Minimum unit of operation time<br>0: 0.01<br>1: 0.1<br>2: 1<br>3: 10<br>Bit9 to 0: Data part of operation time<br>0000 to 03E7h (0.00 to 9.99) if Minimum unit is 0: 0.01<br>0064 to 03E7h (10.0 to 99.9) if Minimum unit is 1: 0.1 *1<br>0064 to 03E7h (100 to 999) if Minimum unit is 2: 1 *1<br>0064 to 0258h (1,000 to 6,000) if Minimum unit is 3: 10 *2<br>*1. 0000 to 0063h and 03E8 to 03FFh cannot be set.<br>*2. 0000 to 0063h and 0259 to 03FFh cannot be set. | 0 | • | | • | 84<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| C025 | 326Ch<br>--- | Pattern Operation Stage 4 Operation Setting | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: Operation direction selection<br>0: Forward<br>1: Reverse<br>Bit14: Fixed to 0 (Not used)<br>Bit13 to 12: Acceleration/Deceleration time selection<br>0: 1st Acceleration Time 1(F007)/1st Deceleration Time 1(F008)<br>1: 2nd Acceleration Time 1(E010)/2nd Deceleration Time 1(E011)<br>2: 1st Acceleration Time 2(E012)/1st Deceleration Time 2(E013)<br>3: 2nd Acceleration Time 2(E014)/2nd Deceleration Time 2(E015)<br>Bit11 to 10: Minimum unit of operation time<br>0: 0.01<br>1: 0.1<br>2: 1<br>3: 10<br>Bit9 to 0: Data part of operation time<br>0000 to 03E7h (0.00 to 9.99) if Minimum unit is 0: 0.01<br>0064 to 03E7h (10.0 to 99.9) if Minimum unit is 1: 0.1 *1<br>0064 to 03E7h (100 to 999) if Minimum unit is 2: 1 *1<br>0064 to 0258h (1,000 to 6,000) if Minimum unit is 3: 10 *2<br>*1. 0000 to 0063h and 03E8 to 03FFh cannot be set.<br>*2. 0000 to 0063h and 0259 to 03FFh cannot be set. | 0 | • | | • | 84<br>--- | R/W | |
| C026 | 326Dh<br>--- | Pattern Operation Stage 5 Operation Setting | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: Operation direction selection<br>0: Forward<br>1: Reverse<br>Bit14: Fixed to 0 (Not used)<br>Bit13 to 12: Acceleration/Deceleration time selection<br>0: 1st Acceleration Time 1(F007)/1st Deceleration Time 1(F008)<br>1: 2nd Acceleration Time 1(E010)/2nd Deceleration Time 1(E011)<br>2: 1st Acceleration Time 2(E012)/1st Deceleration Time 2(E013)<br>3: 2nd Acceleration Time 2(E014)/2nd Deceleration Time 2(E015)<br>Bit11 to 10: Minimum unit of operation time<br>0: 0.01<br>1: 0.1<br>2: 1<br>3: 10<br>Bit9 to 0: Data part of operation time<br>0000 to 03E7h (0.00 to 9.99) if Minimum unit is 0: 0.01<br>0064 to 03E7h (10.0 to 99.9) if Minimum unit is 1: 0.1 *1<br>0064 to 03E7h (100 to 999) if Minimum unit is 2: 1 *1<br>0064 to 0258h (1,000 to 6,000) if Minimum unit is 3: 10 *2<br>*1. 0000 to 0063h and 03E8 to 03FFh cannot be set.<br>*2. 0000 to 0063h and 0259 to 03FFh cannot be set. | 0 | • | | • | 84<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| C027 | 326Eh<br>--- | Pattern Operation Stage 6 Operation Setting | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: Operation direction selection<br>0: Forward<br>1: Reverse<br>Bit14: Fixed to 0 (Not used)<br>Bit13 to 12: Acceleration/Deceleration time selection<br>0: 1st Acceleration Time 1(F007)/1st Deceleration Time 1(F008)<br>1: 2nd Acceleration Time 1(E010)/2nd Deceleration Time 1(E011)<br>2: 1st Acceleration Time 2(E012)/1st Deceleration Time 2(E013)<br>3: 2nd Acceleration Time 2(E014)/2nd Deceleration Time 2(E015)<br>Bit11 to 10: Minimum unit of operation time<br>0: 0.01<br>1: 0.1<br>2: 1<br>3: 10<br>Bit9 to 0: Data part of operation time<br>0000 to 03E7h (0.00 to 9.99) if Minimum unit is 0: 0.01<br>0064 to 03E7h (10.0 to 99.9) if Minimum unit is 1: 0.1 *1<br>0064 to 03E7h (100 to 999) if Minimum unit is 2: 1 *1<br>0064 to 0258h (1,000 to 6,000) if Minimum unit is 3: 10 *2<br>*1. 0000 to 0063h and 03E8 to 03FFh cannot be set.<br>*2. 0000 to 0063h and 0259 to 03FFh cannot be set. | 0 | ● | | ● | 84<br>--- | R/W | |
| C028 | 326Fh<br>--- | Pattern Operation Stage 7 Operation Setting | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: Operation direction selection<br>0: Forward<br>1: Reverse<br>Bit14: Fixed to 0 (Not used)<br>Bit13 to 12: Acceleration/Deceleration time selection<br>0: 1st Acceleration Time 1(F007)/1st Deceleration Time 1(F008)<br>1: 2nd Acceleration Time 1(E010)/2nd Deceleration Time 1(E011)<br>2: 1st Acceleration Time 2(E012)/1st Deceleration Time 2(E013)<br>3: 2nd Acceleration Time 2(E014)/2nd Deceleration Time 2(E015)<br>Bit11 to 10: Minimum unit of operation time<br>0: 0.01<br>1: 0.1<br>2: 1<br>3: 10<br>Bit9 to 0: Data part of operation time<br>0000 to 03E7h (0.00 to 9.99) if Minimum unit is 0: 0.01<br>0064 to 03E7h (10.0 to 99.9) if Minimum unit is 1: 0.1 *1<br>0064 to 03E7h (100 to 999) if Minimum unit is 2: 1 *1<br>0064 to 0258h (1,000 to 6,000) if Minimum unit is 3: 10 *2<br>*1. 0000 to 0063h and 03E8 to 03FFh cannot be set.<br>*2. 0000 to 0063h and 0259 to 03FFh cannot be set. | 0 | ● | | ● | 84<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| C027 | 326Eh<br>--- | Pattern Operation Stage 6 Operation Setting | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: Operation direction selection<br>0: Forward<br>1: Reverse<br>Bit14: Fixed to 0 (Not used)<br>Bit13 to 12: Acceleration/Deceleration time selection<br>0: 1st Acceleration Time 1(F007)/1st Deceleration Time 1(F008)<br>1: 2nd Acceleration Time 1(E010)/2nd Deceleration Time 1(E011)<br>2: 1st Acceleration Time 2(E012)/1st Deceleration Time 2(E013)<br>3: 2nd Acceleration Time 2(E014)/2nd Deceleration Time 2(E015)<br>Bit11 to 10: Minimum unit of operation time<br>0: 0.01<br>1: 0.1<br>2: 1<br>3: 10<br>Bit9 to 0: Data part of operation time<br>0000 to 03E7h (0.00 to 9.99) if Minimum unit is 0: 0.01<br>0064 to 03E7h (10.0 to 99.9) if Minimum unit is 1: 0.1 *1<br>0064 to 03E7h (100 to 999) if Minimum unit is 2: 1 *1<br>0064 to 0258h (1,000 to 6,000) if Minimum unit is 3: 10 *2<br>*1. 0000 to 0063h and 03E8 to 03FFh cannot be set.<br>*2. 0000 to 0063h and 0259 to 03FFh cannot be set. | 0 | • | | • | 84<br>--- | R/W | |
| C028 | 326Fh<br>--- | Pattern Operation Stage 7 Operation Setting | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: Operation direction selection<br>0: Forward<br>1: Reverse<br>Bit14: Fixed to 0 (Not used)<br>Bit13 to 12: Acceleration/Deceleration time selection<br>0: 1st Acceleration Time 1(F007)/1st Deceleration Time 1(F008)<br>1: 2nd Acceleration Time 1(E010)/2nd Deceleration Time 1(E011)<br>2: 1st Acceleration Time 2(E012)/1st Deceleration Time 2(E013)<br>3: 2nd Acceleration Time 2(E014)/2nd Deceleration Time 2(E015)<br>Bit11 to 10: Minimum unit of operation time<br>0: 0.01<br>1: 0.1<br>2: 1<br>3: 10<br>Bit9 to 0: Data part of operation time<br>0000 to 03E7h (0.00 to 9.99) if Minimum unit is 0: 0.01<br>0064 to 03E7h (10.0 to 99.9) if Minimum unit is 1: 0.1 *1<br>0064 to 03E7h (100 to 999) if Minimum unit is 2: 1 *1<br>0064 to 0258h (1,000 to 6,000) if Minimum unit is 3: 10 *2<br>*1. 0000 to 0063h and 03E8 to 03FFh cannot be set.<br>*2. 0000 to 0063h and 0259 to 03FFh cannot be set. | 0 | • | | • | 84<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| C030 | 3271h<br>--- | 2nd Frequency Reference Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 15<br>0: Operator (UP and DOWN keys) (balanceless bumpless switching unavailable)<br>1: Analog Voltage Input (Input Terminal [AI1])<br>2: Analog Current Input (Input Terminal [AI2] (AII))<br>3: Analog Voltage Input (Input Terminal [AI1]) + Analog Current Input (Input Terminal [AI2] (AII))<br>5: Analog Voltage Input (Input Terminal [AI2] (AIV))<br>7: UP/DOWN control<br>8: Operator (UP and DOWN keys) (balanceless bumpless switching available)<br>10: Pattern operation<br>12: Pulse train input<br>13: Calculation result<br>14: RS-485 communication<br>15: Fieldbus (Reserved) | 2 | | | • | 1<br>--- | R/W | |
| C031 | 3272h<br>--- | Input Terminal [AI1] Offset | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-5.0 to 5.0 % | 0.0% | • | | • | 4<br>--- | R/W | |
| C032 | 3273h<br>--- | Input Terminal [AI1] Gain (Command) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 400.00 % | 100.00 % | • | | • | 5<br>--- | R/W | |
| C033 | 3274h<br>--- | Input Terminal [AI1] Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 5.00 s | 0.05s | • | | • | 5<br>--- | R/W | |
| C034 | 3275h<br>--- | Input Terminal [AI1] Gain (Analog Input) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 100.00 % | 100.00 % | • | | • | 5<br>--- | R/W | |
| C035 | 3276h<br>--- | Input Terminal [AI1] Polarity Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Bipolar<br>1: Unipolar | 1 | | | • | 1<br>--- | R/W | |
| C050 | 3285h<br>--- | Input Terminal [AI1, AI2] Bias Analog Input for 1st Frequency Command | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 100.00 % | 0.00% | • | | • | 5<br>--- | R/W | |
| C053 | 3288h<br>--- | Input Terminal [AI1, AI2] Normal/Inverse Operation for 1st Frequency Command | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Normal<br>1: Inverse | 0 | • | | • | 1<br>--- | R/W | |
| C054 | 3289h<br>--- | Input Terminal [AI1, AI2] Normal/Inverse Operation for 2nd Frequency Command | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Normal<br>1: Inverse | 0 | • | | • | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| C055 | 328Ah<br>--- | Input Terminal [AI1] Bias (Command) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-200.00 to 200.00 % | 0.00% | • | | • | 6<br>--- | R/W | |
| C056 | 328Bh<br>--- | Input Terminal [AI1] Bias (Analog Input) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 100.00 % | 0.00% | • | | • | 5<br>--- | R/W | |
| C058 | 328Dh<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 2 | • | | • | 1<br>--- | R/W | |
| C059 | 328Eh<br>--- | Input Terminal [AI1] Analog Input Adjustment Maximum Scale | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999.00 to 9990.00 | 100.00 | | | • | 12<br>--- | R/W | |
| C060 | 328Fh<br>--- | Input Terminal [AI1] Analog Input Adjustment Minimum Scale | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999.00 to 9990.00 | 0.00 | | | • | 12<br>--- | R/W | |
| C089 | 32ACh<br>--- | Set-point Factor Numerator via Communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 1 | • | | • | 2<br>--- | R/W | |
| C090 | 32ADh<br>--- | Set-point Factor Denominator via Communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 1 | • | | • | 2<br>--- | R/W | |

## 5-4-4 P Group Parameter List (Motor 1 Parameters)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| P001 | 3301h<br>--- | 1st Motor Pole Number | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>2 to 128 poles | 4Pole | | | • | 1<br>--- | R/W | |
| P002 | 3302h<br>--- | 1st Motor Capacity | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.01 to 1000 kW | 5.50kW | | • | • | 11<br>--- | R/W | |
| P003 | 3303h<br>--- | 1st Motor Rated Current | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 500.0 A | 21.00A | | • | • | 19<br>--- | R/W | |
| P004 | 3304h<br>--- | 1st Auto Tuning Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 5<br>0: Disable<br>1: Tune the motor parameters while stopped<br>2: Tune the motor parameters while rotating<br>4: Tune the PM motor magnetic pole position offset while rotating<br>5: Tune the motor %R1 and %X while stopped | 0 | | | • | 21<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| P005 | 3305h<br>--- | 1st Online Tuning Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Disable<br>1: Enable | 0 | • | | • | 1<br>--- | R/W | |
| P006 | 3306h<br>--- | 1st Motor No-Load Current | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 500.0 A | 10.55A | | • | • | 19<br>--- | R/W | |
| P007 | 3307h<br>--- | 1st Motor Parameter %R1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 50.00 % | 3.17% | • | • | • | 5<br>--- | R/W | |
| P008 | 3308h<br>--- | 1st Motor Parameter %X | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 50.00 % | 11.47% | • | • | • | 5<br>--- | R/W | |
| P009 | 3309h<br>--- | 1st Slip Compensation Gain for Driving | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 200.0 % | 100.0% | • | | • | 3<br>--- | R/W | |
| P010 | 330Ah<br>--- | 1st Slip Compensation Response Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.01 to 10.00 s | 0.12s | • | | • | 5<br>--- | R/W | |
| P011 | 330Bh<br>--- | 1st Slip Compensation Gain for Braking | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 200.0 % | 100.0% | • | | • | 3<br>--- | R/W | |
| P012 | 330Ch<br>--- | 1st Rated Slip Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 15.00 Hz | 1.00Hz | | • | • | 5<br>--- | R/W | |
| P013 | 330Dh<br>--- | 1st Iron Loss Factor 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 20.00 % | 2.86% | • | • | • | 5<br>--- | R/W | |
| P016 | 3310h<br>--- | 1st Magnetic Saturation Factor 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 300.0 % | 92.0% | • | • | • | 3<br>--- | R/W | |
| P017 | 3311h<br>--- | 1st Magnetic Saturation Factor 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 300.0 % | 84.2% | • | • | • | 3<br>--- | R/W | |
| P018 | 3312h<br>--- | 1st Magnetic Saturation Factor 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 300.0 % | 70.5% | • | • | • | 3<br>--- | R/W | |
| P019 | 3313h<br>--- | 1st Magnetic Saturation Factor 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 300.0 % | 58.3% | • | • | • | 3<br>--- | R/W | |
| P020 | 3314h<br>--- | 1st Magnetic Saturation Factor 5 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 300.0 % | 46.1% | • | • | • | 3<br>--- | R/W | |
| P030 | 331Eh<br>--- | 1st PM Motor Starting Method | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 4<br>0: Pull-in by current<br>1: IPM motor type 1<br>2: SPM motor type<br>3: Pull-in by current for IPM motor<br>4: IPM motor type 2 | 1 | | | • | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| P040 | 3328h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 15% | | | • | 1<br>--- | R/W | |
| P041 | 3329h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 1.0% | • | | • | 4<br>--- | R/W | |
| P053 | 3335h<br>--- | 1st Motor %X Correction Factor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 300 % | 100% | • | | • | 1<br>--- | R/W | |
| P055 | 3337h<br>--- | 1st Motor Torque Current under Vector Control | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 500.0 A | 16.71A | | • | • | 19<br>--- | R/W | |
| P056 | 3338h<br>--- | 1st Induced Voltage Factor under Vector Control | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>50 to 100 % | 95% | | • | • | 1<br>--- | R/W | |
| P057 | 3339h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0.137s | • | • | • | 7<br>--- | R/W | |
| P060 | 333Ch<br>--- | 1st PM Motor Armature Resistance | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 50.00 Ω | 0.253ohm | | • | • | 45<br>--- | R/W | |
| P061 | 333Dh<br>--- | 1st PM Motor d-axis Inductance | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 500.0mH | 4.77mH | | • | • | 24<br>--- | R/W | |
| P062 | 333Eh<br>--- | 1st PM Motor q-axis Inductance | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 500.0mH | 10.70mH | | • | • | 24<br>--- | R/W | |
| P063 | 333Fh<br>--- | 1st PM Motor Induced Voltage Ke | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 240 V (200 V class series)<br>0 to 500 V: (400 V class series)<br>Voltage at rated speed | 177V | | • | • | 1<br>--- | R/W | |
| P064 | 3340h<br>--- | 1st PM Motor Iron Loss | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 20.0%<br>100% = Motor rated current<br>Iron loss at rated speed | 5.5% | • | • | • | 3<br>--- | R/W | |
| P065 | 3341h<br>--- | 1st PM Motor d-axis Inductance Magnetic Saturation Correction | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 100.0%<br>999: Factory default<br>100.0% = No magnetic saturation | 32767.0% | • | | • | 3<br>--- | R/W | |
| P074 | 334Ah<br>--- | 1st PM Motor Reference Current at Starting | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>10 to 200%<br>100% = Motor rated current | 80% | • | | • | 1<br>--- | R/W | |
| P083 | 3353h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 32767.0% | • | | • | 3<br>--- | R/W | |
| P084 | 3354h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 32767.0 | | | • | 3<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| P085 | 3355h<br>--- | 1st PM Motor Flux Limitation Value | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>50.0 to 150.0 ; 999<br>50.0 to 150.0%<br>999: Factory default | 32767.0<br>% | • | | • | 3<br>--- | R/W | |
| P086 | 3356h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0.0 | | | • | 3<br>--- | RO | |
| P087 | 3357h<br>--- | 1st PM Motor Reference Current for Magnetic Pole Detection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 200%<br>100% = Motor rated current | 60% | | | • | 1<br>--- | R/W | |
| P088 | 3358h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 32767 | | | • | 1<br>--- | R/W | |
| P089 | 3359h<br>--- | 1st PM Motor Control Switch Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 ; 1 to 100% | 0% | | | • | 1<br>--- | R/W | |
| P090 | 335Ah<br>--- | 1st PM Motor Overcurrent Protection Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 ; 0.01 to 500.0<br>0.00: Disable<br>0.01 to 500.0 A | 50.00A | | • | • | 19<br>--- | R/W | |
| P095 | 335Fh<br>--- | 1st PM Motor Magnetic Pole position Offset | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 359.9 ; 999<br>0.0 to 359.9°<br>999: Offset not adjusted | 32767.0<br>deg | • | | • | 3<br>--- | R/W | |

## 5-4-5 H Group Parameter List (High Level Functions)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| H003 | 33C3h<br>--- | Data Initialization | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 8<br>0: Disable<br>1: Initialize all parameters<br>2: Initialize motor 1 parameters<br>3: Initialize motor 2 parameters<br>4: Restore user defined data<br>5: Initialize all parameters (except I/O and communications)<br>6: Initialize Drive App parameters<br>7: Clear alarm history<br>8: Clear selection of favorite parameters | 0 | | | | 1<br>--- | R/W | |
| H004 | 33C4h<br>--- | Retry Count at Trip | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 ; 1 to 20<br>0: Disable<br>1 to 20 | 0 | • | | • | 1<br>--- | R/W | |
| H005 | 33C5h<br>--- | Retry Standby Time at Trip | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.5 to 20.0 s | 5.0s | • | | • | 3<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| H006 | 33C6h<br>--- | Cooling Fan Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2<br>0: Always Fan ON<br>1: ON/OFF control effective<br>2: ON/OFF control effective (according to only internal temperature) | 0 | ● | | ● | 1<br>--- | R/W | |
| H007 | 33C7h<br>--- | Acceleration/Deceleration Pattern Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Disable (Linear acceleration/deceleration)<br>1: S-curve acceleration/deceleration (Weak)<br>2: S-curve acceleration/deceleration (Arbitrary: According to H057 to H060)<br>3: Curve acceleration/deceleration | 0 | ● | | ● | 1<br>--- | R/W | |
| H008 | 33C8h<br>--- | Reverse Rotation Prevention Function | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2<br>0: Disable<br>1: Reverse rotation inhibited<br>2: Forward rotation inhibited | 0 | | | ● | 1<br>--- | R/W | |
| H009 | 33C9h<br>--- | Starting Mode Auto Search Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2<br>0: Disable<br>1: Enable only at restart after momentary power failure<br>2: Enable at normal start and restart after momentary power failure | 0 | | | ● | 1<br>--- | R/W | |
| H011 | 33CBh<br>--- | Stop Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Normal deceleration<br>1: Free run stop | 0 | ● | | ● | 1<br>--- | R/W | |
| H012 | 33CCh<br>--- | Instantaneous Overcurrent Limiting Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Disable<br>1: Enable | 1 | ● | | ● | 1<br>--- | R/W | |
| H013 | 33CDh<br>--- | Powe Interruption Restart Wait Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.1 to 100.0 s | 0.5s | ● | ● | ● | 3<br>--- | R/W | |
| H014 | 33CEh<br>--- | Deceleration Setting During Current Limit for Restart Mode after Power Interruption | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 ; 0.01 to 100.00 ; 999<br>0.00: Selected deceleration time<br>0.01 to 100.00 Hz/s<br>999: According to current limiter | 999<br>(32767) | ● | | ● | 5<br>--- | R/W | |
| H015 | 33CFh<br>--- | Continuous Running Voltage Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>200 to 300 V (200 V class series)<br>400 to 600 V (400 V class series) | 235V | ● | ● | ● | 1<br>--- | R/W | |
| H016 | 33D0h<br>--- | Allowable Time for Power Interruption Restart | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 30.0 ; 999<br>0.0 to 30.0 s<br>999: Auto judgment | 999<br>(32767) | ● | | ● | 3<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| H018 | 33D2h<br>--- | Torque Control Operate Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Disable (Speed control)<br>2: Torque current command input<br>3: Torque command input | 0 | | | • | 1<br>--- | R/W | |
| H026 | 33DAh<br>--- | Thermistor Function Selection (MOH) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Disable<br>1: PTC (Inverter immediately trips with OH4 displayed)<br>2: PTC (Inverter issues output signal MOH and continues to run) | 0 | • | | • | 1<br>--- | R/W | |
| H027 | 33DBh<br>--- | 1st Thermistor Error Detection Level (MOH) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 5.00 V | 1.60V | • | | • | 5<br>--- | R/W | |
| H028 | 33DCh<br>--- | Droop Control | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-60.0 to 0.0 Hz | 0.0Hz | • | | • | 4<br>--- | R/W | |
| H042 | 33EAh<br>--- | Main Circuit Capacitor Service Life Coefficient (Measurement Value) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 ; 1 ; 2 to 65535<br>0: Start measurement<br>1: Measurement failure<br>2 to 65535: Measurement value | 0 | • | | • | 1<br>--- | R/W | |
| H043 | 33EBh<br>--- | Cumulative Run Time of Cooling Fan | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9,999 (in 10 hours) | 0x10h | • | | • | 74<br>--- | R/W | |
| H044 | 33ECh<br>--- | 1st Startup Count for Motor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65,535 | 0 | • | | • | 1<br>--- | R/W | |
| H045 | 33EDh<br>--- | Mock Alarm | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Disable<br>1: Enable (Generate mock alarm) | 0 | • | | • | 1<br>--- | R/W | |
| H046 | 33EEh<br>--- | Auto Search Delay Time 2 for Starting Mode | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.1 to 100.0 s | 1.0s | • | • | • | 3<br>--- | R/W | |
| H047 | 33EFh<br>--- | Main Circuit Capacitor Service Life Coefficient (Initial Value) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 ; 1 ; 2 to 65535<br>0: Start measurement<br>1: Measurement failure<br>2 to 65535: Measurement value | 0 | • | | • | 1<br>--- | R/W | |
| H048 | 33F0h<br>--- | Cumulative Run Time of Capacitors on Printed Circuit Boards | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 (in 10 hours) | 0x10h | • | | • | 74<br>--- | R/W | |
| H049 | 33F1h<br>--- | Auto Search Delay Time 1 for Starting Characteristic | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 10.0 s | 0.0s | • | | • | 3<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| H054 | 33F7h 33F6h | Jogging Acceleration Time | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0.00 to 6000 s | 6.00s | • | | • | --- 6 | R/W | |
| H055 | 33F9h 33F8h | Jogging Deceleration Time | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0.00 to 6000 s | 6.00s | • | | • | --- 6 | R/W | |
| H056 | 33FBh 33FAh | Deceleration Time for Forced Stop | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0.00 to 6000 s | 6.00s | • | | • | --- 6 | R/W | |
| H057 | 33FCh --- | S-curve Acceleration Range Frequency at Starting | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0 to 100 % | 10% | • | | • | 1 --- | R/W | |
| H058 | 33FDh --- | S-curve Acceleration Range Frequency at End | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0 to 100 % | 10% | • | | • | 1 --- | R/W | |
| H059 | 33FEh --- | S-curve Deceleration Range Frequency at Starting | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0 to 100 % | 10% | • | | • | 1 --- | R/W | |
| H060 | 33FFh --- | S-curve Deceleration Range Frequency at End | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0 to 100 % | 10% | • | | • | 1 --- | R/W | |
| H061 | 3400h --- | UP/DOWN Control Initial Value Selection | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0 to 1<br>0: 0.00Hz<br>1: Last UP/DOWN command value | 1 | | | • | 1 --- | R/W | |
| H063 | 3402h --- | Frequency Lower Limit Operation Selection | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Frequency Command is the Frequency Lower Limit.<br>1: Frequency Command is 0Hz | 0 | • | | • | 1 --- | R/W | |
| H064 | 3403h --- | Low Frequency during Protecting Overload | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0.0 ; 0.1 to 590.0<br>0.0: Depends on Frequency Lower Limit(F16)<br>0.1 to 590.0 Hz | 1.6Hz | • | | • | 3 --- | R/W | |
| H067 | 3406h --- | Auto Energy Saving Operation Condition Selection | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Enable only at constant speed<br>1: Enable in all modes | 0 | • | | • | 1 --- | R/W | |
| H068 | 3407h --- | 1st Slip Compensation Operating Conditions Selection | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Enable during acceleration/deceleration, enable at base frequency or higher<br>1: Disable during acceleration/deceleration, enable at base frequency or higher<br>2: Enable during acceleration/deceleration, disable at base frequency or higher<br>3: Disable during acceleration/deceleration, at base frequency or higher | 0 | | | • | 1 --- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| H069 | 3408h<br>--- | Anti-regenerative Control Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 5<br>0: Disable<br>2: Torque limit control with forced stop after three times deceleration time has passed<br>3: Main Circuit DC Voltage control with forced stop after three times deceleration time has passed<br>4: Torque limit control without forced stop<br>5: Main Circuit DC Voltage control without force-to-stop | 0 | ● | | ● | 1<br>--- | R/W | |
| H070 | 3409h<br>--- | Overload Prevention Control | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 ; 0.01 to 100.00 ; 999<br>0.00: Depend on selected deceleration time<br>0.01 to 100.00 Hz/s<br>999: Cancel | 999<br>(32767) | ● | | ● | 5<br>--- | R/W | |
| H071 | 340Ah<br>--- | Over-Excitation Control Selection during Deceleration Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Disable<br>1: Enable | 0 | ● | | ● | 1<br>--- | R/W | |
| H072 | 340Bh<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 1 | ● | | ● | 1<br>--- | R/W | |
| H074 | 340Dh<br>--- | Torque Limit Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Torque limit<br>1: Torque current limit | 1 | | | ● | 1<br>--- | R/W | |
| H075 | 340Eh<br>--- | Torque Limit Operation Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Four quadrants independent<br>1: Four quadrants identical | 0 | | | ● | 1<br>--- | R/W | |
| H076 | 340Fh<br>--- | Frequency Rising Limit for Torque Limit | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 590.0 Hz | 5.0Hz | ● | | ● | 3<br>--- | R/W | |
| H077 | 3410h<br>--- | Service Life of Main Circuit Capacitor Remaining Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 8760 (in 10 hours) | 8760x10h | ● | | ● | 74<br>--- | R/W | |
| H078 | 3412h<br>3411h | 1st Motor Maintenance Interval | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 ; 1 to 9999<br>0: Disable<br>1 to 9999 (in 10 hours) | 8760x10h | ● | | ● | ---<br>74 | R/W | |
| H079 | 3413h<br>--- | 1st Preset Startup Count for Motor Maintenance | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 ; 1 to 65535<br>0: Disable<br>1 to 65,535 | 0 | ● | | ● | 1<br>--- | R/W | |
| H080 | 3414h<br>--- | 1st Output Current Fluctuation Damping Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 1.00 | 0.20 | ● | | ● | 5<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
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| H081 | 3415h<br>--- | Light Alarm Selection 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | • | | • | 1<br>--- | R/W | |
| H082 | 3416h<br>--- | Light Alarm Selection 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | • | | • | 1<br>--- | R/W | |
| H084 | 3418h<br>--- | Pre-excitation Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>100 to 400 % | 100% | • | | • | 1<br>--- | R/W | |
| H085 | 3419h<br>--- | Pre-excitation Timer | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 ; 0.01 to 30.00<br>0.00: Disable<br>0.01 to 30.00 s | 0.00s | • | | • | 5<br>--- | R/W | |
| H086 | 341Ah<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0 | • | | • | 1<br>--- | R/W | |
| H089 | 341Dh<br>--- | Motor Electronic Thermal Overload Protection Data Retention | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Disable<br>1: Enable | 1 | • | | • | 1<br>--- | R/W | |
| H090 | 341Eh<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0 | • | | • | 1<br>--- | R/W | |
| H092 | 3420h<br>--- | Continuous Running at the Momentary Power Failure P Proportional Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 10.000 ; 999<br>0.000 to 10.000<br>999: Auto | 999<br>(32767) | • | | • | 7<br>--- | R/W | |
| H093 | 3421h<br>--- | Continuous Running at the Momentary Power Failure Integral Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.010 to 10.000 ; 999<br>0.010 to 10.000 s<br>999: Auto | 999<br>(32767) | • | | • | 7<br>--- | R/W | |
| H094 | 3423h<br>3422h | 1st Cumulative Motor Run Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 (in 10 hours) | 0x10h | | | • | ---<br>74 | R/W | |
| H095 | 3424h<br>--- | DC Injection Braking Start Characteristic Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Slow response<br>1: Quick response | 1 | • | | • | 1<br>--- | R/W | |
| H096 | 3425h<br>--- | STOP Key Priority/Start Check Function | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Disable STOP key priority, disable start check function<br>1: Enable STOP key priority, disable start check function<br>2: Disable STOP key priority, enable start check function<br>3: Enable STOP key priority, enable start check function | 0 | • | | • | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
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| H098 | 3427h<br>--- | Protection/Maintenance Function Mode Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255<br>Bit7: Reserved<br>Bit6: Braking transistor error detection<br>0: Disable<br>1: Enable<br>Bit5: Detect charge register overheat<br>0: Enable<br>1: Disable<br>Bit4: Judge main circuit capacitor life<br>0: Disable<br>1: Enable<br>Bit3: Main circuit capacitor life judgment selection<br>0: Factory default standard<br>1: User measurement value standard<br>Bit0 to 2: Reserved | 80 | • | | • | 1<br>--- | R/W | |
| H099 | 3428h<br>--- | Password 2 Setting/Verification | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | • | | | 1<br>--- | R/W | |
| H114 | 348Eh<br>--- | Anti-regenerative Control Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 50.0 ; 999<br>0.0 to 50.0 %<br>999: Auto | 999<br>(32767) | • | | • | 3<br>--- | R/W | |
| H116 | 3490h<br>--- | Fire Mode (Mode selection) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 22<br>0: FMS ON (Mode 1)<br>1: FMS Toggle (Mode 1)<br>2: FMS Latch (Mode 1)<br>10: FMS ON (Mode 2)<br>11: FMS Toggle (Mode 2)<br>12: FMS Latch (Mode 2)<br>20: FMS ON (Mode 3)<br>21: FMS Toggle (Mode 3)<br>22: FMS Latch (Mode 3) | 0 | | | • | 1<br>--- | R/W | |
| H117 | 3491h<br>--- | Fire Mode (Confirmation time) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.5 to 10.0 s | 3.0s | • | | • | 3<br>--- | R/W | |
| H118 | 3492h<br>--- | Fire Mode (Reference frequency) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 ; 0.1 to 590.0Hz<br>0.0: Follow the ordinary reference frequency<br>0.1 to 590.0 Hz | 0.0Hz | • | | • | 3<br>--- | R/W | |
| H119 | 3493h<br>--- | Fire Mode (Rotation direction) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Follow the run command specified with F02, etc.<br>2: Forward rotation<br>3: Reverse rotation | 0 | | | • | 1<br>--- | R/W | |
| H120 | 3494h<br>--- | Fire Mode (Start method) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Follows the start methods specified with power failure<br>1: Auto search | 0 | • | | • | 1<br>--- | R/W | |
| H121 | 3495h<br>--- | Fire Mode (Reset interval) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.5 to 20.0 s | 5.0s | • | | • | 3<br>--- | R/W | |

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| H130 | 349Eh<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 999<br>(32767) | • | | • | 7<br>--- | R/W | |
| H131 | 349Fh<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 999<br>(32767) | • | | • | 7<br>--- | R/W | |
| H133 | 34A1h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 999<br>(32767) | • | | • | 7<br>--- | R/W | |
| H134 | 34A2h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 999<br>(32767) | • | | • | 7<br>--- | R/W | |
| H147 | 34AFh<br>--- | Speed Control Jogging Feed Forward Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99.99 s | 0.00s | • | | • | 5<br>--- | R/W | |
| H154 | 34B6h<br>--- | Torque Bias Function Selec-tion | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 5<br>0: Invalid<br>1: Operator (H155 to H157)<br>2: Analog input<br>4: RS-485 communication<br>5: Fieldbus (Reserved) | 0 | | | • | 1<br>--- | R/W | |
| H155 | 34B7h<br>--- | Torque Bias Level 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-300 to +300 % | 0% | • | | • | 2<br>--- | R/W | |
| H156 | 34B8h<br>--- | Torque Bias Level 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-300 to +300 % | 0% | • | | • | 2<br>--- | R/W | |
| H157 | 34B9h<br>--- | Torque Bias Level 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-300 to +300 % | 0% | • | | • | 2<br>--- | R/W | |
| H158 | 34BAh<br>--- | Torque Bias Mechanical Loss Compensation | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 300 % | 0% | • | | • | 1<br>--- | R/W | |
| H159 | 34BBh<br>--- | Torque Bias Startup Timer | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 1.00 s | 0.00s | | | • | 5<br>--- | R/W | |
| H161 | 34BDh<br>--- | Torque Bias Shutdown Timer | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 1.00 s | 0.00s | | | • | 5<br>--- | R/W | |
| H162 | 34BEh<br>--- | Torque Bias Limit | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 300 % | 200% | | | • | 1<br>--- | R/W | |
| H173 | 34C9h<br>--- | Magnetic Flux Level at Light Load | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>10 to 100% | 100% | • | | • | 1<br>--- | R/W | |
| H180 | 34D0h<br>--- | Brake Error De-tection Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 10.00 s | 1.00s | • | | • | 5<br>--- | R/W | |
| H185 | 34D5h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0 | | | • | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| H190 | 34DAh<br>--- | Output phase order selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Normal (UVW)<br>1: Inverse (UWV) | 0 | | | • | 1<br>--- | R/W | |
| H193 | 34DDh<br>--- | User Preference Dataset Registration | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Disable<br>1: Store | 0 | | | | 1<br>--- | R/W | |
| H194 | 34DEh<br>--- | User Preference Dataset Protection Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Unprotected<br>1: Protected | 0 | • | | • | 1<br>--- | R/W | |
| H195 | 34DFh<br>--- | DC Injection Braking Startup Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 ; 0.01 to 30.00<br>0.00: Disable<br>0.01 to 30.00 s<br>Only motor 1 is effective | 0.00s | • | | • | 5<br>--- | R/W | |
| H196 | 34E0h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 999<br>(32767) | • | | • | 7<br>--- | R/W | |
| H197 | 34E1h<br>--- | User password 1 Mode selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2<br>0: Display all, but prevent changes<br>1: Display and allow changes in quick-setup only<br>2: Do not use | 0 | • | | • | 1<br>--- | R/W | |
| H198 | 34E2h<br>--- | User Password 1 Setting/Verification | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | • | | | 1<br>--- | R/W | |
| H199 | 34E3h<br>--- | User Password 1 Setting | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Disable<br>1: Protected | 0 | • | | | 1<br>--- | R/W | |
| H309 | 360Ah<br>--- | Output Terminal [DO1] ON Delay Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 100.0 s | 0.0s | | | • | 3<br>--- | R/W | |
| H310 | 360Bh<br>--- | Output Terminal[DO1] OFF Delay Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 100.0 s | 0.0s | | | • | 3<br>--- | R/W | |
| H313 | 360Eh<br>--- | Output Terminal [ROA, ROB] ON Delay Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 100.0 s | 0.0s | | | • | 3<br>--- | R/W | |
| H314 | 360Fh<br>--- | Output Terminal [ROA, ROB] OFF Delay Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 100.0 s | 0.0s | | | • | 3<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
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| H315 | 3610h<br>--- | Logical Expression 1 Operation Target 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Refer to other sheet<br>* 27,100,206,207,208 Can't be selected | 0 | | | • | 1<br>--- | R/W | |
| H316 | 3611h<br>--- | Logical Expression 1 Operation Target 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Refer to other sheet<br>* 27,100,206,207,208 Can't be selected | 0 | | | • | 1<br>--- | R/W | |
| H317 | 3612h<br>--- | Logical Expression 1 Logical Operator | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2<br>0: AND<br>1: OR<br>2: XOR | 0 | | | • | 1<br>--- | R/W | |
| H318 | 3613h<br>--- | Logical Expression 2 Operation Target 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Refer to other sheet<br>* 27,100,206,207,208 Can't be selected | 0 | | | • | 1<br>--- | R/W | |
| H319 | 3614h<br>--- | Logical Expression 2 Operation Target 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Refer to other sheet<br>* 27,100,206,207,208 Can't be selected | 0 | | | • | 1<br>--- | R/W | |
| H320 | 3615h<br>--- | Logical Expression 2 Logical Operator | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2<br>0: AND<br>1: OR<br>2: XOR | 0 | | | • | 1<br>--- | R/W | |
| H321 | 3616h<br>--- | Logical Expression 3 Operation Target 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Refer to other sheet<br>* 27,100,206,207,208 Can't be selected | 0 | | | • | 1<br>--- | R/W | |
| H322 | 3617h<br>--- | Logical Expression 3 Operation Target 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Refer to other sheet<br>* 27,100,206,207,208 Can't be selected | 0 | | | • | 1<br>--- | R/W | |
| H323 | 3618h<br>--- | Logical Expression 3 Logical Operator | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2<br>0: AND<br>1: OR<br>2: XOR | 0 | | | • | 1<br>--- | R/W | |
| H324 | 3619h<br>--- | Input Terminal [DI1] Response Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 400 ms | 1ms | | | • | 1<br>--- | R/W | |
| H325 | 361Ah<br>--- | Input Terminal [DI2] Response Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 400 ms | 1ms | | | • | 1<br>--- | R/W | |
| H326 | 361Bh<br>--- | Input Terminal [DI3] Response Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 400 ms | 1ms | | | • | 1<br>--- | R/W | |
| H327 | 361Ch<br>--- | Input Terminal [DI4] Response Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 400 ms | 1ms | | | • | 1<br>--- | R/W | |
| H328 | 361Dh<br>--- | Input Terminal [DI5] Response Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 400 ms | 1ms | | | • | 1<br>--- | R/W | |

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| H329 | 361Eh<br>--- | Input Terminal [DI6] Response Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 400 ms | 1ms | | | • | 1<br>--- | R/W | |
| H330 | 361Fh<br>--- | Input Terminal [DI7] Response Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 400 ms | 1ms | | | • | 1<br>--- | R/W | |
| H332 | 3621h<br>--- | Torque Reference Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 5<br>0: Analog input<br>2: Operator (H333)<br>4: RS-485 communication<br>5: Fieldbus (Reserved) | 0 | | | • | 1<br>--- | R/W | |
| H333 | 3622h<br>--- | Torque Reference | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 200 % | 0% | • | | • | 1<br>--- | R/W | |
| H334 | 3623h<br>--- | Torque Bias Polarity Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: As signed<br>1: Depend on run direction | 0 | | | • | 1<br>--- | R/W | |
| H411 | 36CFh<br>--- | Input Phase Loss Protection Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Disable (Continue to run)<br>1: Enable (Trip) | 1 | • | | • | 1<br>--- | R/W | |
| H412 | 36D0h<br>--- | Output Phase Loss Protection Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Disable (Continue to run)<br>1: Enable (Trip) | 0 | • | | • | 1<br>--- | R/W | |
| H413 | 36D1h<br>--- | Silent inverter operation | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Normal operation (default)<br>1: Silent operation | 0 | | | • | 1<br>--- | R/W | |
| H435 | 36EDh<br>--- | Touch Probe 1 Source | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 6<br>1: External Latch Input 1 (EXT1)<br>2: External Latch Input 2 (EXT2)<br>6: Phase Z | 1 | | | • | 1<br>--- | R/W | |
| H436 | 36EEh<br>--- | Touch Probe 2 Source | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 6<br>1: External Latch Input 1 (EXT1)<br>2: External Latch Input 2 (EXT2)<br>6:Phase Z | 2 | | | • | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| H437 | 36EFh<br>--- | Touch Probe Function | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15 to 13: Fixed to 0<br>Bit12: Latch operation 2<br>0: Disable<br>1: Enable<br>Bit11 to 10: Latch trigger 2<br>00: EXT2<br>01: Phase Z<br>10: H435/H436 (60D0h)<br>11: Reserved (No-trigger)<br>Bit9: Latch mode 2<br>0: Trigger First Event Mode<br>1: Continuous Mode<br>Bit8: Latch function 2<br>0: Disable<br>1: Enable<br>Bit7 to 5: Fixed to 0<br>Bit4: Latch operation 1<br>0: Disable<br>1: Enable<br>Bit3 to 2: Latch trigger 1<br>00: EXT1<br>01: Phase Z<br>10: H435/H436 (60D0h)<br>11: Reserved (No-trigger)<br>Bit1: Latch mode 1<br>0: Trigger First Event Mode<br>1: Continuous Mode)<br>Bit0: Latch function 1<br>0: Disable<br>1: Enable | 0 | • | | • | 1<br>--- | R/W | |
| H438 | 36F0h<br>--- | Feedback Value Comparison Signal Off Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 100.0% | 100.0% | | | • | 3<br>--- | R/W | |
| H439 | 36F1h<br>--- | Feedback Value Comparison Signal On Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 100.0% | 0.0% | | | • | 3<br>--- | R/W | |
| H440 | 36F2h<br>--- | Free Run Stop Restart Allow-able Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 30.0 s | 30.0s | | | • | 3<br>--- | R/W | |
| H441 | 36F3h<br>--- | Free Run Stop Restart Opera-tion Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 2<br>1: Starting with matching frequency<br>2: Starting with active matching frequency | 2 | | | • | 1<br>--- | R/W | |
| H442 | 36F4h<br>--- | Slip compensa-tion Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Disable<br>1: Enable | 0 | • | | • | 1<br>--- | R/W | |
| H443 | 36F6h<br>36F5h | UP/DOWN con-trol (Preset fre-quency) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 590.00 Hz | 0.00Hz | • | | • | ---<br>5 | R/W | |
| H444 | 36F8h<br>36F7h | UP/DOWN con-trol (Preset PID command) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999.00 to 9990.00 | 0.00 | • | | • | ---<br>6 | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| H449 | 36FCh<br>--- | Drive app operation | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Inactive<br>1: Active | 0 | | | • | 1<br>--- | R/W | |
| H451 | 372Fh<br>372Eh | Braking resistor rated power | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.001 to 99.99 kW | 0.001kW | • | | • | ---<br>7 | R/W | |
| H452 | 3731h<br>3730h | Braking resistor resistance | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.01 to 999 Ω | 0.01ohm | • | | • | ---<br>5 | R/W | |
| H453 | 3733h<br>3732h | Display Coefficient 1 for Transport Time / Auxiliary Display Coefficient 1 for Speed Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 9999 | 1.000 | • | | • | ---<br>7 | R/W | |
| H454 | 3735h<br>3734h | Display Coefficient for Integrated Power | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 ; 0.001 to 9999<br>0.000: Cancel and reset<br>0.001 to 9999 | 0.010 | • | | • | ---<br>7 | R/W | |
| H455 | 3737h<br>3736h | Input Terminal [AI1] Analog Input Adjustment Maximum Scale | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999.00 to 9990.00 | 100.00 | | | • | ---<br>6 | R/W | |
| H456 | 3739h<br>3738h | Input Terminal [AI1] Analog Input Adjustment Minimum Scale | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999.00 to 9990.00 | 0.00 | | | • | ---<br>6 | R/W | |
| H461 | 3742h<br>--- | 1st PM Motor Armature Resistance | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 50.00 Ω | 0.253ohm | | • | • | 7<br>--- | R/W | |
| H462 | 3743h<br>--- | 1st PM Motor d-axis Inductance | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 500.0mH | 4.77mH | | • | • | 5<br>--- | R/W | |
| H463 | 3744h<br>--- | 1st PM Motor q-axis Inductance | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 500.0mH | 10.70mH | | • | • | 5<br>--- | R/W | |
| H464 | 3746h<br>3745h | 2nd Display Coefficient for Transport time / Auxiliary Display Coefficient for Speed Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 9999 | 1.000 | • | | • | ---<br>7 | R/W | |
| H465 | 3748h<br>3747h | PID Control Maximum Scale | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999.00 to 9990.00 | 100.00 | | | • | ---<br>6 | R/W | |
| H466 | 374Ah<br>3749h | PID Control Minimum Scale | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999.00 to 9990.00 | 0.00 | | | • | ---<br>6 | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| H467 | 374Ch 374Bh | PID Control Multistep PID Command 1 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV -999.00 to 9990.00 | 0.00 | ● | | ● | --- 6 | R/W | |
| H468 | 374Eh 374Dh | PID Control Multistep PID Command 2 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV -999.00 to 9990.00 | 0.00 | ● | | ● | --- 6 | R/W | |
| H469 | 3750h 374Fh | PID Control Multistep PID Command 3 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV -999.00 to 9990.00 | 0.00 | ● | | ● | --- 6 | R/W | |
| H470 | 3752h 3751h | Deceleration Time for Homing/Orientation | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.00 to 6000 s | 6.00s | ● | | ● | --- 5 | R/W | |
| H489 | 3723h --- | Er5 communications error processing | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0 to 14 0: Immediately trip with alarm Er5 1: Trip with alarm Er5 after running for the period specified by timer H490 2: Retry during the period specified by timer H490. If the retry fails trip with alarm Er5. If it succeeds continue to run. 3: Continue to run 4: Immediately trip with alarm Er5 5: Immediately trip with alarm Er5 6: Immediately trip with alarm Er5 7: Immediately trip with alarm Er5 8: Immediately trip with alarm Er5 9: Immediately trip with alarm Er5 10: Trip with alarm Er5 after deceleration stop 11: Deceleration stop after running for the period specified by timer H490 and then trip with alarm Er5. 12: Retry during the period specified by timer H490. If the retry fails, trip with alarm Er5 after deceleration stop. If it succeeds, continue to run. 13: Coast to a stop 14: Deceleration stop | 0 | ● | | ● | 1 --- | R/W | |
| H490 | 3724h --- | Er5 timer | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0.0 to 60.0 s | 0.0 | ● | | ● | 3 --- | R/W | |
| H491 | 3725h --- | Frequency Display Unit Selection | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0 to 4 0 : 0.01 Hz 1 : 0.01% (100% : Maximum output frequency) 2 : Revolutions Per Minute (rpm) 3 : User units (Set with H492) 4 : 0.1 Hz | 0 | | | ● | 1 --- | R/W | |
| H492 | 3726h --- | User Units Maximum Value | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 1 to 60000 Sets the value that the drive shows as the maximum output frequency. | 6000 | | | ● | 1 --- | R/W | |
| H493 | 3727h --- | Torque Reference/Limit by Comm | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0 to 1 0 : Disabled 1 : Enabled | 0 | | | ● | 1 --- | R/W | |

## 5-4-6 A Group Parameter List (Motor 2 Parameters)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| A001 | 3841h<br>--- | 2nd Maximum Output Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>5.0 to 590.0 Hz | 60.0Hz | | | ● | 3<br>--- | R/W | |
| A002 | 3842h<br>--- | 2nd Base Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>5.0 to 590.0 Hz | 50.0Hz | | | ● | 3<br>--- | R/W | |
| A003 | 3843h<br>--- | 2nd Rated Voltage at Base Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>80 to 240 V (200 V class series)<br>160 to 500 V (400 V class series) | 200V | | ● | ● | 1<br>--- | R/W | |
| A004 | 3844h<br>--- | 2nd Rated Voltage at Maximum Output Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>80 to 240 V (200 V class series)<br>160 to 500 V (400 V class series) | 200V | | ● | ● | 1<br>--- | R/W | |
| A005 | 3845h<br>--- | 2nd Manual Torque Boost Voltage | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 20.0 %<br>Percentage with respect to 2nd rated voltage at base frequency (A003) | 1.9% | ● | ● | ● | 3<br>--- | R/W | |
| A006 | 3846h<br>--- | 2nd Motor Electronic Thermal Characteristic selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 2<br>1: For a general-purpose motor with shaft-driven cooling fan<br>2: For an inverter-driven motor non-ventilated motor or motor with separately powered cooling fan | 1 | ● | | ● | 1<br>--- | R/W | |
| A007 | 3847h<br>--- | 2nd Motor Electronic Thermal Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 ; 0.01 to 118.8<br>0.00: Disable<br>0.01 to 118.8 A<br><br># Setting range is from 1%(HHD) to 135%(ND) of inverter rated current. | 21.00A | ● | ● | ● | 19<br>--- | R/W | |
| A008 | 3848h<br>--- | 2nd Motor Electronic Thermal Time Constant | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.5 to 75.0 min | 5.0min | ● | | ● | 3<br>--- | R/W | |
| A009 | 3849h<br>--- | 2nd DC Injection Braking Start Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 60.0 Hz | 0.0Hz | ● | | ● | 3<br>--- | R/W | |
| A010 | 384Ah<br>--- | 2nd DC Injection Braking Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 100% (HHD mode)<br>0 to 80% (HND/HD mode)<br>0 to 60% (ND mode)<br>Based on inverter rated current | 0% | ● | | ● | 1<br>--- | R/W | |
| A011 | 384Bh<br>--- | 2nd DC Injection Braking Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 ; 0.01 to 30.00<br>0.00: Disable<br>0.01 to 30.00 s | 0.00s | ● | | ● | 5<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| A012 | 384Ch<br>--- | 2nd Starting Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 60.0 Hz | 0.5Hz | ● | | ● | 3<br>--- | R/W | |
| A013 | 384Dh<br>--- | 2nd V/f Characteristics Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Variable torque load<br>1: Constant torque load | 1 | | | ● | 1<br>--- | R/W | |
| A014 | 384Eh<br>--- | 2nd Drive Control Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 6<br>0: IM V/f control<br>1: IM Dynamic torque vector control without speed sensor<br>3: IM V/f control with speed sensor<br>4: IM Dynamic torque vector control with speed sensor<br>5: IM Vector control without speed sensor<br>6: IM Vector control with speed sensor | 0 | | | ● | 1<br>--- | R/W | |
| A015 | 384Fh<br>--- | 2nd Motor Pole Number | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>2 to 128 poles | 4Pole | | | ● | 1<br>--- | R/W | |
| A016 | 3850h<br>--- | 2nd Motor Capacity | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.01 to 1000 kW | 5.50kW | | ● | ● | 11<br>--- | R/W | |
| A017 | 3851h<br>--- | 2nd Motor Rated Current | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 500.0 A | 21.00A | | ● | ● | 19<br>--- | R/W | |
| A018 | 3852h<br>--- | 2nd Auto-tuning Selection Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 5<br>0: Disable<br>1: Tune the motor parameters while stopped<br>2: Tune the motor parameters while rotating<br>5: Tune the motor %R1 and %X while stopped | 0 | | | ● | 21<br>--- | R/W | |
| A019 | 3853h<br>--- | 2nd Online tuning Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Disable<br>1: Enable | 0 | ● | | ● | 1<br>--- | R/W | |
| A020 | 3854h<br>--- | 2nd Motor No-Load Current | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 500.0 A | 10.55A | | ● | ● | 19<br>--- | R/W | |
| A021 | 3855h<br>--- | 2nd Motor Motor Constant %R1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 50.00 % | 3.17% | ● | ● | ● | 5<br>--- | R/W | |
| A022 | 3856h<br>--- | 2nd Motor Motor Constant %X | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 50.00 % | 11.47% | ● | ● | ● | 5<br>--- | R/W | |
| A023 | 3857h<br>--- | 2nd Slip Compensation Gain for Driving | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 200.0 % | 100.0% | ● | | ● | 3<br>--- | R/W | |
| A024 | 3858h<br>--- | 2nd Slip Compensation Response Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.01 to 10.00 s | 0.12s | ● | | ● | 5<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| A025 | 3859h<br>--- | 2nd Slip Compensation Gain for Braking | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 200.0 % | 100.0% | ● | | ● | 3<br>--- | R/W | |
| A026 | 385Ah<br>--- | 2nd Rated Slip Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 15.00 Hz | 1.00Hz | | ● | ● | 5<br>--- | R/W | |
| A027 | 385Bh<br>--- | 2nd Iron Loss Factor 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 20.00 % | 2.86% | ● | ● | ● | 5<br>--- | R/W | |
| A030 | 385Eh<br>--- | 2nd Magnetic Saturation Factor 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 300.0 % | 92.0% | ● | ● | ● | 3<br>--- | R/W | |
| A031 | 385Fh<br>--- | 2nd Magnetic Saturation Factor 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 300.0 % | 84.2% | ● | ● | ● | 3<br>--- | R/W | |
| A032 | 3860h<br>--- | 2nd Magnetic Saturation Factor 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 300.0 % | 70.5% | ● | ● | ● | 3<br>--- | R/W | |
| A033 | 3861h<br>--- | 2nd Magnetic Saturation Factor 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 300.0 % | 58.3% | ● | ● | ● | 3<br>--- | R/W | |
| A034 | 3862h<br>--- | 2nd Magnetic Saturation Factor 5 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 300.0 % | 46.1% | ● | ● | ● | 3<br>--- | R/W | |
| A040 | 3868h<br>--- | 2nd Slip Compensation Operating Conditions Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Enable during acceleration/deceleration, enable at base frequency or higher<br>1: Disable during acceleration/deceleration, enable at base frequency or higher<br>2: Enable during acceleration/deceleration, disable at base frequency or higher<br>3: Disable during acceleration/deceleration, disable at base frequency or higher | 0 | | | ● | 1<br>--- | R/W | |
| A041 | 3869h<br>--- | 2nd Output Current Fluctuation Damping Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 1.00 | 0.20 | ● | | ● | 5<br>--- | R/W | |
| A043 | 386Bh<br>--- | Speed Control 2 Speed Command Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 5.000 s | 0.020s | ● | | ● | 7<br>--- | R/W | |
| A044 | 386Ch<br>--- | Speed Control 2 Speed Detection Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 0.100 s | 0.005s | ● | | ● | 7<br>--- | R/W | |
| A045 | 386Dh<br>--- | Speed Control 2 P Proportional Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.1 to 200.0 | 10.0 | ● | | ● | 3<br>--- | R/W | |
| A046 | 386Eh<br>--- | Speed Control 2 I Integral Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.001 to 9.999 ; 999<br>0.001 to 9.999 s<br>999: Cancel integral term | 0.100s | ● | | ● | 7<br>--- | R/W | |
| A047 | 386Fh<br>--- | Speed Control 2 FF Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99.99 s | 0.00s | ● | | ● | 5<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| A048 | 3870h<br>--- | Speed Control 2 Output Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 0.100 s | 0.002s | • | | • | 7<br>--- | R/W | |
| A049 | 3871h<br>--- | Speed Control 2 Notch Filter Resonance Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 500 Hz | 200Hz | • | | • | 1<br>--- | R/W | |
| A050 | 3872h<br>--- | Speed Control 2 Notch Filter Attenuation Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 40 dB | 0dB | • | | • | 1<br>--- | R/W | |
| A051 | 3873h<br>--- | 2nd Cumulative Motor Run Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 (in 10 hours) | 0x10h | | | • | 74<br>--- | R/W | |
| A052 | 3874h<br>--- | 2nd Startup Counter for Motor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| A053 | 3875h<br>--- | 2nd Motor 2 %X Correction Factor 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 300 % | 100% | • | | • | 1<br>--- | R/W | |
| A055 | 3877h<br>--- | Torque Current for 2nd Vector Control | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 500.0 A | 16.71A | | • | • | 19<br>--- | R/W | |
| A056 | 3878h<br>--- | Induced Voltage Factor for 2nd Vector Control | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>50 to 100 % | 95% | | • | • | 1<br>--- | R/W | |
| A057 | 3879h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0.137 | • | • | • | 7<br>--- | R/W | |
| A060 | 387Ch<br>--- | 2nd Speed Conversion Coefficient | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 ; 0.01 to 600.00<br>0.00: Using E050 value<br>0.01 to 600.00 | 0.00 | • | | • | 5<br>--- | R/W | |
| A061 | 387Dh<br>--- | 2nd Display Coefficient for Transport time / Auxiliary Display Coefficient for Speed Monitor | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 9999 | 1.000 | • | | • | 45<br>--- | R/W | |
| A062 | 387Eh<br>--- | 2nd Starting Frequency Holding Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 10.00 s | 0.00s | • | | • | 5<br>--- | R/W | |
| A063 | 387Fh<br>--- | 2nd Stop Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 60.0 ; 999<br>0.0 to 60.0 Hz<br>999: According to F025 | 999<br>(32767) | • | | • | 3<br>--- | R/W | |
| A064 | 3880h<br>--- | 2nd Stop Frequency Detection Method Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 100<br>0: Detected speed<br>1: Reference speed<br>100: According to F038 | 100 | | | • | 1<br>--- | R/W | |
| A065 | 3881h<br>--- | 2nd Stop Frequency Holding Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 10.00 s | 0.00s | • | | • | 5<br>--- | R/W | |

## 5-4-7 b Group Parameter List (Velocity Control 3)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| b043 | 392Bh<br>--- | Speed Control 3 Speed Com-mand Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 5.000 s | 0.020s | ● | | ● | 7<br>--- | R/W | |
| b044 | 392Ch<br>--- | Speed Control 3 Speed Detection Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 0.100 s | 0.005s | ● | | ● | 7<br>--- | R/W | |
| b045 | 392Dh<br>--- | Speed Control 3 P Proportional Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.1 to 200.0 | 10.0 | ● | | ● | 3<br>--- | R/W | |
| b046 | 392Eh<br>--- | Speed Control 3 I Integral Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.001 to 9.999 ; 999<br>0.001 to 9.999 s<br>999: Disable | 0.100s | ● | | ● | 7<br>--- | R/W | |
| b047 | 392Fh<br>--- | Speed Control 3 FF Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99.99 s | 0.00s | ● | | ● | 5<br>--- | R/W | |
| b048 | 3930h<br>--- | Speed Control 3 Output Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 0.100 s | 0.002s | ● | | ● | 7<br>--- | R/W | |
| b049 | 3931h<br>--- | Speed Control 3 Notch Filter Resonance Fre-quency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 500 Hz | 200Hz | ● | | ● | 1<br>--- | R/W | |
| b050 | 3932h<br>--- | Speed Control 3 Notch Filter At-tenuation Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 40 dB | 0dB | ● | | ● | 1<br>--- | R/W | |

## 5-4-8 r Group Parameter List (Velocity Control 4)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| r043 | 39EBh<br>--- | Speed Control 4 Speed Command Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 5.000 s | 0.020s | • | | • | 7<br>--- | R/W | |
| r044 | 39ECh<br>--- | Speed Control 4 Speed Detection Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 0.100 s | 0.005s | • | | • | 7<br>--- | R/W | |
| r045 | 39EDh<br>--- | Speed Control 4 P Proportional Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.1 to 200.0 | 10.0 | • | | • | 3<br>--- | R/W | |
| r046 | 39EEh<br>--- | Speed Control 4 I Integral Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.001 to 9.999 ; 999<br>0.001 to 9.999 s<br>999: Disable | 0.100s | • | | • | 7<br>--- | R/W | |
| r047 | 39EFh<br>--- | Speed Control 4 FF Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99.99 s | 0.00s | • | | • | 5<br>--- | R/W | |
| r048 | 39F0h<br>--- | Speed Control 4 Output Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 0.100 s | 0.002s | • | | • | 7<br>--- | R/W | |
| r049 | 39F1h<br>--- | Speed Control 4 Notch Filter Resonance Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 500 Hz | 200Hz | • | | • | 1<br>--- | R/W | |
| r050 | 39F2h<br>--- | Speed Control 4 Notch Filter Attenuation Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 40 dB | 0dB | • | | • | 1<br>--- | R/W | |

## 5-4-9 J Group Parameter List (Applied Functions 1)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| J001 | 3A81h<br>--- | PID Control Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 5<br>0: Disable<br>1: Process normal operation<br>2: Process inverse operation<br>3: Dancer<br>4: Process normal operation, opposite operation available<br>5: Process inverse operation, opposite operation available | 0 | | | ● | 1<br>--- | R/W | |
| J002 | 3A82h<br>--- | PID Control PID Command Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 4<br>0: Digital Operator (Up/Down keys)<br>1: Analog input<br>3: Terminal command UP / DOWN control<br>4: RS-485 communications | 0 | | | ● | 1<br>--- | R/W | |
| J003 | 3A83h<br>--- | PID Control P Proportional Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 30.000 | 0.100 | ● | | ● | 7<br>--- | R/W | |
| J004 | 3A84h<br>--- | PID Control I Integral Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 3600.0 s | 0.0s | ● | | ● | 3<br>--- | R/W | |
| J005 | 3A85h<br>--- | PID Control D Differential Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 600.00 s | 0.00s | ● | | ● | 5<br>--- | R/W | |
| J006 | 3A86h<br>--- | PID Control Feedback Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 900.0 s | 0.5s | ● | | ● | 3<br>--- | R/W | |
| J010 | 3A8Ah<br>--- | PID Control Anti-reset Windup Width | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 200 %<br>Percentage of PID command | 200% | ● | | ● | 1<br>--- | R/W | |
| J011 | 3A8Bh<br>--- | PID Control Select Warning Output Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 7<br>0: Warning from absolute value<br>1: Warning from absolute value with hold<br>2: Warning from absolute value with latch<br>3: Warning from absolute value with hold and latch<br>4: Warning from PID error<br>5: Warning from PID error with hold<br>6: Warning from PID error with latch<br>7: Warning from PID error with hold and latch | 0 | ● | | ● | 1<br>--- | R/W | |
| J012 | 3A8Ch<br>--- | PID Control Upper Limit of Warning (AH) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-100 % to 100 % | 100% | ● | | ● | 2<br>--- | R/W | |
| J013 | 3A8Dh<br>--- | PID Control Lower Limit of Warning (AL) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-100 % to 100 % | 0% | ● | | ● | 2<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| J015 | 3A8Fh<br>--- | PID Control Sleep Frequency for Process Control | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 ; 1.0 to 590.0<br>0.0: Disable<br>1.0 to 590.0 Hz | 0.0Hz | • | | • | 3<br>--- | R/W | |
| J016 | 3A90h<br>--- | PID Control Sleep Timer for Process Control | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 60 s | 30s | • | | • | 1<br>--- | R/W | |
| J017 | 3A91h<br>--- | PID Control Restart Frequency after Stopping for Process Control | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 590.0 Hz | 0.0Hz | • | | • | 3<br>--- | R/W | |
| J018 | 3A92h<br>--- | PID Control PID Output Upper Limit | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-150 to 150 ; 999<br>-150 to 150 %<br>999: Depends on setting of F015 | 999<br>(32767) | • | | • | 2<br>--- | R/W | |
| J019 | 3A93h<br>--- | PID Control PID Output Lower Limit | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-150 to 150 ; 999<br>-150 to 150 %<br>999: Depends on setting of F016 | 999<br>(32767) | • | | • | 2<br>--- | R/W | |
| J023 | 3A97h<br>--- | PID Control Restart Feedback Deviation after Stopping for Process Control | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 100.0 % | 0.0% | • | | • | 3<br>--- | R/W | |
| J024 | 3A98h<br>--- | PID Control Restart Delay Time after Stopping for Process Control | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3600 s | 0s | • | | • | 1<br>--- | R/W | |
| J057 | 3AB9h<br>--- | PID Control Operator PID Reference Position for Dancer | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-100 to 0 to 100 % | 0% | • | | • | 2<br>--- | R/W | |
| J058 | 3ABAh<br>--- | PID Control PID Reference Position Detection Width for Dancer | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 ; 1 to 100<br>0: Disable switching PID constant<br>1 to 100 % (Manually set value) | 0% | • | | • | 1<br>--- | R/W | |
| J059 | 3ABBh<br>--- | PID Control P Gain 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 30.000 | 0.100 | • | | • | 7<br>--- | R/W | |
| J060 | 3ABCh<br>--- | PID Control I Integral Time 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 3600.0 s | 0.0s | • | | • | 3<br>--- | R/W | |
| J061 | 3ABDh<br>--- | PID Control D Differential Time 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 600.00 s | 0.00s | • | | • | 5<br>--- | R/W | |
| J062 | 3ABEh<br>--- | PID Control Block Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to 0003h<br>Bit1: PID output ratio selection<br>0: Ratio to frequency command<br>1: Ratio to maximum frequency<br>Bit0: PID output polarity selection<br>0: Plus (Addition)<br>1: Minus (Subtraction) | 0 | | | • | 1<br>--- | R/W | |

v

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| J063 | 3ABFh<br>--- | Overload Stop Item Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0: Torque<br>1: Current | 0 | ● | | ● | 1<br>--- | R/W | |
| J064 | 3AC0h<br>--- | Overload Stop Detection Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>20 to 200% | 100% | ● | | ● | 1<br>--- | R/W | |
| J065 | 3AC1h<br>--- | Overload Stop Mode Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Disable<br>1: Deceleration stop<br>2: Free run stop<br>3: Mechanical stop | 0 | | | ● | 1<br>--- | R/W | |
| J066 | 3AC2h<br>--- | Overload Stop Operation Mode | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2<br>0: During constant speed running and deceleration<br>1: During constant speed running<br>2: Anytime | 0 | ● | | ● | 1<br>--- | R/W | |
| J067 | 3AC3h<br>--- | Overload Stop Detection Timer | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 600.00 s | 0.00s | ● | | ● | 5<br>--- | R/W | |
| J068 | 3AC4h<br>--- | Brake Control Brake-release Current | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 300.00 % | 100.00 % | ● | | ● | 5<br>--- | R/W | |
| J069 | 3AC5h<br>--- | Brake Control Brake-release Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 25.0 Hz | 1.0Hz | ● | | ● | 3<br>--- | R/W | |
| J070 | 3AC6h<br>--- | Brake Control Brake-release Timer | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 5.000 s | 1.000s | ● | | ● | 7<br>--- | R/W | |
| J071 | 3AC7h<br>--- | Brake Control Brake-applied Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 25.0 Hz | 1.0Hz | ● | | ● | 3<br>--- | R/W | |
| J072 | 3AC8h<br>--- | Brake Control Brake-applied Timer | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 5.000 s | 1.000s | ● | | ● | 7<br>--- | R/W | |
| J090 | 3ADAh<br>--- | Overload Stop Function P gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 2.000 ; 999<br>0.000 to 2.000 times<br>999: 0.050 times | 999 (32767) | ● | | ● | 7<br>--- | R/W | |
| J091 | 3ADBh<br>--- | Overload Stop Function Integral time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.001 to 9.999 ; 999<br>0.001 to 9.999 s<br>999: 0.025 s | 999 (32767) | ● | | ● | 7<br>--- | R/W | |
| J092 | 3ADCh<br>--- | Overload Stop Function Current level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>50.0% to 150.0% | 100.0% | ● | | ● | 3<br>--- | R/W | |
| J095 | 3ADFh<br>--- | Brake control Brake-release Torque | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 300.00 % | 100.00 % | ● | | ● | 5<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| J095 | 3ADFh<br>--- | Brake control Brake-release Torque | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 300.00 % | 100.00 % | • | | • | 5<br>--- | R/W | |
| J096 | 3AE0h<br>--- | Brake Control Operation Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>00 to 7Fh<br>Bit6: Stop condition at Position control<br>0: BRK OFF<br>1: BRK ON<br>Bit4: Brake-applied condition<br>0: Disable RUN command "OFF"<br>1: Enable RUN command "OFF"<br>Bit3 to 1: Reserved<br>Bit0: Speed detection/Speed command<br>0: Speed detection<br>1: Speed command | 0 | • | | • | 1<br>--- | R/W | |
| J097 | 3AE1h<br>--- | Servo Lock Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 9.999 | 0.010 | • | | • | 7<br>--- | R/W | |
| J098 | 3AE2h<br>--- | Servo Lock Completion Timer | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 1.000 s | 0.100s | • | | • | 7<br>--- | R/W | |
| J099 | 3AE3h<br>--- | Servo Lock Completion Range | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 10 | • | | • | 1<br>--- | R/W | |
| J105 | 3B45h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0 | | | • | 1<br>--- | R/W | |
| J106 | 3B46h<br>--- | PID Control Maximum Scale | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999.00 to 9990.00 | 100.00 | | | • | 12<br>--- | R/W | |
| J107 | 3B47h<br>--- | PID Control Minimum Scale | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999.00 to 9990.00 | 0.00 | | | • | 12<br>--- | R/W | |
| J136 | 3B64h<br>--- | PID Control Multistep PID Command 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999.00 to 9990.00 | 0.00 | • | | • | 12<br>--- | R/W | |
| J137 | 3B65h<br>--- | PID Control Multistep PID Command 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999.00 to 9990.00 | 0.00 | • | | • | 12<br>--- | R/W | |
| J138 | 3B66h<br>--- | PID Control Multistep PID Command 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-999.00 to 9990.00 | 0.00 | • | | • | 12<br>--- | R/W | |

## 5-4-10 d Group Parameter List (Applied Functions 2)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| d001 | 3FC1h<br>--- | Speed Control 1 Speed Com-mand Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 5.000 s | 0.020s | ● | | ● | 7<br>--- | R/W | |
| d002 | 3FC2h<br>--- | Speed Control 1 Speed Detection Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 0.100 s | 0.005s | ● | | ● | 7<br>--- | R/W | |
| d003 | 3FC3h<br>--- | Speed Control 1 P Proportional Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.1 to 200.0 | 10.0 | ● | | ● | 3<br>--- | R/W | |
| d004 | 3FC4h<br>--- | Speed Control 1 I Integral Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.001 to 9.999 ; 999<br>0.001 to 9.999 s<br>999: Cancel integral term | 0.100s | ● | | ● | 7<br>--- | R/W | |
| d005 | 3FC5h<br>--- | Speed Control 1 FF Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 99.99 s | 0.00s | ● | | ● | 5<br>--- | R/W | |
| d006 | 3FC6h<br>--- | Speed Control 1 Output Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 0.100 s | 0.002s | ● | | ● | 7<br>--- | R/W | |
| d007 | 3FC7h<br>--- | Speed Control 1 Notch Filter Resonance Fre-quency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 500 Hz | 200Hz | ● | | ● | 1<br>--- | R/W | |
| d008 | 3FC8h<br>--- | Speed Control 1 Notch Filter At-tenuation Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 40 dB | 0dB | ● | | ● | 1<br>--- | R/W | |
| d009 | 3FC9h<br>--- | Speed Control Jogging Speed Command Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 5.000 s | 0.020s | ● | | ● | 7<br>--- | R/W | |
| d010 | 3FCAh<br>--- | Speed Control Jogging Speed Detection Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 0.100 s | 0.005s | ● | | ● | 7<br>--- | R/W | |
| d011 | 3FCBh<br>--- | Speed Control Jogging P Pro-portional Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.1 to 200.0 | 10.0 | ● | | ● | 3<br>--- | R/W | |
| d012 | 3FCCh<br>--- | Speed Control Jogging I In-tegral Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.001 to 9.999 ; 999<br>0.001 to 9.999 s<br>999: Cancel integral term | 0.100s | ● | | ● | 7<br>--- | R/W | |
| d013 | 3FCDh<br>--- | Speed Control Jogging Output Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 0.100 s | 0.002s | ● | | ● | 7<br>--- | R/W | |
| d014 | 3FCEh<br>--- | Input Terminal [PIA][PIB] Pulse Input Format Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Pulse train signing/pulse train input<br>1: Forward/reverse rotation pulse<br>2: Quadrature A/B signal (B phase lead)<br>3: Quadrature A/B signal (A phase lead) | 2 | | | ● | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| d015 | 3FCFh<br>--- | Input Terminal [PIA][PIB] Encoder Pulse Resolution | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>20 to 60000 | 1024 | | | • | 1<br>--- | R/W | |
| d016 | 3FD0h<br>--- | Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 32767 | 1 | • | | • | 1<br>--- | R/W | |
| d017 | 3FD1h<br>--- | Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 32767 | 1 | • | | • | 1<br>--- | R/W | |
| d018 | 3FD2h<br>--- | Input Terminal [PIA][PIB] Pulse Train Filter Time Constant | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 5.000 s | 0.005s | • | | • | 7<br>--- | R/W | |
| d021 | 3FD5h<br>--- | Speed Agreement / Speed Deviation Error Hysteresis Width | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 50.0 % | 10.0% | • | | • | 3<br>--- | R/W | |
| d022 | 3FD6h<br>--- | Speed Agreement / Speed Deviation Error Detection Timer | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 10.00 s | 0.50s | • | | • | 5<br>--- | R/W | |
| d023 | 3FD7h<br>--- | Speed Deviation Error Processing Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 5<br>0: Continue to run 1<br>1: Stop with alarm 1<br>2: Stop with alarm 2<br>3: Continue to run 2<br>4: Stop with alarm 3<br>5: Stop with alarm 4 | 2 | | | • | 1<br>--- | R/W | |
| d024 | 3FD8h<br>--- | Zero Speed Control | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2<br>0: Disable at startup, enable at stop<br>1: Enable at startup, enable at stop<br>2: Disable at startup, disable at stop | 0 | | | • | 1<br>--- | R/W | |
| d025 | 3FD9h<br>--- | Speed Control Speed Loop Switching Time at Parameter Change | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 1.000 s | 0.000s | • | | • | 7<br>--- | R/W | |
| d032 | 3FE1h<br>3FE0h | Speed Limit 1 in Forward | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 110 % | 100% | • | | • | ---<br>1 | R/W | |
| d033 | 3FE3h<br>3FE2h | Speed Limit 2 in Reverse | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 110 % | 100% | • | | • | ---<br>1 | R/W | |
| d035 | 3FE5h<br>--- | Over Speed Detection Level | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 120 ; 999<br>0 to 120 %<br>999: Depend on d032 and d033 | 999<br>(32767) | • | | • | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
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| d041 | 3FEBh<br>--- | Special Control Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 4<br>0: Disable (Normal control)<br>1: Enable (Peripheral speed constant control)<br>2: Master-follower operation (Immediate synchronization mode at the start without Z phase)<br>3: Master-follower operation (Start after synchronization mode)<br>4: Master-follower operation (Immediate synchronization mode at the start with Z phase) | 0 | | | • | 1<br>--- | R/W | |
| d051 | 3FF5h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 10 | | • | • | 2<br>--- | R/W | |
| d052 | 3FF6h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 10 | | • | • | 2<br>--- | R/W | |
| d055 | 3FF9h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0 | | | • | 1<br>--- | R/W | |
| d067 | 4005h<br>--- | Motor Starting Mode Auto Search in Speed Sensor Vector Control | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2<br>0: Disable<br>1: Enable (Only at restart after momentary power failure)<br>2: Enable (At normal start and restart after momentary power failure) | 1 | | | • | 1<br>--- | R/W | |
| d068 | 4006h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 4.0 | | | • | 3<br>--- | R/W | |
| d070 | 4008h<br>--- | Speed Control Slip Frequency Limit | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 100.00 % | 100.00 % | • | | • | 5<br>--- | R/W | |
| d079 | 4011h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 999 (32767) | | | • | 1<br>--- | R/W | |
| d080 | 4012h<br>--- | 1st PM Motor Magnetic Pole Position Pull-in Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.1 to 10.0Hz | 1.0Hz | • | | • | 3<br>--- | R/W | |
| d081 | 4013h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 1 | • | | • | 1<br>--- | R/W | |
| d082 | 4014h<br>--- | Magnetic Flux Weakening Control Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Disable<br>1: Enable | 1 | • | | • | 1<br>--- | R/W | |
| d083 | 4015h<br>--- | Magnetic Flux Weakening Lower Limit | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>10 to 70% | 40% | • | | • | 1<br>--- | R/W | |

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| d084 | 4016h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 5 | • | | • | 1<br>--- | R/W | |
| d085 | 4017h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 95 | • | | • | 1<br>--- | R/W | |
| d086 | 4018h<br>--- | Acc/Dec Output Frequency Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 5.000 s | 0.000s | • | | • | 7<br>--- | R/W | |
| d088 | 401Ah<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 999<br>(32767) | • | | • | 5<br>--- | R/W | |
| d089 | 401Bh<br>--- | PM Motor High-efficiency Control Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Disable<br>1: Enable | 1 | | | • | 1<br>--- | R/W | |
| d090 | 401Ch<br>--- | Magnetic Flux Level during Deceleration | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>100 to 300 % | 120% | • | | • | 1<br>--- | R/W | |
| d091 | 401Dh<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 999<br>(32767) | • | | • | 5<br>--- | R/W | |
| d092 | 401Eh<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0.00 | • | | • | 5<br>--- | R/W | |
| d093 | 401Fh<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 999<br>(32767) | • | | • | 5<br>--- | R/W | |
| d094 | 4020h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 999<br>(32767) | • | | • | 5<br>--- | R/W | |
| d095 | 4021h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 999<br>(32767) | • | | • | 5<br>--- | R/W | |
| d096 | 4022h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 999<br>(32767) | • | | • | 4<br>--- | R/W | |
| d097 | 4023h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 999<br>(32767) | • | | • | 4<br>--- | R/W | |
| d098 | 4024h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0 | • | | • | 1<br>--- | R/W | |
| d099 | 4025h<br>--- | Extension Function 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit 3: Jogging Enable via communications<br>Do not use other bits | 8 | • | | • | 1<br>--- | R/W | |
| d132 | 40A0h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0.500 | • | | • | 7<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
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| d190 | 40DAh<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0 | ● | | ● | 1<br>--- | R/W | |
| d192 | 40DCh<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0.30 | ● | | ● | 5<br>--- | R/W | |
| d198 | 40E2h<br>--- | Reserved | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>Do not use | 0 | ● | | ● | 1<br>--- | R/W | |
| d201 | 4141h<br>--- | Position Control Feed Forward Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 ; 0.01 to 1.50<br>0.00: Disable feed-forward<br>0.01 to 1.50 | 0.00 | ● | | ● | 5<br>--- | R/W | |
| d202 | 4142h<br>--- | Position Control Feed Forward Filter | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 5.000 s | 0.500s | ● | | ● | 7<br>--- | R/W | |
| d203 | 4143h<br>--- | Position Loop Gain 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.1 to 300.0 | 1.0 | ● | | ● | 3<br>--- | R/W | |
| d204 | 4144h<br>--- | Position Loop Gain 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.1 to 300.0 | 1.0 | ● | | ● | 3<br>--- | R/W | |
| d205 | 4145h<br>--- | Position Loop Gain Switch Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 590.0 Hz | 0.0Hz | ● | | ● | 3<br>--- | R/W | |
| d206 | 4146h<br>--- | Electronic Gear Denominator | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 65535 | 1 | | | ● | 1<br>--- | R/W | |
| d207 | 4147h<br>--- | Electronic Gear Numerator | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 65535 | 1 | | | ● | 1<br>--- | R/W | |
| d208 | 4148h<br>--- | Orientation Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Nearest direction (Valid for reverse rotation)<br>1: Command direction (Direction of operation command source) | 1 | | | ● | 1<br>--- | R/W | |
| d209 | 4149h<br>--- | Homing Operation Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>00 to FFh<br>Bit 7: Z phase correction<br>0: Disable<br>1: Enable<br>Bit 4 to 6: Reserved<br>Bit 3: Detection timing of homing limit switch<br>0: By rising edge<br>1: By falling edge<br>Bit 2: OT detected operation selection<br>0: Return at FOT/ROT detection<br>1: Stop at OT detection (Cancel homing)<br>Bit 1: Homing Start direction<br>0: Forward direction<br>1: Reverse direction<br>Bit 0: Homing shaft direction<br>0: Forward direction<br>1: Reverse direction | 0 | | | ● | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
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| d211 | 414Bh<br>--- | Homing Reference Signal Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Z phase<br>1: Origin limit input (ORL)<br>2: Overtravel input in the positive direction (FOT)<br>3: Overtravel input in the negative direction (ROT) | 1 | | | • | 1<br>--- | R/W | |
| d212 | 414Ch<br>--- | Reference Signal for Homing Offset | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 4<br>0: Z phase<br>1: Origin limit input (ORL)<br>2: Overtravel input in the positive direction (FOT)<br>3: Overtravel input in the negative direction (ROT)<br>4: Stopper (Hit and stop) | 0 | | | • | 1<br>--- | R/W | |
| d213 | 414Dh<br>--- | Homing Frequency/Orientation Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.1 to 590.0 Hz | 5.0Hz | • | | • | 3<br>--- | R/W | |
| d214 | 414Eh<br>--- | Creep Frequency | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.1 to 590.0 Hz | 0.5Hz | • | | • | 3<br>--- | R/W | |
| d215 | 414Fh<br>--- | Deceleration Time for Homing/Orientation | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 6000 s | 6.00s | • | | • | 12<br>--- | R/W | |
| d220 | 4154h<br>--- | Position Feedback Store Selection at Power Off | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2<br>0: Disable<br>1: Store Position at low voltage detected<br>2: Store Position and Software OT at low voltage detected | 0 | • | | • | 1<br>--- | R/W | |
| d221 | 4155h<br>--- | Current Position Clear Signal Operation Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Edge<br>1: Level | 0 | • | | • | 1<br>--- | R/W | |
| d222 | 4156h<br>--- | Overtravel Function Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2<br>0: Invalid/Infinite rotation<br>1: Valid (Positioning at OT position at over traveling), normal PTP<br>2: Valid (Immediately stopped at over traveling), normal PTP | 0 | • | | • | 1<br>--- | R/W | |
| d223 | 4157h<br>--- | Detection Level of Excessive Positioning Deviation (MSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2147483647<br>(MSB: 0 to 32767, LSB: 0 to 65535) | 0 | • | | • | 1<br>--- | R/W | |
| d224 | 4158h<br>--- | Detection Level of Excessive Positioning Deviation (LSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2147483647<br>(MSB: 0 to 32767, LSB: 0 to 65535) | 0 | • | | • | 1<br>--- | R/W | |

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| d225 | 4159h<br>--- | Software Overtravel Detection Position in the Positive Direction (MSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 32767 | | | • | 2<br>--- | R/W | |
| d226 | 415Ah<br>--- | Software Overtravel Detection Position in the Positive Direction (LSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 65535 | | | • | 1<br>--- | R/W | |
| d227 | 415Bh<br>--- | Software Overtravel Detection Position in the Negative Direction (MSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | -32768 | | | • | 2<br>--- | R/W | |
| d228 | 415Ch<br>--- | Software Overtravel Detection Position in the Negative Direction (LSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | | | • | 1<br>--- | R/W | |
| d237 | 4165h<br>--- | Positioning Data Type | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Absolute data<br>1: Relative data | 0 | • | | • | 1<br>--- | R/W | |
| d238 | 4166h<br>--- | Position Data Determination Time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.000 to 0.100 s | 0.000s | • | | • | 7<br>--- | R/W | |
| d239 | 4167h<br>--- | Positioning Completed Range | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 9999 | 1 | • | | • | 1<br>--- | R/W | |
| d240 | 165Fh<br>--- | Preset Position (MSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 2<br>--- | R/W | |
| d241 | 1660h<br>--- | Preset Position (LSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 1<br>--- | R/W | |
| d242 | 416Ah<br>--- | Homing Offset (MSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2147483647<br>(MSB: 0 to 32767, LSB: 0 to 65535) | 0 | • | | • | 1<br>--- | R/W | |
| d243 | 416Bh<br>--- | Homing Offset (LSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2147483647<br>(MSB: 0 to 32767, LSB: 0 to 65535) | 0 | • | | • | 1<br>--- | R/W | |

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| d244 | 163Dh<br>--- | Positioning Data 1 (MSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 2<br>--- | R/W | |
| d245 | 163Eh<br>--- | Positioning Data 1 (LSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 1<br>--- | R/W | |
| d246 | 163Fh<br>--- | Positioning Data 2 (MSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 2<br>--- | R/W | |
| d247 | 1640h<br>--- | Positioning Data 2 (LSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 1<br>--- | R/W | |
| d248 | 1641h<br>--- | Positioning Data 3 (MSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 2<br>--- | R/W | |
| d249 | 1642h<br>--- | Positioning Data 3 (LSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 1<br>--- | R/W | |
| d250 | 1643h<br>--- | Positioning Data 4 (MSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 2<br>--- | R/W | |
| d251 | 1644h<br>--- | Positioning Data 4 (LSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 1<br>--- | R/W | |
| d252 | 1645h<br>--- | Positioning Data 5 (MSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 2<br>--- | R/W | |
| d253 | 1646h<br>--- | Positioning Data 5 (LSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 1<br>--- | R/W | |
| d254 | 1647h<br>--- | Positioning Data 6 (MSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 2<br>--- | R/W | |
| d255 | 1648h<br>--- | Positioning Data 6 (LSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 1<br>--- | R/W | |
| d256 | 1649h<br>--- | Positioning Data 7 (MSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 2<br>--- | R/W | |
| d257 | 164Ah<br>--- | Positioning Data 7 (LSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| d258 | 164Bh<br>--- | Positioning Data 8 (MSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | ● | | ● | 2<br>--- | R/W | |
| d259 | 164Ch<br>--- | Positioning Data 8 (LSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | ● | | ● | 1<br>--- | R/W | |
| d277 | 418Dh<br>--- | Positioning Data Setting Selection via communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Disable Communications Positioning Data (S020, S021)<br>1: Enable Communications Positioning Data (S020, S021) | 0 | ● | | ● | 1<br>--- | R/W | |
| d278 | 418Eh<br>--- | Restarting Positioning Range Setting | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 ; 1 to 9999<br>0: Disable<br>1 to 9999 | 0 | ● | | ● | 1<br>--- | R/W | |
| d279 | 418Fh<br>--- | Position Mode and Set Mode Control | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 5<br>0: SPD Necessary, POS-SET edge control<br>1: SPD Necessary, POS-SET level control<br>2: SPD Necessary, Always updated<br>3: SPD Unnecessary, POS-SET edge control<br>4: SPD Unnecessary, POS-SET level control<br>5: SPD Unnecessary, Always updated | 0 | | | ● | 1<br>--- | R/W | |
| d280 | 4190h<br>--- | Over Travel Forced Stop Operation Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Servo lock after deceleration stop<br>1: Er6 fault occurs after deceleration stop | 0 | ● | | ● | 1<br>--- | R/W | |
| d281 | 4191h<br>--- | Position count direction | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Normal (Same as speed control)<br>1: Inverse | 0 | | | ● | 1<br>--- | R/W | |
| d282 | 4192h<br>--- | Position Range Setting | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 or 3<br>0: Linear (No Wrap-around)<br>3: Rotation (Wrap-around) | 3 | | | ● | 1<br>--- | R/W | |
| d296 | 1035h<br>--- | Current Reference Position Monitor (MSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | | | ● | 2<br>--- | RO | |
| d297 | 1036h<br>--- | Current Reference Position Monitor (LSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | | | | 1<br>--- | RO | |
| d298 | 1037h<br>--- | Current Feedback Position Monitor (MSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | | | ● | 2<br>--- | RO | |
| d299 | 1038h<br>--- | Current Feedback Position Monitor (LSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | | | | 1<br>--- | RO | |

## 5-4-11 y Group Parameter List (Comms Command Selection)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| y092 | 425Ch<br>--- | Forced Operation Command | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: RS<br>Bit14: DI7<br>Bit13: DI6<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: ---<br>Bit7: ---<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: RV<br>Bit0: FW | 0 | • | | • | 14<br>--- | R/W | |
| y095 | 425Fh<br>--- | Data Clear Processing for Communications Error | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Do not clear the data of parameters S when a communications error occurs. (compatible with the conventional inverters)<br>1: Clear the data of parameters S001, S005, and S019 when a communications error occurs<br>2: Clear the run command assigned bit of parameter S006 when a communications error occurs<br>3: Clear both data 1 and 2 above | 0 | • | | • | 1<br>--- | R/W | |
| y097 | 4261h<br>--- | Communication Data Storage Selection | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 2<br>0: Store into nonvolatile memory (Rewritable times are limited)<br>1: Write into temporary memory (Rewritable times are unlimited)<br>2: Save all data from temporary memory to nonvolatile memory (After all data is saved, return to Data 1) | 1 | • | | | 1<br>--- | R/W | |
| y099 | 4263h<br>--- | Command Selection via Tool and Communications | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0: Frequency/torque and terminal commands according to settings of F02/E102 and F01/C30<br>1: Frequency/torque command via Tool and Communications<br>- Commands from frequency command (S01)/torque command (S02)/torque bias command (S24) are valid.<br>2: Terminal command via Tool and Communications<br>- Settings from communication data [DO] terminal (S07) and communication data [AO] terminal (S12) are valid.<br>3: Frequency/torque and terminal commands via Tool and Communications<br>- Commands from frequency command (S01)/torque command (S02)/torque bias command (S24) are valid.<br>- Settings from communication data [DO] terminal (S07) and communication data [AO] terminal (S12) are valid. | 0 | • | | • | 1<br>--- | R/W | |

## 5-4-12 o Group Parameter List (Ethernet and protocol Settings)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| o201 | 4441h<br>--- | IP address setting 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 192 | ● | | | 1<br>--- | R/W | |
| o202 | 4442h<br>--- | IP address setting 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 168 | ● | | | 1<br>--- | R/W | |
| o203 | 4443h<br>--- | IP address setting 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | ● | | | 1<br>--- | R/W | |
| o204 | 4444h<br>--- | IP address setting 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 10 | ● | | | 1<br>--- | R/W | |
| o205 | 4445h<br>--- | Subnet mask setting 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 255 | ● | | | 1<br>--- | R/W | |
| o206 | 4446h<br>--- | Subnet mask setting 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 255 | ● | | | 1<br>--- | R/W | |
| o207 | 4447h<br>--- | Subnet mask setting 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 255 | ● | | | 1<br>--- | R/W | |
| o208 | 4448h<br>--- | Subnet mask setting 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | ● | | | 1<br>--- | R/W | |
| o209 | 4449h<br>--- | Default gateway setting 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | ● | | | 1<br>--- | R/W | |
| o210 | 444Ah<br>--- | Default gateway setting 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | ● | | | 1<br>--- | R/W | |
| o211 | 444Bh<br>--- | Default gateway setting 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | ● | | | 1<br>--- | R/W | |
| o212 | 444Ch<br>--- | Default gateway setting 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 255 | 0 | ● | | | 1<br>--- | R/W | |
| o213 | 444Dh<br>--- | IP address setting mode | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 3<br>0:Static<br>1:Hardware switch<br>2:DHCP<br>3:DCP | 0 | ● | | | 1<br>--- | R/W | |
| o214 | 444Eh<br>--- | Protocol setting | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>1 to 3<br>1:PROFINET-RT<br>2:EtherNet/IP<br>3:Modbus TCP | 2 | ● | | | 1<br>--- | R/W | |
| o215 | 444Fh<br>--- | KEEP-ALIVE time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>10 to 720 | 60s | ● | | | 1<br>--- | R/W | |
| o216 | 4450h<br>--- | Modbus TCP Monitoring time | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.0 to 60.0<br>0.0:Disable | 0.0s | ● | | | 3<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| o221 | 4455h<br>--- | Write function code mapping 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o222 | 4456h<br>--- | Write function code mapping 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o223 | 4457h<br>--- | Write function code mapping 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o224 | 4458h<br>--- | Write function code mapping 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o225 | 4459h<br>--- | Write function code mapping 5 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o226 | 445Ah<br>--- | Write function code mapping 6 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o227 | 445Bh<br>--- | Write function code mapping 7 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o228 | 445Ch<br>--- | Write function code mapping 8 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o229 | 445Dh<br>--- | Write function code mapping 9 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o230 | 445Eh<br>--- | Write function code mapping 10 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o231 | 445Fh<br>--- | Write function code mapping 11 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o232 | 4460h<br>--- | Write function code mapping 12 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o233 | 4461h<br>--- | Write function code mapping 13 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o234 | 4462h<br>--- | Write function code mapping 14 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o235 | 4463h<br>--- | Write function code mapping 15 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o236 | 4464h<br>--- | Write function code mapping 16 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| o237 | 4465h<br>--- | Write function code mapping 17 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o238 | 4466h<br>--- | Write function code mapping 18 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o239 | 4467h<br>--- | Write function code mapping 19 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o240 | 4468h<br>--- | Write function code mapping 20 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o241 | 4469h<br>--- | Write function code mapping 21 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o242 | 446Ah<br>--- | Write function code mapping 22 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o243 | 446Bh<br>--- | Write function code mapping 23 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o244 | 446Ch<br>--- | Write function code mapping 24 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o245 | 446Dh<br>--- | Write function code mapping 25 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o246 | 446Eh<br>--- | Write function code mapping 26 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o247 | 446Fh<br>--- | Write function code mapping 27 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o248 | 4470h<br>--- | Write function code mapping 28 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o249 | 4471h<br>--- | Write function code mapping 29 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o250 | 4472h<br>--- | Write function code mapping 30 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o251 | 4473h<br>--- | Write function code mapping 31 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o252 | 4474h<br>--- | Write function code mapping 32 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| o253 | 4475h<br>--- | Read function code mapping 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o254 | 4476h<br>--- | Read function code mapping 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o255 | 4477h<br>--- | Read function code mapping 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o256 | 4478h<br>--- | Read function code mapping 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o257 | 4479h<br>--- | Read function code mapping 5 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o258 | 447Ah<br>--- | Read function code mapping 6 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o259 | 447Bh<br>--- | Read function code mapping 7 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o260 | 447Ch<br>--- | Read function code mapping 8 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o261 | 447Dh<br>--- | Read function code mapping 9 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o262 | 447Eh<br>--- | Read function code mapping 10 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o263 | 447Fh<br>--- | Read function code mapping 11 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o264 | 4480h<br>--- | Read function code mapping 12 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o265 | 4481h<br>--- | Read function code mapping 13 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o266 | 4482h<br>--- | Read function code mapping 14 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o267 | 4483h<br>--- | Read function code mapping 15 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |
| o268 | 4484h<br>--- | Read function code mapping 16 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| o269 | 4485h<br>--- | Read function code mapping 17 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o270 | 4486h<br>--- | Read function code mapping 18 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o271 | 4487h<br>--- | Read function code mapping 19 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o272 | 4488h<br>--- | Read function code mapping 20 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o273 | 4489h<br>--- | Read function code mapping 21 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o274 | 448Ah<br>--- | Read function code mapping 22 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o275 | 448Bh<br>--- | Read function code mapping 23 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o276 | 448Ch<br>--- | Read function code mapping 24 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o277 | 448Dh<br>--- | Read function code mapping 25 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o278 | 448Eh<br>--- | Read function code mapping 26 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o279 | 448Fh<br>--- | Read function code mapping 27 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o280 | 4490h<br>--- | Read function code mapping 28 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o281 | 4491h<br>--- | Read function code mapping 29 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o282 | 4492h<br>--- | Read function code mapping 30 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o283 | 4493h<br>--- | Read function code mapping 31 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o284 | 4494h<br>--- | Read function code mapping 32 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | ● | | | 1<br>--- | R/W | |
| o299 | 44A3h<br>--- | Apply Ethernet settings | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1 | 0 | | | | 1<br>--- | R/W | |

## 5-4-13 S Group Parameter List (Communications Commands)

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | Format 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| S001 | 5001h<br>--- | Frequency Reference | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767<br>+20,000 or -20,000 = Maximum output frequency | 0 | • | | • | 29<br>--- | R/W | |
| S002 | 5002h<br>--- | Torque Reference | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 % | 0.00% | • | | • | 6<br>--- | R/W | |
| S003 | 5003h<br>--- | Torque Current Command | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 % | 0.00% | • | | • | 6<br>--- | R/W | |
| S005 | 5006h<br>5005h | Frequency Reference | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.00 to 655.35 Hz | 0.00Hz | • | | • | ---<br>5 | R/W | |
| S006 | 5007h<br>--- | Operation command | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: RS<br>Bit14: DI7<br>Bit13: DI6<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: ---<br>Bit7: ---<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: RV<br>Bit0: FW | 0 | • | | • | 14<br>--- | R/W | |
| S007 | 5008h<br>--- | Communication Data Terminal [DO] | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>Bit15: ---<br>Bit14: ---<br>Bit13: ---<br>Bit12: ---<br>Bit11: ---<br>Bit10: ---<br>Bit9: ---<br>Bit8: RO<br>Bit7: ---<br>Bit6: ---<br>Bit5: ---<br>Bit4: ---<br>Bit3: ---<br>Bit2: ---<br>Bit1: DO2<br>Bit0: DO1 | 0 | • | | • | 15<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| S013 | 500Eh<br>--- | PID Control PID Command via Communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32,768 to 32,767<br>-20,000 = -100%, 20,000 = 100% | 0 | • | | • | 29<br>--- | R/W | |
| S014 | 500Fh<br>--- | Alarm Reset Command | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Disable<br>1: Alarm reset | 0 | • | | • | 1<br>--- | R/W | |
| S015 | 5010h<br>--- | Torque Bias Value via Communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67 | 0.00% | • | | • | 6<br>--- | R/W | |
| S019 | 5014h<br>--- | Speed Command via Communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767 | 0r/min | • | | • | 2<br>--- | R/W | |
| S020 | 5015h<br>--- | Positioning Data via Communication (MSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 2<br>--- | R/W | |
| S021 | 5016h<br>--- | Positioning Data via Communication (LSB) | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>−2147483648 to 2147483647<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | • | | • | 1<br>--- | R/W | |
| S022 | 1621h<br>--- | Torque Reference via Communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327 to 327 % | 0% | • | | • | 2<br>--- | R/W | |
| S023 | 5018h<br>--- | Torque Current Command via Communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327 to 327 % | 0% | • | | • | 2<br>--- | R/W | |
| S024 | 1624h<br>--- | Torque Bias Value | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327 to 327 % | 0% | • | | • | 2<br>--- | R/W | |
| S030 | 501Fh<br>--- | PID Control Feedback Value via Communication | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32,768 to 32,767<br>-20,000 = -100%, 20,000 = 100% | 0 | • | | • | 29<br>--- | R/W | |
| S040 | 5029h<br>--- | Frequency Reference via Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67% | 100.00 % | • | | • | 6<br>--- | R/W | |
| S041 | 502Ah<br>--- | Frequency Reference via Bias | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767<br>-32767 = -100%, 32767 = 100%<br>(100% = Fmax) | 0 | • | | • | 2<br>--- | R/W | |
| S042 | 502Bh<br>--- | ASR Input via Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67% | 100.00 % | • | | • | 6<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| S043 | 502Ch<br>--- | ASR Input via Bias | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-32768 to 32767<br>-32767 = -100%, 32767 = 100%<br>(100% = Fmax) | 0 | • | | • | 2<br>--- | R/W | |
| S044 | 502Dh<br>--- | Torque Refer-ence via Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67% | 100.00<br>% | • | | • | 6<br>--- | R/W | |
| S045 | 502Eh<br>--- | Torque Refer-ence via Bias | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67% | 0.00% | • | | • | 6<br>--- | R/W | |
| S046 | 502Fh<br>--- | PID set point via Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67% | 100.00<br>% | • | | • | 6<br>--- | R/W | |
| S047 | 5030h<br>--- | PID set point via Bias | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-150.00 to 150.00% | 0.00% | • | | • | 6<br>--- | R/W | |
| S048 | 5031h<br>--- | PID present value via Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67% | 100.00<br>% | • | | • | 6<br>--- | R/W | |
| S049 | 5032h<br>--- | PID present value via Bias | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-150.00 to 150.00% | 0.00% | • | | • | 6<br>--- | R/W | |
| S050 | 5033h<br>--- | PID error via Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-327.68 to 327.67% | 100.00<br>% | • | | • | 6<br>--- | R/W | |
| S051 | 5034h<br>--- | PID error via Bias | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>-150.00 to 150.00% | 0.00% | • | | • | 6<br>--- | R/W | |
| S052 | 5035h<br>--- | RUN command via Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1 | 1 | • | | • | 1<br>--- | R/W | |
| S053 | 5036h<br>--- | RUN command via Bias | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1 | 0 | • | | • | 1<br>--- | R/W | |
| S054 | 5037h<br>--- | Driving direction via Gain | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1 | 1 | • | | • | 1<br>--- | R/W | |
| S055 | 5038h<br>--- | Driving direction via Bias | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1 | 0 | • | | • | 1<br>--- | R/W | |
| S098 | 5063h<br>--- | Restore mode | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 1<br>0: Inactive<br>1: Restore | 0 | • | | • | 1<br>--- | R/W | |

## 5-4-14 U Group Parameter List (DriveApp custom parameters and control)

These parameters no not perform any functionality unless a customized DriveApp is installed in the inverter. Check with omron sales support for details about DriveApps.

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| U121 | 4756h 4755h | Drive App parameter 1 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV -2147483648 to 2147483647 | 0 | ● | | ● | --- 2 | R/W | |
| U122 | 4758h 4757h | Drive App parameter 2 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV -2147483648 to 2147483647 | 0 | ● | | ● | --- 2 | R/W | |
| U123 | 475Ah 4759h | Drive App parameter 3 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV -2147483648 to 2147483647 | 0 | ● | | ● | --- 2 | R/W | |
| U124 | 475Ch 475Bh | Drive App parameter 4 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV -2147483648 to 2147483647 | 0 | ● | | ● | --- 2 | R/W | |
| U125 | 475Eh 475Dh | Drive App parameter 5 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV -2147483648 to 2147483647 | 0 | ● | | ● | --- 2 | R/W | |
| U126 | 4760h 475Fh | Drive App parameter 6 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV -2147483648 to 2147483647 | 0 | ● | | ● | --- 2 | R/W | |
| U127 | 4762h 4761h | Drive App parameter 7 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV -2147483648 to 2147483647 | 0 | ● | | ● | --- 2 | R/W | |
| U128 | 4764h 4763h | Drive App parameter 8 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV -2147483648 to 2147483647 | 0 | ● | | ● | --- 2 | R/W | |
| U129 | 4766h 4765h | Drive App parameter 9 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV -2147483648 to 2147483647 | 0 | ● | | ● | --- 2 | R/W | |
| U130 | 4768h 4767h | Drive App parameter 10 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV -2147483648 to 2147483647 | 0 | ● | | ● | --- 2 | R/W | |
| U131 | 4769h --- | Drive App parameter 11 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0 to 65535 | 0 | ● | | ● | 1 --- | R/W | |
| U132 | 476Ah --- | Drive App parameter 12 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0 to 65535 | 0 | ● | | ● | 1 --- | R/W | |
| U133 | 476Bh --- | Drive App parameter 13 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0 to 65535 | 0 | ● | | ● | 1 --- | R/W | |
| U134 | 476Ch --- | Drive App parameter 14 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0 to 65535 | 0 | ● | | ● | 1 --- | R/W | |
| U135 | 476Dh --- | Drive App parameter 15 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0 to 65535 | 0 | ● | | ● | 1 --- | R/W | |
| U136 | 476Eh --- | Drive App parameter 16 | V/f DTV PG V/f PG DTV SLV PGV PM SLV PM PGV 0 to 65535 | 0 | ● | | ● | 1 --- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| U137 | 476Fh<br>--- | Drive App parameter 17 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U138 | 4770h<br>--- | Drive App parameter 18 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U139 | 4771h<br>--- | Drive App parameter 19 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U140 | 4772h<br>--- | Drive App parameter 20 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U141 | 4773h<br>--- | Drive App parameter 21 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U142 | 4774h<br>--- | Drive App parameter 22 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U143 | 4775h<br>--- | Drive App parameter 23 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U144 | 4776h<br>--- | Drive App parameter 24 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U145 | 4777h<br>--- | Drive App parameter 25 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U146 | 4778h<br>--- | Drive App parameter 26 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U147 | 4779h<br>--- | Drive App parameter 27 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U148 | 477Ah<br>--- | Drive App parameter 28 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U149 | 477Bh<br>--- | Drive App parameter 29 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U150 | 477Ch<br>--- | Drive App parameter 30 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U151 | 477Dh<br>--- | Drive App parameter 31 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U152 | 477Eh<br>--- | Drive App parameter 32 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | Set in RUN | KVA diff | EMP Map | For-mat 16bit 32bit | R/W | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| U153 | 477Fh<br>--- | Drive App parameter 33 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U154 | 4780h<br>--- | Drive App parameter 34 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U155 | 4781h<br>--- | Drive App parameter 35 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U156 | 4782h<br>--- | Drive App parameter 36 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U157 | 4783h<br>--- | Drive App parameter 37 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U158 | 4784h<br>--- | Drive App parameter 38 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U159 | 4785h<br>--- | Drive App parameter 39 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |
| U160 | 4786h<br>--- | Drive App parameter 40 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0 to 65535 | 0 | • | | • | 1<br>--- | R/W | |

# 6

# Basic Settings



This section describes the basic functions such as the RUN command.

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# 6-1 Data Initialization

## 6-1-1 Data Initialization

- The parameter initialization function restores changed parameters to the factory default settings.
- It can also clear the fault monitor data.
- When the inverter is newly set after restoring parameters to the factory default settings, execute pa- rameter initialization with “1: Initialize all parameters” set to Data Initialization (H003).
- Note that previous settings cannot be reverted to once Data Initialization (H003) is set to a value other than “0” to execute parameter initialization. After initialization ends, Data Initialization (H003) returns to “0.”

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H003 | Data Initialization | 0: Disable<br>1: Initialize all parameters<br>2: Initialize motor 1 parameters<br>3: Initialize motor 2 parameters<br>4: Restore user defined data<br>5: Initialize all parameters (except I/O and communications)<br>6: Initialize DriveApp parameters<br>7: Clear alarm history | 0 | - |

- During operation, initialization is not possible. Perform initialization after stopping inverter operation. Also, do not enter a RUN command as the inverter might operate unintentionally during initialization.

### Parameter Initialization (H003 = 1)

- When “1: Initialize all parameters” is set to Data Initialization (H003), all parameters excluding the following are set to their default data (values at the time of shipment from the factory).

  Main Circuit Capacitor Service Life Coefficient (Measurement Value) (H042)
  Main Circuit Capacitor Service Life Coefficient (Initial Value) (H047) Service
  Life of Main Circuit Capacitor Remaining Time (H077)
  Cumulative Run Time of Cooling Fan (H043)
  Cumulative Run Time of Capacitors on Printed Circuit Boards (H048)
  1st Startup Count for Motor (H044)
  2nd Startup Counter for Motor (A052)
  1st Cumulative Motor Run Time (H094)
  2nd Cumulative Motor Run Time (A051)
  User Preference Dataset Protection Function Selection (H194)
  Monitor Exclusive Parameters (M, W Parameters)

- Parameters are initialized even if they are protected by a password, and both passwords 1 and 2 are canceled. (Refer to *8-7-2 Password Function* on page 8-71.)

- User preference dataset saved by User Preference Dataset Registration (H193) are not initialized. (Refer to *6-1-2 User Preference Dataset (Registration/Protection)* on page 6-6.)

## Initialize motor 1 parameters (H003 = 2)

- When “2: Initialize motor 1 parameters” is set to Data Initialization (H003), the following parameters are set to their default data (values at the time of shipment from the factory).
  1st Manual Torque Boost Voltage (F009)
  1st Motor Electronic Thermal Level (F011)
  1st Motor Pole Number (P001)
  1st Motor Rated Current (P003)
  1st Motor No Load Current (P006)
  1st Motor Parameter %R1 (P007)
  1st Motor Parameter %X (P008)
  1st Slip Compensation Gain for Braking (P011)
  1st Rated Slip Frequency (P012)
  1st Iron Loss Factor 1 (P013)
  1st Magnetic Saturation Factor 1 (P016)
  1st Magnetic Saturation Factor 2 (P017)
  1st Magnetic Saturation Factor 3 (P018)
  1st Magnetic Saturation Factor 4 (P019)
  1st Magnetic Saturation Factor 5 (P020)
  1st PM Motor Starting Method (P030)
  1st Motor Torque Current under Vector Control (P055)
  1st Induced Voltage Factor under Vector Control (P056)
  1st PM Motor Armature Resistance (P060)
  1st PM Motor d-axis Inductance (P061)
  1st PM Motor q-axis Inductance (P062)
  1st PM Motor Induced Voltage Ke (P063)
  1st PM Motor Iron Loss (P064)
  1st PM Motor Reference Current for Magnetic Pole Detection (P087)
  1st PM Motor Overcurrent Protection Level (P090)
  Auto Search Delay Time 2 for Starting Mode (H046)
  Magnetic Flux Level during Deceleration (d090)

## Initialize Motor 2 Parameters (H003 = 3)

- When “3: Initialize motor 2 parameters” is set to Data Initialization (H003), the following parameters are set to their default data (values at the time of shipment from the factory).
  2nd Manual Torque Boost Voltage (A005)
  2nd Motor Electronic Thermal Level (A007)
  2nd Motor Pole Number (A015)
  2nd Motor Rated Current (A017)
  2nd Motor No Load Current (A020)
  2nd Motor Motor Constant %R1 (A021)
  2nd Motor Motor Constant %X (A022)

2nd Slip Compensation Gain for Braking (A025) 2nd Rated Slip Frequency (A026)
2nd Iron Loss Factor 1 (A027)
2nd Magnetic Saturation Factor 1 (A030)
2nd Magnetic Saturation Factor 2 (A031)
2nd Magnetic Saturation Factor 3 (A032)
2nd Magnetic Saturation Factor 4 (A033)
2nd Magnetic Saturation Factor 5 (A034) Torque Current for 2nd Vector Control (A055)
Induced Voltage Factor for 2nd Vector Control (A056)

## Restore User Defined Data (H003= 4)

- When “4: Restore user defined data” is set to Data Initialization (H003), parameters are initialized using the user preference dataset saved at User Preference Dataset Registration (H193). When there are no user preference dataset, parameters are initialized using factory defaults. (Same opera- tion as when Data Initialization (H003) is set to 1).
- User preference dataset saved by User Preference Dataset Registration (H193) are not initialized. (Refer to *6-1-2 User Preference Dataset (Registration/Protection)* on page 6-6.)
- The following parameters are not initialized.

Main Circuit Capacitor Service Life Coefficient (Measurement Value) (H042)
Main Circuit Capacitor Service Life Coefficient (Initial Value) (H047) Service
Life of Main Circuit Capacitor Remaining Time (H077)
Cumulative Run Time of Cooling Fan (H043)
Cumulative Run Time of Capacitors on Printed Circuit Boards (H048)
1st Startup Count for Motor (H044)
2nd Startup Counter for Motor (A052)
1st Cumulative Motor Run Time (H094)
2nd Cumulative Motor Run Time (A051)
User Preference Dataset Protection Function Selection (H194)
Monitor Exclusive Parameters (M, W Parameters)

## Initialize All Parameters (Except I/O and Communications) (H003 =5)

- When “5: Initialize all parameters (except I/O and communications)” is set to Data Initialization (H003), the following parameters excluding I/O and communications are initialized to their factory defaults.

Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099)
Output Terminal [DO1] Function Selection (E020)
Output Terminal [ROA, ROB] Function Selection (E027)

Also, the following parameters are not initialized.

Main Circuit Capacitor Service Life Coefficient (Measurement Value) (H042)

Main Circuit Capacitor Service Life Coefficient (Initial Value) (H047)
Service Life of Main Circuit Capacitor Remaining Time (H077)
Cumulative Run Time of Cooling Fan (H043)
Cumulative Run Time of Capacitors on Printed Circuit Boards (H048)
1st Startup Count for Motor (H044)
2nd Startup Counter for Motor (A052)
1st Cumulative Motor Run Time (H094)
2nd Cumulative Motor Run Time (A051)
User Preference Dataset Protection Function Selection (H194)
Monitor Exclusive Parameters (M, W Parameters)

## Clear DriveApp Parameters (H003 = 6)

- When “6: Clear DriveApp parameters” is set to Data Initialization (H003), the customized application parameters are returned to default settings. DriveApps are plugin additional functions that we can install in the inverter to perform special applications and customer functions. Please contact Omron sales for details on how to request custom functionality.
- Please be aware that default settings of parameters may not correspond to the ones in standard firmware (as reflected in the parameter lists of this user manual, as customizing the default settings is precisely one of the features of DriveApps.

## Clear Alarm History (H003 = 7)

- When “7: Clear alarm history” is set to Data Initialization (H003), the alarm history and various infor- mation at the time of the alarm are cleared to set to an alarm non-occurring state.
- The alarm information of parameters (refer to *8-1-4 Alarm information* on page 8-15) is initialized.

# 6-1-2 User Preference Dataset (Registration/Protection)

Set User Preference Dataset Registration/Protection by the following parameters. When “4: Restore user defined data” is set to Data Initialization (H003), parameters are initialized using the saved user preference datasets.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H193 | User Preference Data-set Registration | 0: Disable<br>1: Store | 0 | - |
| H194 | User Preference Data-set Protection Function Selection | 0: Unprotected<br>1: Protected | 0 | - |
| Related function | | Data Initialization (H003) | | |

- The set values of parameters that have been changed from the factory defaults can be saved (registered) as user preference dataset. For parameters also that have not been changed from the factory defaults, factory defaults can be saved (registered) as user preference dataset. Note, however, that the following parameters are not targeted for saving as user preference datasets.

  Main Circuit Capacitor Service Life Coefficient (Measurement Value) (H042)
  Main Circuit Capacitor Service Life Coefficient (Initial Value) (H047) Service
  Life of Main Circuit Capacitor Remaining Time (H077)
  Cumulative Run Time of Cooling Fan (H043)
  Cumulative Run Time of Capacitors on Printed Circuit Boards (H048)
  1st Startup Count for Motor (H044)
  2nd Startup Counter for Motor (A052)
  1st Cumulative Motor Run Time (H094)
  2nd Cumulative Motor Run Time (A051)
  User Preference Dataset Protection Function Selection (H194)
  Monitor Exclusive Parameters (M, W Parameters)

- Save user preference dataset by the following procedure.
  Step 1: Set “0: Unprotected” (default value) to User Preference Dataset Protection Function Selection (H195).
  Step 2: When User Preference Dataset Registration (H194) is set to “1: Protected,” registration of the user preference dataset is started.
  Step 3: To protect the user preference dataset, set “1: Protected (save prohibited)” to User Preference Dataset Protection Function Selection (H195).
- To set all user preference datasets to the factory defaults, initialize parameters by Data Initialization (H003) “1: Initialize all parameters,” and then register the datasets by User Preference Dataset Registration (H194).

# 6-2 Setting V/f Control

## 6-2-1 Motor Control Method (V/f Characteristics)

- V/f control is a method of controlling a motor by setting the output voltage and frequency of the in- verter as V/f characteristics. This is effective for using the inverter easily.
- Set 0 and 3 at Drive Control Selection and select the V/f characteristics (output voltage and output frequency).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F042 / A014 | 1st Drive Control Selection / 2nd Drive Control Selection*1 | 0: IM V/f control<br>3: IM V/f control with speed sensor | 0 | - |
| F037 / A013 | 1st V/f Characteristics Selection /2nd V/f Characteristics Selection | 0: Variable torque load<br>1: Constant torque load | 1 | - |

*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].

### V/f Control (Induction Motor) (F042/A014 = 0)

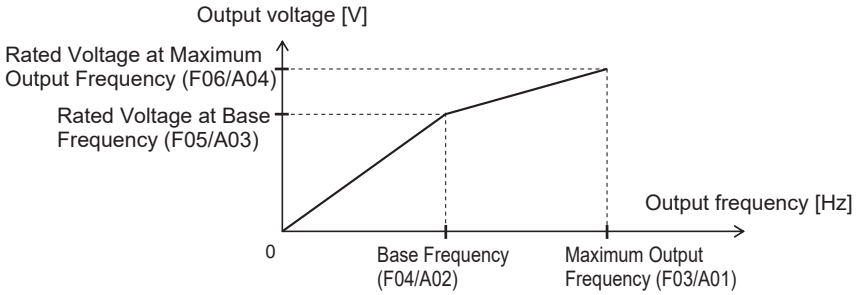
V/f control outputs the voltage and frequency according to a preset V/f pattern to operate the motor. Also, slip compensation function enabled/disabled can be switched by Slip compensation Function Selection (H442). For details on slip compensation, refer to *6-2-3 Slip Compensation* on page 6-14.

### V/f Control with Speed Sensor (Induction Motor) (F042/A014 = 3)

When a load is applied to an induction motor, slip occurs according to characteristics of the motor and this results in a drop in motor rotation speed.
With V/f control with speed sensor, the motor rotation speed is detected by an encoder mounted on the motor shaft, and the slip frequency is compensated by PI control so that the motor rotation speed matches the speed equivalent to the instructed speed. As a result, the speed control accuracy of the motor is improved.

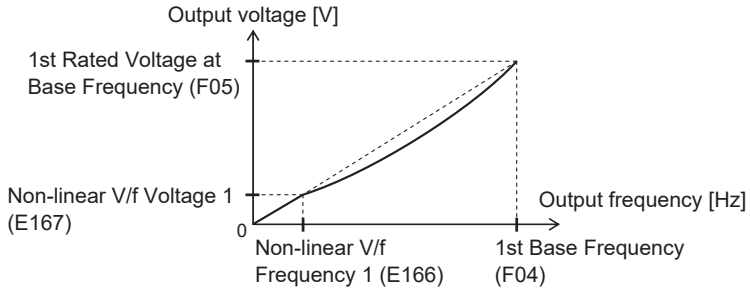
### Constant Torque Characteristics (F037/A013 = 1)

This setting is suitable for cart, conveyor, overhead traveling crane, and other applications where a torque is required, independent of the motor rotation speed.
It enables the output of a constant torque based on the frequency, according to the V/f characteristics that represent the proportional relationship between the output frequency and the output voltage. For the base frequency, set the rated frequency of the motor.
For the maximum frequency, set the highest frequency at which control is performed on the inverter. Note that this must be within the maximum frequency of the motor.




## Reducing Torque Characteristics (F037/A013 = 0)

This setting is suitable for fan, pump, and other applications that do not require large torque at low speeds.
It provides high efficiency, reduced noise and vibration as the output voltage is reduced in the low speed range.
By using the non-linear V/f function, a sufficient startup torque can also be secured as constant torque characteristics up to specified speeds.



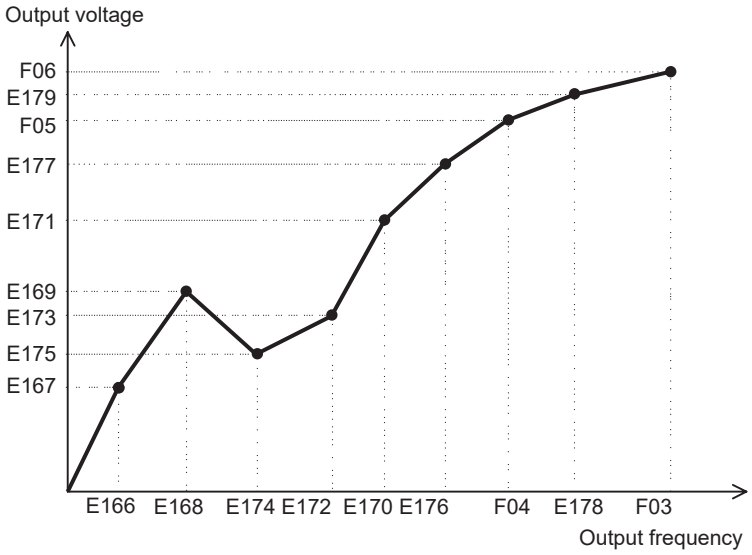

Reducing torque characteristics using non-linear V/f

Reducing torque characteristics are characteristics to the power of two.

## Broken Line V/f Function

- With the non-linear V/f function, V/f characteristics at a total of nine points can be configured as desired by setting the voltage and frequency of seven points in addition to base voltage/frequency and maximum voltage/frequency. When the non-linear V/f function is not used, set “0.0” to the non-linear V/f frequency 1 to 7 that is not to be used.
- Frequency is not in parameter No. order but in of the size of the set value. (Refer to the figure below.)
- The non-linear V/f function can be jointly used with torque boost, reducing torque characteristics and automatic energy saving operation.

| Parameter No. | Function name | Data | Description | Default data | Unit |
|---|---|---|---|---|---|
| E166 | Non-linear V/f Frequency 1 | 0.0: Disable<br>0.1 to 590.0 | Sets the frequency at each break point. | 0.0 | Hz |
| E168 | Non-linear V/f Frequency 2 | | | | |
| E170 | Non-linear V/f Frequency 3 | | | | |
| E172 | Non-linear V/f Frequency 4 | | | | |
| E174 | Non-linear V/f Frequency 5 | | | | |
| E176 | Non-linear V/f Frequency 6 | | | | |
| E178 | Non-linear V/f Frequency 7 | | | | |
| E167 | Non-linear V/f Voltage 1 | 0 to 240 (for 200 V class series) 0 to 500 (for 400 V class series) | Sets the voltage at each break point. | 0 | V |
| E169 | Non-linear V/f Voltage 2 | | | | |
| E171 | Non-linear V/f Voltage 3 | | | | |
| E173 | Non-linear V/f Voltage 4 | | | | |
| E175 | Non-linear V/f Voltage 5 | | | | |
| E177 | Non-linear V/f Voltage 6 | | | | |
| E179 | Non-linear V/f Voltage 7 | | | | |




## 6-2-2 Load Mode Selection

Select either of the heavy load mode (HHD/HD) or the light load mode (HND/ND) according to the application.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F080 | Load Mode Selection | 0: HHD 1: HND<br>3: HD (only for 400 V)<br>4: ND (only for 400 V) | 0 | - |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| Related function | | 1st Drive Control Selection (F042)<br>2nd Drive Control Selection (A014)<br>1st Manual Torque Boost Voltage (F009) 2nd Manual Torque Boost Voltage (A005) 1st Overload Protect Level (F044)<br>2nd Overload Protect Level (E147) Carrier Frequency (F026)<br>1st DC Injection Braking Level (F021) 2nd DC Injection Braking Level (A010) | | |

- Load modes that can be selected differ depending on the voltage specifications and capacity of the inverter.

| Power supply specifications | Load Mode Selection (F080) | | | |
|---|---|---|---|---|
| | 0: HHD | 1: HND | 3: HD | 4: ND |
| Three-phase 200 V full capacity | OK | OK | - | - |
| Three-phase 400V full capacity | OK | OK | OK | OK |
| Single-phase 200 V (2.2 k or less) | OK | OK | - | - |
| Single-phase 200 V (3.7 kW) | OK | - | - | - |

- For loads (such as fans and pumps) that do not require frequent use of the inverter above the rated torque, the light load mode can be selected. The rated current of the inverter increases above that of the heavy load mode, which enables the inverter to drive a motor one size larger. For details on rated current specifications, refer to *1-3-1 Standard Specifications* on page 1-10. The overload capacity differs as shown in the following table on each specification type.

| F080 data | Specification type | | Continuous rated current level | Ambient temperature | Overload capacity |
|---|---|---|---|---|---|
| 0 | Heavy load mode | HHD | Motor whose capacity is two sizes lower than the inverter's one | Up to 50°C | 150% 1min, 200% 0.5 s |
| 3<br>(only for 400 V) | | HD | Motor whose capacity is one size lower than the inverter's one | Up to 40°C | 150% 1 min |
| 1 | Light load mode | HND | Motor whose capacity is one size lower than the inverter's one | Up to 50°C | 120% 1 min |
| 4<br>(only for 400 V) | | ND | Motor whose capacity is the same as the inverter's one | Up to 40°C | 120% 1 min |

## Related Parameters

- Some parameters are restricted by changing the setting of Load Mode Selection (F080).

### When Drive Control Selection (F042/A014) = 0 to 6 (induction motor)

- The set values of the following parameters are overwritten with the following values according to the new settings after changing Load Mode Selection (F080).
  Manual Torque Boost Voltage (F009/A005) Overload Protect Level (F044/E147)

- The upper limit values of the following parameters change according to the new settings after changing Load Mode Selection (F080). When the set values exceed the upper limit, they are overwritten with the upper limit.
  Carrier Frequency (F026)
  DC Injection Braking Level (F021/A010)

| Power supply | Model | Capacity [kW] | Manual Torque Boost Voltage (F009/A005) | | | | Overload Protect Level (F044/E147) | | | | Carrier Frequency (F026) | | | | DC Injection Braking Level (F021/A010) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Set value | | | | Set value | | | | Maximum value (*1) | | | | Maximum value (*1) | | | |
| | | | Load Mode Selection (F080) | | | | Load Mode Selection (F080) | | | | Load Mode Selection (F080) | | | | Load Mode Selection (F080) | | | |
| | | | 0: HHD | 1: HND | 3: HD | 4: ND | 0: HHD | 1: HND | 3: HD | 4: ND | 0: HHD | 1: HND | 3: HD | 4: ND | 0: HHD | 1: HND | 3: HD | 4: ND |
| Three-phase 200V | 3G3M1-A2001 | 0.1 | 8.4 | 6.7 | - | - | 180 | 130 | - | - | 16 | 16 | - | - | 100 | 80 | - | - |
| | 3G3M1-A2002 | 0.2 | 8.4 | 6.7 | - | - | 180 | 130 | - | - | 16 | 16 | - | - | 100 | 80 | - | - |
| | 3G3M1-A2004 | 0.4 | 7.1 | 4.0 | - | - | 180 | 130 | - | - | 16 | 16 | - | - | 100 | 80 | - | - |
| | 3G3M1-A2007 | 0.75 | 3.8 | 2.6 | - | - | 180 | 130 | - | - | 16 | 16 | - | - | 100 | 80 | - | - |
| | 3G3M1-A2015 | 1.5 | 3.0 | 2.4 | - | - | 180 | 130 | - | - | 16 | 16 | - | - | 100 | 80 | - | - |
| | 3G3M1-A2022 | 2.2 | 2.5 | 2.1 | - | - | 180 | 130 | - | - | 16 | 10 | - | - | 100 | 80 | - | - |
| | 3G3M1-A2037 | 3.7 | 2.4 | 2.0 | - | - | 180 | 130 | - | - | 16 | 10 | - | - | 100 | 80 | - | - |
| | 3G3M1-A2055 | 5.5 | 1.9 | 1.9 | - | - | 180 | 130 | - | - | 16 | 16 | - | - | 100 | 80 | - | - |
| | 3G3M1-A2075 | 7.5 | 1.8 | 1.8 | - | - | 180 | 130 | - | - | 16 | 16 | - | - | 100 | 80 | - | - |
| | 3G3M1-A2110 | 11 | 1.3 | 1.3 | - | - | 180 | 130 | - | - | 16 | 16 | - | - | 100 | 80 | - | - |
| | 3G3M1-A2150 | 15 | 1.2 | 1.2 | - | - | 180 | 130 | - | - | 16 | 16 | - | - | 100 | 80 | - | - |
| | 3G3M1-A2185 | 18.5 | 0.9 | 0.9 | - | - | 160 | 130 | - | - | 16 | 16 | - | - | 100 | 80 | - | - |

| Power supply | Model | Capacity [kW] | Manual Torque Boost Voltage (F009/A005) | | | | Overload Protect Level (F044/E147) | | | | Carrier Frequency (F026) | | | | DC Injection Braking Level (F021/A010) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Set value | | | | Set value | | | | Maximum value (*1) | | | | Maximum value (*1) | | | |
| | | | Load Mode Selection (F080) | | | | Load Mode Selection (F080) | | | | Load Mode Selection (F080) | | | | Load Mode Selection (F080) | | | |
| | | | 0: HHD | 1: HND | 3: HD | 4: ND | 0: HHD | 1: HND | 3: HD | 4: ND | 0: HHD | 1: HND | 3: HD | 4: ND | 0: HHD | 1: HND | 3: HD | 4: ND |
| Three-phase 400V | 3G3M1-A4004 | 0.4 | 7.1 | 4.0 | 7.1 | 4.0 | 180 | 130 | 160 | 130 | 16 | 16 | 16 | 10 | 100 | 80 | 80 | 60 |
| | 3G3M1-A4007 | 0.75 | 3.8 | 2.6 | 3.8 | 2.6 | 180 | 130 | 160 | 130 | 16 | 16 | 16 | 10 | 100 | 80 | 80 | 60 |
| | 3G3M1-A4015 | 1.5 | 3.0 | 2.4 | 3.0 | 2.4 | 180 | 130 | 160 | 130 | 16 | 16 | 16 | 10 | 100 | 80 | 80 | 60 |
| | 3G3M1-A4022 | 2.2 | 2.5 | 2.1 | 2.5 | 2.1 | 180 | 130 | 160 | 130 | 16 | 16 | 16 | 10 | 100 | 80 | 80 | 60 |
| | 3G3M1-A4030 | 3.0 | 2.5 | 2.1 | 2.5 | 2.1 | 180 | 130 | 160 | 130 | 16 | 16 | 16 | 10 | 100 | 80 | 80 | 60 |
| | 3G3M1-A4040 | 4.0 | 2.4 | 2.0 | 2.4 | 2.0 | 180 | 130 | 160 | 130 | 16 | 16 | 16 | 10 | 100 | 80 | 80 | 60 |
| | 3G3M1-A4055 | 5.5 | 1.9 | 1.9 | 1.9 | 1.9 | 180 | 130 | 160 | 130 | 16 | 16 | 16 | 10 | 100 | 80 | 80 | 60 |
| | 3G3M1-A4075 | 7.5 | 1.8 | 1.8 | 1.8 | 1.8 | 180 | 130 | 160 | 130 | 16 | 16 | 16 | 10 | 100 | 80 | 80 | 60 |
| | 3G3M1-A4110 | 11 | 1.3 | 1.3 | 1.3 | 1.3 | 180 | 130 | 160 | 130 | 16 | 16 | 16 | 10 | 100 | 80 | 80 | 60 |
| | 3G3M1-A4150 | 15 | 1.2 | 1.2 | 1.2 | 1.2 | 180 | 130 | 160 | 130 | 16 | 16 | 16 | 10 | 100 | 80 | 80 | 60 |
| | 3G3M1-A4185 | 18.5 | 0.9 | 0.9 | 0.9 | 0.9 | 160 | 130 | 160 | 130 | 16 | 16 | 16 | 10 | 100 | 80 | 80 | 60 |
| | 3G3M1-A4220 | 22 | 0.9 | 0.9 | 0.9 | 0.9 | 160 | 130 | 160 | 130 | 16 | 10 | 10 | 6 | 100 | 80 | 80 | 60 |
| Single-phase 200V | 3G3M1-AB001 | 0.1 | 8.4 | 6.7 | - | - | 180 | 130 | - | - | 16 | 10 | - | - | 100 | 80 | - | - |
| | 3G3M1-AB002 | 0.2 | 8.4 | 6.7 | - | - | 180 | 130 | - | - | 16 | 10 | - | - | 100 | 80 | - | - |
| | 3G3M1-AB004 | 0.4 | 7.1 | 4.0 | - | - | 180 | 130 | - | - | 16 | 10 | - | - | 100 | 80 | - | - |
| | 3G3M1-AB007 | 0.75 | 3.8 | 2.6 | - | - | 180 | 130 | - | - | 16 | 10 | - | - | 100 | 80 | - | - |
| | 3G3M1-AB015 | 1.5 | 3.0 | 2.4 | - | - | 180 | 130 | - | - | 16 | 10 | - | - | 100 | 80 | - | - |
| | 3G3M1-AB022 | 2.2 | 2.5 | 2.1 | - | - | 180 | 130 | - | - | 16 | 10 | - | - | 100 | 80 | - | - |
| | 3G3M1-AB037 | 3.7 | 2.4 | - | - | - | 180 | - | - | - | 16 | - | - | - | 100 | - | - | - |

### When Drive Control Selection (F042/A014) = 15, 16 (synchronous motor)

- The set values of the following parameters are overwritten with the following values according to the new settings after changing Load Mode Selection (F080).
  Manual Torque Boost Voltage (F009)

| Power supply | Model | Capacity [kW] | Manual Torque Boost Voltage (F009) | | | |
|---|---|---|---|---|---|---|
| | | | Set value | | | |
| | | | Load Mode Selection (F080) | | | |
| | | | 0: HHD | 1: HND | 3: HD | 4: ND |
| Three-phase 200 V | 3G3M1-A2001 | 0.1 | 8.4 | 6.7 | - | - |
| | 3G3M1-A2002 | 0.2 | 8.4 | 6.7 | - | - |
| | 3G3M1-A2004 | 0.4 | 7.1 | 4.0 | - | - |
| | 3G3M1-A2007 | 0.75 | 6.8 | 3.5 | - | - |
| | 3G3M1-A2015 | 1.5 | 6.8 | 4.9 | - | - |
| | 3G3M1-A2022 | 2.2 | 6.8 | 4.5 | - | - |
| | 3G3M1-A2037 | 3.7 | 5.5 | 4.1 | - | - |
| | 3G3M1-A2055 | 5.5 | 4.9 | 3.4 | - | - |
| | 3G3M1-A2075 | 7.5 | 4.4 | 2.7 | - | - |
| | 3G3M1-A2110 | 11 | 3.5 | 2.1 | - | - |
| | 3G3M1-A2150 | 15 | 2.8 | 1.6 | - | - |
| | 3G3M1-A2185 | 18.5 | 2.2 | 1.3 | - | - |
| Three-phase 400V | 3G3M1-A4004 | 0.4 | 7.1 | 4.0 | 7.1 | 4.0 |
| | 3G3M1-A4007 | 0.75 | 6.8 | 3.5 | 6.8 | 3.5 |
| | 3G3M1-A4015 | 1.5 | 6.8 | 4.9 | 6.8 | 4.9 |
| | 3G3M1-A4022 | 2.2 | 6.8 | 4.5 | 6.8 | 4.5 |
| | 3G3M1-A4030 | 3.0 | 6.8 | 4.5 | 6.8 | 4.5 |
| | 3G3M1-A4040 | 4.0 | 5.5 | 4.1 | 5.5 | 4.1 |
| | 3G3M1-A4055 | 5.5 | 4.9 | 3.4 | 4.9 | 3.4 |
| | 3G3M1-A4075 | 7.5 | 4.4 | 2.7 | 4.4 | 2.7 |
| | 3G3M1-A4110 | 11 | 3.5 | 2.1 | 3.5 | 2.1 |
| | 3G3M1-A4150 | 15 | 2.8 | 1.6 | 2.8 | 1.6 |
| | 3G3M1-A4185 | 18.5 | 2.2 | 1.3 | 2.2 | 1.3 |
| | 3G3M1-A4220 | 22 | 2.2 | 1.1 | 2.2 | 1.1 |
| Single-phase 200 V | 3G3M1-AB001 | 0.1 | 8.4 | 6.7 | - | - |
| | 3G3M1-AB002 | 0.2 | 8.4 | 6.7 | - | - |
| | 3G3M1-AB004 | 0.4 | 7.1 | 4.0 | - | - |
| | 3G3M1-AB007 | 0.75 | 6.8 | 3.5 | - | - |
| | 3G3M1-AB015 | 1.5 | 6.8 | 4.9 | - | - |
| | 3G3M1-AB022 | 2.2 | 6.8 | 4.5 | - | - |
| | 3G3M1-AB037 | 3.7 | 5.5 | - | - | - |

## 6-2-3 Slip Compensation

The slip compensation function calculates the torque generated by the motor to infer the slip amount. As a result of this calculation, the drop in motor rotation speed can be compensated for to suppress the drop in motor rotation speed. This is useful for improving the speed control accuracy of the motor. To enable the slip compensation function, select “0: V/f control” or “3: V/f control with speed sensor” at Drive Control Selection (F042/A014), then set 1 at Slip compensation Function Selection (H442), and

set the conditions for enabling the slip compensation function to Slip Compensation Operating Conditions Selection (H068/A040).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H442 | Slip compensation Function Selection | 0: Disable<br>1: Enable | 0 | - |
| H068 /A040 | 1st Slip Compensation Operating Conditions Selection /<br>2nd Slip Compensation Operating Conditions Selection*1 | 0: Enable during acceleration / deceleration, enable at base frequency or higher<br>1: Disable during acceleration / deceleration, enable at base frequency or higher<br>2: Enable during acceleration / deceleration, disable at base frequency or higher<br>3: Disable during acceleration / deceleration, at base frequency or higher | 0 | - |
| P009 /A023*2 | 1st Slip Compensation Gain for Driving /<br>2nd Slip Compensation Gain for Driving*1 | 0.0 to 200.0 | 100.0 | % |
| P010 /A024 | 1st Slip Compensation Response Time /<br>2nd Slip Compensation Response Time*1 | 0.01 to 10.00 | 0.12 | s |
| P011 /A025*2 | 1st Slip Compensation Gain for Braking /<br>2nd Slip Compensation Gain for Braking*1 | 0.0 to 200.0 | 100.0 | % |
| P012 /A026*2 | 1st Rated Slip Frequency /<br>2nd Rated Slip Frequency*1 | 0.00 to 15.00 | Dependent on capacity | Hz |

*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].

*2. When 0.0% or 0.00 Hz is set to one of P009/A023, P011/A025 and P012/A026, slip compensation is disabled.

Details of 1st Slip Compensation Operating Conditions Selection (H068) and 2nd Slip Compensation Operating Conditions Selection (A040) are as shown in the table below.

| H068/A040 Data | Motor operation state | | Frequency range | |
|---|---|---|---|---|
| | At acceleration/ deceleration | At constant speed | Base frequency or less | Base frequency or more |
| 0 | Enable | Enable | Enable | Enable |
| 1 | Disable | Enable | Enable | Enable |
| 2 | Enable | Enable | Enable | Disable |
| 3 | Disable | Enable | Enable | Disable |

- For Slip Compensation Gain for Driving (P009/A023)/Slip Compensation Response Time (P010/A024)/Slip Compensation Gain for Braking (P011/A025), adjust the compensation amount for when slip compensation is performed and the slip amount in the internal calculation. These can be set in- dividually in the driving mode and the braking mode. The rated slip frequency is archived when set to 100%. When overcompensation (100% or higher) is set in slip compensation, hunting sometimes occurs. So, check this on an actual inverter.
  The slip compensation response time determines the response when slip compensation is per- formed. Basically, there is no need to change the setting.

- Rated slip frequency (P012/A026)
  Set the rated slip frequency of the motor. This is also automatically set by executing auto-tuning.

$$\text{Rated slip frequency (Hz)} = \frac{\text{Synchronous speed - Rated speed}}{\text{Synchronous speed}} \times \text{Base frequency}$$

# 6-3 Motor Parameter Settings

## 6-3-1 Induction Motor Basic Settings

When running an induction motor, set the following parameters to match the rated value of the motor used and the design values of the machinery.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F004 / A002 | 1st Base Frequency / 2nd Base Frequency*1 | 5.0 to 590.0 | 50.0 | Hz |
| F005 / A003 | 1st Rated Voltage at Base Frequency / 2nd Rated Voltage at Base Frequency*1 | 80 to 240: (200 V class series) 160 to 500: (400 V class series) | Dependent on capacity | V |
| F003 / A001 | 1st Maximum Output Frequency / 2nd Maximum Output Frequency*1 | 5.0 to 590.0 | 60.0 | Hz |

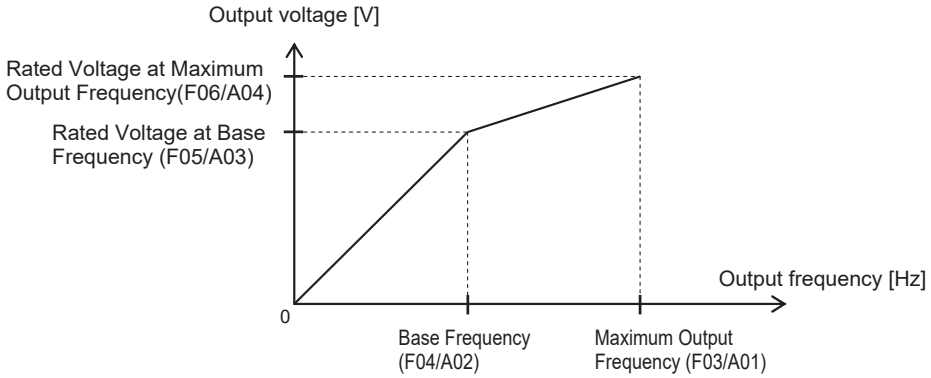
*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].

## 6-3-2 Base Frequency and Maximum Frequency of Motor

To configure the V/f control characteristics output to the motor, set the base frequency and maximum frequency of your motor.
For the base frequency, set the rated frequency of the motor (the frequency listed on the motor rating nameplate).
For the maximum frequency, set the highest frequency required for your application. However, do not exceed the maximum rotation speed of the motor.
Then, set the motor rated voltage to 1st Rated Voltage at Maximum Output Frequency (F006)/2nd Rated Voltage at Maximum Output Frequency (A004).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F004 /A002 | 1st Base Frequency / 2nd Base Frequency*1 | 5.0 to 590.0 | 50.0 | Hz |
| F003 /A001 | 1st Maximum Output Frequency / 2nd Maximum Output Frequency*1 | 5.0 to 590.0 | 60.0 | Hz |
| F005 /A003 | 1st Rated Voltage at Base Frequency / 2nd Rated Voltage at Base Frequency*1 | 80 to 240: (200 V class series) 160 to 500: (400 V class series) | Dependent on capacity | V |
| F006 /A004 | 1st Rated Voltage at Maximum Output Frequency / 2nd Rated Voltage at Maximum Output Frequency*1 | 80 to 240: (200 V class series) 160 to 500: (400 V class series) | Dependent on capacity | V |

*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].




- For these motors, check the rated motor current and select an appropriate inverter based on the rated current of the inverter.
- Do not set the base frequency to lower than the motor rated frequency. Doing so may cause overload or motor burnout.
- Do not select a motor incoming voltage higher than the motor rated voltage. Doing so may cause an overload or motor burnout.

## 6-3-3 Motor Electronic Thermal Function

The motor electronic thermal function prevents the motor from overloading and burning. In addition, M1 has a braking resistor electronic thermal function. (Refer to *6-12-2 Braking Resistor Electronic Thermal Function* on page 6-65.)

- The motor electronic thermal function calculates the electronic thermal calculated value for motor protection based on the output current of the inverter. The status of the electronic thermal function can be checked by the monitor of electronic thermal overload protection for motor (M059). When 100% is reached in the percentage display, motor overload (alarm codes: 17, 18) is detected.
- The motor electronic thermal function sets Motor Electronic Thermal Level (F011/A007), Motor Electronic Thermal Characteristic Selection (F010/A006) and Motor Electronic Thermal Time Constant (F012/A008).
- When Motor Electronic Thermal Overload Protection Data Retention (H089) is set to 1, the electronic thermal cumulative value and thermal cumulative value of the overload early warning are saved in the EEPROM when an insufficient voltage state has occurred, and, when the power is next turned ON, EEPROM saved values are used as the defaults for cumulative values.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F010 /A006 | 1st Motor Electronic Thermal Characteristic Selection /<br>2nd Motor Electronic Thermal Characteristic Selection*1 | 1: For a general-purpose motor with shaft-driven cooling fan<br>2: For an inverter-driven motor non-ventilated motor or motor with separately powered cooling fan | 1 | - |
| F011 /A007 | 1st Motor Electronic Thermal Level /<br>2nd Motor Electronic Thermal Level*1 | 0.00: Disable 0.01 to 118.8<br># Setting range from 1% (HHD) to 135% (ND) of the rated inverter current. | 22.5 | A |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F012 /A008 | 1st Motor Electronic Thermal Time Constant / 2nd Motor Electronic Thermal Time Constant*1 | 0.5 to 75.0 | 5.0 | min |
| M059 | Motor Electronic Thermal Monitor | 0 to 100 | 0 | % |
| H089 | Motor Electronic Thermal Overload Protection Data Retention | 0: Disable<br>1: Enable | 0 | - |
| Related function | | Motor overload (alarm codes: 17, 18) | | |

*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].

## Motor Electronic Thermal Level (F011/A007)

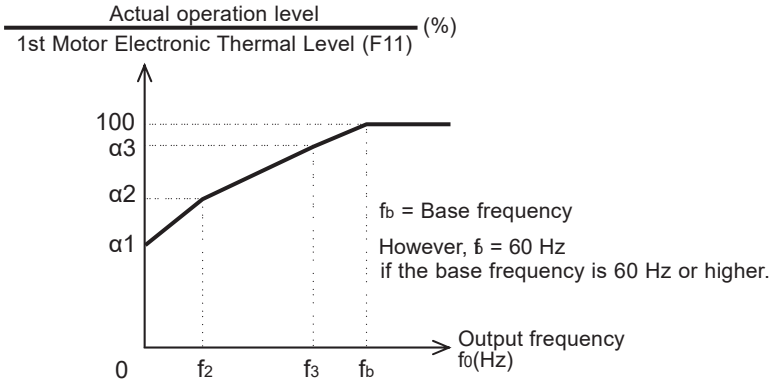
- Set the operation level of the electronic thermal for motor protection. To not use this function, set 0.00.
- Normally, set to the motor continuous allowable current (generally, about 1.0 to 1.1 times the motor rated current) when the motor is run at base frequency.

## Motor Electronic Thermal Characteristic Selection (F010/A006)

- Select the characteristics of the motor cooling system.

### When Motor Electronic Thermal Characteristic Selection (F010/A006) = 1: For a general-purpose motor with shaft-driven cooling fan

- The figure below shows the electronic thermal operation characteristics. Characterization factors α1 to α3 and their switching frequencies f2 and f3 differ according to the characteristics of the motor.




- The following shows each factor that is set according to the motor characteristics selected by motor capacity and motor type (induction motor/PM motor).

Induction motor (IM)

| Motor capacity | Thermal time constant t (factory default) | Thermal time constant setting reference current value Imax | Characterization factor switching frequency | | Characterization factor | | |
|---|---|---|---|---|---|---|---|
| | | | $f_2$ | $f_3$ | α1 | α2 | α3 |
| 0.4, 0.75 kw | 5 min | Continuous allowable current value × 150% | 5 Hz | 7 Hz | 75% | 85% | 100% |
| 1.5 to 3.7 kW | | | | | 85% | 85% | 100% |
| 5.5 to 11 kW | | | | 6 Hz | 90% | 95% | 100% |
| 15 kw | | | | 7 Hz | 85% | 85% | 100% |
| 18.5, 22 kW | | | | 5 Hz | 92% | 100% | 100% |
| 30 to 45 kW | 10 min | | Base Frequency × 33% | Base Frequency × 83% | 54% | 85% | 95% |
| 55 to 90 kW | | | | | 51% | 95% | 95% |
| 110 kw min. | | | | | 53% | 85% | 90% |

Synchronous motor (PM)

| Motor capacity | Thermal time constant t (factory default) | Thermal time constant setting reference current value Imax | Characterization factor switching frequency | | Characterization factor | | |
|---|---|---|---|---|---|---|---|
| | | | $f_2$ | $f_3$ | α1 | α2 | α3 |
| 0.2 to 22 kW | 5 min | Continuous allowable current value × 150% | Base Frequency × 33% | Base Frequency × 33% | 69% | 90% | 90% |
| 30 to 45 kW | 10 min | | | Base Frequency × 83% | 54% | 85% | 95% |
| 55 to 90 kW | | | | | 51% | 95% | 95% |
| 110 kw min. | | | | | 53% | 85% | 90% |

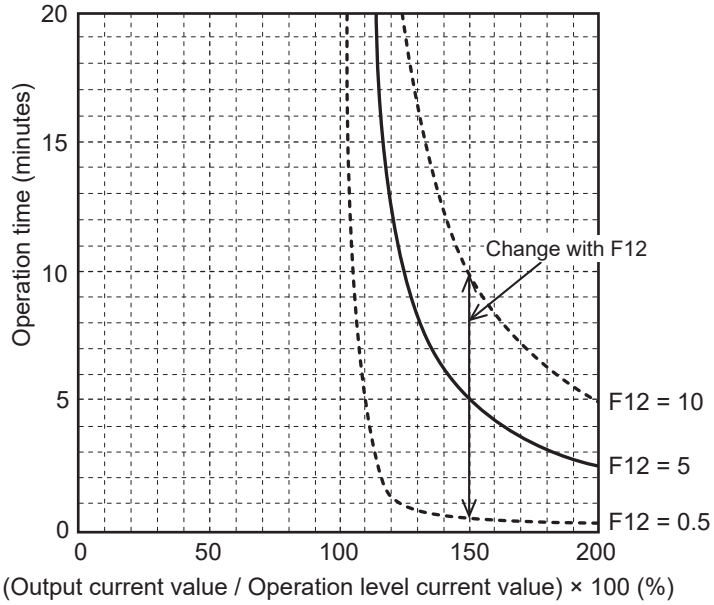
### When Motor Electronic Thermal Characteristic Selection (F010/A006) = 2: For an inverter-driven motor non-ventilated motor or motor with separate- ly powered cooling fan

- The operation level is a constant value without decrease that is set at Motor Electronic Thermal Level (F011/A007) as there is no drop in the cooling effectiveness by output frequency.

## Motor Electronic Thermal Time Constant (F012/A008)

- Set the thermal time constant of the motor. Set the electronic thermal operating time for when a current of 150% of the operation level set at Motor Electronic Thermal Level (F011/A007) flows continuously. The thermal time constant of a general motor is 5 minutes for 22kW or less (factory default).

(Example) When the data of Motor Electronic Thermal Time Constant (F012/A008) is set to “5” (5 minutes)
When a current 150% of the overload detection level set as shown in the figure below flows for 5 minutes, the motor overload (alarm codes: 17, 18) protection function operates. Also, for 120%, the motor overload protection function operates after approx. 12.5 minutes.
The time that an alarm actually is generated is shorter than the set data as the time from when the continuous allowable current (100%) is exceeded up to when the 150% level is reached also is taken into consideration.




## Motor Electronic Thermal Warning

Use this function to output a warning signal before the motor electronic thermal function executes an overload protection. The electronic thermal warning operates at or above the current value set in the Overload early warning 2 Level (OL2) (E034). Generally, set to around 80% to 90% of the current value of the Motor Electronic Thermal Level (F011/A007). The temperature characteristics of the motor are set in Motor Electronic Thermal Characteristic Selection (F010/A006) or Motor Electronic Thermal Time Constant (F012/A008).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020/E027 | Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection | 7: THM (Electronic thermal warning) | - | - |
| E034 | Overload early warning 2 Level (OL2) | 0.00: Disable 0.01 to 176.0<br># Setting range from 1% (HHD) to 200% (ND) of the rated inverter current. | 21.0 | A |

# 6-4 RUN command

## 6-4-1 RUN command selection

Select the input method for the RUN command.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F002 / E102 | 1st RUN Command Selection<br>2nd RUN Command Selection*1 | 1: Terminal command FW or RV<br>5: Ethernet | 5 | - |
| Related function | | Input Terminal [DI6] Function Selection (E098)<br>Input Terminal [DI7] Function Selection (E099)<br>Operation command (S006) | | |

*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].

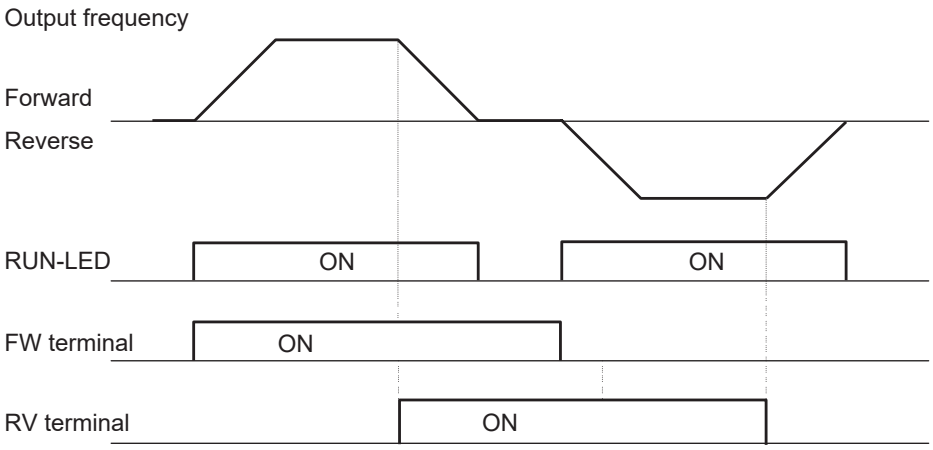
The operation method for data selected at 1st RUN Command Selection (F002)/2nd RUN Command Selection (E102) is as follows.

| Data | Operation method |
|---|---|
| 1 | Forward rotation is performed when the FW terminal turns ON. Reverse rotation is performed when the RV terminal turns ON. Operation stops when both the FW and RV terminals are OFF or both are ON. |
| 5 | When Ethernet is selected, the run operation will depend on the selected protocol. EtherNet/IP, PROFINET (with PROFIdrive profile) and Modbus TCP offer different methods for inverter control with specific methods. Please check Section 5 for details |

- When “1: External signal (Digital input)” is selected at RUN Command Selection (F002/E102), allocate “98: FW (forward rotation)” and “99: RV (reverse rotation)” to each of Input Terminal [DI6] Function Selection (E098) and Input Terminal [DI7] Function Selection (E099). Operation stops when both the FW and RV terminals are ON or both are OFF.
- When “1: External signal (Digital input)” is selected at RUN Command Selection (F002/E102), 3-wire input is possible. Refer to *3-wire Input Function (FW, STP, F/R)* on page 6-49.
- The RUN command from an input terminal can be forcibly enabled via input terminals. Refer to *8-6-3 STO Function by Safety Input Signal* on page 8-62.
- When the inverter is outputting to the motor, operation is in progress and the RUN-LED lights. Lights during deceleration after RUN command OFF. Goes out while the RUN command is ON at frequency reference 0 Hz as there is no output. When zero speed control is being executed, this lights as the inverter outputs even when the frequency reference is 0 Hz.

### Operation example

- The following shows an example of operation by forward command FW input and reverse command RV input when “1: External signal (Digital input)” is selected at RUN Command Selection (F002/E102).


Output frequency
Forward
Reverse
RUN-LED
ON
ON
FW terminal
ON
RV terminal
ON

# 6-5 Frequency Reference

## 6-5-1 Frequency Reference Selection

- Select the input method for the frequency reference.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F001 / C030 | 1st Frequency Reference Selection / 2nd Frequency Reference Selection*1 | 1: Analog Valtage Input (Input Terminal[AI1])<br>7: UP/DOWN control<br>10: Pattern operation<br>12: Pulse train input<br>13: Calculation result<br>15: Ethernet | 15 | - |
| S006 | Operation command | Bit1: REV<br>Bit0: FWD | 0 | - |
| Related function | | Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099) | | |

*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].

The frequency reference method for data selected at 1st Frequency Reference Selection (F001) and 2nd Frequency Reference Selection (C030) is as follows.

| Data | Frequency reference method |
|---|---|
| 1 | Sets the frequency reference via the analog voltage input (input terminal [AI1]). |
| 7 | Sets the frequency reference via the UP and DOWN terminals. |
| 10 | Sets the frequency reference via Pattern Operation Function Selection. |
| 12 | Sets the frequency reference via pulse train input. |
| 13 | The result of calculation of the frequency calculation function is set as the frequency reference. |
| 14 | Sets the frequency reference via Ethernet communication. |

- The forced terminal block function are given priority over the frequency reference selected at Frequency Reference Selection (F001/C030). For details, refer to *8-6-3 STO Function by Safety Input Signal* on page 8-62.

### Command Using Analog Voltage Input (Frequency Reference Selection (F001/C030) = “1”)

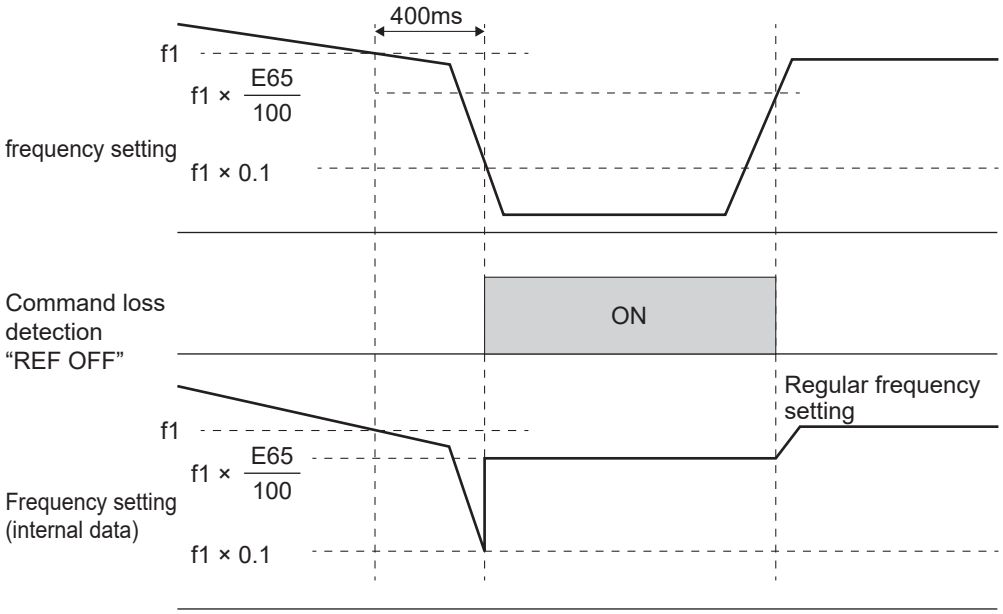
- Analog input can adjust the input signal by gain and bias. (Refer to *8-3-2 Analog Input Adjustment Function* on page 8-35.)
- Behavior when the analog signal is disconnected can be set at analog reference loss detection.

#### Analog Reference Loss Detection

When the analog frequency reference falls to 10% or lower of the frequency reference for 400 ms, the wiring of the analog frequency reference is judged to have become disconnected, operation is continued at the frequency of the ratio set at Reference Loss Detection Operation Selection (E065) for the frequency setting value, and the REF OFF terminal is turned ON.

When the frequency setting value returns to the value set at Reference Loss Detection Operation Selection (E065) or higher, it is judged that the disconnection has been restored, and operation is performed at the legitimate frequency setting.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E065 | Reference Loss Detection Operation Selection | 0: Decelerate to stop<br>20 to 120: Continuous operation frequency ratio<br>999: Disable | 999 | % |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 33: REF OFF (Reference loss detection) | - | - |




- With the frequency reference via analog input, select only linear acceleration/deceleration.

## UP/DOWN Control (Frequency Reference Selection (F001/C030) = "7")

- Refer to *8-9-11 UP/DOWN control* on page 8-110.

## Pattern Operation (Frequency Reference Selection (F001/C030) = "10")

- Refer to *6-5-3 Pattern Operation Function Selection* on page 6-28.

## Command Based on Pulse Train Input (Frequency Reference Selection (F001/C030) = "12")

- Refer to *8-9-18 Pulse Train Frequency Input* on page 8-133.

## Command via Calculation Result of Frequency Calculation Function (Frequency Reference Selection (F001/C030) = “13”)

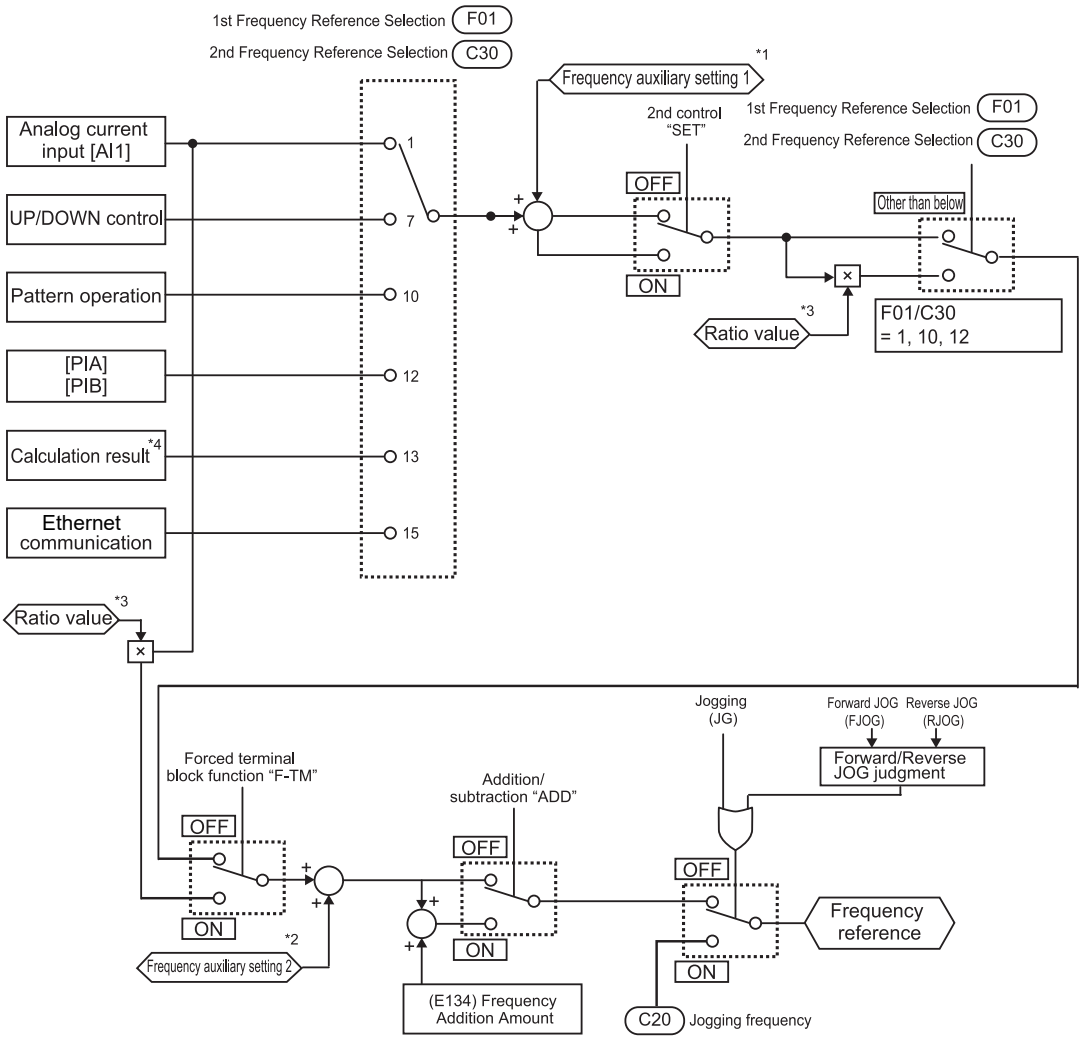
- Refer to *8-9-9 Frequency Calculation Function* on page 8-109.

## Command Based on Communication (Frequency Reference Selection (F001/C030) = “15”)

- When using an unique profile, frequency reference is instructed according to the selected Ethernet protocol. EtherNet/IP, PROFIBUS with PROFIdrive profile and Modbus TCP, have different methods to define reference frequency operation for inverter. Check Section 5 for detail.

## Frequency Reference Correlation Chart

- Set the frequency reference at 1st Frequency Reference Selection (F001) and 2nd Frequency Reference Selection (C030).
  Alternatively, the frequency reference can be switched via multifunction input. Below shows a chart showing the correlation between priority, related parameters, and related multifunction input terminals when the frequency reference is switched.




The presence/absence of the pulse train command depends on the combination of the following parameter settings.

| F01 | C30 | E131 | E132 | E119 | Pulse train command |
|---|---|---|---|---|---|
| Any one is 12 | | Ignore | | | Set frequency |
| Any one is 13 | | Any one is 5 | | 45 | PID feedback |
| Other than the above | | | | 3 | Without |
| Other than the above | | | | | Without |

*1. Auxiliary frequency setting 1 is set by setting 1 to Extended function (E061).
*2. Auxiliary frequency setting 2 is set by setting 2 to Extended function (E061).
*3. Ratio value is set by setting 6 to Extended function (E061).
*4. For details on the result of logical operation, refer to *8-9-9 Frequency Calculation Function* on page 8-109.

## 6-5-2 Frequency Limit

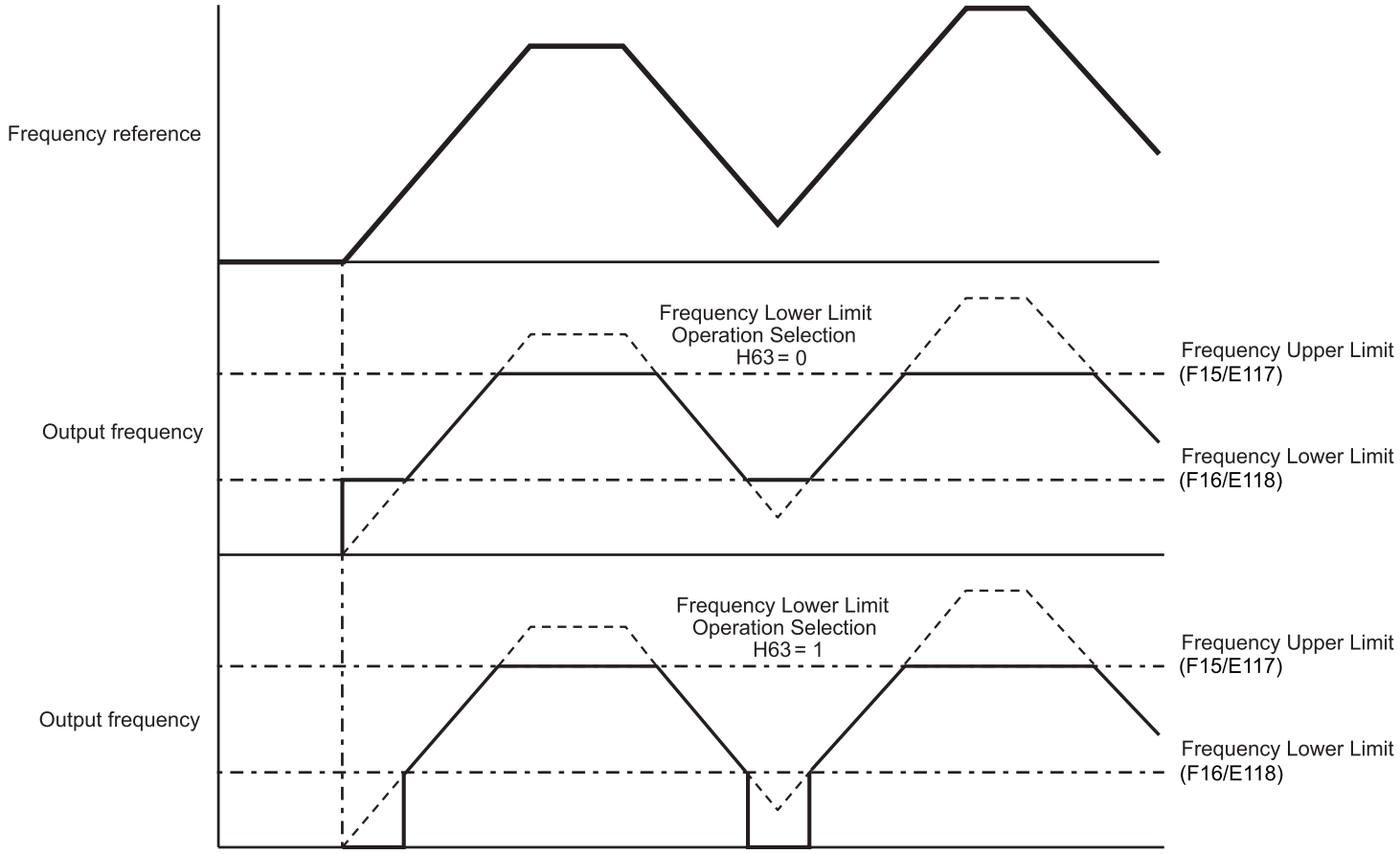
- Use this function to set the upper and lower limits of the output frequency. The set limits will be applied if the input frequency reference is beyond the upper/lower limit(s).
- Be sure to set so that the upper limit (F015/E117) is greater than the lower limit (F016/E118).
- Set the lower limit so that it does not reach or exceed Maximum Output Frequency (F003/A001).
- When 0 Hz is set to the upper limit, operation is limited to 0 Hz and disabled.

- Processing when the set frequency is less than the Frequency Lower Limit (H063) can be selected at Frequency Lower Limit Operation Selection (F016/E118).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F015/E117 | 1st Frequency Upper Limit/2nd Frequency Upper Limit*1 | 0.00 to 590.00 | 70.0 | Hz |
| F016/E118 | 1st Frequency Lower Limit/2nd Frequency Lower Limit*1 | 0.00 to 590.00 | 0.0 | Hz |
| H063 | Frequency Lower Limit Operation Selection | 0: Frequency Command is the Frequency Lower Limit.<br>1: Frequency Command is 0Hz | 0 | - |

*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].

- When “0: Frequency Command is the Frequency Lower Limit” is selected at Frequency Lower Limit Operation Selection (H063), the output frequency becomes the frequency set at Frequency Lower Limit (F016/E118) even if the frequency reference is set to less than Frequency Lower Limit (F016/E118). Even if 0 Hz is set to the frequency reference, priority is given to the lower limit. For this reason, turn the RUN command OFF to stop output.




## 6-5-3 Pattern Operation Function Selection

- To perform pattern operation, set Frequency Reference Selection (F001/C030) = “10.”

- The pattern operation function operates according to seven preset patterns.
- Operation time, rotation direction, acceleration/deceleration time, and the frequency reference are set to patterns.
- Three pattern operations can be selected: one cycle operation, repetition operation and constant speed operation after 1 cycle operation,
- The status of pattern operation can be output to output terminals [DO1] and [ROA, ROB].

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| C021 | Pattern Operation Function Selection | 0: 1 cycle operation (Pattern operation)*1<br>1: Repetition operation (Pattern operation)<br>2: Constant speed operation (Pattern operation) after 1 cycle operation*2 | 0 | - |
| C022 to C028 | Pattern Operation Stage 1 to 7 Operation Setting | Bit 15:<br>0 = Forward<br>1 = Reverse<br>Bit 14: Fixed to 0 (Not used)<br>Bit 13 to 12: Acceleration/Deceleration time selection<br>0: 1st Acceleration Time 1 (F007)/1st Deceleration Time 1 (F008)<br>1: 2nd Acceleration Time 1 (E010)/2nd Deceleration Time 1 (E011)<br>2: 1st Acceleration Time 2 (E012)/1st Deceleration Time 2 (E013)<br>3: 2nd Acceleration Time 2 (E014)/2nd Deceleration Time 2 (E015)<br>Bit 11 to 10: Minimum unit of operation time 0: 0.01<br>1: 0.1<br>2: 1<br>3: 10<br>Bit 9 to 0: Data part of operation time<br>0000 to 03E7 hex (0.00 to 9.99) if Minimum unit is 0: 0.01<br>0064 to 03E7 hex (10.0 to 99.9) if Minimum unit is 1: 0.1 #1<br>0064 to 03E7 hex (100 to 999) if Minimum unit is 2: 1 #1<br>0064 to 0258 hex (1000 to 6000) if Minimum unit is 3: 10 #2<br><br>#1. 0000 to 0063 hex and 03E8 to 03FF hex cannot be set.<br>#2. 0000 to 0063 hex and 0259 to 03FF hex cannot be set. | 0 | - |
| C005 to C011 | Multi-step Frequency Reference 1 to 7 | 0.0 to 590.00 | 0.0 | Hz |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020/E027 | Output Terminal [DO1] Function Selection/ Output Terminal [ROA, ROB] Function Selection | 16: TU (transition to pattern operation stage)<br>17: TO (pattern operation cycle operation completion) | - | - |

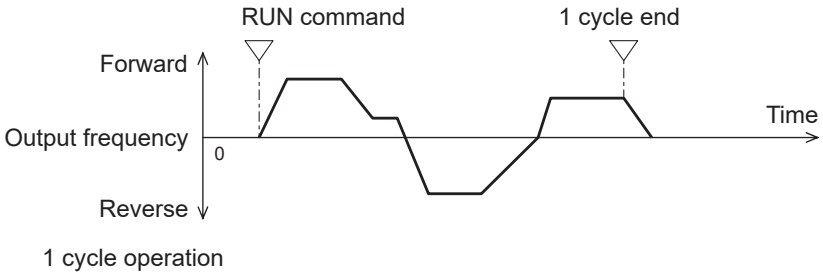
*1. With the deceleration time after end of one cycle, a deceleration stop is performed according to the setting value of 1st Deceleration Time 1 (F008).

*2. With constant speed operation after end of one cycle, constant speed operation is performed according to the last set frequency in pattern operation.

## Pattern Operation Function Selection

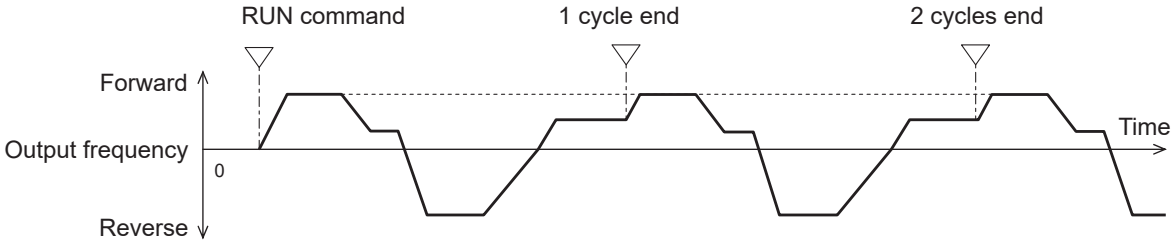
- Operation is as follows when “0” to “2” is set at Pattern Operation Function Selection (C021).

1. Pattern Operation Function Selection (C021) = “0: 1 cycle operation”
   A deceleration stop is performed after one cycle operation by the preset pattern.



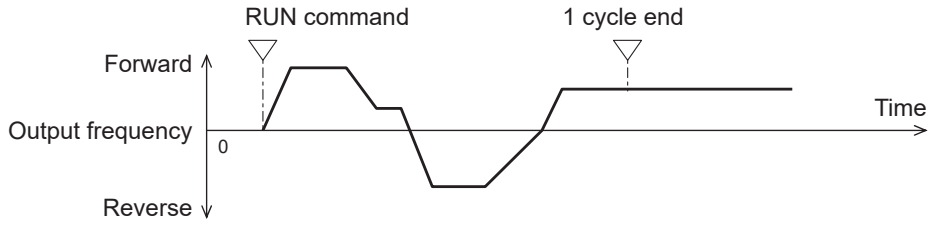

1 cycle operation

2. Pattern Operation Function Selection (C021) = “1: Repetition operation”
   Operation by the preset pattern is repeated.




Repetition operation

3. Pattern Operation Function Selection (C021) = “2: Constant speed operation after 1 cycle operation”
   After one cycle operation by the preset pattern, constant speed operation is performed in accordance with the last set frequency of pattern operation.
   To stop constant speed operation, turn the RUN command OFF.




Constant speed operation after 1 cycle operation

## Pattern Operation Setting

- To set the patterns in pattern operation, set the operation time, rotation direction and acceleration/deceleration time to Pattern Operation Stage 1 to 7 Operation Setting (C022 to C028). The following describes the method for setting stages in Operator and in Sysmac Studio.

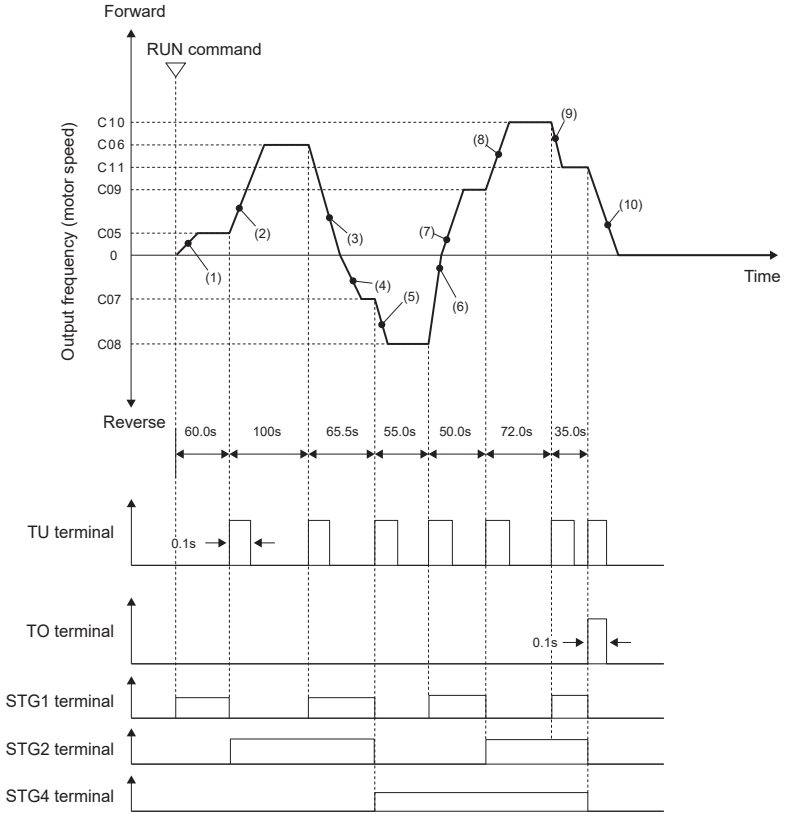
<Setting stages in Sysmac Studio>
Pattern Operation Stage 1 Operation Setting (C022 to C028) Example:
In case of (reverse rotation, 2nd deceleration time, 10.0 s) Rotation direction Reverse: 8000 hex
Acceleration/deceleration time 2nd acceleration/deceleration time: 1000 hex
Operation time 10.0 s = 0.1 × 100: 0400 hex + 0064 hex
Accordingly, the set value becomes 8000 hex + 1000 hex + 0400 hex + 0064 hex = 9464 hex

- Stages set with an operation time of 0.0 are disabled and are ignored.
- Each of Multi-step Frequency Reference 1 to 7 (C005 to C011) is applied to the frequency setting of stages 1 to 7.
- The signal can be output at completion of cycle operation when the pattern operation stage is transitioned to by allocating “16: Pattern operation stage transition (TU)” and “17: Pattern operation cycle completed (TO)” to output terminals [DO1] and [ROA, ROB]. For details, refer to the operation example figure below.
- When Pattern Operation Function Selection (C021) = 0 is set and pattern operation is started by input via the FW/RV terminals turning ON, the motor stops when the final stage ends even if the FW/RV terminals stay ON.
  At this time, when the value of Frequency Reference Selection (F001/C030) is changed without turning the FW/RV terminals OFF, operation is immediately started according to the set frequency after the value is changed.

## Pattern operation setting examples

| Pattern Operation Function Selection (C021) | Stage No. | Operation time | Rotation direction | Acceleration/ deceleration time | Operation (reference) frequency |
|---|---|---|---|---|---|
| | | Set value | Set value | Set value | |
| 0 | Stage 1 | 60.0 | 0 | 2 | Multi-step Frequency Reference 1 (C005) |
| | Stage 2 | 100.0 | 0 | 1 | Multi-step Frequency Reference 2 (C006) |
| | Stage 3 | 65.5 | 1 | 4 | Multi-step Frequency Reference 3 (C007) |
| | Stage 4 | 55.0 | 1 | 3 | Multi-step Frequency Reference 4 (C008) |
| | Stage 5 | 50.0 | 0 | 2 | Multi-step Frequency Reference 5 (C009) |
| | Stage 6 | 72.0 | 0 | 4 | Multi-step Frequency Reference 6 (C010) |
| | Stage 7 | 35.0 | 0 | 2 | Multi-step Frequency Reference 7 (C011) |

This is illustrated as follows.




With the deceleration time after end of one cycle, a deceleration stop is performed by the setting value of 1st Deceleration Time 1 (F008).

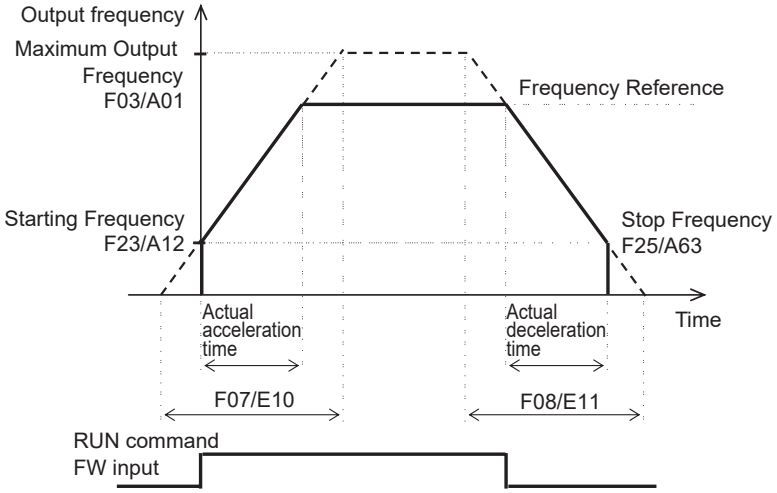
Acceleration times or deceleration times set at (1) to (10)

| | |
|---|---|
| (1) | Acceleration time: E010 |
| (2) | Acceleration time: F007 |
| (3) | Deceleration time: E015 |
| (4) | Acceleration time: E014 |
| (5) | Acceleration time: E012 |
| (6) | Deceleration time: E011 |
| (7) | Acceleration time: E010 |
| (8) | Acceleration time: E014 |
| (9) | Deceleration time: E011 |
| (10) | Deceleration time: F008 |

# 6-6 Acceleration/Deceleration Time Settings

## 6-6-1 Acceleration/Deceleration Time Setting

- Set the motor acceleration/deceleration time.
- The set time here is the acceleration/deceleration time from 0 Hz to the maximum output frequency. The actual acceleration/deceleration time varies depending on the frequency reference value.
- This parameter is for setting the time constant of the primary delay filter with respect to the output frequency during acceleration/deceleration when V/f control (F042/A014 = 0 to 3) is selected. Set this parameter when an overshoot or undershoot occurs when the frequency arrives at the target frequency or the rotation of the motor stops and this causes mechanical problems. Setting a large value stabilizes the output frequency but worsens response.




| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F007 / E010 | 1st Acceleration Time 1 / 2nd Acceleration Time 1*1 | 0.00 to 6000 | 6.00 | s |
| F008 / E011 | 1st Deceleration Time 1 / 2nd Deceleration Time 1*1 | 0.00 to 6000 | 6.00 | s |
| d086 | Acc/Dec Output Frequency Filter | 0.000 to 5.000 | 0.000 | s |

*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].

When a short deceleration time is set, the regenerative amount that is fed back at deceleration increases. When the regenerative amount exceeds the allowable capacity of the inverter, either the deceleration time is extended by the setting of Anti-regenerative Control Function Selection (H069), or overvoltage (alarm code: 7) is detected. To shorten the deceleration time, use the regenerative braking function. For details on the regenerative braking function, refer to *6-12-1 Regenerative Braking Function* on page 6-65.

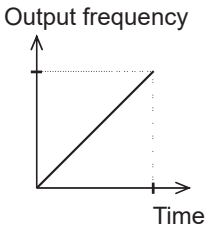
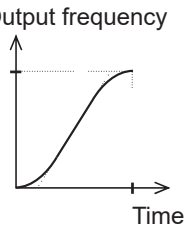
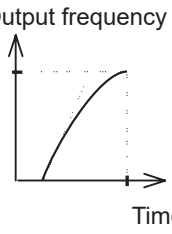
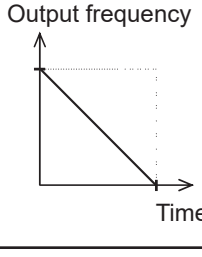
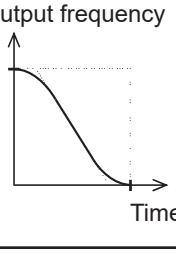
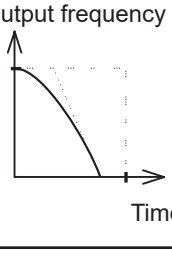
## 6-6-2 Acceleration/Deceleration Pattern

- Use this function to set the acceleration/deceleration pattern.
- Select the acceleration/deceleration pattern at Acceleration/Deceleration Pattern Selection (H007).
- These acceleration/deceleration patterns are enabled also for frequency reference input via analog input terminals.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H007 | Acceleration/Deceleration Pattern Selection | 0: Disable (Linear acceleration/deceleration)<br>1: S-curve acceleration/deceleration<br>2: S-curve acceleration/deceleration (Arbitrary: According to H057 to H060)<br>3: Curve acceleration/deceleration | 0 | - |
| H057 | S-curve Acceleration Range Frequency at Starting | 0 to 100 | 10 | % |
| H058 | S-curve Acceleration Range Frequency at End | | | |
| H059 | S-curve Deceleration Range Frequency at Starting | | | |
| H060 | S-curve Deceleration Range Frequency at End | | | |

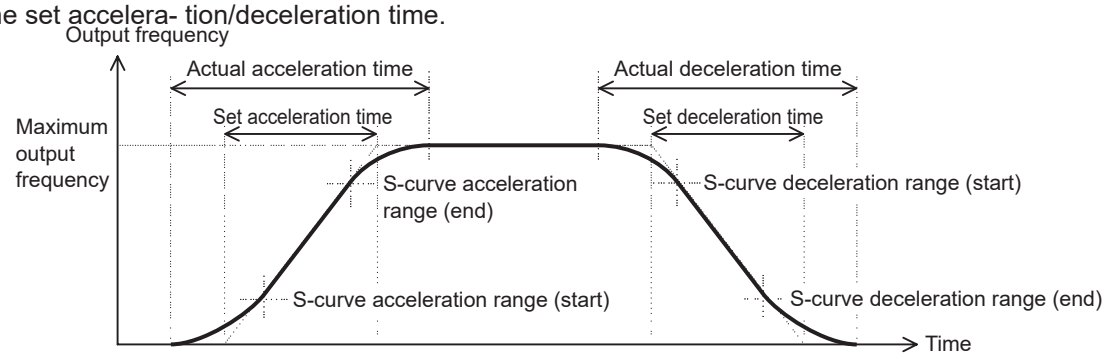
### Pattern Selection

- Set Acceleration/Deceleration Pattern Selection (H007) according to the following table.

| H007 (Acceleration/ Deceleration Pattern Selection) | Set value | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| | Disable (Linear acceleration/deceleration) | S-curve acceleration/ deceleration | S-curve acceleration/ deceleration (Arbitrary) | Curve acceleration/ deceleration |
| At acceleration |  |  | |  |
| At deceleration |  |  | |  |

## S-curve Acceleration/Deceleration Range

- When “2: S-curve acceleration/deceleration (Arbitrary)” is selected at Acceleration/Deceleration Pat- tern Selection (H007), set S-curve Acceleration Range Frequency at Starting (H057)/S-curve Accel- eration Range Frequency at End (H058) and S-curve Deceleration Range Frequency at Start (H059)/S-curve Deceleration Range Frequency at End (H060). When “1: S-curve acceleration/ deceleration” is set at Acceleration/Deceleration Pattern Selection (H007), each are fixed at 5%.
- The larger the values of S-curve Acceleration Range Frequency at Starting (H057), S-curve Acceler- ation Range Frequency at End (H058), S-curve Deceleration Range Frequency at Start (H059) and S-curve Deceleration Range Frequency at End (H060) are, the gentler acceleration/ deceleration is performed. For this reason, the actual acceleration/deceleration time is longer than the set accelera- tion/deceleration time.




| | S-curve accelera- tion range (start) | S-curve accelera- tion range (end) | S-curve decelera- tion range (start) | S-curve decelera- tion range (end) |
|---|---|---|---|---|
| S-curve accelera- tion/deceleration | 5% (fixed) | 5% (fixed) | 5% (fixed) | 5% (fixed) |
| S-curve accelera- tion/deceleration (Arbitrary) | 0 to 100% S- curve Accelera- tion Range Fre- quency at Starting (H057) | 0 to 100% S- curve Accelera- tion Range Fre- quency at End (H058) | 0 to 100% S- curve Decelera- tion Range Fre- quency at Starting (H059) | 0 to 100% S- curve Decelera- tion Range Fre- quency at End (H060) |

## 6-6-3 Acceleration/Deceleration Stop Function

- This function causes the inverter stop accelerating/decelerating temporarily and start running at a constant speed at the frequency output at that time.
- There are two acceleration/deceleration stop methods as follows, which can be used in conjunction with each other.
  - When the output frequency reaches the set frequency, acceleration/deceleration stops for the set stop time.
  - Stop the acceleration/deceleration operation while the HLD terminal is ON.

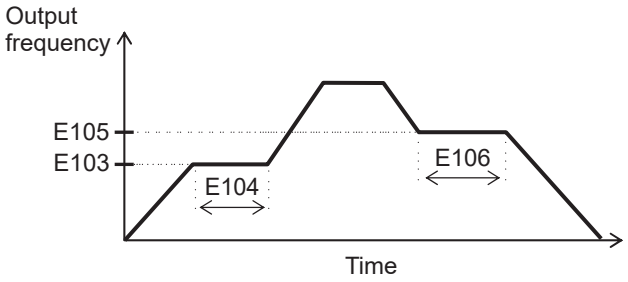
| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E103 | Acceleration Stop Frequency | 0.00: Disable<br>0.01 to 590.00 | 0.00 | Hz |
| E104 | Acceleration Stop Time | 0.0: Disable<br>0.1 to 60.0 | 0.0 | s |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E105 | Deceleration Stop Frequency | 0.00: Disable<br>0.01 to 590.00 | 0.00 | Hz |
| E106 | Deceleration Stop Time | 0.0: Disable<br>0.1 to 60.0 | 0.0 | s |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 163: HLD (Acceleration/ deceleration stop) | - | - |

- If the HLD terminal is ON, acceleration/deceleration operation stops regardless of the stop time. Until the set stop time elapses, acceleration/deceleration stops continuously even if the HLD terminal is turned OFF during the set stop frequency.

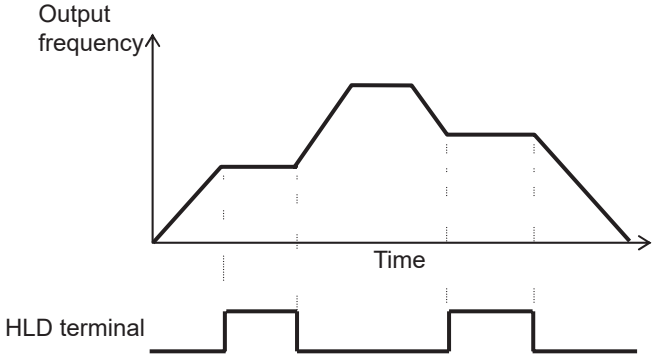
## Stopping when the specified frequency/stop time is reached

- Set the frequency at which acceleration operation is stopped to Acceleration Stop Frequency (E103), and set the time that acceleration operation is stopped to Acceleration Stop Time (E104). To not stop acceleration operation, set Acceleration Stop Time (E104) to 0.0.
- Set the frequency at which deceleration operation is stopped to Deceleration Stop Frequency (E105), and set the time that deceleration operation is stopped to Deceleration Stop Time (E106). To not stop deceleration operation, set Deceleration Stop Time (E106) to 0.0.




## Stopping via input to a multifunction input terminal

- When the HLD terminal is turned ON during acceleration, acceleration is stopped, and when it is turned OFF, acceleration is resumed.
- When the HLD terminal is turned ON during deceleration, deceleration is stopped, and when it is turned OFF, deceleration is resumed.



## 6-6-4 2-step Acceleration/Deceleration Function

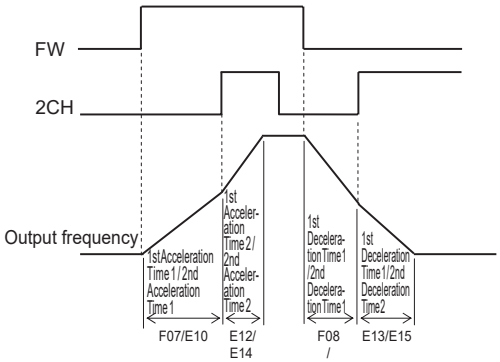
- Use the 2-step acceleration/deceleration function to control two acceleration/deceleration time.
- The acceleration/deceleration time switching method can be selected from the following four. 2-step Acceleration/Deceleration Switching Condition Selection (E125/E126) = “0: Switching by 2CH terminal” (Example 1)
  2-step Acceleration/ Deceleration Switching Condition Selection (E125/E126) = “1: Switching by setting” (Example 2)
  2-step Acceleration/Deceleration Switching Condition Selection (E125/E126) = “2: Forward and reverse” (Example 3)
  2-step Acceleration/Deceleration Switching Condition Selection (E125/E126) = “3: Switching by RT1, RT2 terminals” (Example 4)
- For Acceleration Time 2 (E012/E014) and Deceleration Time 2 (E013/E015), set the time from frequency 0 Hz up to the maximum output frequency in the same way as Acceleration Time 1 (F007/E010) and Deceleration Time 1 (F008/E011).
- Acceleration/deceleration pattern and acceleration/deceleration operation stop also can be used.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F007 | 1st Acceleration Time 1 | 0.00 to 6000 | 6.00 | s |
| F008 | 1st Deceleration Time 1 | | | |
| E010 | 2nd Acceleration Time 1*1 | | | |
| E011 | 2nd Deceleration Time 1*1 | | | |
| E012 | 1st Acceleration Time 2 | | | |
| E013 | 1st Deceleration Time 2 | | | |
| E014 | 2nd Acceleration Time 2*1 | | | |
| E015 | 2nd Deceleration Time 2*1 | | | |
| E125 / E126 | 1st 2-step Acceleration / Deceleration switching Condition Selection / 2nd 2-step Acceleration / Deceleration Switching Condition Selection*1 | 0: Switching by 2CH terminal<br>1: Switching by setting<br>2: Forward and reverse<br>3: Switching by RT1, RT2 terminals | 0 | - |
| E127 / E128 | 1st 2-step Acceleration Switching Frequency / 2nd 2-step Acceleration Switching Frequency*1 | 0.00 to 590.0 | 0.00 | Hz |
| E129 / E130 | 1st 2-step Deceleration Switching Frequency / 2nd 2-step Deceleration Switching Frequency*1 | | | |
| d086 | Acc/Dec Output Frequency Filter | 0.000 to 5.000 | 0.000 | s |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 159: 2CH (2-step acceleration/deceleration)<br>4: RT1 (Acceleration/deceleration selection(2-step))<br>5: RT2(Acceleration/deceleration selection(4-step)) | - | - |

*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].

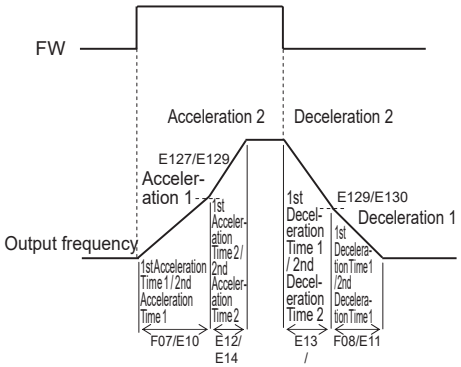
## 2-step Acceleration/Deceleration Switching Condition Selection (E125/E126) = “0: Switching by 2CH terminal” (Example 1)

- When 2CH terminal (159: 2-step Acceleration/Deceleration) is ON, acceleration/deceleration is performed at acceleration time 2 (E012/E014) or deceleration time 2 (E013/E015). When the terminal is OFF, acceleration/deceleration is performed at acceleration time 1 (F007/E010) or deceleration time 1 (F008/E011).



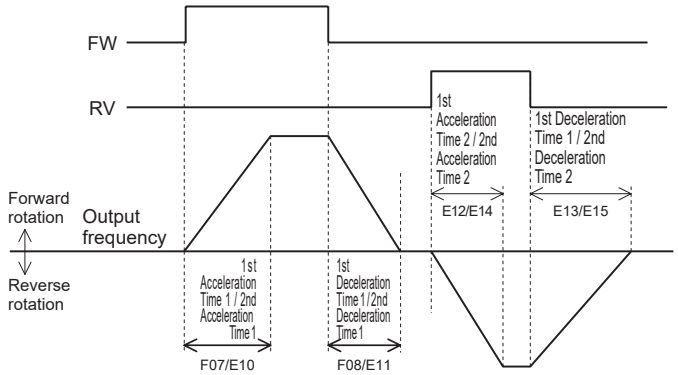

## 2-step Acceleration/Deceleration Switching Condition Selection (E125/E126) = “1: Switching by setting” (Example 2)

- During forward rotation, acceleration is performed at acceleration time 1 (E127/E129) from output frequency 0 Hz up to 2-step Acceleration Switching Frequency (F007/E010). Acceleration is performed at acceleration time 2 (E127/E129) from 2-step Acceleration Switching Frequency (E012/E014) up to the maximum output frequency.
- During reverse rotation, deceleration is performed at deceleration time 1 (E128/E130) from output frequency 0 Hz up to 2-step Deceleration Switching Frequency (F008/E011). Deceleration is performed at deceleration time 2 (E013/E014) from 2-step Deceleration Frequency (E129/E130) up to the maximum output frequency.




## 2-step Acceleration/Deceleration Switching Condition Selection (E125/E126 = “2: Forward and reverse” (Example 3)

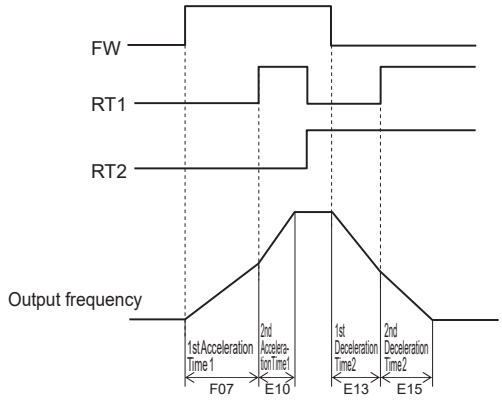
- During forward rotation, acceleration/deceleration is performed at acceleration time 1 (F007/E010) or deceleration time 1 (F008/E011). During reverse rotation, acceleration/deceleration is performed at acceleration time 2 (E012/E014) or deceleration time 2 (E013/E015).




## 2-step Acceleration/Deceleration Switching Condition Selection (E125/E126) = “3: Switching by RT1, RT2 terminals” (Example 4)

- With RT1 terminal and RT2 terminal combined, select the acceleration/deceleration time during which acceleration/deceleration is performed.

| RT2 terminal | RT1 terminal | Selected acceleration/deceleration time |
|---|---|---|
| OFF | OFF | 1st Acceleration Time 1 (F007), 1st Deceleration Time 1 (F008) |
| OFF | ON | 2nd Acceleration Time 1 (E010), 2nd Deceleration Time 1 (E011) |
| ON | OFF | 1st Acceleration Time 2 (E012), 1st Deceleration Time 2 (E013) |
| ON | ON | 2nd Acceleration Time 2 (E014), 2nd Deceleration Time 2 (E015) |



# 6-7 Stop Method Settings

The stop operation methods are as follows.

- Stop by RUN command

| Trigger | Stop operation | Reference page |
|---|---|---|
| FW terminal/RV terminal or 3-wire operation stop | Select stop by Deceleration Time (F008) or free-run stop at Stop Selection (H011). | page 6-49 |
| Operation stop via EtherNet | | page 6-22 |
| Jogging operation stop | | page 6-52 |

- Stop from external input terminal

| Trigger | Stop operation | Reference page |
|---|---|---|
| Forced stop (30: STOP) terminal | Deceleration Time for Forced Stop (H056) | page 8-141 |
| External trip (9: EXT) terminal | Free-run stop | page 8-81 |
| Free-run stop (7: FRS) terminal | Free-run stop | page 8-52 |

- Stop by error occurrence

| Trigger | Stop operation | Reference page |
|---|---|---|
| Trip by error occurrence | Free-run stop | page 9-3 |
| Overvoltage/overcurrent occurrence | Select trip or restart at Overvoltage/Overcurrent Restart Function Selection (E139). | page 8-49 |
| Momentary power failure | Select whether to perform a free-run by trip or perform continuous running or a restart at a momentary power failure at Power Interruption Restart Mode Selection (F014). | page 8-41 |

## 6-7-1 Stop Selection

- Select whether you want the motor to make a deceleration stop according to the deceleration time setting or a free-run stop, when the stop command is input via the Control Circuit Terminal Block.
- Set the operation when the RUN command selected at RUN Command Selection (F002/E102) turns OFF to Stop Selection (H011).
- In position control, a deceleration stop is performed regardless of the setting of Stop Selection (H011).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H011 | Stop Selection | 0: Normal deceleration<br>1: Free run stop | 0 | - |
| H096 | Start Check Function | 0: Disable start check function<br>1: Do not use.<br>2: Enable start check function<br>3: Do not use. | 0 | - |
| Related function | | RUN Command Selection (F002/E102)<br>Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099)<br>Acceleration Time (F007/E010)<br>Deceleration Time (F008/E011) | | |

## When Normal Deceleration Stop Is Selected (Stop Selection (H011) = “0”)

- Deceleration stop according to the selected deceleration hold time. For details, refer to *6-6-1 Accel- eration/Deceleration Time Setting* on page 6-33.

## When Free Run Stop Is Selected (Stop Selection (H011) = “1”)

- By the free run stop function, power to the motor is cut off to stop the motor.
- To use external braking, select free-run stop. Using external braking midway during a deceleration stop may cause an overload or overcurrent.
- If operation is started again during free run operation, the inverter will restart according to Free Run Stop Restart Operation Selection (H441).

# 6-8 Reset

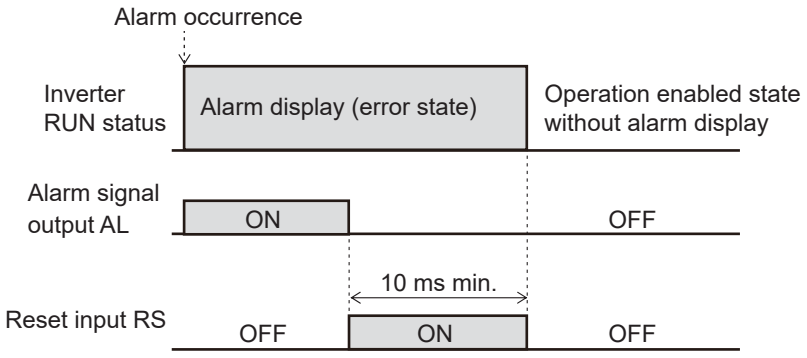
## 6-8-1 Reset Function

- Use the reset function to reset the trip status (output shutoff status caused by occurrence of error) of the inverter.
- The reset function is executed by input terminal “8: RS (Reset)” terminal, Operation command (S006 bit 15: RST) via EtherNet communication or the Alarm Reset Command (S014).
- When a reset is performed with the RUN command ON, the inverter may abruptly start depending on the setting of the Start Check Function (H096). When performing a reset operation, ensure that the RUN command is OFF. For details, refer to *Start Check Function (H096 = “2,” “3”)* on page 8-75.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 8: RS (Reset) | - | - |
| S014 | Alarm Reset Command | 0: Disable<br>1: Alarm reset | 0 | - |
| S006 | Operation command | Bit 15: RST | 0 | - |
| Related function | | Output Terminal [DO1], [ROA, ROB] Function Selection (E020, E027) = [99 (AL: Alarm signal)] | | |

### Reset from Terminal

When the state of the RS (reset) terminal is changed from OFF to ON, the alarm is reset and AL (alarm output) output allocated to the multifunction output terminal is set to OFF. When it is next changed from ON to OFF, the alarm display is erased and the error state is cleared. Ensure at least 10 ms as the time for turning the RS (reset) terminal ON. During normal operation, keep the terminal set to OFF.




### Resetting via EtherNet Communication

- The alarm can be reset by one of the following operations via EtherNet communication.
  - Set 1 to Alarm Reset Command (S014). (After a reset, this command automatically returns to 0.)
  - The state of bit 15 of Operation command (S006) is changed from 0 to 1, then returns to 0. (It does not automatically return to 0.)

- Be sure to confirm that the RUN command is turned OFF before resetting the alarm because the machine may abruptly start depending on the setting of Start Check Function (H096).

# 6-9 Multi-function Input

## 6-9-1 Input Terminal Functions

Functions can be operated via input terminals by allocating the functions to input terminals [DI1] to [DI7]. This section describes primary functions. For details on other functions, refer to *8-2 Multifunction Input/Output Functions List* on page 8-23.

- Set selection of functions to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | Table below or, refer to *8-2 Multi-function Input/Output Functions List* on page 8-23. | - | - |
| H324 to H330 | Input Terminal [DI1] to [DI7] Response Time | 1 to 400 | 1 | ms |

- By setting data in which 1000 is added to the set data, it is possible to switch from an NO contact input to an NC contact input. However, for a function whose input is an NC contact as standard, the contact can be changed to an NO contact by setting data in which 1000 is added. (Refer to *8-2-1 Multifunction Input Selection* on page 8-23.)

  Example 1) SET terminal (2nd control)
  To use the function for an NO contact, set 12. To use the function for an NC contact, set 1012.

  Example 2) STP terminal (3-wire stopping: NC contact)
  To use the function for an NC contact, set 6. To use the function for an NO contact, set 1006.

- If the same function is allocated to the input terminals, and if any one of the input terminals to which the function is allocated, except for the exceptions below, turns ON, the function is handled as ON. If all terminals to which “98: FW (forward rotation)” and “99: RV (reverse rotation)” is allocated are ON, the function is handled as ON.
- Set the response time for each input terminal [DI1] to [DI7] independently. This function is effective for removing noise caused by chattering, etc. Inputs are set when the status matches twice after checking the statues of the input terminals at each individual set response time. For example, when 400 ms is set, up to 800 ms is required until an input is set.

Fig. 1: Example of response time matching twice and recognition of inverter ON

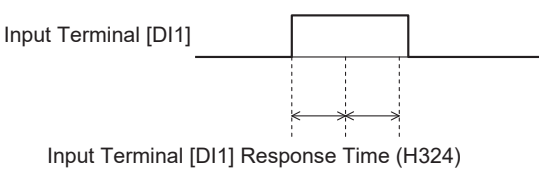
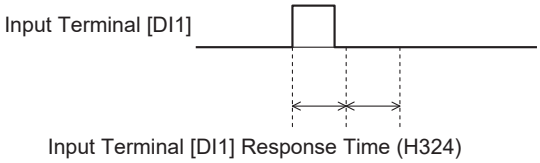


Fig. 2: Example of response time matching less than twice and non-recognition of inverter ON




| Parameter No. | Set data | Function name | Reference item | Reference page |
|---|---|---|---|---|
| E001 to E005, E098, E099 | 6 | SET (2nd control) | 2nd control | page 6-48 |
| | 98 | FW (forward rotation)*1 | Forward run command | |
| | 99 | RV (reverse rotation)*1 | Reverse run command | |
| | 6 | STP (3-wire stopping: NC contact) | 3-wire input function | page 6-49 |
| | 97 | F/R (3-wire forward/reverse rotation) | | |
| | 0 | CF1 (Multi-step speed setting binary 1) | Multi-step speed operation function | page 6-50 |
| | 1 | CF2 (Multi-step speed setting binary 2) | | |
| | 2 | CF3 (Multi-step speed setting binary 3) | | |
| | 3 | CF4 (Multi-step speed setting binary 4) | | |
| | 173 | SF1 (Multi-step speed setting bit 1) | | |
| | 174 | SF2 (Multi-step speed setting bit 2) | | |
| | 175 | SF3 (Multi-step speed setting bit 3) | | |
| | 176 | SF4 (Multi-step speed setting bit 4) | | |
| | 177 | SF5 (Multi-step speed setting bit 5) | | |
| | 178 | SF6 (Multi-step speed setting bit 6) | | |
| | 179 | SF1 (Multi-step speed setting bit 7) | | |
| | 10 | JG (Jogging) | Jogging | page 6-52 |
| | 159 | 2CH (2-step acceleration/deceleration) | 2-step acceleration/deceleration | page 6-57 |
| | 8 | RS (Reset) | Reset | page 6-57 |

*1. “98: FW (forward rotation)” and “99: RV (reverse rotation)” can be allocated to only Input Terminal [DI6] Function Selection (E098) or Input Terminal [DI7] Function Selection (E099). When one function has been allocated to two terminals, the state is considered to be ON by both terminals turning ON.

## 2nd Control Switch Function (SET)

The M1 Series provides two controls that can be switched as required. There are three types of parameters: shared parameters, parameters for 1st control and parameters for 2nd control. Parameters for 1st control and parameters for 2nd control are switched for to use.

- To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7]. (OFF: 1st control, ON: 2nd control)
- The status of the selected control can be checked via external output terminals by allocating “49: SETM (2nd control under selection)” to Output Terminal [DO1] Function Selection (E020) and Output Terminal [ROA, ROB] Function Selection (E027). When the SET terminal is turned ON, 2nd control is selected, and 2nd control under selection (49: SETM) turns ON.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 12: SET (2nd control) | - | - |
| Related function | | Output Terminal [DO1], [ROA, ROB] Function Selection (E020, E027) = [49 (SETM: 2nd control selection signal)] | | |

- 1st control and 2nd control cannot be switched when operation is stopped. During operation, the SET terminal does not operate even if it is turned ON.

- The functions that can be switched by the SET terminal are as shown below.

| Parameter No. | | Parameter name |
|---|---|---|
| 1st control motor | 2nd control motor | |
| F042 | A014 | Drive control selection |
| F037 | A013 | V/f characteristics selection |
| F002 | E102 | RUN command selection |
| F001 | C030 | Frequency Reference Selection |
| F003 | A001 | Maximum output frequency |
| F004 | A002 | Base Frequency |
| F005 | A003 | Rated Voltage at Base Frequency |
| F006 | A004 | Rated Voltage at Maximum Output Frequency |
| F007 | E010 | Acceleration time 1 |
| F008 | E011 | Deceleration time 1 |
| E012 | E014 | Acceleration time 2 |
| E013 | E015 | Deceleration time 2 |
| E125 | E128 | 2-step Acceleration/Deceleration Switching Condition Selection |
| E127 | E126 | 2-step Acceleration Switching Frequency |
| E129 | E130 | 2-step Deceleration Frequency |
| F010 | A006 | Motor Electronic Thermal Characteristic Selection |
| F011 | A007 | Motor Electronic Thermal Level |
| F012 | A008 | Motor Electronic Thermal Time Constant |
| F015 | E117 | Frequency Upper Limit |
| F016 | E118 | Frequency Lower Limit |
| F020 | A009 | DC Injection Braking Start Frequency |
| F021 | A010 | DC Injection Braking Level |
| F022 | A011 | DC Injection Braking Time |
| F023 | A012 | Starting frequency |
| F024 | A062 | Starting Frequency Holding Time |
| F025 | A063 | Stop Frequency |
| F038 | A064 | Stop Frequency Detection Method Selection |
| F039 | A065 | Stop Frequency Holding Time |
| H068 | A040 | Slip Compensation Operating Conditions Selection |
| H080 | A041 | Output current fluctuation damping gain for motor |
| F043 | E146 | Overload Protect Function Selection |
| F044 | E147 | Overload Protect Level |
| E037 | E056 | Overload Early Warning Detection Level |
| E038 | E055 | Overload Early Warning Detection Timer |

| Parameter No. | | Parameter name |
|---|---|---|
| 1st control motor | 2nd control motor | |
| E039 | A061 | Display Coefficient 1 for Transport Time / Auxiliary Display Coefficient 1 for Speed Monitor |
| E050 | A060 | Display coefficient for speed monitor |
| E112 | E113 | Torque Boost Function Selection |
| F009 | A005 | Manual Torque Boost Voltage |
| E122 | E123 | AVR Function Selection |
| C053 | C054 | Input Terminal [AI1, AI2] Normal/Inverse Operation for 1st Frequency Command |
| P001 | A015 | Pole Number |
| P002 | A016 | Motor capacity |
| P003 | A017 | Motor Rated Current |
| P004 | A018 | Auto Tuning Function Selection |
| P005 | A019 | Online tuning Function Selection |
| P006 | A020 | Motor No Load Current |
| P007 | A021 | Motor Parameter %R1 |
| P008 | A022 | Motor Parameter %X |
| P053 | A053 | Motor %X Correction Factor |
| P009 | A023 | Slip Compensation Gain for Driving |
| P010 | A024 | Slip Compensation Response Time |
| P011 | A025 | Slip Compensation Gain for Braking |
| P012 | A026 | Rated Slip Frequency |
| P013 | A027 | Iron Loss Factor 1 |
| P016 | A030 | Magnetic Saturation Factor 1 |
| P017 | A031 | Magnetic Saturation Factor 2 |
| P018 | A032 | Magnetic Saturation Factor 3 |
| P019 | A033 | Magnetic Saturation Factor 4 |
| P020 | A034 | Magnetic Saturation Factor 5 |
| P055 | A055 | Torque Current for Vector Control |
| P056 | A056 | Induced Voltage Factor for Vector Control |

- The following parameters are enabled only when 1st control is selected. When 2nd control is selected, this control operates by setting the following parameters.

| Parameter No. | Parameter name |
|---|---|
| F018 | Input Terminal [AI1, AI2] Bias for 1st Frequency Command |
| C050 | Input Terminal [AI1, AI2] Bias Analog Input for 1st Frequency Command |
| H195 | DC Injection Braking Startup Time |
| H078 | 1st Motor Maintenance Interval |
| H079 | 1st Preset Startup Count for Motor Maintenance |
| M081 | 1st Remaining Time before the Next Motor Maintenance |
| M085 | 1st Remaining Startup Times before the Next Motor Maintenance |
| P030 | 1st PM Motor Starting Method |
| P060 | 1st PM Motor Armature Resistance |
| P061 | 1st PM Motor d-axis Inductance |
| P062 | 1st PM Motor q-axis Inductance |
| P063 | 1st PM Motor Induced Voltage Ke |
| P064 | 1st PM Motor Iron Loss |

| Parameter No. | Parameter name |
|---|---|
| P065 | 1st PM Motor d-axis Inductance Magnetic Saturation Correction |
| P074 | 1st PM Motor Reference Current at Starting |
| P085 | 1st PM Motor Flux Limitation Value |
| P087 | 1st PM Motor Reference Current for Magnetic Pole Detection |
| P090 | 1st PM Motor Overcurrent Protection Level |
| P095 | 1st PM Motor Magnetic Pole position Offset |
| d080 | 1st PM Motor Magnetic Pole Position Pull-in Frequency |

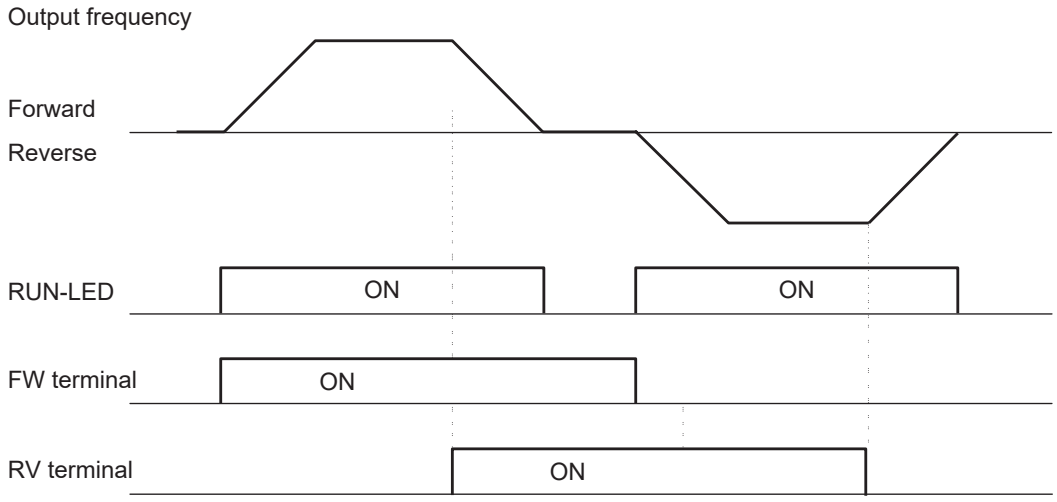
## Forward RUN Command (FW) and Reverse RUN Command (RV)

- To input the forward RUN and reverse RUN commands via the control circuit terminals, allocate “98: FW” and “99: RV” to Input Terminal [DI6] Function Selection (E098) and Input Terminal [DI7] Func- tion Selection (E099). FW (forward rotation) and RV (reverse rotation) can be set to only Input Ter- minal [DI6] Function Selection (E098) and Input Terminal [DI7] Function Selection (E099).
- Set “1: External signal (Digital input)” to 1st RUN Command Selection (F002) and 2nd RUN Com- mand Selection (E102).
- When the same RUN command (FW or RV) is assigned to input terminals [DI6] and [DI7], the func- tion is handled as ON when all assigned terminals are ON.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F002 / E102 | 1st RUN Command Selection / 2nd RUN Command Selection *1 | 1: Terminal command FW or RV | 5 | - |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Func- tion Selection | 98: FW (Forward rotation)<br>99: RV (Reverse rotation) | - | - |

*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].

- When both FW and RV turn ON, operation is the same as when they are both OFF.



## 3-wire Input Function (FW, STP, F/R)

- To select 3-wire input, allocate the three parameters “98: FW (Forward rotation / 3-wire run),” “6: STP (3-wire stop : NC contact)” and “97: F/R (3-wire forward / reverse rotation)” to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099).
- Set “1: External signal (Digital input)” to 1st RUN Command Selection (F002) and 2nd RUN Com- mand Selection (E102).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F002/ E102 | 1st RUN Command Selection / 2nd RUN Command Selection *1 | 1: Terminal command FW or RV | 5 | - |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 98: FW (Forward rotation / 3-wire run)*2<br>6: STP (3-wire stop : NC contact)<br>97: F/R (3-wire forward / reverse rotation) | - | - |

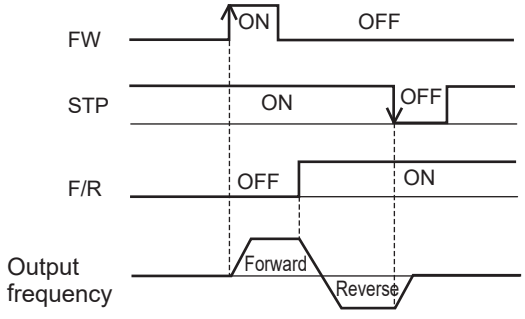
*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].

*2. “98: FW (Forward rotation / 3-wire run)” can be allocated to either Input Terminal [DI6] Function Selection (E098) or Input Terminal [DI7] Function Selection (E099). Also, 3-wire operation cannot be started up by “99: RV (reverse rotation).”

| Data | Symbol | Function name | State | Description |
|---|---|---|---|---|
| 98 | FW | Forward rotation / 3-wire run | ON | Motor start |
| | | | OFF | Hold condition |
| 6 | STP | 3-wire stop : NC contact | ON | Hold condition |
| | | | OFF | Motor stop |
| 97 | F/R | 3-wire forward / reverse rotation | ON | Reverse |
| | | | OFF | Forward |

- To reliably ascertain ON/OFF, continue ON or OFF for the time twice the set value of Input Terminal Response Time (H324 to H330). When Input Terminal Response Time is the default value, continue for 2 ms.
- When the STP terminal signal is disconnected, the input signal turns OFF and the status changes to the stop status. Even if the FW terminal is turned ON in this state, the output frequency is not output.

- The operation timing is as follows.



## Multi-step Frequency Reference

- Use this function to switch the frequency reference set to 16 frequencies or frequency reference set to 8 frequencies based on the combination of selected input terminals.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F001 / C030 | 1st Frequency Reference Selection / 2nd Frequency Reference Selection*1 | 1: Voltage input to terminal [AI1]<br>7: Terminal command UP / DWN control<br>10: Pattern operation<br>12: Pulse train input<br>13: Calculation result<br>15: EtherNet | 15 | - |
| E107 | Multi-step Frequency Selection | 0: Binary (CF1 to CF4)<br>1: Bit (SF1 to SF7) | 0 | - |
| C005 to C019 | Multi-step Frequency Reference 1 to 15 | 0.00 to 590.0 | 0.00 | Hz |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 0 to 3: CF1 to 4 (Multi speed setting binary 1 to 4)<br>173 to 179: SF1 to 7 (Multi speed setting bit 1 to 7) | - | - |

*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].

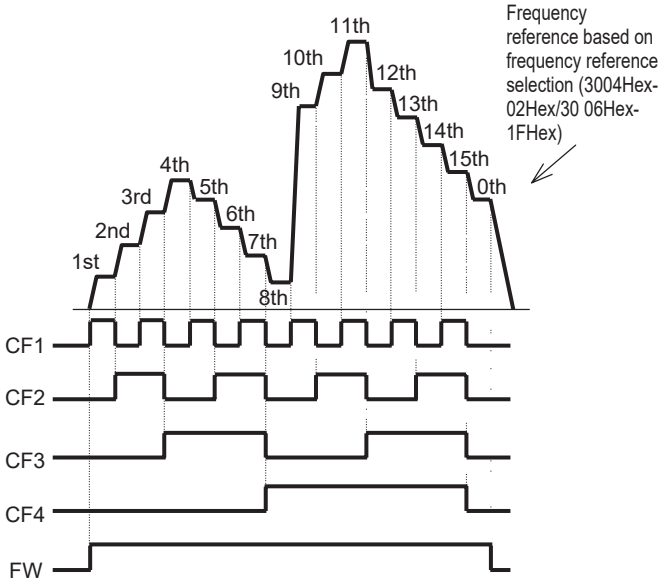
- Select the setting method for 1st Multi-step Frequency Reference 0 or 2nd Multi-step Frequency Reference 0 at 1st Frequency Reference Selection (F001) and 2nd Frequency Reference Selection (C030).
- For the set frequency, Multi-step Frequency Reference 1 to 15 are common in 1st control and 2nd control.
- To switch between Bit (8-step selection with 7 terminals) and Binary (16-step selection with 4 terminals), select “0: Binary (16-step selection with 4 terminals)” or “1: Bit (8-step selection with 7 terminals)” at Multi-step Frequency Selection (E107).
- To switch the frequency reference, allocate “173 to 179: SF1 to 7 (Multi-step frequency reference setting bits 1 to 7)” to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099) in the case of “binary (16-step selection with 4 terminals).” In the case of “8-step selection with 7 terminals,” select “0 to 3: CF1 to 4 (Multi-step frequency reference setting binary 1 to 4).”
- The rotation direction becomes the direction specified by the RUN command.
- With switching of frequency selection in multi-step function, an unintended frequency reference is sometimes selected depending on the deviation of timing of input terminals [DI1] to [DI7].

### Binary Operation

Setting “0: CF1” to “3: CF4” to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099) enables selection of multi-step speeds 0 to 15.

- Use the Multi-step Frequency Reference 1 to 15 (C005 to C019) to set the frequency reference for the multi-step speed 1 to 15.
- When CF1 to CF4 are all OFF, 1st Frequency Reference Selection (F001) and 2nd Frequency Reference Selection (C030) are selected.

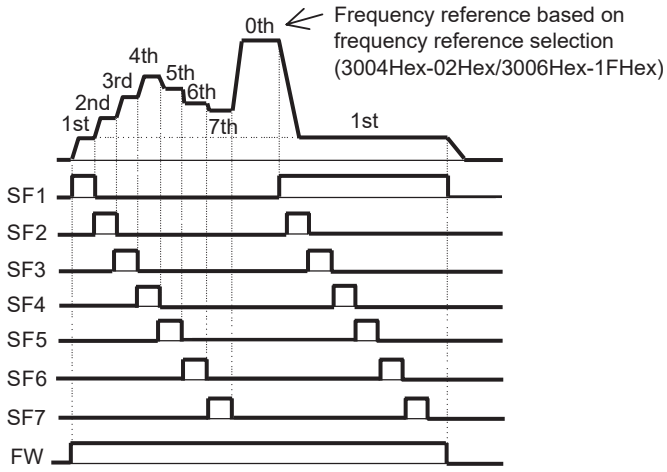
| Multi-step Frequency Reference | CF4 | CF3 | CF2 | CF1 |
|---|---|---|---|---|
| 0th | OFF | OFF | OFF | OFF |
| 1st | | | | ON |
| 2nd | | | ON | OFF |
| 3rd | | | | ON |
| 4th | | ON | OFF | OFF |
| 5th | | | | ON |
| 6th | | | ON | OFF |
| 7th | | | | ON |
| 8th | ON | OFF | OFF | OFF |
| 9th | | | | ON |
| 10th | | | ON | OFF |
| 11th | | | | ON |
| 12th | | ON | OFF | OFF |
| 13th | | | | ON |
| 14th | | | ON | OFF |
| 15th | | | | ON |




## Bit Operation

- Multi-step frequency references 0 to 7 can be selected by input terminals when “173: SF1” to “179: SF7” are set to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099).
- Set the frequency reference of SF1 to SF7 to Multi-step Frequency Reference 1 to 7 (C005 to C011).
- When SF1 to SF7 are all OFF, 1st Frequency Reference Selection (F001) and 2nd Frequency Reference Selection (C030) are selected.
- When multiple terminals are turned ON simultaneously, priority is given to the terminal with the smallest number among SF1 to SF7. (“Disabled” in the following table indicates that speed is selected regardless of the ON/OFF status.)

| Multi-step Frequency Reference | SF7 | SF6 | SF5 | SF4 | SF3 | SF2 | SF1 |
|---|---|---|---|---|---|---|---|
| 0th | OFF | OFF | OFF | OFF | OFF | OFF | OFF |
| 1st | Disabled | Disabled | Disabled | Disabled | Disabled | Disabled | ON |
| 2nd | Disabled | Disabled | Disabled | Disabled | Disabled | ON | OFF |
| 3rd | Disabled | Disabled | Disabled | Disabled | ON | OFF | OFF |
| 4th | Disabled | Disabled | Disabled | ON | OFF | OFF | OFF |
| 5th | Disabled | Disabled | ON | OFF | OFF | OFF | OFF |
| 6th | Disabled | ON | OFF | OFF | OFF | OFF | OFF |
| 7th | ON | OFF | OFF | OFF | OFF | OFF | OFF |




- A smaller number is sometimes selected for the frequency reference depending on the timing of switching.

## Jogging (JG)

The jogging function operates according to the jogging terminal (10: JG) and RUN command (FW or RV terminal), forward rotation jogging terminal (94: FJOG) and reverse rotation jogging terminal (95: RJOG), and command arriving via communication.

- Jogging terminal (10: JG) and RUN command (FW or RV terminal)
- Forward rotation jogging terminal (94: FJOG) and reverse rotation jogging terminal (95: RJOG)
- Jogging execution via communication

- Jogging frequency (C020), acceleration time (H054) and deceleration time (H055) of jogging opera- tion can be set. Select jogging operation at start and stop of jogging at Jogging Operation Selection (E111).
- During position control, jogging operation is disabled.
- Speed control during jogging operation can be adjusted by filter, gain, etc.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 10: JG (Jogging)<br>94: FJOG (Forward rotation jogging)<br>95: RJOG (Reverse rotation jogging) | - | - |
| E111 | Jogging Operation Selection | 0: Free run stop on jogging stop, disabled in operation<br>1: Deceleration stop on jogging stop, disabled in operation<br>2: DC injection braking on jogging stop, disabled in operation*1<br>3: Free run stop on jogging stop, enabled in operation<br>4: Deceleration stop on jogging stop, enabled in operation<br>5: DC injection braking on jogging stop, enabled in operation*1 | 4 | - |
| C020 | Jogging Frequency | 0.00 to 590.00 | 0.00 | Hz |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H054 | Jogging Acceleration Time | 0.00 to 6000 | 6.00 | s |
| H055 | Jogging Deceleration Time | 0.00 to 6000 | 6.00 | s |
| d099 | Extension Function 1 | Bit 3: Jogging Enable via communications<br>Do not use other bits | 0008 hex | - |
| d009 | Speed Control Jogging Speed Command Filter | 0.000 to 5.000 | 0.02 | s |
| d010 | Speed Control Jogging Speed Detection Filter | 0.000 to 0.100 | 0.005 | s |
| d011 | Speed Control Jogging P Proportional Gain | 0.1 to 200.0 | 10.0 | - |
| d012 | Speed Control Jogging I Integral Time | 0.001 to 9.999<br>999: Cancel integral term | 0.1 | s |
| H147 | Speed Control Jogging Feed Forward Gain | 0.00 to 99.99 | 0.00 | s |
| d013 | Speed Control Jogging Output Filter | 0.000 to 0.100 | 0.002 | s |
| Related function | | DC Injection Braking Selection (E114) | | |

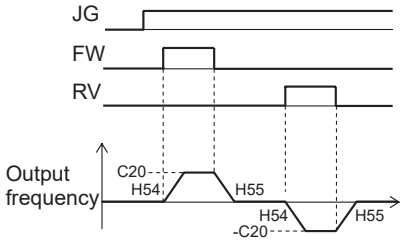
*1. When the Jogging Operation Selection (E111) setting is “2: DC injection braking on jogging stop, disabled in operation” or “5: DC injection braking on jogging stop, enabled in operation,” DC Injection Braking Selection (E114) must be set. Refer to *8-5-1 DC Injection Braking (DB)* on page 8-55.

### Switching by JG terminal

- Jogging is executed by turning the JG terminal ON and then turning the FW and RV terminals ON.
- Set the jogging operation stop method and whether to enable or disable the jogging function dur- ing operation at Jogging Operation Selection (E111).
- For 100 ms after the RUN command turns ON, jogging operation can be switched to by the JG (Jogging) terminal regardless of the setting of Jogging Operation Selection (E111).
- Set the frequency for jogging operation at Jogging Frequency (C020).
- Set the acceleration time and deceleration time during jogging operation at Jogging Acceleration Time (H054) and Jogging Deceleration Time (H055).

### Disabled in operation (when Jogging Operation Selection (E111) = “0,” “1,” “2”)

- Turn the JG terminal ON and then turn the FW or RV terminal ON.
- During operation (FW terminal is ON, RV terminal is ON), the jogging function is disabled. Note, however, that the function is enabled within 100 ms of starting operation. During operation, the jogging operation is enabled, and jogging operation is started.



- Jogging operation is not performed if the JG terminal turns ON after the FW terminal turns ON first and 100 ms or more elapses. To perform jogging operation, turn the JG terminal ON and then turn the FW or RV terminal ON.

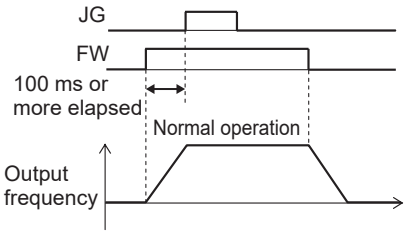



Fig.: Operation of setting when disabled while inverter is running

### Enabled in operation (when Jogging Operation Selection (E111) = “3,” “4,” “5”)

- Jogging is performed even if the FW terminal turns ON first.

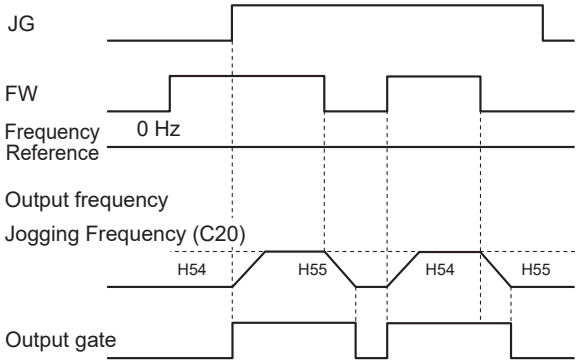



Fig.: Jogging operation switching while inverter is running

However, if the JG terminal turns OFF first, the motor comes to a free-run state.

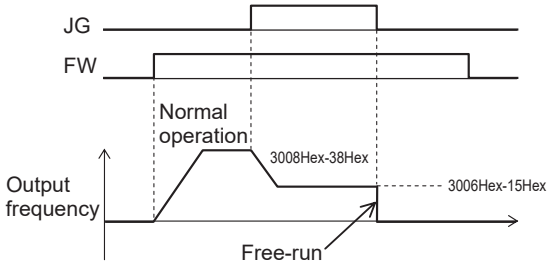



Fig.: Operation when jogging is canceled

If the JG terminal is turned ON again with the motor in a free-run state (JG terminal OFF and FW terminal ON), jogging operation is started again.
If the FW terminal is turned OFF with the motor in a free-run state (JG terminal OFF and FW terminal ON), and the FW terminal is turned ON again, normal operation is performed.

### Relationship with DC braking

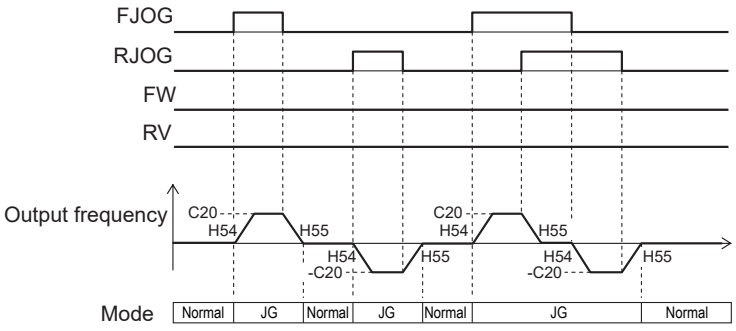
When the jogging function is used to perform inching, the inverter sometimes does not come to an exact stop in applications such as turntables and rotates an extra bit more before it comes to a stop.

In vector control, the braking torque just before the stop can be adjusted so that the inverter comes to an exact stop by adjusting the speed adjuster (ASR). However, in V/f control, sufficient braking torque sometimes cannot be ensured simply by adjusting the torque boost.
In cases like these, jogging operation and the DC braking function are used in combination to adjust inching.
For details on DC braking, refer to *8-5-1 DC Injection Braking (DB)* on page 8-55.
Operation when the RUN command is turned OFF during jog operation with the DB (DC braking) terminal turned ON is as follows.
(Example: When External DC Injection Braking Edge/Level Selection (E115) = "1: Level operation")

- When Jogging Operation Selection (E111) = 0, 3, operation immediately becomes free run when the RUN command turns OFF, and immediately DC braking by the DB terminal operates.
- When Jogging Operation Selection (E111) = 1, 2, 4, 5, DC braking by the DB terminal operates immediately when the RUN command turns OFF.

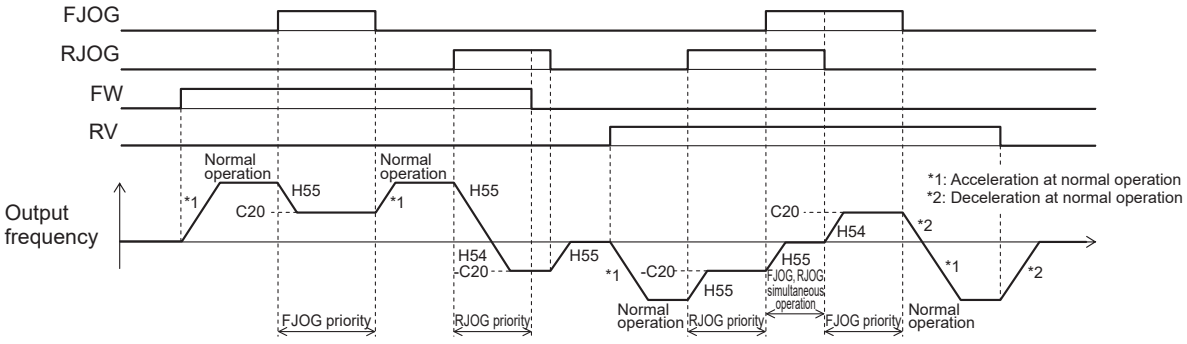
## Forward Rotation Jogging/Reverse Rotation Jogging

- When the FJOG (Forward rotation jogging) terminal or RJOG (Reverse rotation jogging) terminal is turned ON when the RUN command is OFF, forward rotation or reverse rotation jogging operation can be performed. Deceleration stop is performed according to the acceleration/deceleration time regardless of Jogging Operation Selection (E111).




FJOG, RJOG operation

Fig.: Jogging operation by FJOG and RJOG terminals during an operation stop



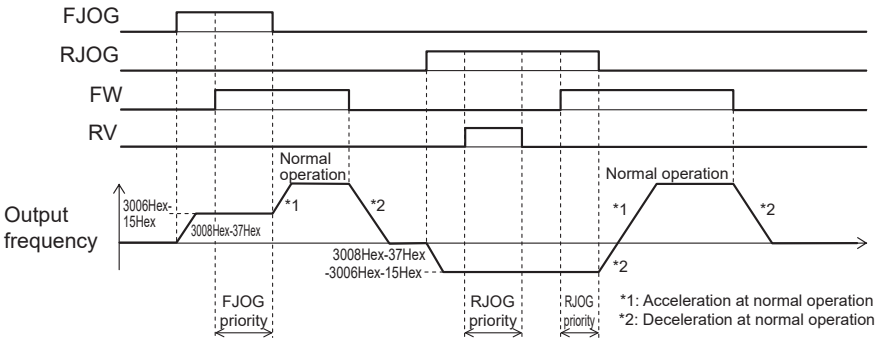

FJOG, RJOG ON while FW, RV are ON

Fig.: Jogging operation by FJOG and RJOG terminals while inverter is running

- When the FJOG (Forward rotation jogging) terminal and RJOG (Reverse rotation jogging) termi- nal are both ON, operation is the same as when they are both OFF.
- Operation during a stop follows the setting of Jogging Operation Selection (E111), though the en- abled/disabled during operation settings are not affected.
- FJOG (Forward rotation jogging) terminal and RJOG (Reverse rotation jogging) terminal are giv- en priority over jogging operation by the FW terminal/RV terminal and the JG terminal.

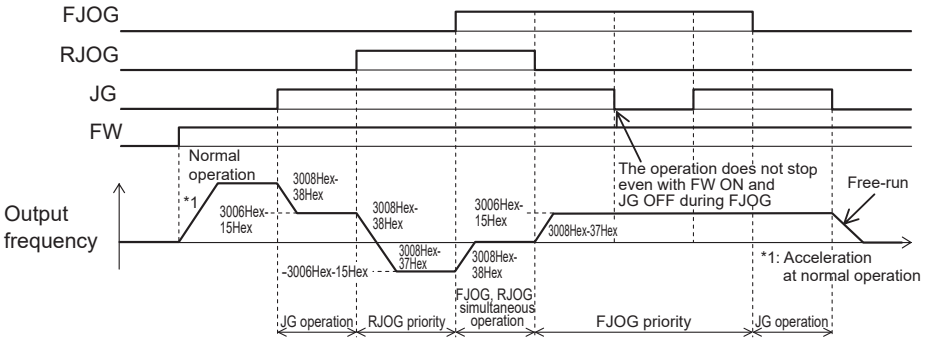
| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 94: FJOG (Forward rotation jogging)<br>95: RJOG (Reverse rotation jogging) | - | - |

- Operation when the FW and RV terminals turn ON while the FJOG and RJOG terminals are ON is as follows.




FW, RV ON while FJOG, RJOG are ON

- Combinations of the JG terminal and FJOG terminal, RJOG terminal while jogging during operation is enabled act as follows.




Combinations of JG and FJOG, RJOG while jogging during operation is enabled

## Jogging function via communication

- When Extension Function 1 (d099) bit 3 is “0: Jogging Disable via communications,” this function is enabled only when 1st RUN Command Selection (F002) is “1: External signal (Digital input).”
- When Extension Function 1 (d099) bit 3 is “1: Jogging Enable via communications,” forward rotation jogging or reverse rotation jogging operations are possible by the command arriving via communication regardless of the value of Extension Function 1 (d099) bit 3. When commands via communication are enabled, input terminal is disabled.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 10: JG (Jogging)<br>94: FJOG (Forward rotation jogging)<br>95: RJOG (Reverse rotation jogging) | - | - |
| S006 | Operation command | Bit15: RST<br>Bit14: DI7<br>Bit13: DI6<br>Bit12: -<br>Bit11: -<br>Bit10: -<br>Bit9: -<br>Bit8: -<br>Bit7: -<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: REV<br>Bit0: FWD | 0 | - |

- Allocate this function to “10: JG (Jogging),” “94: FJOG (Forward rotation jogging)” and “95: RJOG (Reverse rotation jogging)” input terminals in Input Terminal [DI1] to [DI7] Function Selection, and operate Operation command (S006) via communication to perform jogging.

### Adjustment of jogging operation

- This function is for adjusting the speed control during jogging operation. As this speed control pa- rameter is used only in jogging operation, jogging operation with a speed response faster than during normal operation can be performed.
- For details on parameters, refer to the parameters (d001 to d006) for speed control during nor- mal operation that are applicable in *7-5-1 Speed Control Settings* on page 7-26. There are no parameters relating to the notch filter for jogging.

## 2-step acceleration/deceleration

- For details on the 2-step acceleration/deceleration function, refer to *6-6-4 2-step Acceleration/ Decel- eration Function* on page 6-37.

## Reset

- For details on a reset, refer to *6-8-1 Reset Function* on page 6-42.

# 6-10 Multi-function output

## 6-10-1 Multifunction Output Selection

- Inverter status can be output from output terminals by allocating functions to output terminals [DO1] and [ROA, ROB]. This section describes seven types of primary functions. For details on other functions, refer to *8-2 Multifunction Input/Output Functions List* on page 8-23.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | Table below or, refer to *8-2 Multifunction Input/Output Functions List* on page 8-23. | - | - |
| H309 | Output Terminal [DO1] ON Delay Time | 0.0 to 100.0 | 0.0 | s |
| H313 | Output Terminal [ROA, ROB] ON Delay Time | | | |
| H310 | Output Terminal [DO1] OFF Delay Time | 0.0 to 100.0 | 0.0 | s |
| H314 | Output Terminal [ROA, ROB] OFF Delay Time | | | |

- Set this at Output Terminal [DO1] Function Selection (E020) and Output Terminal [ROA, ROB] Function Selection (E027).
- An NO contact output can be changed to an NC contact output by setting data in which 1000 is added to the set data, and, as a result, the operations of set signals are reversed.
- Each multifunction output terminal can be allocated with the ON/OFF delay time independently.
- The output terminal [DO1] is open collector output, and the output terminal [ROA, ROB] is relay output.
- The following functions have an OFF delay time of 0.1 s even if the OFF delay time is not set. When these functions are allocated to output terminals, the OFF delay becomes the time obtained by adding 0.1 s to Output Terminal [DO1] OFF Delay Time (H310) and Output Terminal [ROA, ROB] OFF Delay Time (H314).
  Inverter output limited (5: IOL) terminal, Electronic thermal warning (7: THM) terminal, Overload prevention control in progress (36: OLP) terminal, Overload early warning 2 (37: OL2) terminal, Overload early warning (38: OL) terminal, Low current signal (41: LOC) terminal, PID deviation excessive (42: OD) terminal, PID wakeup timer stopped (44: PID-STP) terminal, Overtorque (46: OTQ) terminal, Thermistor detection (56: MOH) terminal

| Parameter No. | Data | Function name | Reference item | Reference page |
|---|---|---|---|---|
| E020, E027 | 0 | RUN (Signal during run) | Signal during run | page 6-59 |
| | 1 | FAR1 (Frequency arrival 1 (constant speed)) | Constant speed arrival signal | page 6-60 |
| | 99 | AL (Alarm signal) | Alarm signal | page 6-61 |
| | 70 | ZS (0 Hz detection signal) | 0 Hz detection signal | page 6-61 |
| | 10 | IRDY (Operation ready completion) | Operation ready completion | page 6-59 |
| | 52 | FWR (Forward run signal) | Forward run signal | page 6-59 |
| | 53 | RVR (Reverse run signal) | Reverse run signal | page 6-60 |

## Operation Ready Completion Signal (IRDY)

- This signal is output when the inverter becomes ready to operate (ready to accept the RUN command).

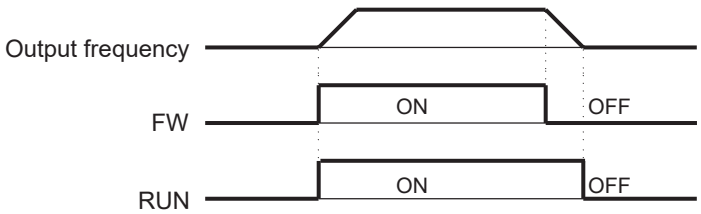
| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 10: IRDY (Operation ready completion) | - | - |

- When this signal is not output, the inverter does not operate even if the RUN command is input.
- If this signal is not output, check if the input power supply voltage (L1/R, L2/S,L3/T) is within the specification range.

## Signal during RUN (RUN), Inverter Output Signal (RUN2)

- This signal is output while the inverter is running (RUN command ON).
- The signal during RUN (RUN) and inverter output signal (RUN2) are output also when the inverter is decelerating after the RUN command turns OFF.
- When in a free-run state (output shutoff status), the signal during RUN (RUN) and inverter output signal (RUN2) are not output even if the RUN command is turned ON. (Note that on the Operator, the RUN LED is lit when the RUN command is ON.)
- The signal during RUN (RUN) is not output while DC braking is operating, during tuning of motor parameters while stopped, and during pre-excitation by the EXITE terminal. The inverter output signal (RUN2) is output.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 0: RUN (Signal during run)<br>35: RUN2 (Inverter output in progress) | - | - |




- The signal is not output when at stop frequency and starting frequency or below

## Forward Run Signal (FWR)

- This signal is output while the inverter performs forward operation.

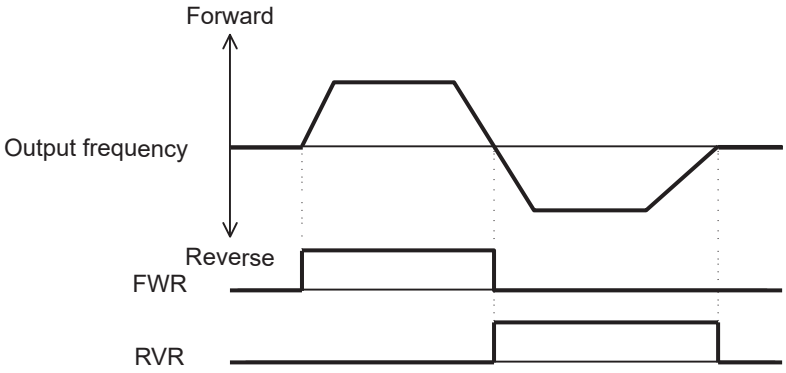
| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 52: FWR (Forward run signal) | - | - |

- This signal is not output while the inverter performs reverse operation, when it is stopped or during free-run. Note, however, that during control methods with speed sensor, judgment is performed based on the speed detection value to output the signal even in free-run status.

## Reverse Run Signal (RVR)

- This signal is output while the inverter performs reverse operation.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 53: RVR (Reverse run signal) | - | - |




- This signal is not output while the inverter performs forward operation, when it is stopped or during free-run. Note, however, that during control methods with speed sensor, judgment is performed based on the speed detection value to output the signal even in free-run status.

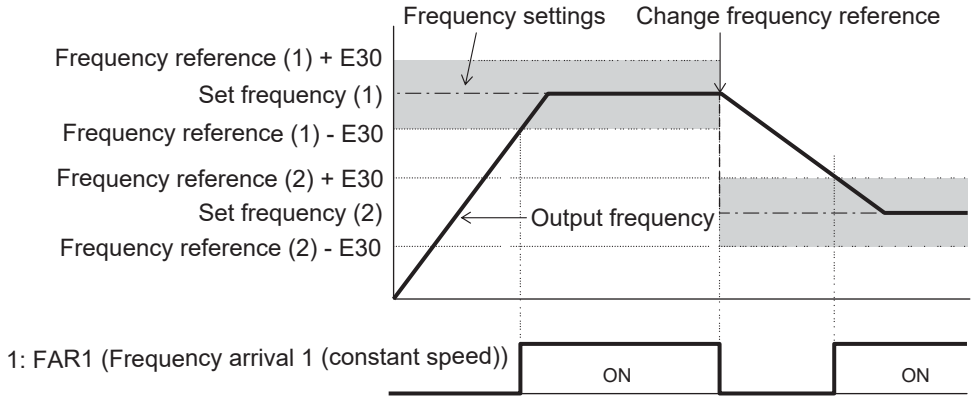
## Frequency Arrival 1 (Constant Speed) (FAR1)

- This signal is output when the output frequency arrives at the frequency reference.
- The detection width of the frequency arrival signal is set at Frequency Arrival Detection Width (FAR1/FAR2/FAR3/FDT3/FDT4) (E030).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 1: FAR1 (Constant speed arrival signal) | - | - |
| E030 | Frequency Arrival Detection Width (FAR1 / FAR2 / FAR3 / FDT3 / FDT4) | 0.0 to 10.0 | 2.5 | Hz |

- When the output frequency is within the range of ± Frequency Arrival Detection Width (FAR1/ FAR2/ FAR3/FDT3/FDT4) (E030) centering around the frequency reference, ON is output, and when it is outside the range, this signal turns OFF.
- During free-run or when the set frequency is less than the stop frequency, the RUN command turns OFF, and turns OFF during a deceleration stop.

- The figure below shows an example of changing the frequency reference from frequency reference (1) to frequency reference (2).




## Alarm Signal (AL)

- The inverter detects an overcurrent, overvoltage, or some other abnormality, and outputs an alarm signal (AL).
- The alarm signal is the default data of Output Terminal [ROA, ROB] Function Selection (E027).
- A trip state can be canceled by resetting the inverter, by which the alarm signal is also turned OFF.
- For details on a reset, refer to *6-8-1 Reset Function* on page 6-42.

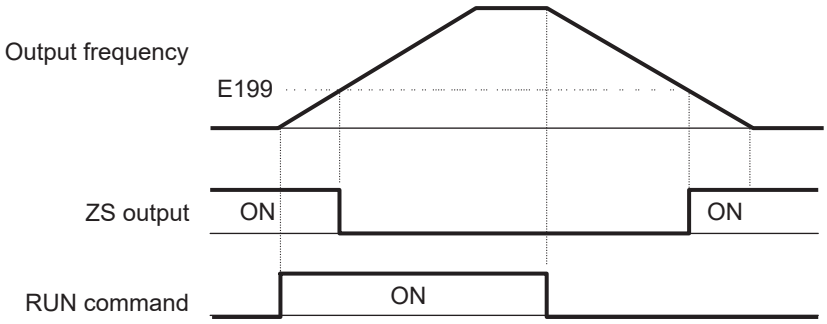
| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 99: AL (Alarm signal) | - | - |

## 0 Hz Detection Signal (ZS)

- This signal is output when the output frequency of the inverter falls below the 0Hz Detection Output Detection Level (ZS) (E199).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 70: ZS (0 Hz detection signal) | - | - |
| E199 | 0Hz Detection Output Detection Level (ZS) | 0.00 to 100.00 | 0.00 | Hz |

- This signal is output when the output frequency of the inverter falls below the 0Hz Detection Output Detection Level (ZS) (E199) also when the RUN command is OFF.
- This signal turns ON if the speed command value (output frequency) or the speed detection value is less than the 0Hz Detection Output Detection Level (ZS) (E199), and turns OFF if it is at 0Hz Detection Output Detection Level (ZS) (E199) or higher regardless of the alarm status or free-run after the power is turned ON.


Output frequency
E199
ZS output
ON
ON
RUN command
ON

# 6-11 Torque Boost Function Settings

## 6-11-1 Torque boost

- The torque boost function is for increasing the output torque if it is not sufficient at lower speeds.
- This inverter provides two torque boost options: Manual torque boost for manual torque adjustment and Automatic torque boost for automatic torque adjustment.
- Automatic torque boost is enabled when “0: IM V/f control,” “1: IM Dynamic torque vector control without speed sensor,” “3: IM V/f control with speed sensor” or “4: IM Dynamic torque vector control with speed sensor” is selected at Drive Control Selection (F042/A014).
- Manual torque boost is enabled when “0: IM V/f control” or “3: IM V/f control with speed sensor” is selected at Drive Control Selection (F042/A014).
- The default is automatic torque boost set to enabled. (Torque Boost Function Selection (E112/E113) = 1)

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F042 / A014 | 1st Drive Control Selection / 2nd Drive Control Selection | 0: IM V/f control<br>1: IM Dynamic torque vector control<br>3: IM V/f control with speed sensor<br>4: IM Dynamic torque vector control with speed sensor | 0 | - |
| E112 / E113 | 1st Torque Boost Function Selection / 2nd Torque Boost Function Selection | 0: Manual torque boost 1:<br>Automatic torque boost | 1 | - |
| F009 /A005 | 1st Manual Torque Boost Voltage / 2nd Manual Torque Boost Voltage | 0.0 to 20.0%<br><br>Percentage of Rated Voltage at Base Frequency (F005/A003) | 1.9 | % |
| Related function | | Base Frequency (F004/A002)<br>Rated Voltage at Base Frequency (F005/A003)<br>Motor Parameter (P001/A015 to P003/A017, P006/A020 to P020/A034) | | |

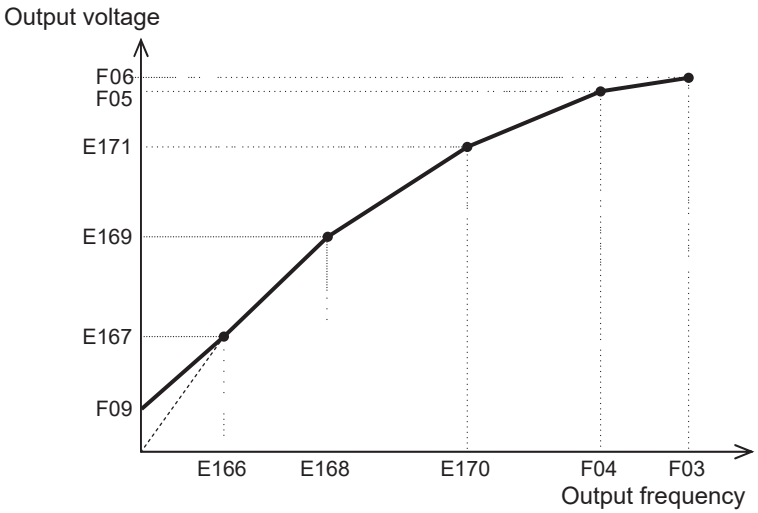
### Automatic Torque Boost (E112/E113 = 1)

- With this setting, the inverter increases the output voltage automatically depending on the load condition.
- When automatic torque boost function is enabled, the non-linear V/f function is disabled.
- To use automatic torque boost, either set 1st Base Frequency (F004), 1st Rated Voltage at Base Frequency (F005), and motor parameters (P001/A015 to P003/A017 and P006/A020 to P020/A034) to match the motor capacity or motor characteristics, or execute auto-tuning (P004).
- To use automatic torque boost, set “1: Constant torque load” to V/f Characteristics Selection (F037/A013). When “0: Variable torque load” is set, manual torque boost is selected regardless of the setting of Torque Boost Function Selection (E112/E113).
- Automatic torque boost controls to match the motor characteristics. To use the automatic torque boost function effectively, either set Base Frequency (F004/A002), Rated Voltage at Base

Frequency (F005/A003), and motor parameters (P001/A015 to P003/A017 and P006/A020 to P020/A034) to match the motor capacity or motor characteristics, or execute auto-tuning.

## Manual Torque Boost Voltage (E112/E113 = 0)

- With the torque boost by Manual Torque Boost Voltage (F009/A005), a constant voltage is added to the V/f characteristics before output regardless of the load. The optimum voltage suited to the motor and load are manually adjusted by the Manual Torque Boost Voltage (F009/A005) to ensure starting torque. Adjust the voltage to a level at which startup is possible and overexcitation does not occur in a no-load state or light load state.
- When the non-linear V/f function is used in combination with the manual torque boost function, the torque boost is enabled at the lowest non-linear V/f frequency or less.




- When Manual Torque Boost Voltage (F009/A005) is set to 0.0%, manual torque boost is disabled.

# 6-12 Measures Against Overvoltage

## 6-12-1 Regenerative Braking Function

- During motor deceleration and elevator descent, regenerative energy sometimes is returned to the inverter and an overvoltage is detected due to an excessive regenerative amount.
- The regenerative braking function uses the built-in or an external regenerative braking resistor to de- crease the internal Main Circuit DC Voltage of the inverter by converting the regenerated energy from the motor into heat via external braking resistors.
- The 3G3M1 Series has a built-in regenerative braking circuit and a regenerative braking function operates at all times regardless of whether the inverter is running or has stopped.

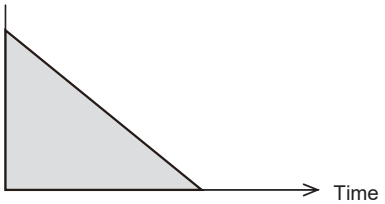
## 6-12-2 Braking Resistor Electronic Thermal Function

- Either use a braking resistor with thermal contact or use the braking resistor electronic thermal function for overheat protection of the external braking resistor.
- Use the braking resistor electronic thermal function by setting each of Electronic Thermal for Resistor Adiabatic Power (F050), Resistor Rated Power (F051) and Resistor Ohmic Value (F052). These values are determined by inverter model and type of braking resistor.
- To use the regenerative braking function, set Anti-regenerative Control Function Selection (H069) to “0: Disable.”

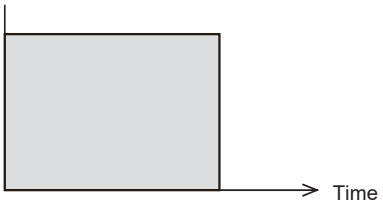
| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F050 | Resistor Adiabatic Power | 1 to 9000<br>32767: Disable | 32767 | kWs |
| F051 | Resistor Rated Power | 0.001 to 99.99 | 0.001 | kW |
| F052 | Resistor Ohmic Value | 0.01 to 999 | 0.01 | Ω |
| W161 | Braking Resistor Thermal Monitor | 0.0 to 100.0 | 0.0 | % |
| Related function | | Anti-regenerative Control Function Selection (H069) | | |

- Set the Electronic Thermal for Resistor adiabatic power (F050) and Electronic Thermal for Resistor rated power (F051) by the following formula depending on how the braking load is applied.

### When braking load during deceleration decreases with time

| How to apply a braking load | Allowable average loss | Thermal braking resistance value |
|---|---|---|
| Braking load (kW)<br>  <br> | Electronic Thermal for Braking Resistor Discharging Capacity (3004Hex-33Hex) =<br>$\frac{\text{Braking time (s)} \times \text{Motor capacity (kW)}}{2}$ | Electronic Thermal for Braking Resistor Allowable Average Loss (3004Hex-34Hex) =<br>$\frac{\%ED(\%)^{*1}}{100} \times \text{Motor capacity (kW)}$<br>2 |

## When braking load at deceleration is a constant speed

| How to apply a braking load | Allowable average loss | Thermal braking resistance value |
|---|---|---|
| Braking load (kW)<br>  <br> | Electronic Thermal for Braking Resistor Discharging Capacity (3004Hex-33Hex) =<br><br>Braking time (s) × Motor capacity (kW) | Electronic Thermal for Braking Resistor Allowable Average Loss (3004Hex-34Hex) =<br><br>$\frac{\%ED(\%)^{*1}}{100}$ × Motor capacity (kW) |

*1. %ED indicates the usage rate. It is the percentage of the time under braking in the interval where the brake is applied. (Reference: *A-10-3 Overview of Braking Resistor Selection* on page A-290)

- When a braking resistor capable of outputting a temperature detection signal is applied, allocate “9: EXT (external trip)” to one of input terminals [DI1] to [DI7], and connect the temperature de- tection signal of the braking resistor.
- Even if there is actually little temperature rise, the electronic thermal sometimes is activated and the overheating protection (alarm code: 16 hex) is generated depending on the braking resistor specifications. Check the specifications of the braking resistor and set its parameter.

# 7

# Motor and Control Functions



This section describes the vector control and applied functions characteristic of this inverter.


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# 7-1 Details of Motor Control Methods

Select the control method best suited to type of motor to be driven and application. Set the control method to be used in 1st Drive Control Selection (F042)/2nd Drive Control Selection (A014).
Available control methods differ according to the type of motor.
Vector control without speed sensor and vector control with speed sensor can be set only to 1st motor control.

## 7-1-1 Motor Control Methods

### Dynamic Torque Vector Control (IM: Induction Motor)

To make full use of motor torque, torque corresponding to load is calculated, and the voltage/current vector is optimally controlled according to that calculated value. When dynamic torque vector control is selected, automatic torque boost and slip compensation are automatically enabled. This function is useful for enhancing response to load fluctuation or other external disturbances and improving the speed control accuracy of the motor. Note, however, that this control is open loop V/f control and does not control current like in vector control. For this reason, response to sudden load external disturbances may not be possible, though it does have advantages such as a maximum torque larger than that of vector control.

### Dynamic Torque Vector Control with Speed Sensor (IM: Induction motor)

With regard to V/f control with speed sensor, to make full use of motor torque, torque corresponding to load is calculated, and the voltage/current vector is optimally controlled according to that calculated value. This control is useful for enhancing response to load fluctuation or other external disturbances and improving the speed control accuracy of the motor.

### Vector Control without Speed Sensor

Speed control is performed based on the motor speed inferred from voltage and current, motor current is further divided into excitation current and torque current, and vector control for controlling each of these currents is performed. The required response can be achieved by adjusting the control constants (PI constants) with speed control (PI controller).
With vector control, a certain degree of difference (voltage margin) between the induction voltage of the motor and voltage that can be output from the inverter is required as motor current is controlled. Generally, the voltage of a general-purpose motor is matched to the commercial power supply. However, due to the necessity for this voltage margin, the terminal voltage of the motor must be kept low when performing control. When the terminal voltage of the motor is kept low when performing control, the rated torque of the motor cannot be output even if the rated current of the motor according to specification is applied. To ensure the rated torque, the rated current must be increased (the same applies in vector control with speed sensor).

## Vector Control with Speed Sensor (IM: Induction motor)

Speed control is performed based on the motor rotation position and speed detected according to the feedback signal from the motor's PG, motor current is further divided into excitation current and torque current, and vector control for controlling each of these currents is performed. The required response can be achieved by adjusting the control constants (PI constants) with speed control (PI controller). Compared with speed sensorless vector control, vector control with speed sensor affords speed control with even higher accuracy and faster response.

## Vector Control without Speed Sensor (PM: Synchronous Motor)

Speed control is performed based on the motor speed inferred from voltage and current, motor current is further divided into excitation current and torque current, and vector control for controlling each of these currents is performed. The required response can be achieved by adjusting the control constants (PI constants) of speed control (PI controller).

## Vector Control with Speed Sensor (PM: Synchronous Motor)

Speed control is performed based on the motor rotation speed and magnetic pole position detected according to the feedback signal from the motor's speed/magnetic pole position sensor, motor current is further divided into excitation current and torque current, and vector control for controlling each of these currents is performed. The required response can be achieved by adjusting the control constants (PI constants) of speed control (PI controller). Compared with sensorless vector control, vector control with sensor affords a wider speed control range and speed control with higher response.

# 7-1-2 Basic Motor Parameter Settings

Set the basic parameters for motor control and protection.
Setting the correct motor parameters to the inverter is effective in stabilizing motor behavior as appropriate values are obtained for the control result.

- Match the base frequency to the rated frequency stipulated for the motor. Setting the base frequency lower than the rated frequency might result in motor burnout.
- The rated frequency of a general induction motor is designed to be within the range 50 to 60 Hz. When setting the maximum frequency to 60 Hz or higher, check the maximum allowable frequency in the motor specifications. Setting a maximum frequency and rated voltage exceeding the motor specifications might result in motor burnout.

## Basic Parameter Settings

| Item | Inverter parameter | | Setting range | Description | Default value |
|---|---|---|---|---|---|
| Capacity | P002 / A016 | 1st Motor Capacity / 2nd Motor Capacity | 0.01 to 1000 kW | Sets the motor capacity. | Dependent on capacity |

| Item | Inverter parameter | | Setting range | Description | Default value |
|---|---|---|---|---|---|
| Number of poles | P001 / A015 | 1st Motor Pole Number / 2nd Motor Pole Number | 2 to 128 poles | Sets the number of poles of the motor. | 4 |
| Frequency | F004 / A002 | 1st Base Frequency / 2nd Base Frequency | 5.0 to 590.0 Hz | Sets the base frequency of the motor. | 50.0 |
| | F003 / A001 | 1st Maximum Output Frequency / 2nd Maximum Output Frequency | 5.0 to 590.0 Hz | Sets the maximum frequency of the motor. | 60.0 |
| Voltage | F005 / A003 | 1st Rated Voltage at Base Frequency / 2nd Rated Voltage at Base Frequency | 80 to 240 V: AVR operation (200 V class series) 160 to 500 V: AVR operation (400 V class series) | Sets the base voltage of the motor. | Dependent on capacity |
| | F006 / A004 | 1st Rated Voltage at Maximum Output Frequency / 2nd Rated Voltage at Maximum Output Frequency | 80 to 240 V: AVR operation (200 V class series) 160 to 500 V: AVR operation (400 V class series) | Sets the maximum voltage of the motor. | Dependent on capacity |
| Current | P003 / A017 | 1st Motor Rated Current / 2nd Motor Rated Current | 0.00 to 500.0 A | Set the rated current of the motor. | Dependent on capacity |

## Capacity and Number of Poles

Set the capacity and number of poles of the motor.
Note that when the capacity is changed, specific parameters on the inverter are initialized to their factory defaults.
After setting the capacity, either perform auto-tuning or manual input the motor constants that have been prepared.
When the correct motor constants are set, operation is optimized so it becomes stable.
Cleared default values are for auto-tuning, and action may not be as expected if the values deviate from actual motor constants. For this reason, ensure that the motor constants are set correctly.

## Base Frequency/Base Voltage

Match 1st Base Frequency (F004)/2nd Base Frequency (A002) and 1st Rated Voltage at Base Frequency (F005)/2nd Rated Voltage at Base Frequency (A003) to the rated frequency and rated voltage of the motor.
The base frequency is found as follows from the rated rotation speed (min-1) of the motor and the number of poles.

- Base frequency (Hz) = Rated rotation speed (min-1) × number of poles/120

## Maximum Frequency/Maximum Output Voltage

Set the maximum frequency and maximum output voltage of the motor.

## Rated Current

Set the motor rated current matched to the motor specifications. Motor protection sometimes does not function properly if the motor rated current is not set properly.
Also, motor control sometimes becomes unstable if the motor rated current is not set properly.

# 7-1-3 Motor Parameter Settings

When motor parameters are correctly set matched to the motor control method, control is compensated and motor behavior is stabilized.

Note that when the capacity is changed, specific parameters on the inverter are initialized to their factory defaults.
After setting the capacity, either perform auto-tuning or manual input the motor constants that have been prepared.
For details on auto-tuning, refer to *7-8-1 Motor Off-line Auto-tuning* on page 7-70.

Save the set parameter values as a user preference dataset so that motor constants can be recovered if they are initialized unintentionally.
For details on the user preference dataset, refer to *6-1-1 Data Initialization* on page 6-3.

Set the following constants according to the settings of 1st Drive Control Selection (F042)/2nd Drive Control Selection (A014).

## Dynamic Torque Vector Control (With/without Speed Sensor) (Induction Motor)

| Parameter No. | Function name | Set data | Default data |
|---|---|---|---|
| F042 / A014 | 1st Drive Control Selection / 2nd Drive Control Selection | 1: IM Dynamic torque vector control | 0 |
| F004 / A002 | 1st Base Frequency / 2nd Base Frequency | Motor rated value | 50.0Hz |
| F005 / A003 | 1st Rated Voltage at Base Frequency / 2nd Rated Voltage at Base Frequency | | Dependent on capacity |
| P002 / A016 | 1st Motor Capacity / 2nd Motor Capacity | | Dependent on capacity |
| P003 / A017 | 1st Motor Rated Current / 2nd Motor Rated Current | | Dependent on capacity |

| Parameter No. | Function name | Set data | Default data |
|---|---|---|---|
| P006 / A020 | 1st Motor No Load Current / 2nd Motor No Load Current | When rotation tuning can be performed, this does not need to be set. When rotation tuning is not possible, either set the values given in the test report for the motor, or set the value calculated by the following formula. $\sqrt{(3007Hex-04Hex)^2-(3007Hex-38Hex)^2}$ | Dependent on capacity |
| F003 / A001 | 1st Maximum Output Frequency / 2nd Maximum Output Frequency | Design specification value | 60.0Hz |
| F007 | 1st Acceleration Time 1 | | 6.0 s |
| F008 | 1st Deceleration Time 1 | | 6.0 s |

## Vector Control (With/without Speed Sensor) (IM: Induction Motor)

| Parameter No. | Function name | Set data | Default data |
|---|---|---|---|
| F042 / A014 | 1st Drive Control Selection / 2nd Drive Control Selection | 4: IM Dynamic torque vector control with speed sensor<br>6: IM Vector control with speed sensor | 0 |
| F004 / A002 | 1st Base Frequency / 2nd Base Frequency | Motor rated value | 50.0Hz |
| F005 / A003 | 1st Rated Voltage at Base Frequency / 2nd Rated Voltage at Base Frequency | | Dependent on capacity |
| P001 / A015 | 1st Motor Pole Number / 2nd Motor Pole Number | | 4 |
| P002 / A016 | 1st Motor Capacity / 2nd Motor Capacity | | Dependent on capacity |
| P003 / A017 | 1st Motor Rated Current / 2nd Motor Rated Current | | Dependent on capacity |
| P006 / A020 | 1st Motor No Load Current / 2nd Motor No Load Current | When rotation tuning can be performed, this does not need to be set. When rotation tuning is not possible, either set the values given in the test report for the motor, or set the value calculated by the following formula. $\sqrt{(3007Hex-04Hex)^2-(3007Hex-38Hex)^2}$ | Dependent on capacity |
| F003 / A001 | 1st Maximum Output Frequency / 2nd Maximum Output Frequency | Design specification value | 60.0Hz |
| F007 | 1st Acceleration Time 1 | | 6.0 s |
| F008 | 1st Deceleration Time 1 | | 6.0 s |

## Vector Control (With/without Speed Sensor) (PM: Synchronous Motor)

| Parameter No. | Function name | Set data | Default data |
|---|---|---|---|
| F042 | 1st Drive Control Selection | 15: PM Vector control without speed and pole position sensor<br>16: PM Vector control with speed and pole position sensor | 0 |
| F026 | Carrier Frequency | Motor specification | 2kHz |
| F004 | 1st Base Frequency | Motor rated value | 50.0Hz |
| F005 | 1st Rated Voltage at Base Frequency | | Dependent on capacity |
| P001 | 1st Motor Pole Number | | 4 |
| P002 | 1st Motor Capacity | | Dependent on capacity |
| P003 | 1st Motor Rated Current | | Dependent on capacity |
| P030 | 1st PM Motor Starting Method | 0: Pull-in by current<br>1: For IPM type 1(Interior permanent magnet synchronous motor)<br>2: For SPM type (Surface permanent magnet synchronous motor) 3: Pull-in by current for IPM type 4: For IPM type 2(Interior permanent magnet synchronous motor) | 1 |
| P063 | 1st PM Motor Induced Voltage Ke | When unknown, perform rotation tuning. | Dependent on capacity |
| P064 | 1st PM Motor Iron Loss | When unknown, set 0%. | Dependent on capacity |
| P090 | 1st PM Motor Overcurrent Protection Level | When unknown, set 2x the rated current. | Dependent on capacity |
| F003 | 1st Maximum Output Frequency | Design specification value | 60.0Hz |
| F015 | 1st Frequency Upper Limit | | 70.0Hz |
| F007 | 1st Acceleration Time 1 | | 6.0 s |
| F008 | 1st Deceleration Time 1 | | 6.0 s |

## When Control with Speed Sensor Is Selected as Control Method

When a control with speed sensor is selected as the control method, the following parameters matched to the encoder specifications are required.

| Parameter No. | Function name | Set data | Default data |
|---|---|---|---|
| d014 | Input Terminal [PIA][PIB] Pulse Input Format Selection | 2: Quadrature A/B signal (B phase lead)<br>3: Quadrature A/B signal (A phase lead) | 2 |

| Parameter No. | Function name | Set data | Default data |
|---|---|---|---|
| d015 | Input Terminal [PIA][PIB] Encoder Pulse Resolution | Number of pulses of motor encoder to be controlled<br>0400 (hexadecimal display) / 1024 P/R | 0400 (hexadecimal display) |
| d016 | Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator | Set the speed reduction ratio of the motor and encoder.<br>When the encoder is directly coupled to the motor, this does not need to be set. (Default value = 1) Motor speed = Encoder speed × (d017)/(d016) | 1 |
| d017 | Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator | | 1 |

## Parameters That Do Not Require Setting

The following table shows parameters whose values are determined by other parameters or parameters that do not need to be changed from their factory default values.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| P013 / A027 | 1st Iron Loss Factor 1 / 2nd Iron Loss Factor 1 | 0.00 to 20.00% | Dependent on capacity | % |
| P055 / A055 | 1st Motor Torque Current under Vector Control / Torque Current for 2nd Vector Control | 0.00 to 2000A | Dependent on capacity | A |
| P056 / A056 | 1st Induced Voltage Factor under Vector Control / Induced Voltage Factor for 2nd Vector Control | 50 to 100% | Dependent on capacity | % |
| P065 | 1st PM Motor d-axis Inductance Magnetic Saturation Correction | 0.0 to 100% (100.0%=No magnetic saturation)<br>999 (Factory default) | 999 | % |
| P074 | 1st PM Motor Reference Current at Starting | 10 to 200% (Based on the rated current of the motor) | 80 | % |
| P085 | 1st PM Motor Flux Limitation Value | 50.0 to 150.0%<br>999 (Factory default) | 999 | % |
| P087 | 1st PM Motor Reference Current for Magnetic Pole Detection | 0 to 200% (Based on the rat- ed current of the motor) | 0 | % |

# 7-2 V/f control with speed feedback

The 3G3M1 Series Inverter can perform V/f control with speed feedback by using the pulse train input function mounted as standard.
This control enables highly accurate and stable speed control based on the feedback of the pulse generator (PG) signal or the phase A/B signals from the encoder.
This section describes the settings and functions of V/f control with speed feedback.

## 7-2-1 Settings of V/f Control with Speed Feedback

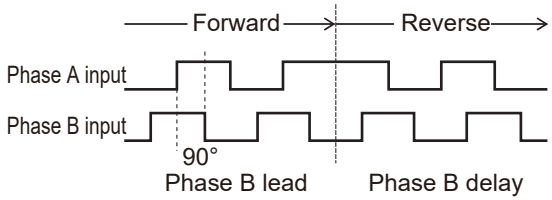
In this control mode, the inverter can perform highly accurate and stable speed control as V/f control, based on the speed feedback data.

- To use this function, set “3: IM V/f control with speed sensor” at 1st Drive Control Selection (F042)/2nd Drive Control Selection (A014).
- Set the type of the pulse train signal to input in Input Terminal [PIA][PIB] Pulse Input Format Selection (d014), and the number of pulses per one rotation of the motor (×1 multiplication) in Input Terminal [PIA][PIB] Encoder Pulse Resolution (d015).
- Set values in Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator (d016) and Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator (d017) according to the speed reduction ratio of the motor and encoder.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F042 / A014 | 1st Drive Control Selection/ 2nd Drive Control Selection | 3: IM V/f control with speed sensor | 0 | - |
| d014 | Input Terminal [PIA][PIB] Pulse Input Format Selection | 0: Pulse train signing/pulse train input<br>1: Forward/reverse rotation pulse<br>2: Quadrature A/B signal (B phase lead)<br>3: Quadrature A/B signal (A phase lead) | 2 | - |
| d015 | Input Terminal [PIA][PIB] Encoder Pulse Resolution | 20 to 60000 | 1024 | Pulse |
| d016 | Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator | 1 to 32767 | 1 | - |
| d017 | Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator | 1 to 32767 | 1 | - |

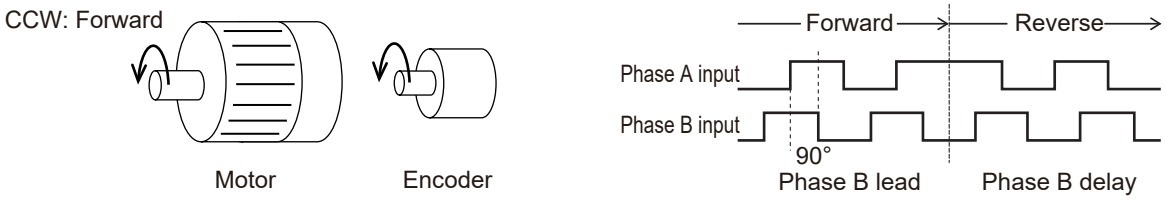
### Details of Input Terminal [PIA][PIB] Pulse Input Format Selection (d014)

The Input Terminal [PIA][PIB] Pulse Input Format Selection (d014) setting causes the inverter to recognize the feedback rotation direction as shown below.

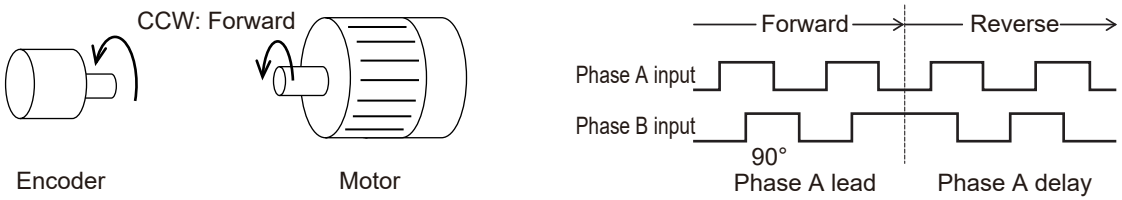
| d014 data | Pulse input method | Remarks |
|---|---|---|
| 2 | Quadrature A/B signal (B phase lead) |  |

| d014 data | Pulse input method | Remarks |
|---|---|---|
| 3 | Quadrature A/B signal (A phase lead) | When d014 = 2, reverse rotation (A phase lead becomes forward rotation). |

The counterclockwise direction (CCW) as viewed from the shaft side is taken as the forward rotation direction of the motors. At this time, if the output pulse of the encoder is B phase lead, set “2: Quadrature A/B signal (B phase lead)” at Input Terminal [PIA][PIB] Pulse Input Format Selection (d014).




If the output pulse of the encoder is A phase lead, set “3: Quadrature A/B signal (A phase lead)” at Input Terminal [PIA][PIB] Pulse Input Format Selection (d014).




**Additional Information**

In the case of a motor that complies with the IEC Standards, forward rotation causes the motor to rotate clockwise (CW).
Either connect the output pulse of the encoder during forward (CW) rotation so that it becomes B phase lead, or set Input Terminal [PIA][PIB] Pulse Input Format Selection (d014) to match the output pulse of the encoder.

## 7-2-2 Protective Detection

The following protective detection functions can be used. Use them according to your application.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d021 | Speed Agreement / Speed Deviation Error Hysteresis Width | 0.0 to 50.0 | 10.0 | % |
| d022 | Speed Agreement / Speed Deviation Error Detection Timer | 0.00 to 10.00 | 0.50 | s |
| d023 | Speed Deviation Error Processing Selection | 0: Continue to run 1<br>1: Stop with alarm 1<br>2: Stop with alarm 2<br>3: Continue to run 2<br>4: Stop with alarm 3<br>5: Stop with alarm 4 | 2 | - |
| d032 | Speed Limit 1 in Forward | 0 to 110 | 100 | % |
| d033 | Speed Limit 2 in Reverse | 0 to 110 | 100 | % |
| d035 | Over Speed Detection Level | 0 to 120,<br>999: Depend on d032, d033 | 999 | % |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 71: DSAG (Speed agreement)<br>76: DSE (Excessive speed deviation) | - | - |

## Overspeed error detection

If the output frequency exceeds the overspeed protection level, the inverter detects the overspeed protection alarm (alarm code: 1B) and shuts off (trips) inverter output.

- Conditions that cause an overspeed protection alarm Over Speed Detection Level (d035) = 999

<Forward rotation side> Overspeed protection level = 1st Maximum Output Frequency (F003)/2nd Maximum Output Frequency (A001) × Speed Limit 1 in Forward (d032) (%) × 120 (%)

<Reverse rotation side> Overspeed protection level = 1st Maximum Output Frequency (F003)/2nd Maximum Output Frequency (A001) × Speed Limit 2 in Reverse (d033) (%) × 120 (%)

Over Speed Detection Level (d035) = Other than 999

Overspeed protection level = 1st Maximum Output Frequency (F003)/2nd Maximum Output Frequency (A001) × Over Speed Detection Level (d035) (%)

## Speed mismatch/excessive speed deviation

If the state where the difference between the frequency reference and the actual frequency exceeds the set value of Speed Agreement / Speed Deviation Error Hysteresis Width (d021) continues for Speed Agreement / Speed Deviation Error Detection Timer (d022), this state is judged to be a speed mismatch/excessive speed deviation, post-detection processing is performed according to the setting of Speed Deviation Error Processing Selection (d023).

| d023 data | Function | Detection condition | Post-detection processing | Error detection width when speed command > F004 |
|---|---|---|---|---|
| 0 | Continue to run 1 | When the speed command (after software start processing) cannot be followed due to a heavy overload, for example, and the detection speed drops compared with the speed command, a PG error is not judged. | The excessive speed deviation “DSE” signal is output and the inverter continues to operate. | Even at 1st Base Frequency (F004) or higher, constant at “detection width = d021 × maximum frequency.” |
| 1 | Stop with alarm 1 | | Inverter free-run at speed mismatch/ excessive speed deviation (alarm code: 2F) | |
| 2 | Stop with alarm 2 | There are no exception conditions. | | |

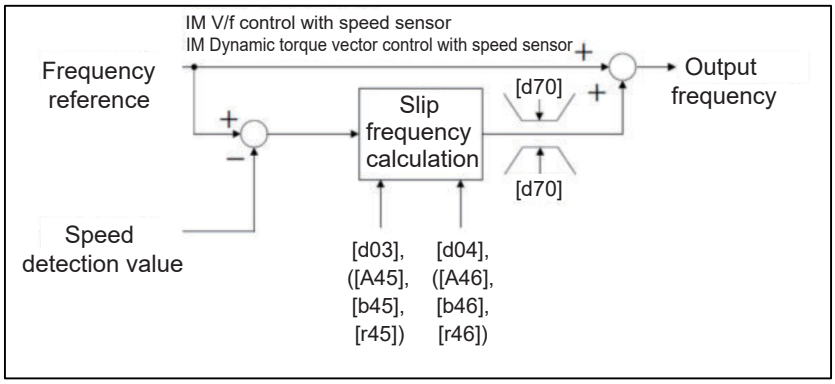
| d023 data | Function | Detection condition | Post-detection processing | Error detection width when speed command > F004 |
|---|---|---|---|---|
| 3 | Continue to run 2 | When the speed command (after software start processing) cannot be followed due to a heavy overload, for example, and the detection speed drops compared with the speed command, a PG error is not judged. | The excessive speed deviation "DSE" signal is output and the inverter continues to operate. | At 1st Base Frequency (F004) or lower, constant at "detection width = d021 × maximum frequency." At 1st Base Frequency (F004) or higher, "detection width = d021 × speed command × maximum frequency / base frequency." |
| 4 | Stop with alarm 3 | | Inverter free-run at speed mismatch/ excessive speed deviation (alarm code: 2F) | |
| 5 | Stop with alarm 4 | There are no exception conditions. | | |

When Continue to run (0 or 3) is set in Speed Deviation Error Processing Selection (d023), inverter output is not shut off (tripped). For this reason, allocate "76: DSE (excessive speed deviation)" to Output Terminal [DO1] Function Selection (E020) and Output Terminal [ROA, ROB] Function Selection (E027), and configure a sequence that, for example, stops control.
To judge that the speed deviation is within the setting range, allocate "71: DSAG (speed agreement)."

## 7-2-3 Adjustments for V/f Control with Speed Feedback

You can adjust the V/f control with speed feedback function with the gain settings shown below. However, the function cannot be adjusted when using a motor that causes an extremely large slip (10% of the rated rotation speed or higher) or in applications where such a large load that causes the motor to stall (or step out) is applied. If so, set the type and capacity of the motor again.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d003 | Speed Control 1 P Proportional Gain | 0.1 to 200.0 | 10.0 | time |
| d004 | Speed Control 1 I Integral Time | 0.001 to 9.999<br>999: Disable | 0.100 | s |
| d070 | Speed Control Slip Frequency Limit | 0.00 to 100.00 | 100.00 | % |



### V/f control with speed feedback slip compensation proportional gain

At first, adjust the proportional gain for speed feedback control.

- Check and gradually increase the set value of PG feedback value (W116).
- While checking the PG feedback value (W116), increase the value within the range where the motor speed is stable.
- If the motor speed fluctuates or the motor vibrates wildly, decrease the set value until it becomes stable.
- When adjusting the response if the load is actually activated, increase the set value to improve response, or decrease the set value to make it stable.

### V/f control with speed feedback slip compensation integral time

Next, adjust the integral time for speed feedback control.

- Check and gradually decrease the set value of PG feedback value (W116).
- Decrease the value in the PG feedback value (W116) until it matches the reference frequency.
- If the motor speed fluctuates or the motor vibrates wildly, increase the set value until it becomes stable.
- When adjusting the response if the load is actually activated, decrease the set value to improve response, or increase the set value to make it stable.

### Speed control limiter

Speed Control Slip Frequency Limit (d070) is the limiter for the slip frequency that is added to the frequency reference. The maximum frequency is taken to be 100%. Ordinarily, leaving this setting at 100% causes no problems.

# 7-3 Sensorless Vector Control

A characteristic of an induction motor is that its rotation speed drops when output torque increases. When sensorless vector control is selected, the relationship between the output torque and rotation speed of an induction motor can be improved and high torque can be output even at low speeds. Sensorless vector control enables a high starting torque of 200% to be output at 0.5 Hz.
An auto-tuning function (rotation method, stop method) that automatically sets motor constants also is mounted on the inverter.

## 7-3-1 Sensorless Vector Control Parameter Settings

- Set the 1st Drive Control Selection (F042)/2nd Drive Control Selection (A014) to “5: IM Vector control without speed sensor.”
- Set 1st Motor Capacity (P002)/2nd Motor Capacity (A016), 1st Motor Pole Number (P001)/2nd Man- ual Torque Boost Voltage (A005), 1st Motor Rated Current (P003)/2nd Motor Rated Current (A017) according to the motor in use.
- When rotation tuning is not possible, set 1st Motor No Load Current (P006)/2nd Motor No Load Cur- rent (A020) by the formula below. When rotation tuning is possible, setting is not required.

  $\sqrt{(P03)^2-(P55)^2}$

- Set the rated frequency of the motor to 1st Base Frequency (F005)/2nd Base Frequency (A003), and set the motor rated voltage to 1st Rated Voltage at Base Frequency (F005)/2nd Rated Voltage at Base Frequency (A003). If the motor synchronous speed can be confirmed, set the value calculated by the formula below to F004/A002.

  $$\frac{\text{Synchronous speed}}{120} \times \text{Number of poles}$$

- To use this function, set the motor constants of the motor in use according to *7-8-1 Motor Off-line Auto-tuning* on page 7-70 and *7-3-2 Motor Parameter Settings* on page 7-16.
- Motor magnetic flux is controlled according to the instructed torque by setting “1: Enable” in Magnet- ic Flux Weakening Control Function Selection (d082). When the instructed torque is small, motor magnetic flux is weakened and stability of control is improved with Magnetic Flux Weakening Lower Limit (d083) as the lower limit.
- Set the magnetic flux weakening lower limit value in % units in Magnetic Flux Weakening Lower Limit (d083). If the lower limit value is set to too low, there is the risk of the problems of hunting and speed delay.
  Use the lower limit value at its factory default (40%) as far as feasibly possible.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F042 | 1st Drive Control Selection | 1 : IM Dynamic torque vector control without speed sensor<br>5 : IM Vector control without speed sensor | 0 (V/f) | - |
| A014 | 2nd Drive Control Selection*7-3-1 Sensorless Vector Control Parameter Settings* on page 7-15 | 1: IM Dynamic torque vector control without speed sensor<br>5: IM Vector control without speed sensor | | |
| P002 / A016 | 1st Motor Capacity / 2nd Motor Capacity | 0.01 to 1000 kW | Dependent on capacity | kW |
| P001 / A005 | 1st Motor Pole Number / 2nd Manual Torque Boost Voltage | 2 to 128 poles | 4 | Pole |
| P003 / A017 | 1st Motor Rated Current / 2nd Motor Rated Current | 0.00 to 500.0 A | 21 | A |
| P006 / A020 | 1st Motor No Load Current / 2nd Motor No Load Current | 0.00 to 500.0 A | 10.55 | A |
| F004 / A002 | 1st Base Frequency / 2nd Base Frequency | 5.0 to 590.0 | 50.0 | Hz |
| F005 / A003 | 1st Rated Voltage at Base Frequency / 2nd Rated Voltage at Base Frequency | 80 to 240 V: AVR operation (200 V class series)<br>160 to 500 V: AVR operation (400 V class series) | 200 | V |
| d082 | Magnetic Flux Weakening Control Function Selection | 0: Disable<br>1: Enable | 0 | - |
| d083 | Magnetic Flux Weakening Lower Limit | 10 to 70% | 40 | % |

*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].

**Precautions for Correct Use**

- The inverter may not provide sufficient performance characteristics due to the current accuracy if the motor is two or more sizes smaller than the maximum applicable motor capacity.
- The motor may rotate in the reverse direction at low frequencies (a few Hz or less) because of the current accuracy. In this case, use the Reverse Rotation Prevention Function (H008) function or refer to *7-3-3 Adjustments for Sensorless Vector Control* on page 7-17 to adjust the motor parameter settings.

## 7-3-2 Motor Parameter Settings

- Ordinarily, offline auto-tuning is performed to set motor parameters.
  However, if offline auto-tuning ends in error, for example, when the inverter does not reach 50% of its rated current during auto-tuning, set the motor parameters manually.
- To increase the performance of vector control, set each parameter value again according to the mo- tor in use.
- Obtain the motor’s datasheet from the motor manufacturer and set each motor parameter. For the following set values, set the data for one phase in a Y-connection after conversion in 1st Base Frequency (F004)/2nd Base Frequency (A002).

1st Motor No Load Current (P006)/2nd Motor No Load Current (A020) : Set the no-load current of the motor, or set the current value measured when the motor is in isolated no-load operation in 1st Base Frequency (F004)/2nd Base Frequency (A002).

1st Motor Parameter %R1 (P007)/2nd Motor Motor Constant %R1 (A021) : Set the wiring resistance value on the primary side of the motor for one phase in a Y-connection as a percentage Ohmic drop. Calculate by the following formula.

$$\%R1 = \frac{R1 + \text{Cable R1}}{V/(\sqrt{3} \times I)} \times 100\ (\%)$$

R1: Motor primary resistance (Ω)
Cable R1: Resistance value c of output side cable
V: Motor rated voltage (V)
I: Motor rated current (A)

1st Motor Parameter %X (P008)/2nd Motor Motor Constant %X (A022) : Set the leakage inductance for one phase in a Y-connection motor as a percentage reactance drop. Calculate by the following formula.

$$\%X = \frac{X1 + X2 \times XM/(X2+XM) + \text{Cable X}}{V/(\sqrt{3} \times I)} \times 100\ (\%)$$

X1: Motor primary leakage reactance (Ω)
X2: Motor secondary leakage reactance (primary converted value)
XM: Motor excitation reactance (Ω)
Cable X: Reactance of output side cable (Ω)
V: Motor rated voltage (V)
I: Motor rated current (A)

1st Rated Slip Frequency (P012)/2nd Rated Slip Frequency (A026) : Set the rated slip frequency in a Y-connection motor as Hz.

- After setting each motor parameter, adjust the parameters according to *7-3-3 Adjustments for Sensorless Vector Control* on page 7-17.
- To increase response, increase the setting of Speed Control 1 P Proportional Gain (d003)/Speed Control 2 P Proportional Gain (A045), and decrease the setting if motor hunting occurs.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| P006/A020 | 1st Motor No Load Current / 2nd Motor No Load Current | 0.00 to 500.0 A | 10.55 | A |
| P007/A021 | 1st Motor Parameter %R1 / 2nd Motor Motor Constant %R1 | 0.00 to 50.00 % | 3.17 | % |
| P008/A022 | 1st Motor Parameter %X / 2nd Motor Motor Constant %X | 0.00 to 50.00 % | 11.47 | % |
| P012/A026 | 1st Rated Slip Frequency / 2nd Rated Slip Frequency | 0.00 to 15.00 Hz | 1.00 | Hz |

## 7-3-3 Adjustments for Sensorless Vector Control

- To use sensorless vector control, perform offline auto-tuning.
  If offline auto-tuning cannot be performed, set the parameters of the motor in use according to *7-3-2 Motor Parameter Settings* on page 7-16.

- The inverter may not provide sufficient performance characteristics if the motor is two or more sizes smaller than the maximum applicable motor capacity. This is because the inverter requires a current accuracy of at least 50% of the rated current.
- If sensorless vector control does not provide the intended performance characteristics, adjust the motor parameters depending on the phenomenon, as shown in the following table.

| Operation status | Phenomenon | Description of adjustment | Adjustment item |
|---|---|---|---|
| Power running | Actual motor speed is lower than target speed. | Increase the slip compensation gain (drive) or rated slip gradually. | P009/A023<br>P012/A026 |
| | Actual motor speed is higher than target speed. | | |
| Regeneration | Torque is insufficient at low frequencies (a few Hz). | Increase %R1 and no-load current gradually. | P007/A021<br>P006/A020 |
| During startup | Shock occurs during startup. | Adjust the speed control P gain. | d003/A045 |
| | Motor rotates momentarily in opposite direction to instructed rotational direction. | Set rotational direction limitation. | H008 |
| At deceleration | Motor is hunting. | Adjust the speed control P gain. | d003/A045 |
| Torque limiting | Torque becomes insufficient at low frequencies when torque limit is enabled. | Decrease the torque limit. | F040<br>F041<br>E016<br>E017 |
| Low frequency operation | Rotation is unstable. | Adjust the speed control P gain. | d003/A045 |

## Final Torque Reference Monitor Function

This function monitors the torque reference value that is input during operation under sensorless vector control.
The torque reference monitor function estimates the torque value equivalent to the rated current of the inverter as 100%.
To convert it to the rated motor torque ratio, use the following formula: Rated motor torque ratio = Monitor value × Rated output current of inverter / Rated motor current

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| M084 | Actual torque value/<br>Final Torque command value | -327 to 327 | 0 | % |

## Output Torque Monitor Function

To monitor the output torque, reference the torque calculation value (W007).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| W007 | Actual torque value/ Torque command value | -999 to 999 | 0 | % |

# 7-4 PM Motor

The 3G3M1 Series provides the PM motor mode.
Synchronous motors (PM motors) that are more efficient than induction motors (IM motors) can be controlled.
This section describes the PM motor mode.

## 7-4-1 PM Motor and PM Motor Control

### PM Motor

A PM motor (abbreviation for “Permanent Magnet motor”) is a motor that uses permanent magnets for the motor rotor.
Generally, it is also called a synchronous motor. Compared with induction motors that are used conventionally for the inverter, PM motors allow no current flow on the rotor side, which results in highly efficient operation due to reduced loss.
In terms of the internal construction, there are various types of PM motors: IPM motors (interior permanent magnet type), SPM motors (surface permanent magnet type), and so on.
PM motors have the control characteristics as shown below.
When using the PM motor mode of the 3G3M1 Series Inverter, understand the following characteristics before selecting the inverter type and function settings.

- The applied AC power must be synchronized with the rotor permanent magnets.
  Although the motor allows a large current to flow, it cannot output a sufficient torque if the AC power is not synchronized.
- The permanent magnets used for the rotor are subject to demagnetization if a large current flows in the PM motor.
  Once a rotor is demagnetized, the motor cannot output a sufficient torque and must be replaced.

### PM Motor Control

PM motor control with speed feedback can be selected on the 3G3M1 Series.
As large startup torque cannot be output, PM motor control without speed feedback is suitable for applications with reduced torque characteristics (which do not require torque at low speeds) such as fans and pumps.
For applications with constant torque characteristics such as general transfer equipment and elevating axes (which require a torque exceeding the rated torque also at low speeds), select PM motor control with speed feedback.
In PM motor control without speed feedback, use control with startup torque at 50% or less of the motor rated torque to keep the PM motor in a synchronized state.
Follow the steps below to use PM motor control.

1. Switch to the PM motor mode (*7-4-2 Switching to PM Motor Mode* on page 7-21)
2. Execute offline auto-tuning for PM motor parameters (*7-8-1 Motor Off-line Auto-tuning* on page 7-70)
3. Set PM motor parameters (*7-3-2 Motor Parameter Settings* on page 7-16)

Refer to this section if offline auto-tuning fails.

4. Adjust the PM motor mode (*7-4-4 Adjustment of PM Motor Mode Settings* on page 7-22)

## Parameters with Changed Default Data

Changing the control method switches the default data for the following parameters.

| Parameter No. | Function name | F042 set value | |
|---|---|---|---|
| | | Changed from 15, 16 to other than 15, 16 | Changed from other than 15, 16 to 15, 16 |
| F003 | 1st Maximum Output Frequency | 60 | 90 |
| F004 | 1st Base Frequency | 50 | 90 |
| F005 | 1st Rated Voltage at Base Frequency | 200/400 | Individual capacity values for PMSM |
| F006 | 1st Rated Voltage at Maximum Output Frequency | 200/400 | Individual capacity values for PMSM |
| F011 | 1st Motor Electronic Thermal Level | Individual capacity values for IM | Individual capacity values for PMSM |
| F012 | 1st Motor Electronic Thermal Time Constant | 5 minutes | Less than 18.5 kW: 2 minutes<br>18.5 kw or more: 5 minutes |
| F015 | 1st Frequency Upper Limit | 70 | 90 |
| F023 | 1st Starting Frequency | 0.5 | 1 |
| F026 | Carrier Frequency | 2 | 4 |
| E050 | 1st Frequency Conversion Coefficient | 30 | 20 |
| P001 | 1st Motor Pole Number | 4 | 6 |
| P003 | 1st Motor Rated Current | Individual capacity values for IM | Individual capacity values for PMSM |
| d001 | Speed Control 1 Speed Command Filter | 0.02 | 0.2 |
| d002 | Speed Control 1 Speed Detection Filter | 0.005 | 0.025 |
| d003 | Speed Control 1 P Proportional Gain | 10 | 2 |
| d004 | Speed Control 1 I Integral Time | 0.1 | 0.6 |
| d006 | Speed Control 1 Output Filter | 0.002 | 0 |

| Parameter No. | Function name | F042 set value | |
|---|---|---|---|
| | | Changed from 15 to other than 15 | Changed from other than 15 to 15 |
| d067 | Motor Starting Mode Auto Search in Speed Sensor Vector Control | 1 | 2 |

## 7-4-2 Switching to PM Motor Mode

To switch to the PM motor control mode, set “15: PM Vector control without speed and pole position sensor” or “16: PM Vector control with speed and pole position sensor” to 1st Drive Control Selection (F042), and switch to the PM motor mode.

The PM motor can be connected only in drive control selection 1.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F042 | 1st Drive Control Selection | 15 : PM Vector control without speed and pole position sensor<br>16 : PM Vector control with speed and pole position sensor | 0 | - |

## 7-4-3 Offline Auto-tuning for PM Motor Parameters

For details on auto-tuning a PM motor, refer to *7-8-1 Motor Off-line Auto-tuning* on page 7-70.

## 7-4-4 Adjustment of PM Motor Mode Settings

### PM Motor Adjustment Parameters

For the adjustment of PM motor control, this inverter provides parameters for the control method during startup, parameters for stableness and responsiveness, and initial pole position estimation functions. The following table summarizes the parameters.
For details on how to adjust these parameters, refer to the next section onwards.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F024 | 1st Starting Frequency 1 Holding Time | 0.00 to 10.00 | 0.00 | s |
| F026 | Carrier Frequency | 0: 0.75 kHz<br>1 to 16 | 2 | kHz |
| d003 | Speed Control 1 P Proportional Gain | 0.1 to 200.0 | 10.0 | time |
| d004 | Speed Control 1 I Integral Time | 0.001 to 9.999<br>999: Disable | 0.100s | |
| P030 | 1st PM Motor Starting Method | 0: Pull-in by current<br>1: For IPM type 1(Interior permanent magnet synchronous motor)<br>2: For SPM type (Surface permanent magnet synchronous motor)<br>3: Pull-in by current for IPM type<br>4: For IPM type 2(Interior permanent magnet synchronous motor) | 1 | - |
| P061 | 1st PM Motor d-axis Inductance | 0.00 to 500.00 | 4.77 | mH |
| P062 | 1st PM Motor q-axis Inductance | 0.00 to 500.00 | 10.70 | mH |
| P074 | 1st PM Motor Reference Current at Starting | 10 to 200<br>(Based on the rated current of the motor) | 80 | % |
| P089 | 1st PM Motor Control Mode Field Control → Vector Control switching level} | 0 to 100 | 0 | % |

**Precautions for Correct Use**

- On a PM motor, even if the DC injection braking function is enabled, the regenerative energy is returned to the inverter. If an overvoltage trip occurs during DC injection braking or during deceleration, consider use of a braking resistor.
- If a holding brake is provided, release the brake before running the motor. If this timing is not correct, the PM motor will stall.
- Derating of the output current may be required depending on the installation environment or the setting of Carrier Frequency (F026). For derating in each inverter model, refer to *Derating characteristics* on page 8-104.

## PM Motor Adjustment

Adjust the PM motor as shown in the table below depending on its operation status and the phenomenon.

| Operation status | Phenomenon | Description of adjustment | Adjustment item |
|---|---|---|---|
| During startup | Motor rotates in reverse or rotates slightly. | The motor may rotate slightly in magnetic pole alignment during startup.<br>Set 1st PM Motor Starting Method P030 to 1 to suppress the rotation amount during startup.<br>When operation is performed with P030 set to 0 or 3, reverse rotation becomes difficult by lowering P074. | P030<br>P074 |
| | Motor stalls or causes an overcurrent trip. | If the motor stalls during startup, a large current may flow, which causes an overcurrent trip.<br>Increase the PM motor starting current value.<br>Increasing the PM motor starting current value improves the magnetic pole alignment during startup, which results in an increase in the startup torque.<br>However, setting this parameter to an excessively large value may cause detection of an overload.<br>Check the value in the monitor of electronic thermal overload protection for motor (monitor mode: 5_62). | P074 |
| | | Increase the PM motor starting time value. This increases the time during which the starting current flows to improve magnetic pole alignment during startup, which results in an increase in the startup torque. | F024 |
| | Motor starting time is too long. | Set P030 correctly according to the motor in use. | P030 |

| Operation status | Phenomenon | Description of adjustment | Adjustment item |
|---|---|---|---|
| Motor rotating | Rotation is unstable. | If the motor rotation is unstable during startup, increase the motor starting current.<br>However, setting this parameter to an excessively large value may cause detection of an overload. Check the value in the monitor of electronic thermal overload protection for motor (monitor mode: 5_62). | P074 |
| | A shock or overcurrent trip occurs. | Adjust the speed control gain to a larger value and the integral time to a smaller value. | d003, d004 |
| | Motor is hunting or vibrating. | Adjust the speed control gain to a smaller value and the integral time to a larger value. | d003, d004 |
| | | Increase the carrier frequency if it is low. | F026 |
| | | Gradually increase the PM motor d-axis inductance. | P061 |
| | | Gradually increase the PM motor q-axis inductance. | P062 |

## Overcurrent protection

PM motors must set with an allowable current value for preventing the permanent magnet from becoming demagnetized. If a current exceeding this allowable current value is allowed to pass, the magnetic force of the permanent magnet weakens and the desired motor characteristics can no longer be obtained.
When a current of current value set in 1st PM Motor Overcurrent Protection Level (P090) or higher flows, overcurrent protection alarms (alarm code: 01, 02, 03) are output to protect the motor.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| P090 | 1st PM Motor Overcurrent Protection Level | 0.00 to 4000A<br>(0.00: No active) | 50.00 | A |

## High-efficiency Control

In the operation of PM motors, motor parameters are used to perform high-efficiency control. Operation of a PM motor with the motor parameters unknown or in a state where rotation tuning cannot be performed is sometimes possible by disabling high-efficiency control.
To disable high-efficiency control, set PM Motor High-efficiency Control Selection (d089) to 0.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d089 | PM Motor High-efficiency Control Selection | 0: Disable<br>1: Enable | 1 | - |

## Magnetic Position Detection Completed Signal (PTD)

The ON signal is output when the magnetic pole position is detected at PM motor startup. This parameter is enabled when P030 is set to other than 0.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020, E027 | Output Terminal [DO1] Function Selection, Output Terminal [ROA, ROB] Function Selection | 89: PTD (magnetic position detection completed signal) | - | - |

## Synchronous Motor Magnetic Pole Position Pull-in Frequency

When using an encoder having A, B and Z phase outputs in PM Vector control with speed and pole position sensor, pull-in operation at the magnetic pole position is performed at the frequency set at d080 during the period up to detection of the Z phase immediately after power is turned ON as the magnetic pole position is unknown. After detection of the Z phase, the magnetic pole position referenced to the magnetic pole position sensor offset set to P095 is established, and regular operation is switched to.
Generally, there is no need for adjustment.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d080 | 1st PM Motor Magnetic Pole Position Pull-in Frequency | 0.1 to 10.0 | 1.0 | Hz |

# 7-5 Speed Control

The 3G3M1 Series is provided with speed control.
This section describes the speed control settings and functions.

## 7-5-1 Speed Control Settings

Speed control parameters can be selected from four types by combining speed control signals. Speed control is enabled in vector control with speed sensor, V/f control with speed sensor and vector control without speed sensor (permanent magnet synchronous motor). Speed control parameters can be adjusted to perform optimum speed control.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d001/A043/ b043/r043 | Speed Control 1 Speed Command Filter / Speed Control 2 Speed Command Filter / Speed Control 3 Speed Command Filter / Speed Control 4 Speed Command Filter | 0.000 to 5.000 | 0.02 | s |
| d002/A044/ b044/r044 | Speed Control 1 Speed Detection Filter / Speed Control 2 Speed Detection Filter / Speed Control 3 Speed Detection Filter / Speed Control 4 Speed Detection Filter | 0.000 to 0.100 | 0.005 | s |
| d003/A045/ b045/r045 | Speed Control 1 P Proportional Gain / Speed Control 2 P Proportional Gain / Speed Control 3 P Proportional Gain / Speed Control 4 P Proportional Gain | 0.1 to 200.0 | 10 | - |
| d004/A046/ b046/r046 | Speed Control 1 I Integral Time / Speed Control 2 I Integral Time / Speed Control 3 I Integral Time / Speed Control 4 I Integral Time | 0.001 to 9.999<br>999: Disable | 0.1 | s |
| d005/A047/ b047/r047 | Speed Control 1 FF Gain / Speed Control 2 FF Gain / Speed Control 3 FF Gain / Speed Control 4 FF Gain | 0.00 to 99.99 | 0 | s |
| d006/A048/ b048/r048 | Speed Control 1 Output Filter / Speed Control 2 Output Filter / Speed Control 3 Output Filter / Speed Control 4 Output Filter | 0.000 to 0.100 | 0.002 | s |
| d007/A049/ b049/r049 | Speed Control 1 Notch Filter Resonance Frequency / Speed Control 2 Notch Filter Resonance Frequency / Speed Control 3 Notch Filter Resonance Frequency / Speed Control 4 Notch Filter Resonance Frequency | 1 to 500 | 200 | Hz |
| d008/A050/ b050/r050 | Speed Control 1 Notch Filter Attenuation Level / Speed Control 2 Notch Filter Attenuation Level / Speed Control 3 Notch Filter Attenuation Level / Speed Control 4 Notch Filter Attenuation Level | 0 to 40 | 0 | dB |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 78: Speed control parameter selection 1<br>79: Speed control parameter selection 2 | - | - |

## Switching Speed Control Constants

In readiness for cases where speed control constants must be changed according to changes in load or machine conditions, the 3G3M1 has four speed control constants. These can be switched by speed control parameter selection 1 terminal input “MPRM1” and speed control parameter selection 2 “MPRM2.” Speed control constants 1 and 2 can also be switched by the “SET (2nd control)” terminal.

| Input signal | | Switching speed control constants |
|---|---|---|
| MPRM2 | MPRM1 | |
| OFF | OFF | Speed control constant 1: d001 to d008 |
| OFF | ON | Speed control constant 2: A043 to A050 |
| ON | OFF | Speed control constant 3: b043 to b050 |
| ON | ON | Speed control constant 4: r043 to r050 |

| Input signal SET | Switching speed control constants |
|---|---|
| OFF | Speed control constant 1: d001 to d008 |
| ON | Speed control constant 2: A043 to A050 |

## Speed Command Filter (d001/A043/b043/r043)

This parameter is for setting the time constant of the primary lag filter for the speed set value. Adjust this parameter, for example, when overshooting in response to changes in the speed command is large.
Setting a large filter time constant stabilizes the output and reduces overshoot in response to changes in the speed setting though the speed response becomes slower.

## Speed Detection Filter (d002/A044/b044/r044)

This parameter is for setting the time constant of the primary lag filter with respect to the speed detection value. This is a filter for feedback. Set it when the mechanical system vibrates.
Adjust this parameter, for example, when ripple (vibration component) is carried on the speed detection signal as a result of the control target (mechanical system) such as belt deflection, and hunting caused by that vibration component prevents gain, etc. of the PI controller from being sufficiently increased (response is slow). Also, set this parameter when there are few pulses from the encoder which results in a speed that causes vibration.
When the filter time constant is increased, the speed detection value is stabilized, and the gain of the PI controller can be increased even if ripple is carried on the speed detection signal. Note, however,

that as speed detection itself is delayed, speed response slows down, overshooting increases and sometimes results in hunting.

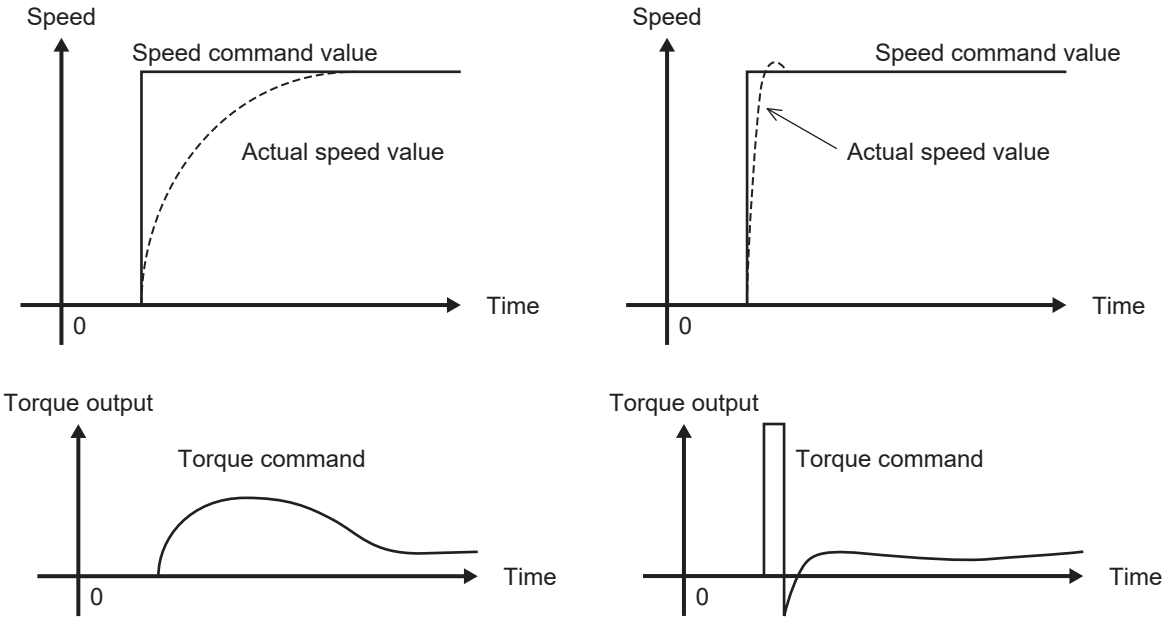
## P (Gain) (d003/A045/b045/r045), I (Integral Time) (d004/A046/b046/r046)

These parameters are for setting the gain and integral time of the speed controller (ASR).
By setting d004 = 999, the integral operation can be disabled.

- P (gain)
  Definition of P gain = 1.0 is a torque command of 100% (100% torque output at each capacity) when the speed deviation (speed command - actual speed) is 100% (equivalent to the maximum speed setting).
  Adjust the P gain according to the moment of inertia of the machine connected to the motor shaft. When the moment of inertia increases, P gain also must be increased to ensure the same response. When P gain is increases, control response becomes faster, however, the motor speed sometimes overshoots and the motor hunts. Also, machine resonance and excessive noise amplitude causes the machine or motor to generate abnormal noise.
  If this happens, the resonance amplitude can be decreased by lowering P gain. However, excessively decreasing P gain causes control response to slow down, low-frequency speed fluctuations to occur, and stabilization of the motor speed to take longer.
- I (integral time)
  When the integral time is set to a small value, response is fast as the correction time for deviation is short. To allow overshooting to enable the target speed to be reached quickly, decrease the set value, and when overshooting cannot be allowed, increase the set value.
  In cases where machine resonance occurs and abnormal machine noise is emitted from the motor and gears, the resonance point can be moved to the low frequency side to suppress resonance in the high frequency region by increasing the integral time.

## FF (Gain) (d005/A047/b047/r047)

This parameter performs feedforward control for adding the torque that is determined from the amount of change in the speed command directly to the torque command.
PI control of the speed controller is feedback control whereby corrective action (following the speed command) is performed according to the result (actual speed value) of the control target. Accordingly, with this control, correction also is effective on external disturbances that cannot be measured and causes that cannot be directly measured such as the uncertainty of control target characteristics. However, changes also in known command amounts are corrected after they appear in deviation (speed command - actual speed value) later on. As the control value (torque command) is required in advance for known causes, faster-response control can be expected by adding that control value directly to the torque command. This parameter is for performing this kind of control. Feedforward control adds the torque that is determined from the amount of change in the speed command directly to the torque command.
This is effective when the load inertia is already known. As shown conceptually in the figure below, the speed of the actual value following the command amount when feedforward control is disabled and when it is enabled is completely different. Note, however, that, in order to obtain maximum effect, the PI constants of feedback control should be adjusted to balance well with this set value.




Although the above effect can be obtained by setting the P gain of the speed controller to a higher value, increasing gain is counterproductive as is it also increases system response and produces machine resonance and vibration sound.

## Notch Filter Resonance Frequency (d007/A049/b049/r049) and Notch Filter Attenuation Level (d008/A050/b050/r050)

The speed loop gain at only near a preset resonance point can be lowered to suppress machine resonance. The notch filter can be used only when “vector control with speed sensor” is selected. Setting a higher speed loop gain to increase speed response may result in machine resonance being generated.

To suppress machine resonance, the speed loop gain must be lowered to lower the overall speed response. If the notch filter is used at this time, the speed loop gain at only near the preset resonance point can be lowered, and the speed loop gain at other than the resonance point can be set higher. As a result, the overall speed response can be increased.

When “0” (dB) is set to “attenuation level,” the notch filter is disabled.

## Speed Control Speed Loop Switching Time at Parameter Change (d025)

Parameters can be switched even when the inverter is operating. The parameters that can be switched include the P gain and I integral time of the speed control system. When these parameters are switched while the inverter is operating, in some load operating conditions, sudden torque fluctuations may occur and cause mechanical shock which may be problematic.

To alleviate this kind of shock, suppress sudden fluctuations in torque by setting the ramp function in Speed Control Speed Loop Switching Time at Parameter Change (d025) when switching parameters.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d025 | Speed Control Speed Loop Switching Time at Parameter Change | 0.000 to 1.000 | 0.000 | s |

## Slip Frequency Limit (d070)

A limiter can be set to PI calculation output of speed control systems by V/f control with speed sensor and dynamic torque vector control with speed sensor. This is enabled only when “3: IM V/f control with speed sensor” or “4: IM Dynamic torque vector control with speed sensor” is selected at Drive Control Selection (F042/A014).

In a normal control state, PI calculation output is within “slip frequency × maximum torque %.” When an abnormal state, for example, a temporary excessive load, occurs, PI calculation output devi- ates considerably and it sometimes takes time to return to a normal state. For this reason, abnormal operation can be suppressed by limiting PI calculation output.

# 7-6 Torque control

The 3G3M1 Series provides the torque control mode.
This section describes the torque control settings and functions.

## 7-6-1 Torque Control Settings

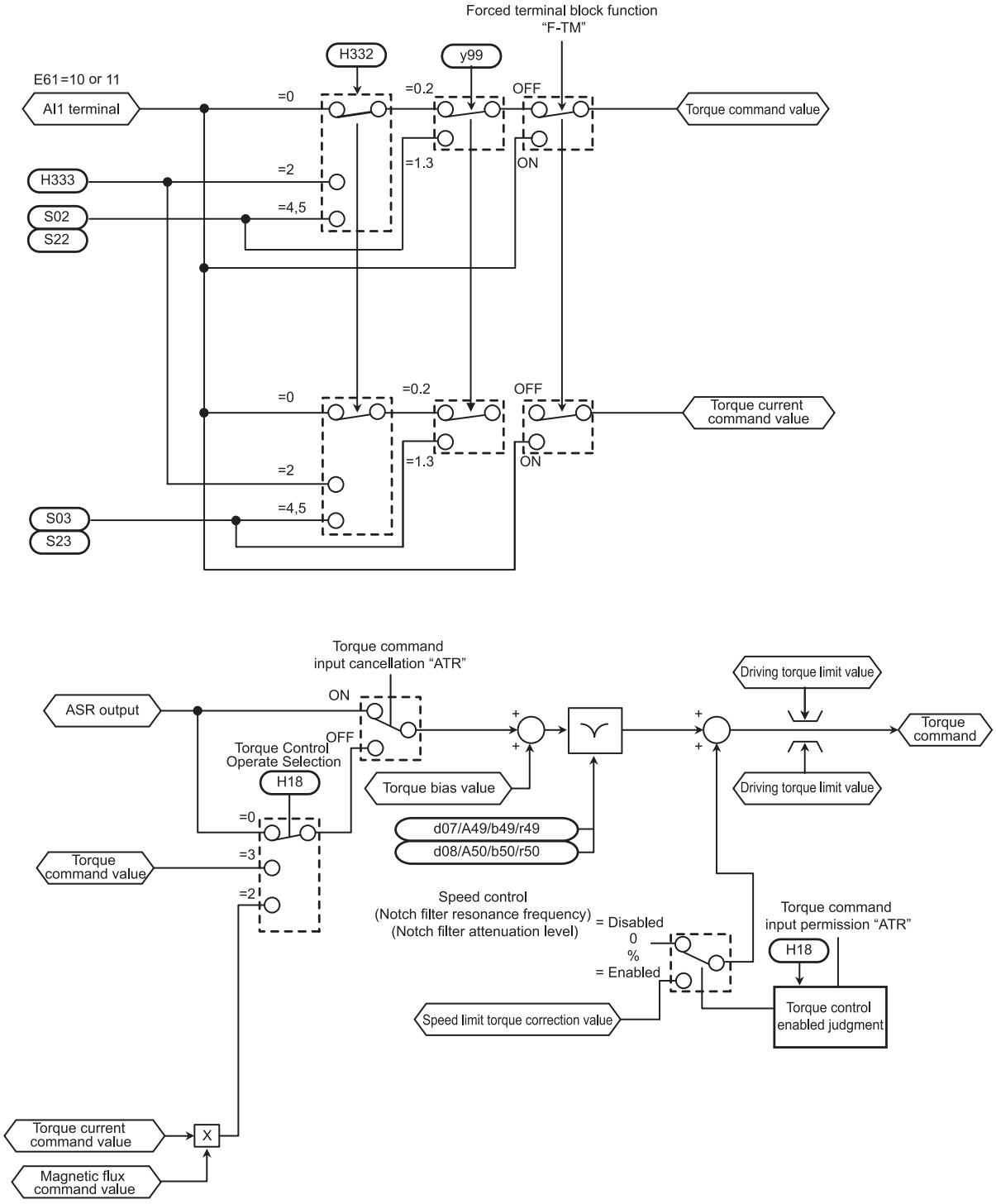
The inverter provides torque control that controls the output torque of the motor.

- This function is enabled when “5: IM Vector control without speed sensor,” “6: IM Vector control with speed sensor” and “16: PM Vector control with speed and pole position sensor” are set in 1st Drive Control Selection (F042)/2nd Drive Control Selection (A014).
- Torque control can be switched between enabled and disabled by the setting of parameter H018. Torque control can be switched to speed control by turning “23: ATR (torque control cancel)” allocated to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099) to ON with the torque reference enabled.
- Select torque command input in Torque Reference Selection (H332). One of Torque Reference (H333), analog input and fieldbus (option) can be selected.
  When instructing the torque command by analog input, torque becomes 0% to 200% at 0 to 10 V.
- Because, under torque control, the speed of the inverter is determined by the balance between torque and load, to prevent the inverter from going out of control, set the speed limit/acceleration level as a percentage of the maximum frequency in d032 (for forward rotation) and d033 (for reverse rotation).
- The torque command value of this torque control function takes the motor rated torque to be 100%.
- When “4: B/D (torque polarity detection)” is allocated to a multifunction output terminal, the signal for distinguishing drive torque or braking torque is output. The OFF signal is output when the torque is drive torque, and the ON signal is output when the torque is braking torque.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H018 | Torque Control Operate Selection | 0: Disable (Speed control)<br>2: Torque current command input<br>3: Torque command input | 0 | - |
| H332 | Torque Reference Selection | 0: Analog input<br>2: Parameter (Torque Reference) (H333)<br>5: EtherNet | 0 | - |
| H333 | Torque Reference | 0 to 200 % | 0 | % |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 23: ATR (torque control cancel) | - | - |
| E020, E027 | Output Terminal [DO1] Function Selection, Output Terminal [ROA, ROB] Function Selection | 4: B/D (torque polarity detection) | - | - |
| E061 | Input Terminal [AI1] Function Selection | 10: Torque command<br>11: Torque current command | - | - |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| y099 | Command Selection via Tool and Communications | 0 to 3<br>0: Frequency/torque and terminal commands according to settings of F002/E102 and F001/C030<br>1: Frequency/torque command via Tool and Communications<br>- Commands from frequency command (S001)/torque command (S002)/torque bias command (S024) are valid.<br>2: Terminal command via Tool and Communications<br>- Settings from communication data [DO] terminal (S007) and communication data [AO] terminal (S012) are valid.<br>3: Frequency/torque and terminal commands via Tool and Communications<br>- Commands from frequency command (S001)/torque command (S002)/torque bias command (S024) are valid.<br>- Settings from communication data [DO] terminal (S007) and communication data [AO] terminal (S012) are valid. | 0 | - |
| S002 | Torque Reference | -327.68 to 327.67*1 | 0.00 | % |
| S003 | Torque Current Command | -327.68 to 327.67*1 | 0.00 | % |
| S022 | Torque Reference via Communication | -327 to 327*1 | 0 | % |
| S023 | Torque Current Command via Communication | -327 to 327*1 | 0 | % |

*1. The upper and lower limits of the torque command via communications are ±200.00%. When the command contains a value exceeding the ±200.00% range, the torque command is limited internally to ±200.00%.




## 7-6-2 Torque Bias Function Settings

This function is for applying bias to the torque command in torque control.

- This function is enabled when "5: IM Vector control without speed sensor," "6: IM Vector control with speed sensor" and "16: PM Vector control with speed and pole position sensor" are set in 1st Drive Control Selection (F042)/2nd Drive Control Selection (A014).
- Select the command source of torque bias in Torque Bias Function Selection (H154).
  "0: Torque bias invalid"
  Disables torque bias.

“1: Torque bias (Level 1 to 3)”
Switches the torque bias level according to “TB1” and “TB2” allocated to multifunction input terminals.

| Input signal | | Torque bias value selection |
|---|---|---|
| TB1 | TB2 | |
| OFF | OFF | No torque bias |
| OFF | ON | H155: Torque bias level 1 |
| ON | OFF | H156: Torque bias level 2 |
| ON | ON | H157: Torque bias level 3 |

“2: Analog torque bias”
Set Input Terminal [AI1] Function Selection (E061) to “9: torque bias,” and determine the torque bias value by analog voltage input.

When “62: H-TB (Torque bias hold)” is allocated to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099) and the terminal is turned ON, the torque bias level currently entered to that input is held.

“5: Fieldbus”
Set Torque Bias Value via Communication (S015)/Torque Bias Value (S024) via the fieldbus.

- The torque command value of this torque control function takes the motor rated torque to be 100%.
- Set the polarity of the instructed torque bias value in Torque Bias Polarity Selection (H334).
  “0: Signed”
  The forward torque increases when the torque bias value is positive (+) and the reverse torque increases when the torque bias value is negative (−), independent of the operation direction.
  “1: Depends on the run direction”
  The direction in which torque bias works depends on the RUN command direction.

| | | |
|---|---|---|
| Forward command | | Forward torque increases when torque bias value is positive (+).<br>Reverse torque increases when torque bias value is negative (-). |
| Reverse command | : | Reverse torque increases when torque bias value is positive (+).<br>Forward torque increases when torque bias value is negative (-). |

- Set Torque Bias Mechanical Loss Compensation (H158) to compensate for mechanical loss.
- Shock is sometimes large when the torque bias is simply added. Startup with little shock is possible by setting a timer in Torque Bias Startup Timer (H159). Set the timer as the time for adding 100% torque. When 0 is set, all the torque bias value is added instantaneously.
- Torque bias can be gradually excluded in the same way as the startup timer by setting Torque Bias Shutdown Timer (H161). Set the timer as the time for subtracting 100% torque. When 0 is set, all the torque bias value is subtracted.
- The maximum torque bias value can be limited by setting Torque Bias Limit (H162).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H154 | Torque Bias Function Selection | 0: Invalid<br>1: Parameter ""torque bias 1 to 3"" (H155 to H157)<br>2: Analog input 5: EtherNet | 0 | - |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H155/<br>H156/<br>H157 | Torque Bias Level 1<br>Torque Bias Level 2<br>Torque Bias Level 3 | -300 to +300 % | 0 | % |
| H158 | Torque Bias Mechanical Loss Compensation | 0 to 300 | 0 | % |
| H159 | Torque Bias Startup Timer | 0.00 to 1.00 | 0.00 | s |
| H161 | Torque Bias Shutdown Timer | 0.00 to 1.00 | 0.00 | s |
| H162 | Torque Bias Limit | 0 to 300 | 200 | % |
| H334 | Torque Bias Polarity Selection | 0: Signed<br>1: Depends on the run direction | 0 | - |
| S015 | Torque Bias Value via Communication | -327.68 to 327.67 | 0.00 | % |
| S024 | Torque Bias Value | -327 to +327<br>(Truncate to S015 set value) | 0 | % |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 60: TB1 (Torque bias command 1)<br>61: TB2 (Torque bias command 2)<br>62: H-TB (Torque bias hold) | - | - |

# 7-7 Position Control

On the 3G3M1 Series, the PG feedback signal can be used to perform position control.
The pulses of the feedback signal are counted internally by the inverter, and operation is performed so that moving amount is to the specified position data.
In vector control with speed sensor or V/f control with speed sensor, the speed and position are calculated based on the feedback signal. In vector control without speed sensor or V/f control without speed sensor, only position is calculated based on the feedback signal. The inverter is also mounted with an orientation function as an applied function for position control.
The position control function can be used in 1st and 2nd control. However, note that only one set of position control related parameters is provided for the position control function.
The current position monitors are updated at any time and operation mode of inverter (speed control, position control or torque control).

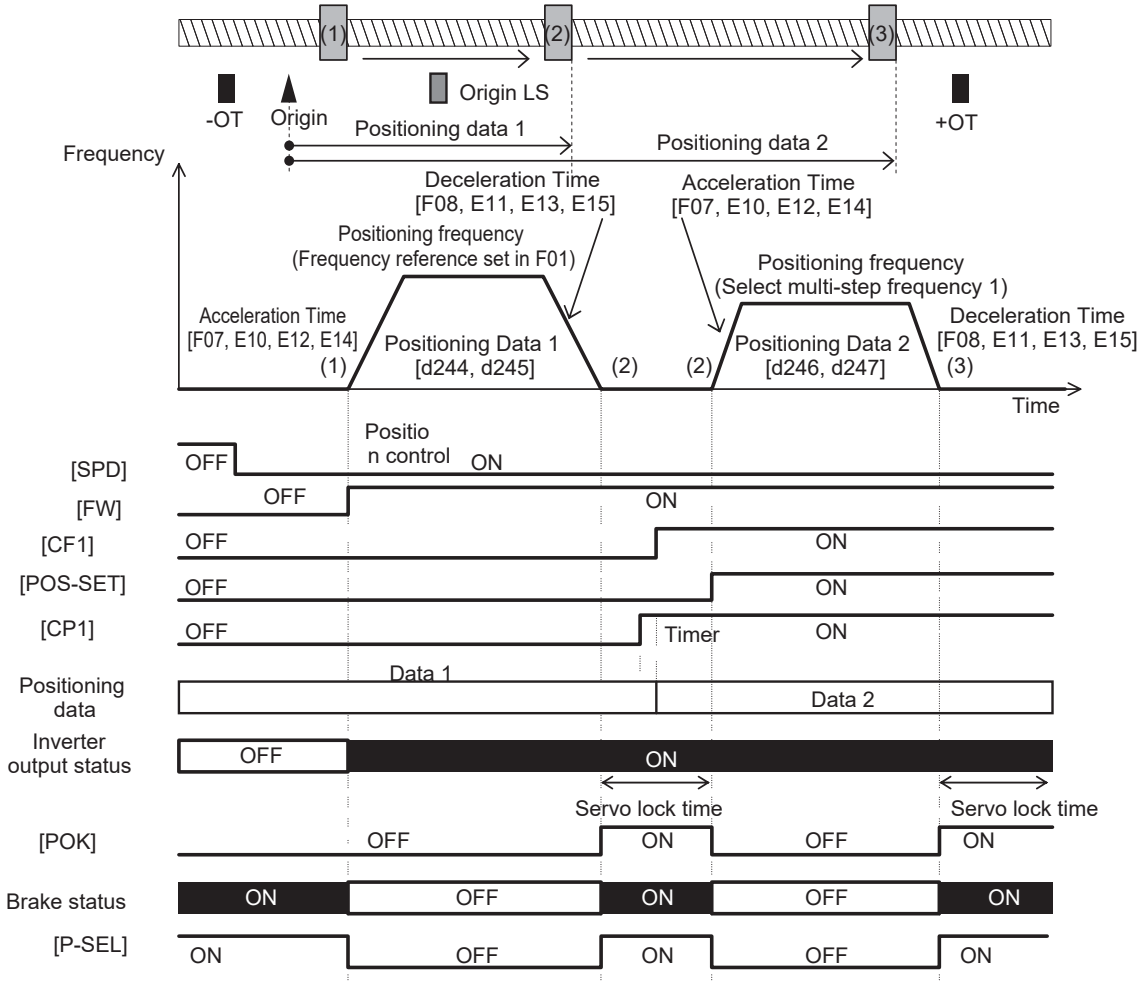
## 7-7-1 Basic Operation

Positioning control can be enabled by either of the following methods:
- d279 = 0, 1, or 2, and digital input "SPD" turned OFF (only possible method in M1 V1.0)
- d279 = 3, 4, or 5 (available from M1 V1.1)

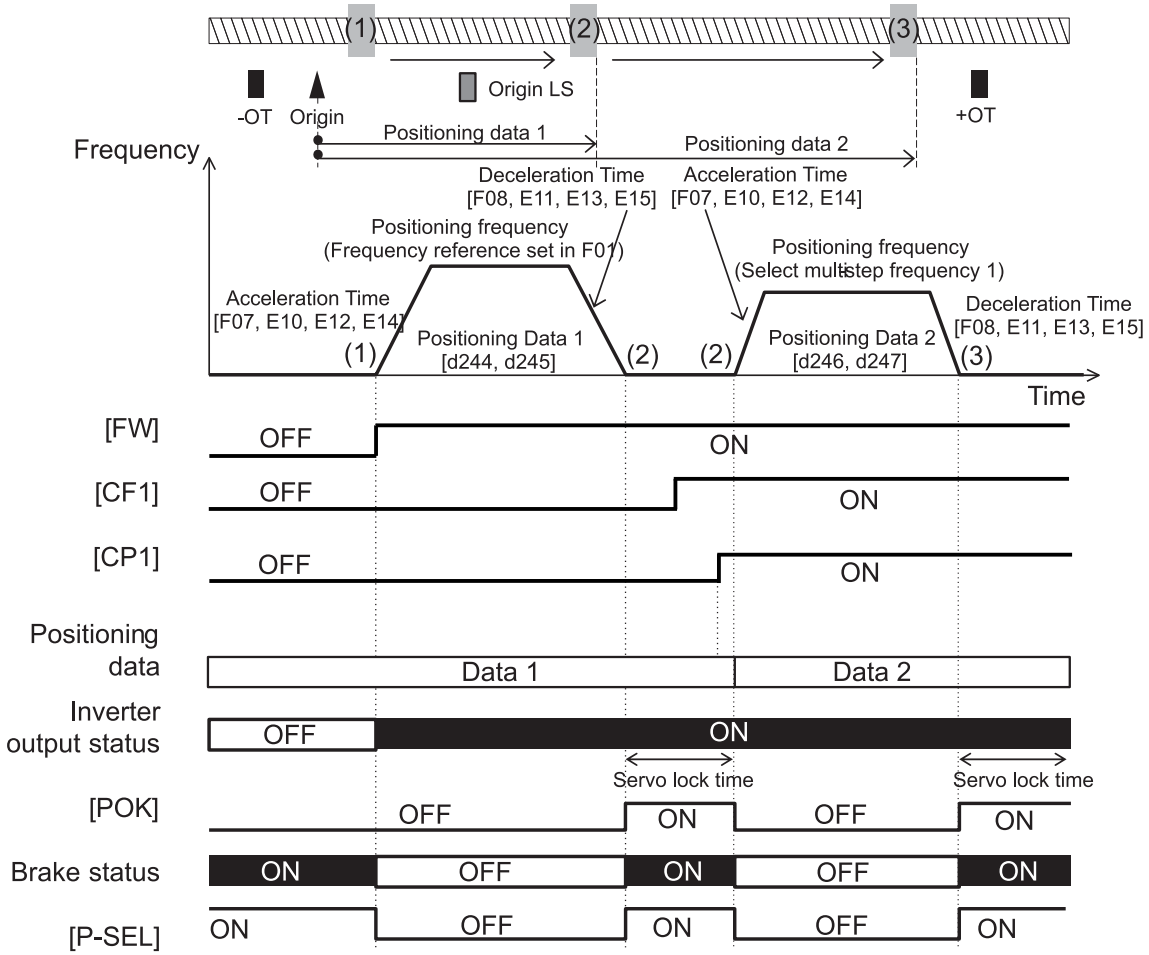
After that, the operation is started by inputting the RUN command. The system accelerates to the set frequency, then decelerates and stops to reach the specified position data. When movement stops, the servo lock is activated.
The position reference can be set via communication registers, and an indexer mode operation with 8 preset references can be selected using the multifunction inputs "CP1," "CP2," and "CP3." Movement is retriggered either by a change in the position reference data (target position changed) when d279 = 2 or 5, or by turning ON the "POS-SET" multifunction input when d279 = 0, 1, 3, or 4. When the target position is reached and the servo lock is activated, the digital output "POK" turns ON. If "P-SEL" is turned ON when the mechanical brake is applied during a servo lock, the electric angle is fixed so that the mechanical brake can be engaged.

**Position control command method**

| d279 | "SPD" terminal assignment for enabling position control | Target position update condition |
|---|---|---|
| 0 | Needed | "POS-SET" edge control |
| 1 | | "POS-SET" level control |
| 2 | | Always updated |
| 3 | Not needed | "POS-SET" edge control |
| 4 | | "POS-SET" level control |
| 5 | | Always updated |




**Example when d279 is 0 (default value)**

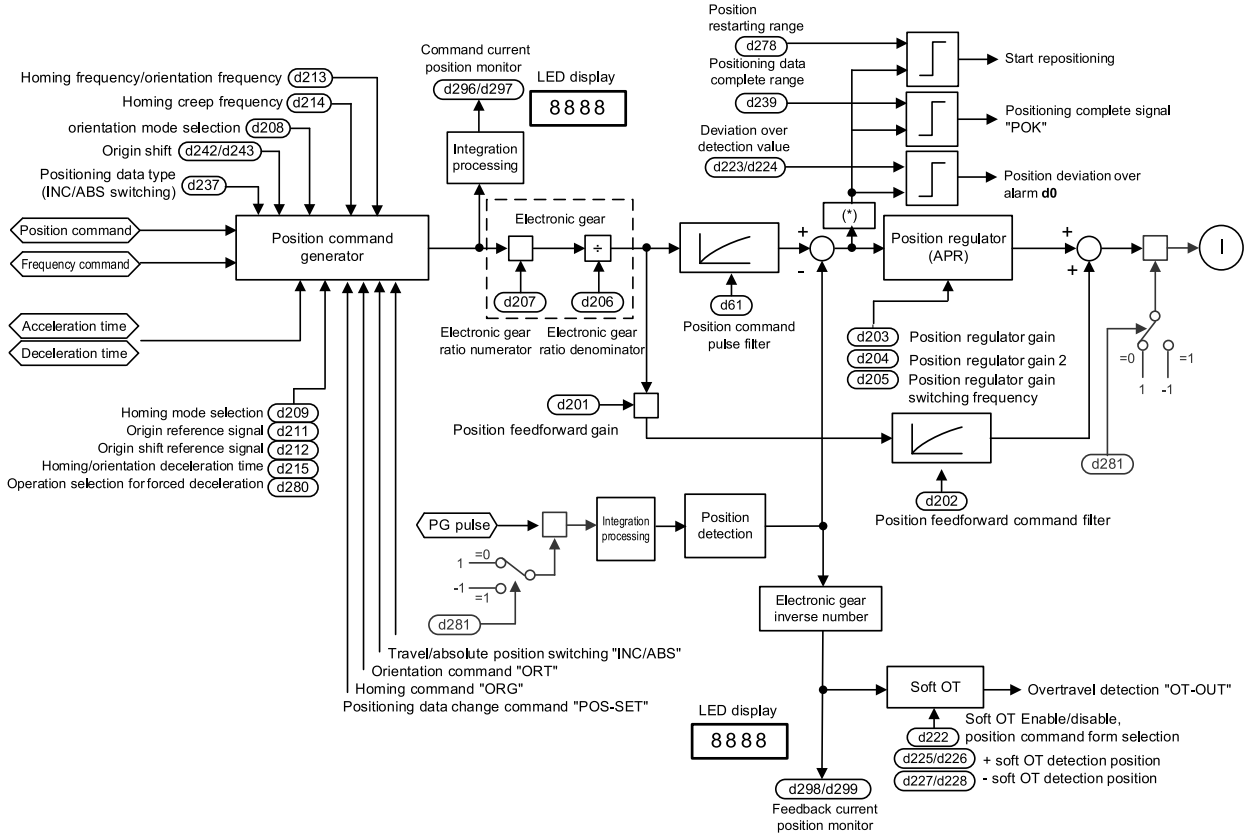



**Example when d279 is 5 (no POS-SET or SPD terminals needed)**

| List of input terminal functions | | |
|---|---|---|
| **Data** | **Terminal function** | **Description** |
| 42 | ORL: Origin search limit signal | The return-to-origin operation proceeds as follows: After "ORL" is turned ON during the return-to-origin operation, the system moves by the homing offset from the initial Z phase of the PG and then stops. |
| 119 | P-SEL: ASR integral term cancellation | When "P-SEL" is turned ON, the integral term of the speed controller is canceled, and proportional (P) operation is performed. When the mechanical brake is applied during position control, the motor cannot rotate even if a position error exists. This can cause the integral term to accumulate, potentially leading to an overload trip. Use this function in such cases. |
| 135 | INC/ABS: Increment/absolute position switching | When "INC/ABS" is turned ON, the positioning data is taken as an incremental position from the current position. When "INC/ABS" is turned OFF, the positioning data is taken as an absolute position from the origin. |
| 136 | ORT: Orientation command | The orientation operation is started when "ORT" is turned ON. |

| List of input terminal functions | | |
|---|---|---|
| **Data** | **Terminal function** | **Description** |
| 137 | SPD: Speed/position switching | This terminal function is enabled only when d279=0, 1, or 2.<br>Position control mode is enabled when "SPD" is turned OFF. The mode switches to speed control mode when "SPD" is turned ON.<br>This function can be activated during operation. After positioning via position control, the state transitions to a servo lock state (in vector control) or to a DC braking state (in V/f control). |
| 138 | ORG: Return-to-origin startup signal | The mode changes to return-to-origin mode when "ORG" is turned ON. |
| 139 | FOT: Forward rotation drive prohibited | The overtravel detection signal in the positive direction is input when "FOT" is turned OFF. Use this for emergency stop and return-to-origin operations. |
| 140 | ROT: Reverse rotation drive prohibited | The overtravel detection signal in the negative direction is input when "ROT" is turned OFF. Use this for emergency stop and return-to-origin operations. |
| 141 | PCLR: Current position clear | The current position is cleared to zero when "PCLR" is turned ON. |
| 142 | PSET: Current position preset | When "PSET" is turned ON, the current position is taken as Preset Position (MSB) (d240) and Preset Position (LSB) (d241). |
| 144 | POS-SET: Position change command | When "POS-SET" is turned ON, the target position is changed, and movement to the new target position is started. |
| 145<br>146<br>147 | CP1: Position command selection 1<br>CP2: Position command selection 2<br>CP3: Position command selection 3 | Select Positioning Data 1 to 8 (d244 to d259) using combinations of these inputs. |

| List of output terminal functions | | |
|---|---|---|
| **Data** | **Terminal function** | **Description** |
| 82 | POK: Positioning completed | This turns ON upon completion of positioning (when the position deviation is equal to or less than the Positioning Completed Range (d239)). |
| 151 | OT-OUT: Overtravel detection | This turns ON when a software overtravel is detected or the overtravel detection signal is received. |
| 152 | STOP-OUT: Forced stop detection | This turns ON when a forced deceleration stop is initiated by the multifunction input function "STOP" or when an overtravel is detected. |




**Position Control Diagram**

## 7-7-2 Position Control Gain

Position control generates the torque command and speed command to drive the inverter based on the deviation between the current position and command position according to operation patterns that are generated from position data (target position). Basically, position control assumes that speed control has already been adjusted under a real load and that acceleration and deceleration are possible without any problem. Position control gain adjusts the response of position control. To increase response, set larger values in Position Loop Gain 1 (d203) and Position Loop Gain 2 (d204). Setting too large a value causes hunting or overshooting. To switch the gain at low speed and high speed, set the switching frequency in Position Loop Gain Switch Frequency (d205). If the system starts to vibrate when system rigidity is weak and gain is increased, set a large value in Position Control Feed Forward Gain (d201).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d201 | Position Control Feed Forward Gain | 0.00: Cancel<br>0.01 to 1.50 | 0.00 | - |
| d202 | Position Control Feed Forward Filter | 0.000 to 5.000 | 0.500 | s |
| d203 | Position Loop Gain 1 (low speed side) | 0.1 to 300.0 | 1.0 | - |
| d204 | Position Loop Gain 2 (high speed side) | 0.1 to 300.0 | 1.0 | - |
| d205 | Position Loop Gain Switch Frequency | 0.0 to 590.0 | 0.0 | Hz |

## 7-7-3 Electronic Gear

With position control, the moving amount is basically managed by the number of pulses of the PG. However, it is more convenient to manage moving amounts referenced to physical numeric values (user values). The conversion ratio of user values to number of PG pulses can be set as an electronic gear.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d206 | Electronic Gear Denominator | 1 to 65535 | 1 | - |
| d207 | Electronic Gear Numerator | 1 to 65535 | 1 | - |

### How to calculate the electronic gear

Electronic gear numerator/electronic gear denominator ratio can be calculated based on the moving amount per user values unit (position resolution) [mm/user preference], moving amount per single rotation of the motor [mm/rev] and number of PG pulses per single rotation of the motor [pulse/rev].

$$\frac{\text{Electronic gear numerator}}{\text{Electronic gear denominator}} = \frac{\text{Moving amount per user value [mm/user value]}}{\text{Moving amount per 1 PG pulse [mm/pulse]}}$$

$$= \frac{\dfrac{\text{Moving amount per user value [mm/user value]}}{\text{Moving amount per motor rotation [mm/rev]}}}{\text{Number of pulses per motor rotation [pulse/rev]}}$$

Set the electronic gear reduced so that each of the electronic gear numerator/electronic gear denominator reduced become integers of 65535 or less.

Example)

When the moving amount per user values unit is 0.1 [mm/user preference], machine speed at motor speed of 1,800 [r/min] is 150 [m/min] and the number of PG pulses is 1,000 [pulse/rev]

$$\frac{\text{Electronic gear numerator}}{\text{Electronic gear denominator}} = \frac{\dfrac{0.1\ \text{[mm/user value]}}{150 \times 1000 / 1800\ \text{[mm/rev]}}}{1000\text{[pulse/rev]}} = \frac{180}{150} = \frac{12}{10}$$

## 7-7-4 Acceleration/Deceleration Time Selection

The normal acceleration/deceleration time is selected during position control. Even if the acceleration/deceleration time selection is switched or parameter values are changed during position control operation, the new selection or parameter values are not reflected in operation. These are reflected when the next position control operation is started.

The following table summarizes acceleration/deceleration time selections.

| SET terminal | E125 E126 | 2CH terminal | Output frequency | Forward / reverse | RT2 terminal | RT1 terminal | Acceleration time | Deceleration time |
|---|---|---|---|---|---|---|---|---|
| 1st control | 0: 2CH | OFF | - | - | - | - | F007 1st Acceleration Time 1 | F008 1st Deceleration Time 1 |
| | | ON | - | - | - | - | E012 1st Acceleration Time 2 | E013 1st Deceleration Time 2 |
| | 1: Switch frequency | - | Disable | - | - | - | F007 1st Acceleration Time 1 | F008 1st Deceleration Time 1 |
| | 2: Switching normal / reverse rotation | - | - | Disable | - | - | F007 1st Acceleration Time 1 | F008 1st Deceleration Time 1 |
| | 3: RT1/2 | - | - | - | OFF | OFF | F007 1st Acceleration Time 1 | F008 1st Deceleration Time 1 |
| | | - | - | - | OFF | ON | E010 2nd Acceleration Time 1 | E011 2nd Deceleration Time 1 |
| | | - | - | - | ON | OFF | E012 1st Acceleration Time 2 | E013 1st Deceleration Time 2 |
| | | - | - | - | ON | ON | E014 2nd Acceleration Time 2 | E015 2nd Deceleration Time 2 |
| 2nd control | 0: 2CH | OFF | - | - | - | - | E010 2nd Acceleration Time 1 | E011 2nd Deceleration Time 1 |
| | | ON | - | - | - | - | E014 2nd Acceleration Time 2 | E015 2nd Deceleration Time 2 |
| | 1: Switch frequency | - | Disable | - | - | - | E010 2nd Acceleration Time 1 | E011 2nd Deceleration Time 1 |
| | 2: Switching normal / reverse rotation | - | - | Disable | - | - | E010 2nd Acceleration Time 1 | E011 2nd Deceleration Time 1 |
| | 3: RT1/2 | - | - | - | OFF | OFF | F007 1st Acceleration Time 1 | F008 1st Deceleration Time 1 |
| | | - | - | - | OFF | ON | E010 2nd Acceleration Time 1 | E011 2nd Deceleration Time 1 |
| | | - | - | - | ON | OFF | E012 1st Acceleration Time 2 | E013 1st Deceleration Time 2 |
| | | - | - | - | ON | ON | E014 2nd Acceleration Time 2 | E015 2nd Deceleration Time 2 |

Acceleration/deceleration time selection during position control is basically the same as in speed control, with the exception of limits being applied to the following:

- LAC terminal disabled
- The function for switching the acceleration/deceleration time according to the output frequency when “1: Switch frequency” is set to 1st 2-step Acceleration/ Deceleration switching Condition Selection (E125)/2nd 2-step Acceleration/Deceleration Switching Condition Selection (E126) is disabled. Ordi- narily, the acceleration/deceleration time is used when the output frequency is the threshold or less.
- The function for switching the acceleration/deceleration time according to the forward rotation/ reverse rotation when “2: Forward/reverse” is set to 1st 2-step Acceleration/ Deceleration switching Condition Selection (E125)/2nd 2-step Acceleration/Deceleration Switching Condition Selection (E126) is disabled. Ordinarily, the acceleration/deceleration time on the forward rotation side is used.

Deceleration Time for Forced Stop (H056) is selected for the acceleration/deceleration time in the following cases:

- When the RUN command (FWD, REV) is shut off and deceleration is performed during position control
- When an emergency stop is performed by detection of an overtravel (OT) or input of the “STOP” signal

## 7-7-5 Positioning data

The motion drive allows setting positioning data for up to eight points, configurable in user-defined units. The desired positioning data is selected by combining position command selection signals "CP1," "CP2," and "CP3," which are triggered through digital inputs. To prevent contact chattering, the system only switches between positions when the position command selection signals remain stable for the duration of the Position Data Determination Time (parameter d238). Positioning data can be modified during active position control. To apply a newly updated position, the position change com- mand "POS-SET" must be activated, provided parameter d279 is set to 0, 1, 3, or 4. If the position is changed while the motion is stopped, activating the "POS-SET" command is unnecessary. When d279 is set to 2 or 5, the position is automatically updated upon changing the target, so there is no need for "POS-SET" operation.

| “CP3” | “CP2” | “CP1” | Parameter | Data | Range (user value unit) |
|---|---|---|---|---|---|
| OFF | OFF | OFF | d244, d245 | Positioning data 1 | -2147483648 to 2147483647 (80000000h to 7FFFFFFFh) |
| OFF | OFF | ON | d246, d247 | Positioning data 2 | -2147483648 to 2147483647 |
| OFF | ON | OFF | d248, d249 | Positioning data 3 | -2147483648 to 2147483647 |
| OFF | ON | ON | d250, d251 | Positioning data 4 | -2147483648 to 2147483647 |
| ON | OFF | OFF | d252, d253 | Positioning data 5 | -2147483648 to 2147483647 |
| ON | OFF | ON | d254, d255 | Positioning data 6 | -2147483648 to 2147483647 |
| ON | ON | OFF | d256, d257 | Positioning data 7 | -2147483648 to 2147483647 |
| ON | ON | ON | d258, d259 | Positioning data 8 | -2147483648 to 2147483647 |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005<br>E098<br>E099 | Input Terminal [DI1] to [DI7] Function Selection | 135 (1135):<br>Increment/absolute position switching “INC/ABS”<br>144 (1144):<br>Position change command “POS-SET”<br>145 (1145):<br>Position command selection 1 “CP1”<br>146 (1146):<br>Position command selection 2 “CP2”<br>147 (1147):<br>Position command selection 3 “CP3” | - | - |
| d237 | Positioning Data Type | 0: Absolute position (ABS)<br>1: Relative position (INC) | 0 | - |
| d238 | Position Data Determination Time | 0.000 to 0.100 s | 0.000 | s |
| d277 | Positioning Data Setting Selection via communication | 0: Disable Communications Positioning Data (S20, S21)<br>1: Enable Communications Positioning Data (S20, S21) | 0 | - |
| d279 | Position Mode and Set Mode Control | Enabling position with “SPD” assignment necessary:<br>0: “POS-SET” edge control<br>1: “POS-SET” level control<br>2: Always updated<br>Enabling position regardless “SPD” assignment:<br>3: “POS-SET” edge control<br>4: “POS-SET” level control<br>5: Always updated | 0 | - |
| d281 | Position count direction | 0: Normal (Same as speed control)<br>1: Inverse | 0 | - |
| S020 | Positioning Data via Communication (MSB) | -2147483648 to 2147483647<br>(80000000h to 7FFFFFFFh)<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | - |
| S021 | Positioning Data via Communication (LSB) | -2147483648 to 2147483647<br>(80000000h to 7FFFFFFFh)<br>(MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | - |

## Positioning Data Type (d237)

Handling of the positioning data set to positioning data 1 to 8 can be switched between handling as absolute positions or as moving amounts.

To switch handling when necessary, use increment/absolute position switching “INC/ABS” (data = 135) in the multifunction input terminal function.

When “INC/ABS” is allocated to multifunction input terminals, the d237 setting is disabled.

## Position Data Determination Time (d238)

When position command selection 1 “CP1” to position command selection 3 “CP3” is switched, chattering may cause the selected positioning data to change. In cases like these, set the time up to settling of the positioning data to d238.

### Positioning Data Setting Selection via communication (d277)

Positioning data can also be assigned via communication. To assign positioning data via communication, set 1 to d277. The upper four digits and lower four digits of the positioning data are assigned to Positioning Data via Communication (MSB) (S020) and Positioning Data via Communication (LSB) (S021), respectively.
To reflect positioning data, turn the position change command “POS-SET” ON.
While commands via communication are enabled, Positioning Data 1 (MSB) (d244) and Positioning Data 1 (LSB) (d245) are switched to S020 and S021. These parameters can also be switched to positioning data 2 to 8 by position command selection 1 “CP1” to position command selection 3 “CP1.”

### Position Mode and Set Mode Control (d279)

Use to select the way of changing between speed control and position control and also selecting the way to update the target position to execute the movement.

- d279 = 0, 1, or 2: it is necessary to have SPD assigned to an input
  d279 = 3, 4, or 5, it is not necessary to have SPD assigned
- When the parameter is 0 or 3, a positive edge with “POS-SET” assigned to an input is required after the position data has been changed
- When the parameter is 1 or 4, “POS-SET” needs to be kept at 1 to be able to continuously change the target position data and have it updated.
- With the parameter set to 2 or 5, it is not necessary to have “POS-SET” assigned, as the target position updates every time the position changes.

### Position count direction (d281)

Depending on the equipment, the direction of rotation of the motor and the direction of position counting may not match. This parameter allows the motor rotation direction and position count direction to be set individually.

| Parameter No. | Function name | Data | Default data |
|---|---|---|---|
| d281 | Position Count direction | 0: Normal (same as speed control)<br>1: Inverse | 0 |

- When the parameter is set to 1 and the speed is negative, the pulses increase. However, if the speed is positive, the pulses decrease.
- If it is set to 0, it reverses the count: when the speed is positive, the pulses increase, and when it's negative, the pulses decrease.

## 7-7-6 Position Wrap-around Range Setting (d282)

This parameter is to set whether to limit the position data to 32 bits or whether to wrap it to the other end when it exceeds the 32-bit range.

| Parameter No. | Function name | Data | Default data |
|---|---|---|---|
| d282 | Position Range Setting | 0: Linear (No Wrap-around)<br>3: Rotation (Wrap-around) | 3 |

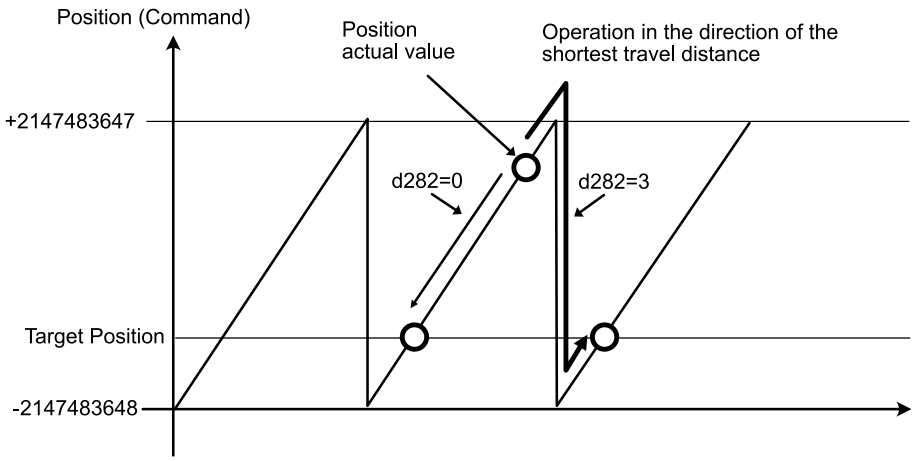
- If d282 = 0 and a movement occurs that causes the position data to exceed the 32-bit range, the position data will be limited to the 32- bit range.

- If d282 = 3 and a movement occurs that causes the position data to exceed the 32-bit range, the position data will be wrapped around to the other end.

In addition, in the absolute position command, if the amount of movement will be smaller if the movement was wrapped around at the 32-bit range, the movement is made in the direction with the shortest travel distance.

For example, if the current position is 1,800,000,000 and the large negative target position -2,100,000,000 is given (apparently backwards position by 3900000000) it moves 394,967,296 counts to the forward rotation side instead (shortest with wrap around passing through the max position value).

Depending on the positional distance between the actual value and target position, operation is performed in the direction with a shorter travel distance.




## 7-7-7 Overtravel (OT)

When a movement limit point is passed through, there is the risk of mechanical failure or accident. For this reason, the movement limit point can be detected by the hardware and input digitally as an overtravel (OT) signal. OT detection causes a deceleration stop for the time set in Deceleration Time for Forced Stop (H056) and then servos change to a locked state. When Over Travel Forced Stop Operation Selection (d280) = 1, a deceleration stop is performed and then the operation error (alarm code: 24) is generated. Plus side overtravel “FOT” and minus side overtravel “ROT” can be allocated independently. The overtravel signal is enabled (NC contact is made) when it is OFF, for safety reasons. When an overtravel is detected, overtravel detection signal “OT-OUT” is output as a digital output.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005<br>E098<br>E099 | Input Terminal [DI1] to [DI7] Function Selection | 139 (1139): Forward rotation driving prohibited “FOT”<br>140 (1140): Reverse rotation driving prohibited “ROT” | - | - |
| d280 | Over Travel Forced Stop Operation Selection | 0: Servo lock after deceleration stop<br>1: Operation error (alarm code: 24) after a deceleration stop | 0 | - |

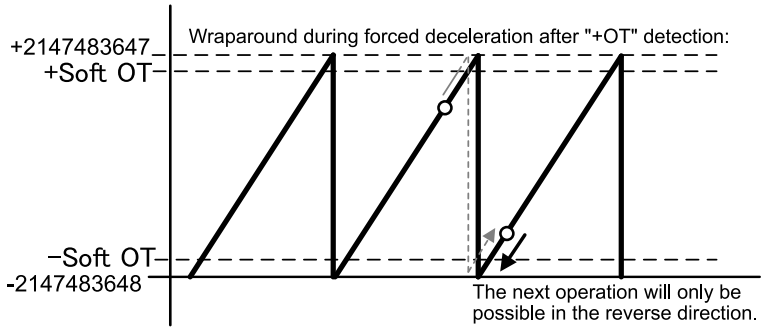
## 7-7-8 Software OT

With overtravel (OT), the movement limit point is basically detected by the hardware. However, the limit point position can be set by number of pulses as a software OT. The limit point position can be set in two directions independently by + software OT and - software OT. Operation when a software OT is detected can be selected in Overtravel Function Selection (d222). When an OT limit point does not exist, for example, on a rotating body, leave parameter d222 at its default value (= 0).

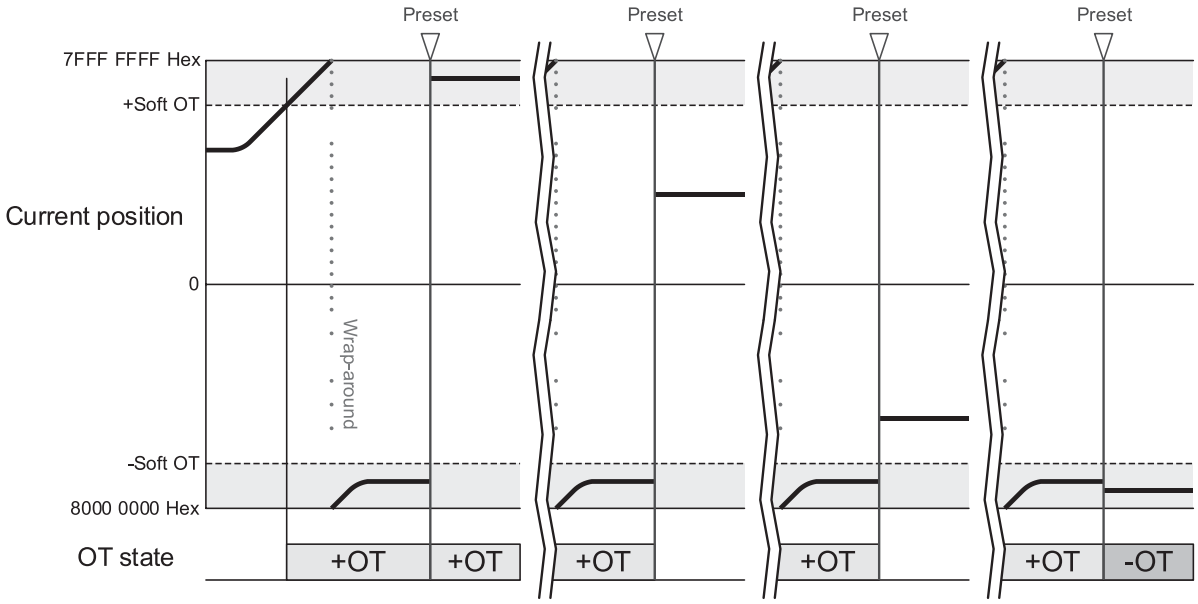
| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d222 | Overtravel Function Selection | 0: Invalid/Infinite rotation<br>1: Valid (Positioning at OT position at over traveling), normal PTP<br>2: Valid (Immediately stopped at over traveling), normal PTP | 0 | - |
| d225 | Software Overtravel Detection Position in the Positive Direction (MSB) | -2147483648 to 2147483647 (MSB: -32768 to 32767, LSB: 0 to 65535) | 2147483647 | - |
| d226 | Software Overtravel Detection Position in the Positive Direction (LSB) | | | |
| d227 | Software Overtravel Detection Position in the Negative Direction (MSB) | -2147483648 to 2147483647 (MSB: -32768 to 32767, LSB: 0 to 65535) | −2147483648 | - |
| d228 | Software Overtravel Detection Position in the Negative Direction (LSB) | | | |

### Behavior when Software OT occurs

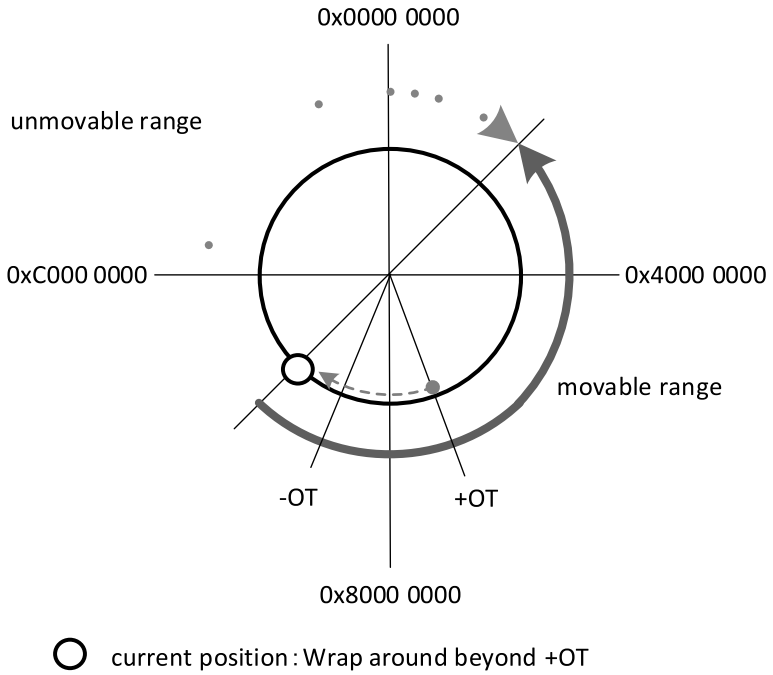
- If d222=2, even if it wraps around after exceeding soft OT, it memorizes that it is in OT state and can only operate in the return direction from then on.




- When the current position is reset/preset or the OT position settings is changed, regardless of the OT state memorized according to the movement history up to that point, the OT state is re-determined based on the new current position and OT position.



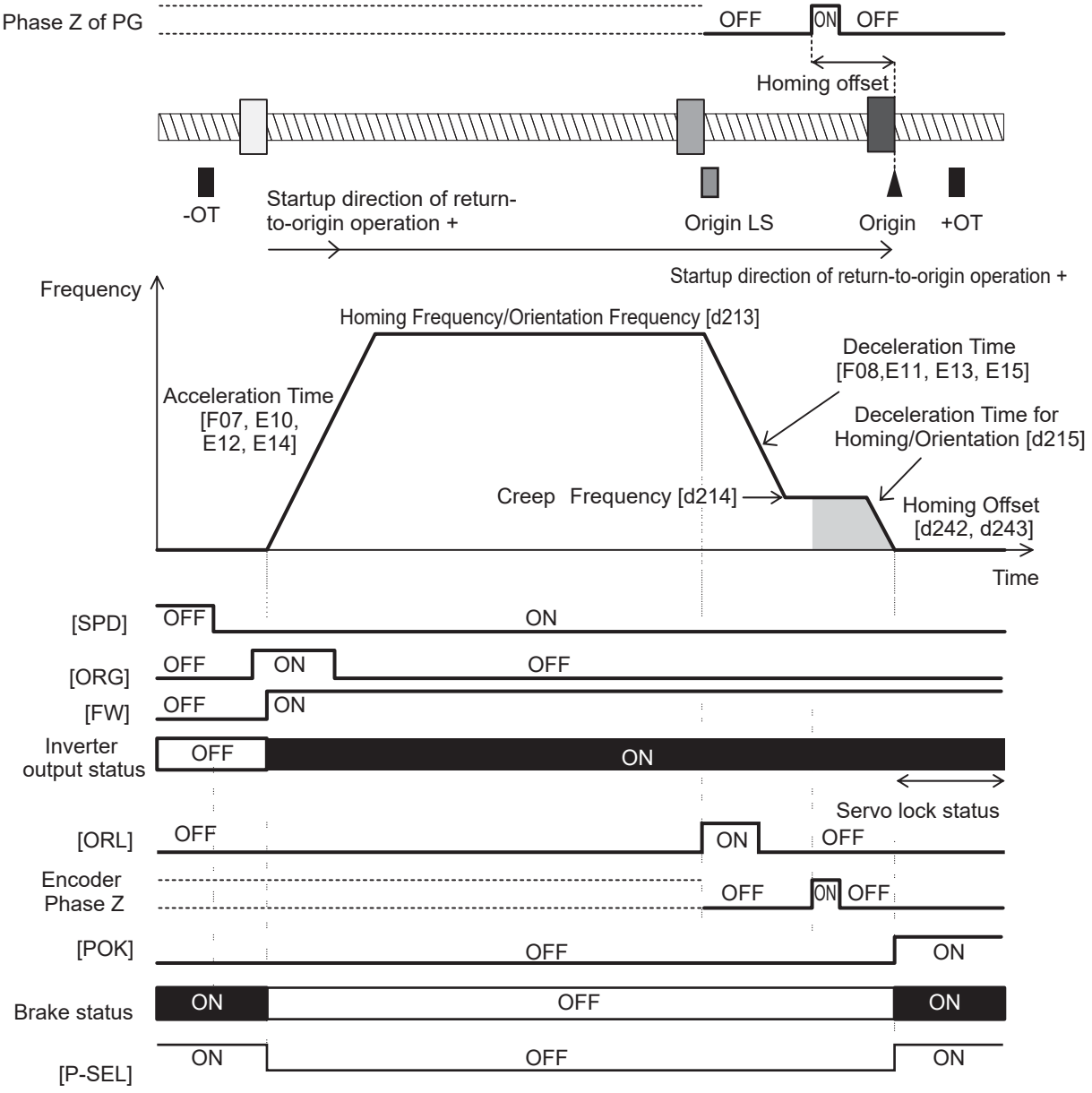

- When wraparound & shortest path travel is enabled due to d282=3, the movable range in the soft OT state is up to half a circle (31-bits) in the allowed direction from the current position. For example, the movable range in the +OT status is as follows.




## 7-7-9 Basic Return-to-origin Operation

The return-to-origin operation is started when the RUN command is input with multifunction input terminal “SPD” set to OFF and terminal “ORG” set to ON. Specify the operation direction in Homing Operation Selection (d209). The return-to-origin operation is as follows. Acceleration is performed to the frequency set in Homing Frequency/Orientation Frequency (d213), and, after the moving body has turned origin search limit signal "ORL" ON, movement is performed from the initial Z phase signal (reference signal for homing offset) by the amounts set in the homing offsets (Homing Offset (MSB)

(d242) and Homing Offset (LSB) (d243)), and movement is stopped. The positioning completed signal "POK" also is output. When overtravel turns ON before the origin limit switch, reverse rotation operation is performed to search for the origin limit switch.




## Homing Operation Selection (d209)

This parameter defines the startup direction of return-to-origin operation, moving direction of return-to-origin operation, operation at detection of an overtravel, and limit switch detection timing.

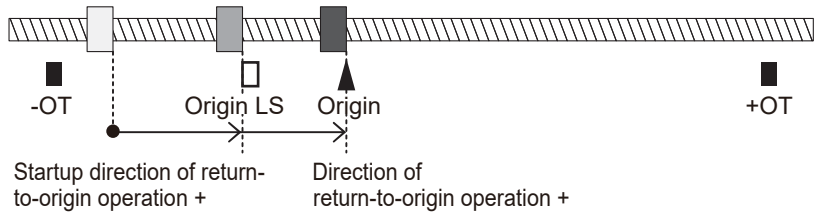
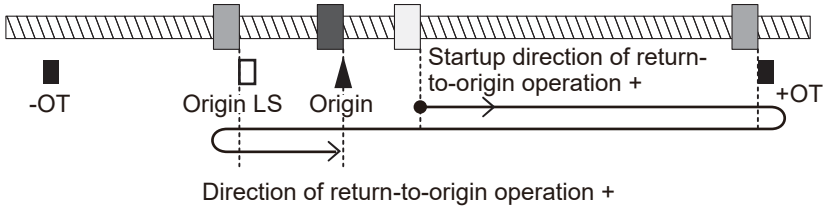
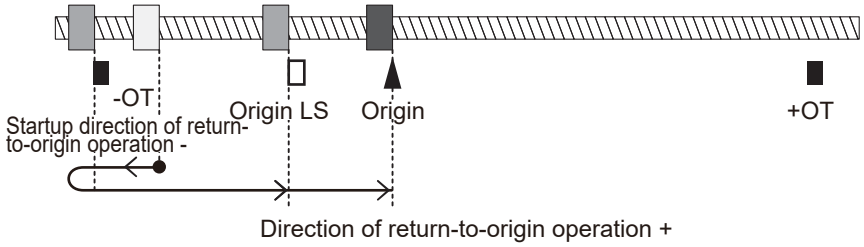
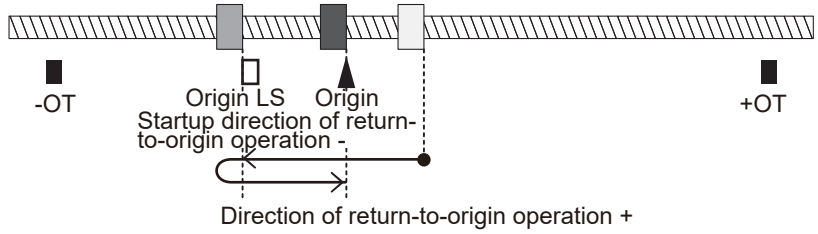
bit 0 : Startup direction of return-to-origin operation 0: Forward rotation direction, 1: Reverse rotation direction
Return-to-origin operation starts in the direction defined by this bit regardless of the direction specified in the RUN command from the inverter.

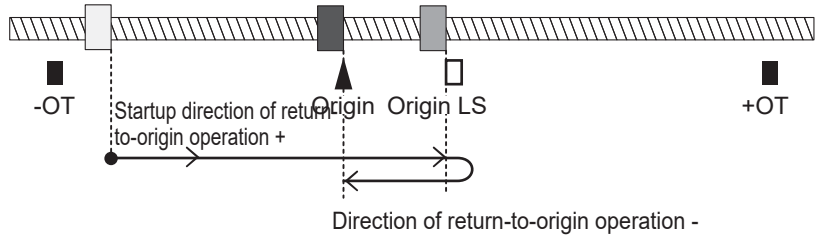
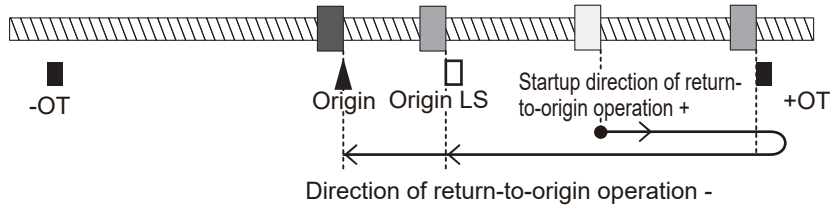
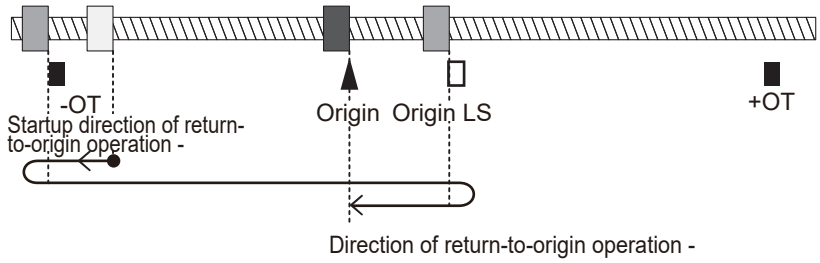
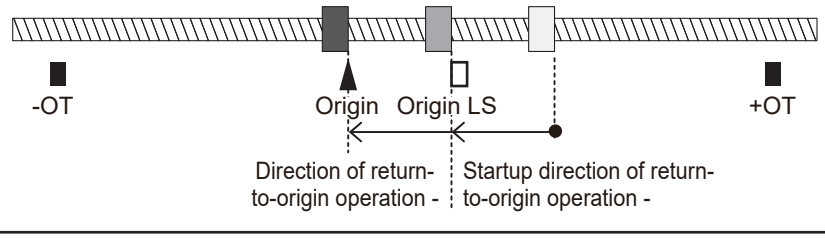
bit 1 : Direction of return-to-origin operation 0: Forward rotation direction, 1: Reverse rotation direction.
This bit defines the direction of movement of the return-to-origin operation. When the reverse of the startup direction is set, ORL (origin search limit signal) is detected, then operation is paused and is reversed.

bit 2 : Return-to-origin operation overtravel operation selection 0: Reversal by overtravel detec- tion, 1: Stop by overtravel detection
This bit defines whether to stop or reverse operation when an overtravel is detected before ORL (origin search limit signal) is detected.

bit 3 : Origin limit switch timing selection 0: ON edge detection, 1: OFF edge detection This bit defines whether or not to detect the limit switch at its ON edge or OFF edge.

The figure below shows action according to the setting of the d209 parameter. In the figure, it is assumed that bit 2 = 0 and reverse operation is performed at detection of an overtravel.

<table>
<tr><th colspan="2">[d209 bit 1] Direction of return-to-origin operation<br>0: Forward rotation direction (+)</th><th>When origin position > origin limit switch position</th></tr>
<tr><th>Startup direction of return-to-origin operation [d209 bit 0]</th><th>Initial position</th><th>Return-to-origin pattern diagram</th></tr>
<tr><td rowspan="2">0: + direction</td><td>- side from origin limit switch</td><td> 
</td></tr>
<tr><td>+ side from origin limit switch</td><td> 
</td></tr>
<tr><td rowspan="2">1: - direction</td><td>- side from origin limit switch</td><td> 
</td></tr>
<tr><td>+ side from origin limit switch</td><td> 
</td></tr>
</table>

| [d209 bit 1] Direction of return-to-origin operation 1: Reverse rotation direction (+) | | When origin position < origin limit switch position |
|---|---|---|
| **Startup direction of return-to-origin operation [d209 bit 0]** | **Initial position** | **Return-to-origin pattern diagram** |
| 0: + direction | - side from origin limit switch |  |
| | + side from origin limit switch |  |
| 1: - direction | - side from origin limit switch |  |
| | + side from origin limit switch |  |

## Homing Reference Signal Selection (d211), Reference Signal for Homing Offset (d212)

The reference signal for homing is to switch from the homing frequency to the homing creep frequency. The reference signal for homing starts incrementing of the homing offset. Ordinarily, the signal of the origin limit switch is taken as the reference signal for homing and the Z phase signal is taken as the reference signal for homing offset (factory default). When return-to-origin is configured using other signals, select the reference signal for homing and reference signal for homing offset according to the table below. When Reference Signal for Homing Offset (d212) is set to other than “0: Z pulse of position encoder”, the reference signal for homing is not included in the configuration, and so the Homing Reference Signal Selection (d211) setting is disabled.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d211 | Homing Reference Signal Selection | 0: Z phase<br>1: Origin limit input (ORL)<br>2: Overtravel input in the positive direction (FOT)<br>3: Overtravel input in the negative direction (ROT) | 1 | - |
| d212 | Reference Signal for Homing Offset | 0: Z phase<br>1: Origin limit input (ORL)<br>2: Overtravel input in the positive direction (FOT)<br>3: Overtravel input in the negative direction (ROT)<br>4: Stopper (Hit and stop) | 0 | - |
| d214 | Creep Frequency | 0.1 to 590.0 Hz | 0.5 | Hz |

| d211: Reference signal for homing | d212: Reference signal for homing offset | Frequency at start of homing offset | Operation |
|---|---|---|---|
| 0: Z phase | 0: Z phase (factory default) | Creep frequency | Homing offset is started at the first detection of the Z phase after startup at the creep frequency |
| 1: Origin limit switch (factory default) | | Homing frequency to homing creep frequency | |
| 2: Overtravel switch in the positive direction | | Homing frequency to homing creep frequency | Deceleration to creep frequency at reverse operation by detection of overtravel |
| 3: Overtravel switch in the negative direction | | | |
| Disable | 1: Origin limit switch | Homing frequency | |
| | 2: Overtravel switch in the positive direction | Homing frequency to homing creep frequency | Deceleration to creep frequency at reverse operation by detection of overtravel |
| | 3: Overtravel switch in the negative direction | | |
| | 4: Stopper | Homing frequency to homing creep frequency | Operation is instantaneously reversed after judgment of collision with the stopper by generation of the torque limit, and homing offset is performed at the creep frequency |

## 7-7-10 Clearing of position

The current position is cleared to zero by digital input “PCLR” turning ON. The current position can be cleared to zero in either position control and speed control. Either of the ON edge and ON level can be selected as the timing to clear the current position.

When “PCLR” is turned ON during position control operation, the current position is cleared to zero and movement to the target position is performed. When “PCLR” is turned ON after position control stop, the current position is cleared to zero, however, movement to the target position is not started. To perform movement, either turn the RUN command OFF then back ON again, or turn “POS-SET” ON.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005<br>E098<br>E099 | Input Terminal [DI1] Function Selection to Input Terminal [DI7] Function Selection | 141 (1141): Current position clear “PCLR” | - | - |
| d221 | Current Position Clear Signal Operation Selection | 0: Clear at edge detection<br>1: Clear at level detection | 0 | |

## 7-7-11 Position preset

The current position can be overwritten by the setting of Preset Position (MSB) (d240) and Preset Position (LSB) (d241) at the ON edge of digital input “PSET.” The current position can be preset in either position control and speed control.
When “PSET” is turned ON during position control operation, the current position is overwritten by the preset position and movement to the target position is performed. When “PSET” is turned ON after position control stop, the current position is overwritten, however, movement to the target position is not started. To perform movement, either turn the RUN command OFF then back ON again, or turn “POS-SET” ON.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005<br>E098<br>E099 | Input Terminal [DI1] Function Selection to Input Terminal [DI7] Function Selection | 142 (1142): Current position preset “PSET” | - | - |
| d240 | Preset Position (MSB) | -2147483648 to 2147483647 (MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | - |
| d241 | Preset Position (LSB) | | | |

### Position control by pulse train input

Position control can be performed with pulse train input used as the pulse position command.
When digital input “SPD” is turned OFF with “12: Pulse train input” set to 1st Frequency Reference Selection (F001)/2nd Frequency Reference Selection (C030), position control is made to operate by taking the pulses according to the pulse train input as the position command pulse.
For details on the pulse train input method, refer to *8-9-18 Pulse Train Frequency Input* on page 8-133.

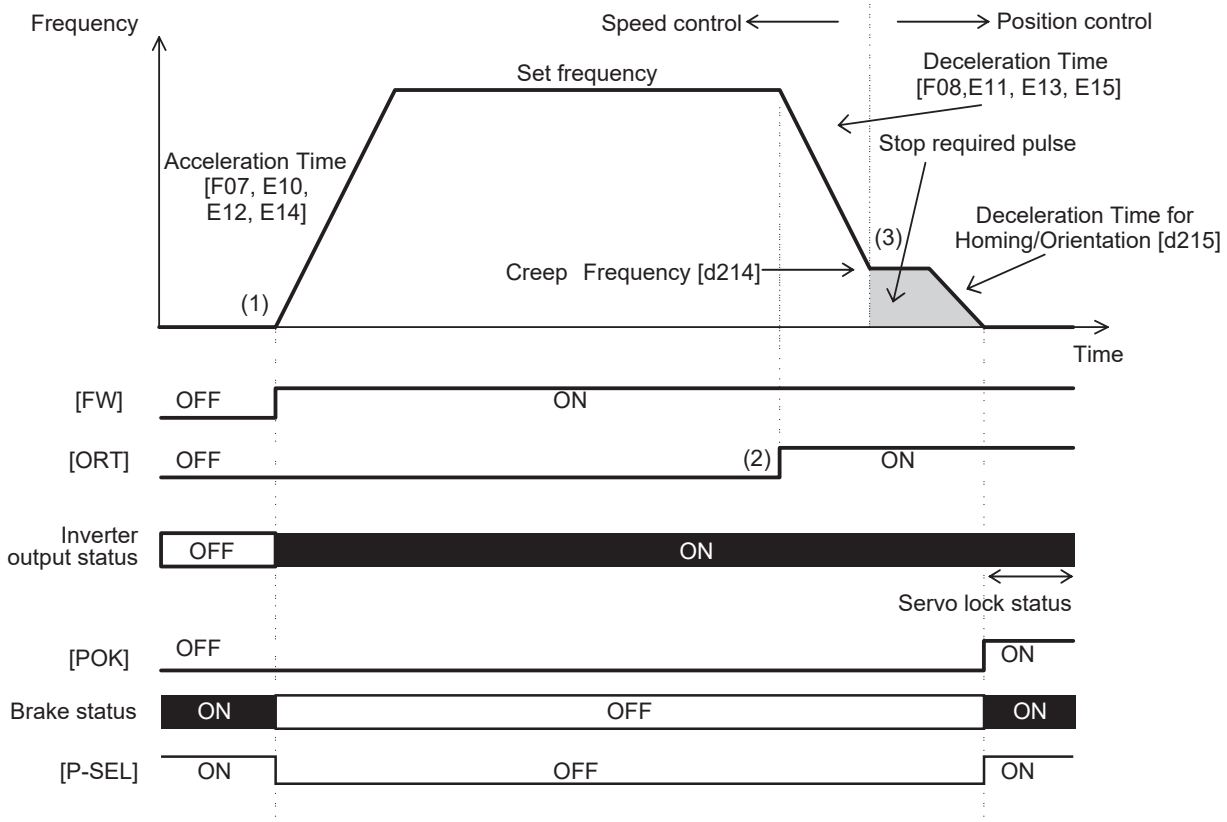
## 7-7-12 Orientation

The orientation function can be used as an applied function for position control. In speed control, orientation can be performed during operation or while operation is stopped.

### Orientation during speed control

With speed control, a motor in rotation can be stopped at a desired mechanical position. When digital input “ORT” is turned ON (2) during operation in speed control, deceleration is performed up to the frequency set in Homing Frequency/Orientation Frequency (d213) for the currently selected deceleration time, control transitions to the position control mode (3), the rotation amount that allows

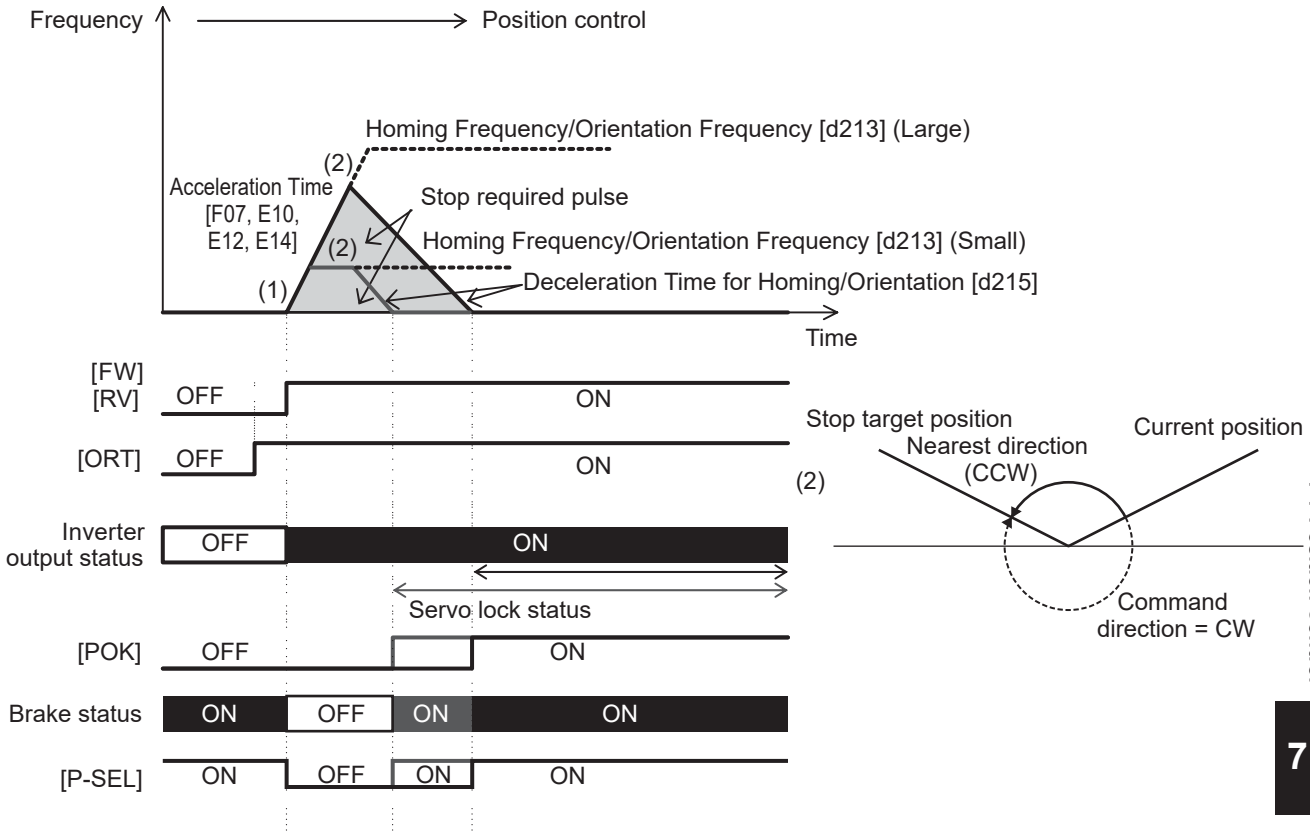
a deceleration stop at the setting in Deceleration Time for Homing/Orientation (d215) up to the position of the currently selected positioning data is calculated from the current position, and the motor rotates for that calculated rotation amount and stops.
The positioning data can be selected from Positioning Data 1 to 8 (d244 to d259) by digital input position command selection signals “CP1,” “CP2” and “CP3”. When assigning positioning data as factory default absolute positions (ABS), the absolute positions are referenced to the Z phase of the encoder. To assign positioning data as absolute positions referenced not to the Z phase of the encoder but to the machine origin position, Positioning Data 1 to 8 (d244 to d259) can be handled as it is as the positioning data of the machine origin reference by setting the position offset of the “encoder Z phase - machine origin position” to Homing Offset (MSB) (d242) and Homing Offset (LSB) (d243).




## Orientation from a stopped state

When the control mode is vector control with speed sensor, servo lock operation is performed when positioning by orientation is completed, and digital output “POK” is output if positional deviation is within Positioning Completed Range (d239). When the positioning position is changed from this state and orientation is performed again with “POS-SET” set to ON, control changes to position control and positioning is performed within one rotation. At this time, either of “Nearest direction” operation which performs positioning by the shortest distance or “Command direction” operation which follows the direction instructed in the RUN command can be selected at Orientation Selection (d208) regardless of the operation direction. In V/f control with speed sensor, the control mode changes to DC braking and the inverter maintains output. In orientation from a stopped state, rotation is never performed beyond one rotation even if a value exceeding one rotation is programmed in the positioning data.

If the RUN command turns ON after the orientation command “ORT” is turned ON during an inverter output stop, orientation operation is performed immediately without operating up to the set frequency by speed control. Note, however, that when operation is performed after the orientation command “ORT” is turned ON from a stopped state immediately after the power is turned ON, operation by speed control is always performed for one rotation or more to detect the Z phase and the orientation operation is performed.




When using the orientation function, vector control with speed sensor, by which speed feedback control is performed by a machine shaft encoder, can be selected as the control mode when the motor to machine shaft transmission gear ratio (speed reduction ratio) is (as a guideline) approx. 5x. In the case of vector control with speed sensor, servo lock operation is performed after a positioning stop, and, if external force is applied after the stop, resistance torque is generated in an attempt to hold the stop position.

On the other hand, when the machine shaft to motor shaft transmission gear ratio (speed reduction ratio) is large, it will be difficult to detect the motor speed at low-speed rotation, and machine performance sometimes can no longer be sufficiently demonstrated unless an encoder with a large number of pulses is used. On machines to which an encoder with a large number of pulses cannot be attached or that have a large transmission gear ratio, use V/f control with speed sensor and not vector control with speed sensor that performs speed feedback control from a machine shaft encoder. Servo lock operation is not possible in V/f control with speed sensor. When an external force is applied after a stop, use a mechanical brake. Also, in V/f control with speed sensor, torque boost sometimes must be adjusted or automatic torque boost sometimes must be set to generate torque at ultra low speeds immediately before a stop.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 78(1078): Speed control parameter selection 1 “MPRM1”<br>79(1079): Speed control parameter selection 2 “MPRM2”<br>135(1135): Increment/absolute position switching “INC/ABS”<br>136(1136): Orientation command “ORT”<br>137(1137): Speed/position switching “SPD”<br>141(1141): Current position clear “PCLR”<br>142(1142): Current position preset “PSET”<br>143(1143): Teaching command “TEACH”<br>144(1144): Position change command “POS-SET”<br>145(1145): Position command selection 1 “CP1”<br>146(1146): Position command selection 2 “CP2”<br>147(1147): Position command selection 3 “CP3” | - | - |
| E020 E027 | Output Terminal [DO1] Function Selection, Output Terminal [ROA, ROB] Function Selection | 82(1082): Positioning completed “POK” | - | - |
| d003, A045, b045, r045 | Speed Control 1 P Proportional Gain, Speed Control 2 P Proportional Gain, Speed Control 3 P Proportional Gain, Speed Control 4 P Proportional Gain | 0.1 to 200.0 | 10.00 | time |
| d004 | Speed Control 1 I Integral Time | 0.001 to 9.999 s<br>999: Cancel integral term | 0.100 | s |
| A046 | Speed Control 2 I Integral Time | 0.001 to 9.999 s<br>999: Cancel integral term | | |
| b046 | Speed Control 3 I Integral Time | 0.001 to 9.999 s<br>999: Disable | | |
| r046 | Speed Control 4 I Integral Time | 0.001 to 9.999 s<br>999: Disable | | |
| d201 | Position Control Feed Forward Gain | 0.00: Disable feed-forward<br>0.01 to 1.50 | 0.00 | - |
| d202 | Position Control Feed Forward Filter | 0.000 to 5.000 s | 0.500 | s |
| d203 | Position Loop Gain 1 | 0.1 to 300.0 | 1.0 | time |
| d204 | Position Loop Gain 2 | 0.1 to 300.0 | 1.0 | time |
| d205 | Position Loop Gain Switch Frequency | 0.0 to 590.0 Hz | 0.0 | Hz |
| d206 | Electronic Gear Denominator | 1 to 65535 | 1 | - |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d207 | Electronic Gear Numerator | 1 to 65535 | 1 | - |
| d208 | Orientation Selection | 0: Nearest direction (Valid for reverse rotation)<br>1: Command direction (Direction of operation command source) | 1 | - |
| d209 | Homing Operation Selection | Bit 7: Z phase correction 0: Disable<br>1: Enable<br>Bit 4 to 6: Reserved<br>Bit 3: Detection timing of homing limit switch<br>0: By rising edge<br>1: By falling edge<br>Bit 2: OT detected operation selection<br>0: Return at FOT/ROT detection<br>1: Stop at OT detection (Cancel homing)<br>Bit 1: Homing Start direction<br>0: Forward direction<br>1: Reverse direction<br>Bit 0: Homing shaft direction<br>0: Forward direction<br>1: Reverse direction | 0 | - |
| d213 | Homing Frequency/Orientation Frequency | 0.1 to 590.0 Hz | 5.0 | Hz |
| d215 | Deceleration Time for Homing/Orientation | 0.00 to 6000 s | 6.00 | s |
| d221 | Current Position Clear Signal Operation Selection | 0: Edge<br>1: Level | 0 | - |
| d237 | Positioning Data Type | 0: Absolute position (ABS)<br>1: Relative position (INC) | 0 | - |
| d238 | Position Data Determination Time | 0.000 to 0.100 s | 0.000 | s |
| d239 | Positioning Completed Range | 0 to 9999 | 1 | - |
| d240 | Preset Position (MSB) | -2147483648 to 2147483647<br>(MSB: -32768 to 32767,<br>LSB: 0 to 65535) | 0 | - |
| d241 | Preset Position (LSB) | | | |
| d242 | Homing Offset (MSB) | -2147483648 to 2147483647<br>(MSB: -32768 to 32767,<br>LSB: 0 to 65535) | 0 | - |
| d243 | Homing Offset (LSB) | | | |
| d244 | Positioning Data 1 (MSB) | -2147483648 to 2147483647<br>(MSB: -32768 to 32767,<br>LSB: 0 to 65535) | 0 | - |
| d245 | Positioning Data 1 (LSB) | | | |
| d246 | Positioning Data 2 (MSB) | -2147483648 to 2147483647<br>(MSB: -32768 to 32767,<br>LSB: 0 to 65535) | 0 | - |
| d247 | Positioning Data 2 (LSB) | | | |
| d248 | Positioning Data 3 (MSB) | -2147483648 to 2147483647<br>(MSB: -32768 to 32767,<br>LSB: 0 to 65535) | 0 | - |
| d249 | Positioning Data 3 (LSB) | | | |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d250 | Positioning Data 4 (MSB) | -2147483648 to 2147483647 (MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | - |
| d251 | Positioning Data 4 (LSB) | | | |
| d252 | Positioning Data 5 (MSB) | -2147483648 to 2147483647 (MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | - |
| d253 | Positioning Data 5 (LSB) | | | |
| d254 | Positioning Data 6 (MSB) | -2147483648 to 2147483647 (MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | - |
| d255 | Positioning Data 6 (LSB) | | | |
| d256 | Positioning Data 7 (MSB) | -2147483648 to 2147483647 (MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | - |
| d257 | Positioning Data 7 (LSB) | | | |
| d258 | Positioning Data 8 (MSB) | -2147483648 to 2147483647 (MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | - |
| d259 | Positioning Data 8 (LSB) | | | |
| d277 | Positioning Data Setting Selection via communication | 0: Disable Communications Positioning Data (S20, S21)<br>1: Enable Communications Positioning Data (S20, S21) | 0 | - |

## Position Loop Gain 1 (low speed side) (d203), Position Loop Gain 2 (high speed side) (d204)

## Position Loop Gain Switch Frequency (d205)

## Speed control P (gain) (d003, A045, b045, r045)

## Speed control I (integral time) (d004, A046, b046, r046)

In orientation operation, the response of position control can be switched during deceleration and during a stop.

The larger the set value, the more improved response becomes, the shorter the settling time becomes and the more holding performance can be improved during a servo lock stop. However, setting too large a value causes hunting. Adjust this parameter so that hunting does not occur. Also, when increasing the gain of the position controller, also adjust the speed adjuster (ASR). To switch speed control P (gain) and speed control I (integral time), use parameter selection 1 and 2 “MPRM1” and “MPRM2.”

## Electronic Gear Denominator (d206), Electronic Gear Numerator (d207)

Positioning data in orientation can be handled as an angle, number of pulses or other user value.

Example) When the PG of number of pulses 1024 [pulse/rev] is used and the moving amount per user value is 1 [pulse/user value] for the equivalent number of pulses 4x the PG pulses

$$\frac{\text{Electronic gear numerator}}{\text{Electronic gear denominator}} = \frac{\text{Moving amount per user value}}{\text{Moving amount per 1 PG pulse}} = \frac{\frac{1}{4 \times 1024}\ \text{[rev/user value]}}{\frac{1}{1024}\ \text{[rev/pulse]}} = \frac{1}{4}\ \text{[pulse/user value]}$$

Example) When the moving amount per user value is 0.01 [°/user value], the moving amount per single motor rotation is 360.00 [°/rev], and the number of PG pulses per single motor rotation is 4096 (1024 × 4x) [pulse/rev]

$$\frac{\text{Electronic gear numerator}}{\text{Electronic gear denominator}} = \frac{\text{Moving amount per user value}}{\text{Moving amount per 1 PG pulse}} = \frac{\dfrac{0.01\ [°/\text{user value}]}{360.00\ [°/\text{rev}]}}{\dfrac{}{4096[\text{pulse/rev}]}} = \frac{4096}{36000}\ [\text{pulse/user value}]$$

## Orientation Selection (d208)

When Orientation Selection (d208) is set to “0: Nearest direction (Valid for reverse rotation),” the moving amount to the positioning data instructed from the current position rotates in the smaller direction (nearest direction) regardless of the direction instructed in the RUN command. Note, however, that when operation has not been performed even once after the power is turned ON, operation starts in the direction instructed in the RUN command and orientation is performed as the near direction is unknown. Then, positioning is performed by the nearest direction. When Orientation Selection (d208) is set to “1: Command direction (Direction of operation command source),” operation starts in the direction instructed in the RUN command at all times and orientation is performed.

## Homing Operation Selection (d209)

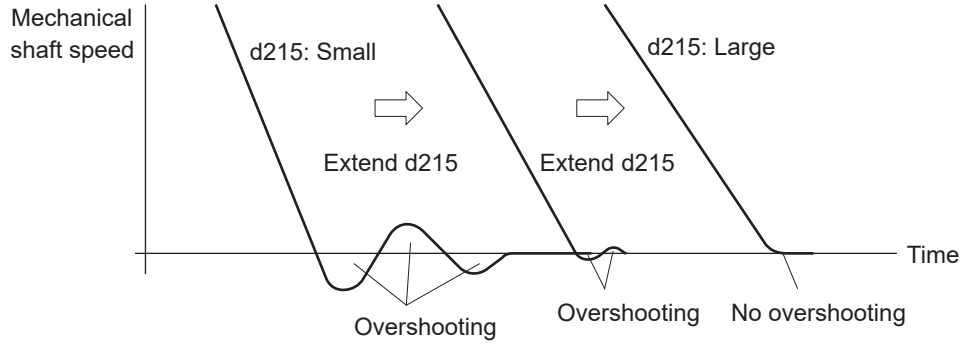
In a pulse encoder, variance sometimes occurs between the output timing of the A, B phase pulses and Z phase pulse. If a position error of one pulse occurs on the machine side when positioning is performed to the same position during forward rotation and reverse rotation, set 1 to “bit 7: Z phase correction” in Homing Operation Selection (d209). Occurrence of position error caused by the rotational direction can be suppressed by enabling this correction.

## Homing Frequency/Orientation Frequency (d213)

This is the frequency when speed control is switched to position control by the orientation command “ORT” during speed control. If the preset frequency is high, the time up to completion of positioning increases, and when torque limit deceleration is performed, the position deviation over alarm (alarm code: 38) sometimes occurs. To perform torque limit deceleration, set the frequency when switching from speed control to position control to as low a frequency as possible.
In V/f control with speed sensor, when the preset frequency is low, it becomes difficult to position to the instructed positioning position unless torque boost is adjusted or automatic torque boost is used. Adjust all of Deceleration Time for Homing/Orientation(d215), Position Loop Gain 1 (low speed side) (d203) and Position Loop Gain 2 (high speed side) (d204) so that the desired settling time is reached in keeping with the control method.

## Deceleration Time for Homing/Orientation (d215)

Set the deceleration time from Homing Frequency/Orientation Frequency (d213). This deceleration time can be adjusted to adjust the set time when overtravel or overshooting occurs on the instructed position.

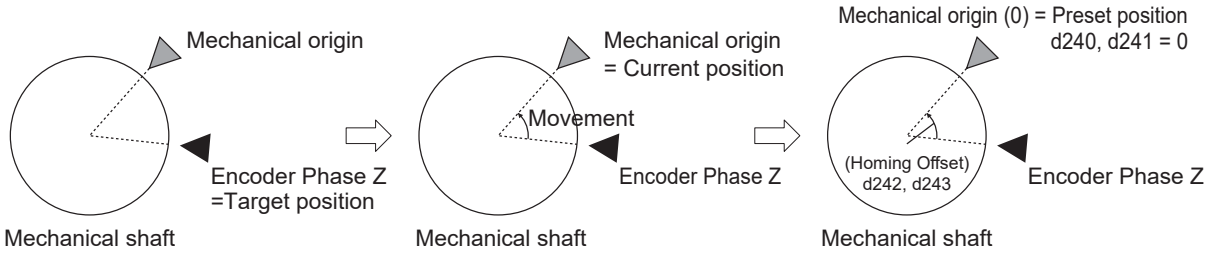


## Preset Position (MSB) (d240), Preset Position (LSB) (d241)

The current reference position and current feedback position can be set to any position referenced to the machine origin. In orientation, ordinarily, the position offset between the machine origin and the Z phase of the encoder is handled as the homing offset. For this reason, set Preset Position (MSB) (d240) and Preset Position (LSB) (d241) as “0.”

## Homing Offset (MSB:d242,LSB:d243)

The homing offset in orientation is equivalent to the position offset between the machine origin and the Z phase of the encoder. Adjust the homing offset by the following procedure.




1) When the orientation command is turned ON with the target position set as 0, perform positioning with the Z phase position of the encoder as the origin.
2) Then, operate the motor, and move the machine shaft to the machine origin position and stop movement there. Set the Current Feedback Position Monitor (MSB) (d298) and Current Feedback Position Monitor (LSB) (d299) at this time to Homing Offset (MSB) (d242) and Homing Offset (LSB) (d243). Then, when the current position preset “PSET” is turned ON with Preset Position (MSB) (d240) and Preset Position (LSB) (d241) set to “0,” “0” is set to Current Feedback Position Monitor (MSB) (d298) and Current Feedback Position Monitor (LSB) (d299).
3) For confirmation, perform orientation again. Perform orientation with the current position as “0” (origin), and check that orientation to the machine origin position is possible.

## Positioning Data 1 to 8 (d244 to d259) and Position Data Determination Time (d238)

This parameter is for setting the positioning position referenced to the machine origin in orientation. Up to eight points can be set, and multipoint positioning can be performed continuously by using position command selection 1 to 3 “CP1 to CP3.” To prevent malfunction caused by chattering when the position command selection signal is used to switch positioning data, set a time for chattering to settle or longer in Position Data Determination Time (d238). To enable changes to the positioning data with the RUN command ON, be sure to turn the position change command “POS-SET” ON. As changes to the positioning data while the RUN command is OFF are reset when operation is started, operation by position change command “POS-SET” is not required. Orientation operation differs from position control in that, even when a value greater than one rota- tion is set to positioning data, the value is automatically corrected to a position within one rotation when the operation is actually performed.

To assign positioning data as an incremental amount of movement relative to the current position, set movement in Positioning Data Type (d237). To switch handling when necessary, use increment/absolute position switching “INC/ABS” (data = 135) in the multifunction input terminal function. When this function is allocated, the d237 setting is disabled.

### Positioning Data Setting Selection via communication (d277)

In orientation, to use Positioning Data via Communication (MSB) (S020) and Positioning Data via Communication (LSB) (S021) via communication to perform positioning, set “1” to Positioning Data Setting Selection via communication (d277) to enable positioning commands via communication, just as in position control.

## 7-7-13 Functions That Are Disabled in Position Control

When speed/position switching is set to “SPD” OFF and the RUN command is ON, the following functions are disabled.

Jogging operation, PID control, starting frequency hold, stop frequency hold, DC braking, Zero Speed Control, restart after momentary power failure, retry, offline tuning, anti-regenerative control, overload prevention, Stop Selection (H011), pickup, torque control, 1st/2nd control.

## 7-7-14 Position Monitor

Use this function to monitor the feedback current position and instructed current position. The feedback current position is the value obtained by totaling the number of feedback pulses and converting them to user values. The instructed current position is not the target position but the momentary instructed position based on the position instruction pattern, and is the same as the feedback current position during a stop.

Monitors d298, d299 and W142, W143 display the actual position in all drive conditions.

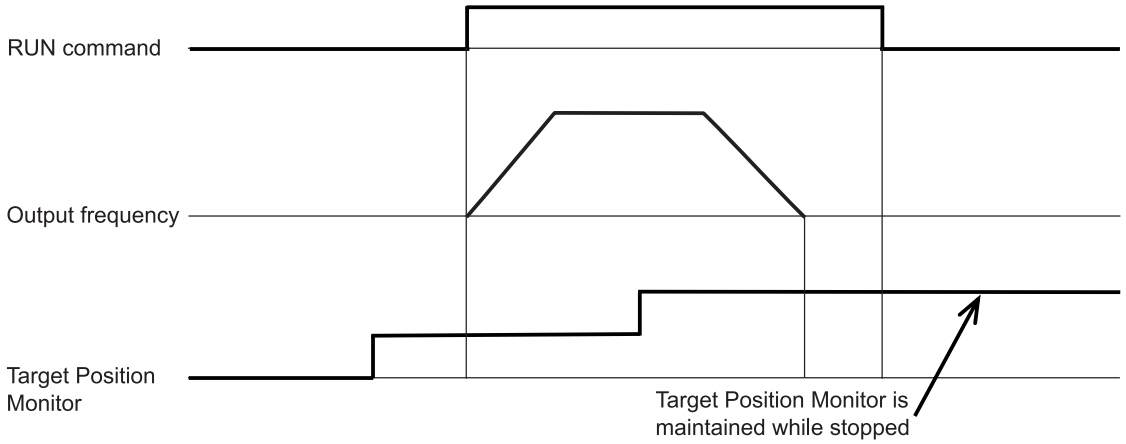
| Parameter No. | Function name | Data |
|---|---|---|
| d296 | Current Reference Position Monitor (MSB) | -2147483648 to 2147483647 (MSB: -32768 to 32767, LSB: 0 to 65535) |
| d297 | Current Reference Position Monitor (LSB) | |
| d298 | Current Feedback Position Monitor (MSB) | -2147483648 to 2147483647 (MSB: -32768 to 32767, LSB: 0 to 65535) |
| d299 | Current Feedback Position Monitor (LSB) | |
| W142 | Current Feedback Position Monitor (MSB) | -2147483648 to 2147483647 (MSB: -32768 to 32767, LSB: 0 to 65535) |
| W143 | Current Feedback Position Monitor (LSB) | |
| W144 | Target Position Monitor (MSB) | -2147483648 to 2147483647 (MSB: -32768 to 32767, LSB: 0 to 65535) |
| W145 | Target Position Monitor (LSB) | |
| W173 | Set Target Position Monitor (MSB) | -2147483648 to 2147483647 (MSB: -32768 to 32767, LSB: 0 to 65535) |
| W174 | Set Target Position Monitor (MSB) | |

### Feedback Positions (d296, d297, d298, d299 and W142, W143)

- Parameters d298, d299 and W142, W143 display the actual position in all drive conditions.
- Parameter d296 and d297 show the command position based on the current position reference se- lection.

## Target Positions (W144. W145 and W173, W174)

- Parameters W144 and W145 display the actual target position that the drive is moving towards while in RUN mode. If the drive is not in RUN, it will display 0.
- Parameters W173 and W174 show the position configured via input like CP1, CP2, and CP3 config- uration. Unlike the previous parameters, the drive does not necessarily move to this target position until the target is updated. The value is always displayed, regardless of whether the drive is in RUN or not.




## 7-7-15 Restarting Positioning

If the motor moves out of the Restarting Positioning Range Setting (d278) while operation is still ON after positioning is performed by position control, the inverter automatically starts repositioning the motor again. When the motor is in the Positioning Completed Range (d239) even if outside of the position restarting range, the motor does not operate.
When the motor current position moves out of the range ±d278 from the target value, it moves to the target position.
The restarting positioning function is useful in V/f control. In vector control, servo lock operation is performed after completion of position control operation, so processing to stop at the target position functions at all times.
When the current position is overwritten during a stop, the restarting positioning function is disabled.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d239 | Positioning Completed Range | 0 to 9999 | 1 | - |
| d278 | Restarting Positioning Range Setting | 0: Disable<br>1 to 9999 | 9999 | - |

## 7-7-16 Brake Control during Position Control

The output state of the brake signal during a position control stop can be set at bit 6 of Brake Control Operation Selection (J096).

## At Brake Release

In V/f control, with the RUN command ON, when the output current is at the current set in Brake Control Brake-release Current (J068) or higher, the frequency reference is at the frequency set in Brake Control Brake-release Frequency (J069) or higher, and the time set in J070 elapses, “BRK” is turned ON regardless of the setting of J096 bit 6.

In vector control, when J096 bit 6 = 0, the RUN command is ON, the output current is at the current set in Brake Control Brake-release Current (J068) or higher, the torque command is at the torque set in Brake control Brake-release Torque (J095) or higher, and the time set in J070 elapses, “BRK” is turned ON.

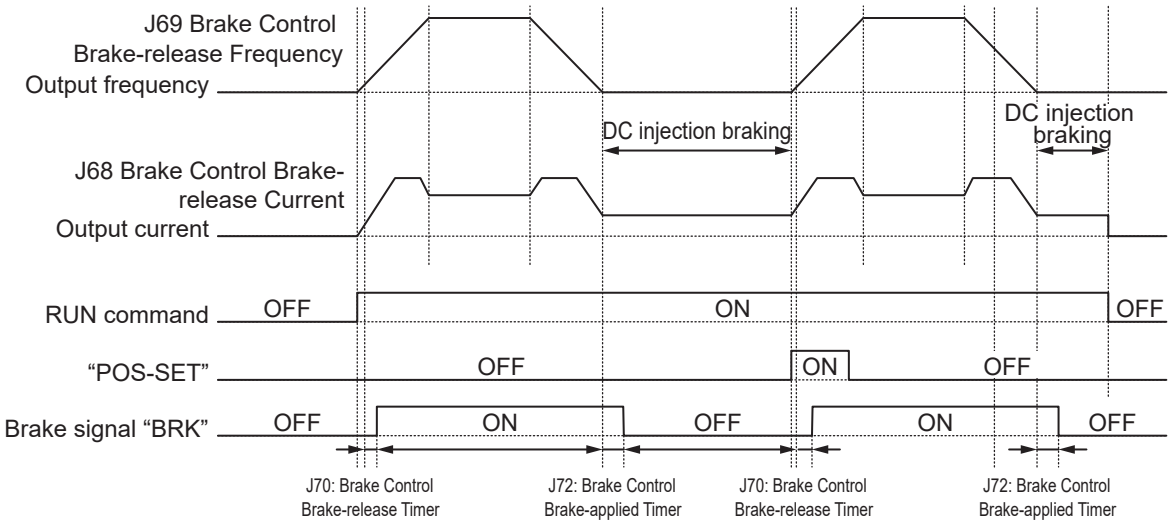
In vector control, if the output current is at the current set in Brake Control Brake-release Current (J068) or higher, the torque command is at the torque set in Brake control Brake-release Torque (J095) or higher, and the time set in Brake Control Brake-release Timer (J070) elapses when J096 bit 6 = 1 and the servo lock state is entered by the servo lock terminal turning ON, the brake release signal “BRK” is turned ON even if the RUN command is OFF.

## At Application of Brake

When a stop is made at the target position with J096 bit 6 = 0, the brake release signal “BRK” is turned ON when the time set at Brake Control Brake-applied Timer (J072) elapses even if the RUN command is ON.
When a stop is made at the target position with J096 bit 6 = 1, the brake release signal “BRK” is not turned ON even if the time set at Brake Control Brake-applied Timer (J072) elapses if the RUN command is ON.

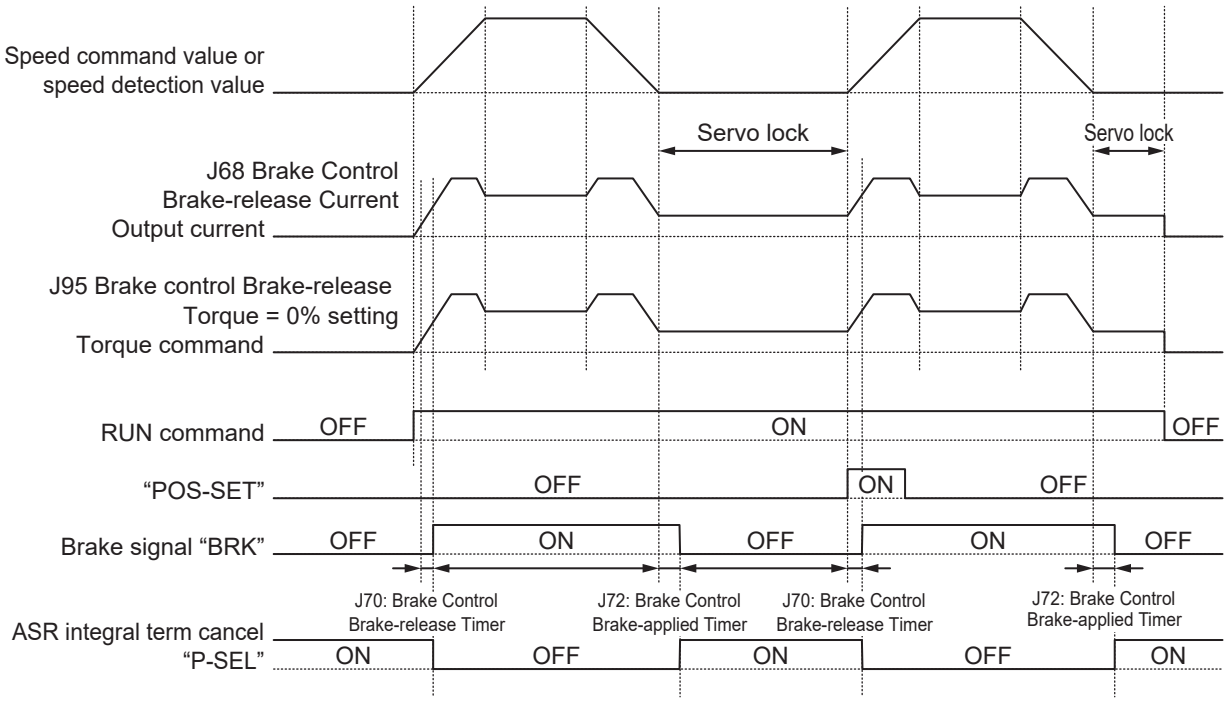
When the brake is applied during position control, the motor cannot rotate even if there exists position error. For this reason, the integral term accumulates which sometimes causes an overload trip to occur. When ASR integral term cancel “P-SEL” allocated to a multifunction input terminal is turned ON, the integral term of the speed controller is canceled and P operation is performed.

| Parameter No. | Function name | Data |
|---|---|---|
| J096 | Brake Control Operation Selection | bit 6 = 0: Position control stopped, brake signal OFF (brake applied)<br>bit 6 = 1: Position control stopped, brake signal ON (brake released) |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 119: P-SEL (ASR integral term cancellation) |



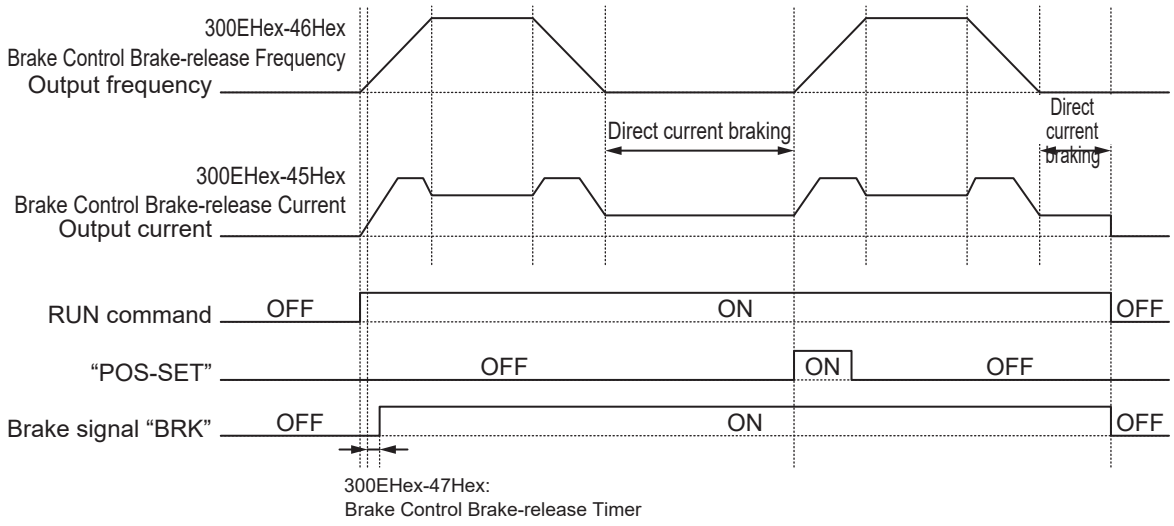

J96 bit6 0: Brake signal ON during position control stop 1: Brake signal released during position control stop

V/f control J96 bit 6 = 0 Operation time chart



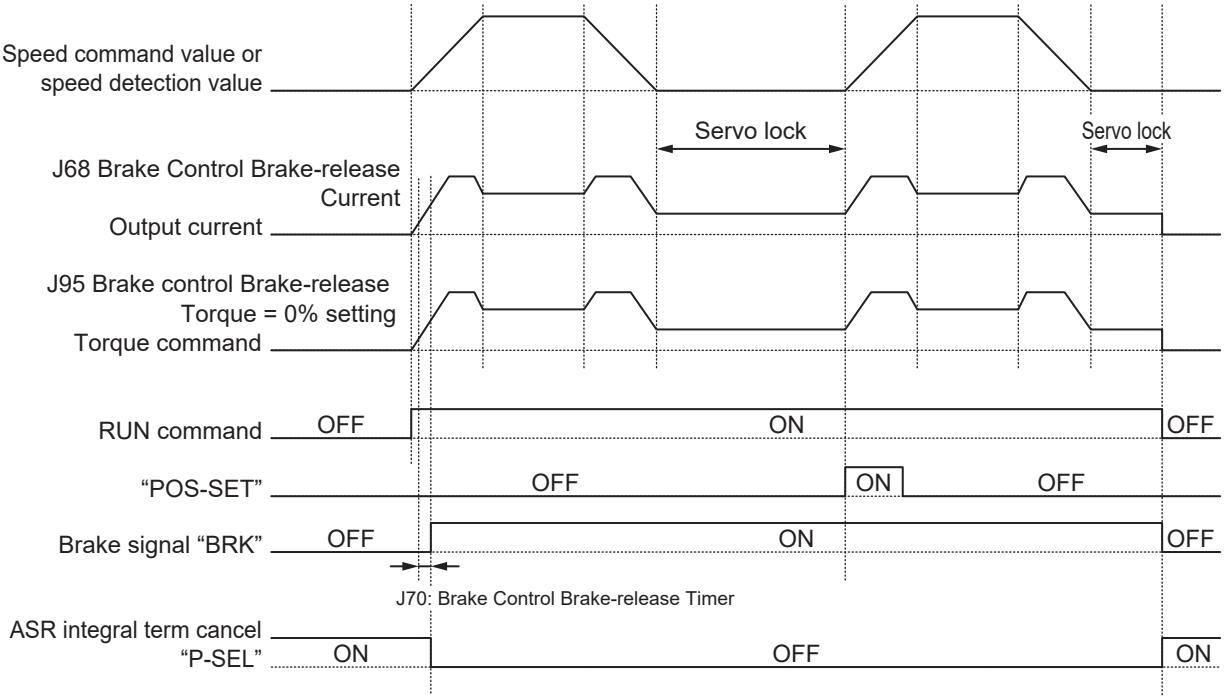

J96 bit6 0: Brake signal ON during position control stop 1: Brake signal released during position control stop

Vector control J96 bit 6 = 0 Operation time chart




300EHex-61Hex bit6 0: Brake signal ON during position control stop 1: Brake signal released during position control stop

V/f control 300EHex-61Hex bit 6 = 1 Operation time chart




J96 bit6 0: Brake signal ON during position control stop 1: Brake signal released during position control stop

Vector control J96 bit 6 = 0 Operation time chart

## 7-7-17 Position Store Selection at Power OFF

When parameter d220 is set to "1: Store Position at Low Voltage Status," the current feedback position (d298, d299) is saved to EEPROM when a low voltage condition is detected and is restored upon the next power ON.

When set to "2: Store Position and Software OT at Low Voltage Detection," it functions similarly to option 1 for position storage, but also stores the state of the OT (over-travel) limit.
If set to "0: Invalid," the stored data is cleared and reset to zero upon the next power ON.
Even if EEPROM storage is enabled during a low voltage condition, any motor rotation occurring while the power is off cannot be detected, which may result in position errors. Therefore, it is recommended to use a mechanical brake when utilizing this function.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d220 | Position Feedback Store Selection at Power Off | 0: Disable<br>1: Store at low voltage status<br>2: Store Position and Software OT at Low Voltage detect | 0 | - |

## 7-7-18 Excessive Positional Deviation

Excessive positional deviation is judged when the deviation between the current reference position and current feedback position exceeds the detection level of excessive positioning deviation (d223, d224).
When excessive positional deviation occurs, the excessive positional deviation alarm (d0) is immediately output and the motor runs freely.
In position control, the current reference position is overwritten with the current feedback position when inverter output turns OFF, and the positional deviation of APR is cleared. For this reason, the excessive positional deviation alarm (d0) can be reset when the alarm stops and inverter output turns OFF.

Positional deviation is closely related to positioning frequency and position command gain. When a certain frequency reference is output at a certain position reference gain, a constant positional deviation is always required. Due to this fact, positional deviation can be improved by either increasing the detection level of excessive positioning deviation (d223, d224) or by increasing the position control gain (d203 and d204) when the excessive positional deviation alarm (d0) occurs.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d223 | Detection Level of Excessive Positioning Deviation (MSB) | 0: Disable (MSB: 0, LSB: 0)<br>1 to 2147483647<br>(MSB: 0 to 32767, LSB: 0 to 65535) | 0 | - |
| d224 | Detection Level of Excessive Positioning Deviation (LSB) | | 0 | - |

## 7-7-19 Touch Probe (Latch) Function

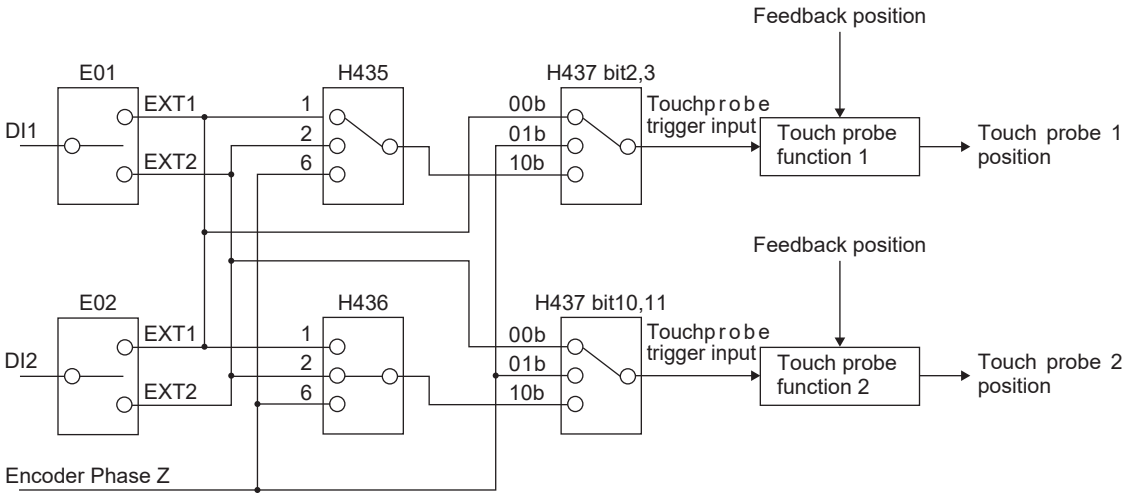
This is a function that latches the feedback position when the external latch input signal or the encoder Z-phase is started.
This function is disabled if neither of “187: EXT1 (External latch input 1)” and “188: EXT2 (External latch input 2)” is allocated to Input Terminal [DI1] Function Selection (E001) and Input Terminal [DI2] Function Selection (E002), and if the selection trigger is not encoder Z-phase.
This function is also disabled when bit 0 (Latch function 1) and bit 8 (Latch function 2) of Touch Probe Function (H437) are 0.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H435 | Touch Probe 1 Source | 1: External Latch Input 1 (EXT1)<br>2: External Latch Input 2 (EXT2)<br>6: Encoder Phase Z | 1 | - |
| H436 | Touch Probe 2 Source | 1: External Latch Input 1 (EXT1)<br>2: External Latch Input 2 (EXT2)<br>6: Encoder Phase Z | 1 | - |
| H437 | Touch Probe Function | 0000 to FFFF hex | 0 | - |
| W148 | Touch Probe 1 Positive Edge (MSB) | -2147483648 to 2147483647 (80000000h to 7FFFFFFFh) (MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | - |
| W149 | Touch Probe 1 Positive Edge (LSB) | | 0 | - |
| W150 | Touch Probe 2 Positive Edge (MSB) | -2147483648 to 2147483647 (80000000h to 7FFFFFFFh) (MSB: -32768 to 32767, LSB: 0 to 65535) | 0 | - |
| W151 | Touch Probe 2 Positive Edge (LSB) | | 0 | - |
| W152 | Touch Probe Status | 0000 to FFFF hex | 0 | - |
| E001, E002 | Input Terminal [DI1] Function Selection, Input Terminal [DI2] Function Selection | 187: EXT1 (External latch input 1)*1<br>188: EXT2 (External latch input 2)*1 | - | - |

*1. External latch cannot be allocated to other than multifunction input DI1 and DI2.

## Setting the Trigger Signal

The trigger of the touch probe function can be selected as shown in the figure below.




## Explanation of Bits of Touch Probe Function (H437)

Each bit of the touch probe function is as shown below.

| b15 | b14 | b13 | b12 | b11 | b10 | b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | EPs | TriSel | | Cont | Ena | 0 | 0 | 0 | EPs | TriSel | | Cont | Ena |
| Touch probe function 2 | | | | | | | | Touch probe function 1 | | | | | | | |

Ena: Touch probe function disabled (0) or enabled (1)

Cont: Touch probe operation Trigger First Event Mode(0) / Continuous Mode(1)
TriSel: Touch probe trigger input switching

| bit 3(11) | bit 2(10) | Select trigger input |
|---|---|---|
| 0 | 0 | EXT1 |
| 0 | 1 | Z-phase |
| 1 | 0 | According to the touch probe trigger selection H435 and H436 |
| 1 | 1 | The trigger signal input is considered to be “0.” |

Eps: Latch operation enabled (1) or disabled (0) during Active edge

## Explanation of Bits of Touch Probe Status (W152)

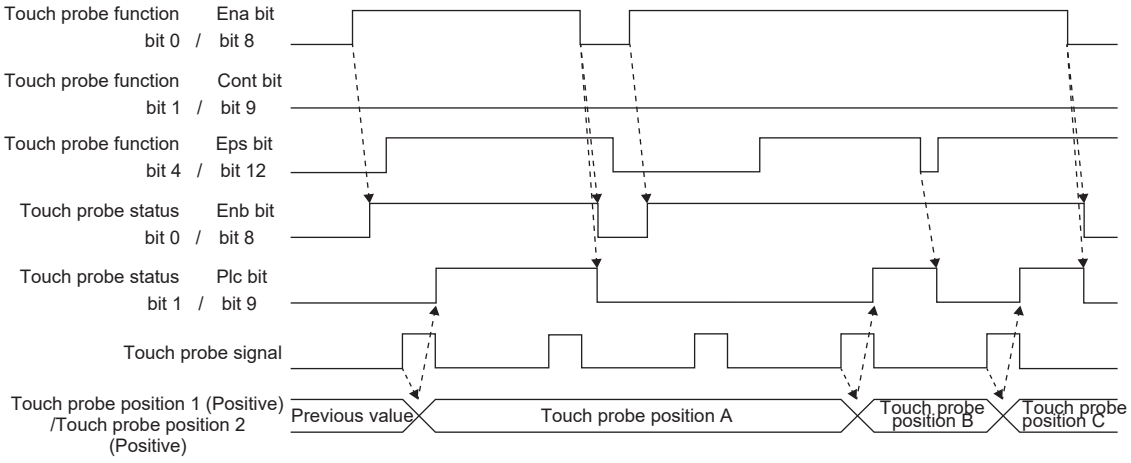
Each bit of the touch probe status is as shown below.

| b15 | b14 | b13 | b12 | b11 | b10 | b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | Plc | Enb | 0 | 0 | 0 | 0 | 0 | 0 | Plc | Enb |
| Touch probe function 2 | | | | | | | | Touch probe function 1 | | | | | | | |

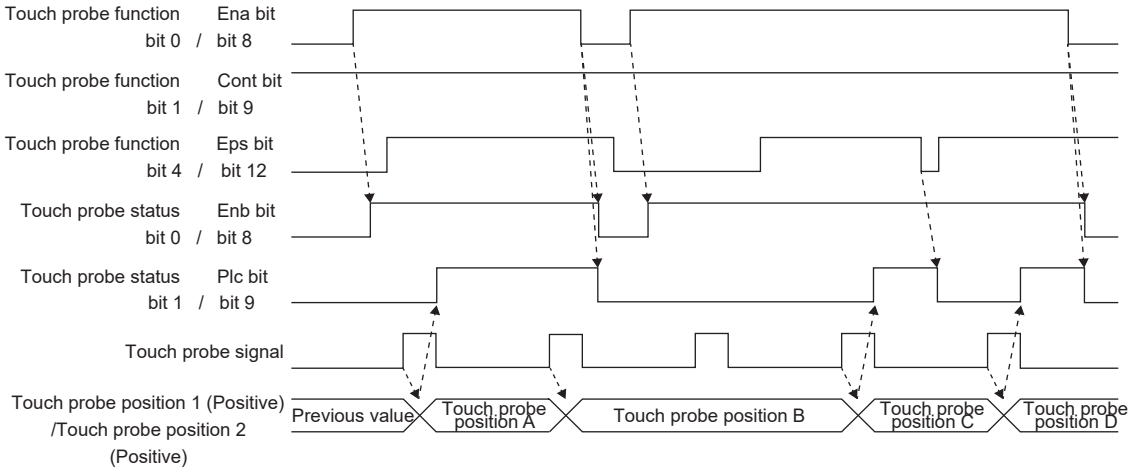
Enb: Touch probe function disabled (0) or enabled (1)
PLc: With (0) or without (1) Latch positive data

## Operation Sequence

### For Cont = 0: Trigger First Event Mode (First Trigger)



## For Cont = 1: Continuous Mode (Continuous)



# 7-8 Motor tuning

## 7-8-1 Motor Off-line Auto-tuning

To perform auto-tuning of the motor, perform the settings according to the control method in *7-1-3 Motor Parameter Settings* on page 7-6, and then perform according to the following procedure.

### Offline Auto-tuning of Induction Motor (IM Motor)

Offline auto-tuning consists of the following five steps:

- Presetting of parameters
- Selection of motor rotation during auto-tuning
- Execution of auto-tuning
- Processing after auto-tuning
- Corrective action in case of an error

***1*** Presetting of parameters

1) Set one of “0: IM V/f control,” “1: IM Dynamic torque vector control,” “3: IM V/f control with speed sensor,” “4: IM Dynamic torque vector control with speed sensor,” “5: IM Vector control without speed sensor” or “6: IM Vector control with speed sensor” to 1st Drive Control Selection (F042)/2nd Drive Control Selection (A014).
2) Referring to *7-1-3 Motor Parameter Settings* on page 7-6, set parameters matched to the control method.

***2*** Tuning method

Check the machine status, and select either “2: Tune the motor parameters while rotating” or “1: Tune the motor parameters while stopped” in 1st Auto Tuning Function Selection (P004)/2nd Auto-tuning Selection Function Selection (A018). When the wiring length has changed after rotation tuning is performed, tuning can be performed by “5: Tune the motor %R1 and %X while stopped.”

| P004 / A018 data | | Data to be tuned | Tuning | Supplementary explanation |
|---|---|---|---|---|
| 1 | Tune the motor parameters while stopped | Primary resistance %R1 (P007/A021)<br>Leakage reactance %X (P008/A022)<br>Rated slip (P012/A026)<br>%X correction factor (P053/A053) | Tuning is performed in a stop state. | When the motor cannot be rotated. |

| P004 / A018 data | | Data to be tuned | Tuning | Supplementary explanation |
|---|---|---|---|---|
| 2 | Tune the motor parameters while rotating | No Load Current (P006/A020)<br>Primary resistance %R1 (P007/A021)<br>Leakage reactance %X (P008/A022)<br>Rated slip (P012/A026)<br>Magnetic saturation factor 1 to 5 (P016/A020)<br>%X correction factor (P053/A053) | Tuning is performed in the following order.<br>• %R1, %X in motor stopped state<br>• No-load current and magnetics a t u r a t i o n factor in motor rotating state (50% of base frequency)<br>• Rated slip in motor stopped state again | When the motor can be rotated safely. |
| 5 | Tune the motor %R1 and %X while stopped | Primary resistance %R1 (P007/A021)<br>Leakage reactance %X (P008/A022)<br>%X correction factor (P053/A053) | Tuning is performed in a stop state. | When the motor cannot be rotated. (Applied only when rotation tuning has been performed and the wiring length has been changed) |

The tuning result is automatically written to the relevant parameter.

3 Preparing the mechanical system

As preparation for performing rotation tuning, remove machine couplings, and disable safety interlocks.

4 Execution of auto-tuning

1) Set the tuning method to the data part of object P004 and the rotation direction to bits 8 and 9.

The value of each bit is as follows.

| b15 | b14 | b13 | b12 | b11 | b10 | b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | REV | FWD | Data part | | | | | | | |

Select one of the following to the data part.

| Data part | Tuning method |
|---|---|
| 01 | Tune the motor parameters while stopped |
| 02 | Tune the motor parameters while rotating |
| 05 | Tune the motor %R1 and %X while stopped |

2) Tuning is started when a value is written to object P004. The time required for auto-tuning is approx. 5 to 40 seconds.

To input the RUN command via the FW or RV terminals, change the setting of F002, and set only the data part in (1) above.

3) After (2) above is completed when the data part of P004 is 02Hex, acceleration is performed up to 50% of the rated speed and rotation tuning is started. When rotation tuning is completed, a deceleration stop is performed. The time required for this operation is approx. 10 seconds excluding the acceleration/deceleration time.

4) When the RUN command via the FW and RV terminals is selected according to the F002 = 1 setting, completion of tuning can be checked by the Tuning Progress (W180) (completion at 100%).

After tuning is completed, turn the RUN command via the FW and RV terminals OFF. For details on how to execute auto-tuning by Sysmac Studio, refer to *Sysmac Studio Version 1 Drive Functions Operation Manual (Cat. No. I589)*.

***5*** Corrective action in case of an error

As unwanted tuning might cause hunting or other malfunctions or worsen operational accuracy, the inverter generates a tuning error (alarm code: 25 Hex) and discards tuning values when an abnormality is found in the tuning result.

When tuning ends in a tuning error (alarm code: 25 Hex), check the following.

- Is inverter output wiring open?
- Has the mechanical brake operated?
- Has the free-run command "FRS" turned ON?
- Are parameter settings correct?

For details on the tuning error (alarm code: 25 Hex), refer to *Tuning Error* on page 7-74.

## Offline Auto-tuning of Synchronous Motor (PM Motor)

Offline auto-tuning consists of the following five steps:

- Presetting of parameters
- Selection of tuning method
- Preparing the mechanical system
- Execution of auto-tuning
- Corrective action in case of an error

***1*** Presetting of parameters

1) Set “15: PM Vector control without speed and pole position sensor” or “16: PM Vector control with speed and pole position sensor” to 1st Drive Control Selection (F042).
2) Referring to *7-1-3 Motor Parameter Settings* on page 7-6, set parameters matched to the control method.

***2*** Selection of tuning method

Check the machine status, and select either “2: Tune the motor parameters while rotating” or “1: Tune the motor parameters while stopped” in 1st Auto Tuning Function Selection (P004).

When performing only offset adjustment of the magnetic pole position sensor, select “4: Tune the PM motor magnetic pole position offset while rotating.” After tuning is finished, adjust the acceleration time and deceleration time, and conformity between the rotational direction of the motor and rotational direction of the machine.

| P004 data | | Data to be tuned | Tuning | Supplementary explanation |
|---|---|---|---|---|
| 1 | Tune the motor parameters while stopped | 1st PM Motor Armature Resistance (P060)<br>1st PM Motor d-axis Inductance (P061)<br>1st PM Motor q-axis Inductance (P062) | Tuning is performed in a stop state. | When the motor cannot be rotated. For example, when the load cannot be removed.<br>P030 = 1 or 2 |
| 2 | Tune the motor parameters while rotating | 1st PM Motor Armature Resistance (P060)<br>1st PM Motor d-axis Inductance (P061)<br>1st PM Motor q-axis Inductance (P062)<br>1st PM Motor Induced Voltage Ke (P063) | The armature resistance, d-axis inductance and q-axis inductance are tuned in a motor stop state. After this, rotation is performed up to 50% of the rated frequency to tune the induced voltage. | When the motor can be rotated safely. |
| | | 1st PM Motor Magnetic Pole position Offset (P095) | The magnetic pole position sensor offset is tuned in a motor rotating state (speed according to d080) | This is implemented only on the case of PM Vector control with speed and pole position sensor (PM) (synchronous motor) (F042 = 16) using an A, B phase magnetic pole position detection type (d014 = 4) encoder. |
| 4 | Tune the PM motor magnetic pole position offset while rotating | 1st PM Motor Magnetic Pole position Offset (P095) | The magnetic pole position sensor offset is tuned in a motor rotating state (speed according to d080) | This is performed when performing tuning of only the magnetic pole position sensor.<br>Select PM Vector control with speed and pole position sensor (F042 = 16) |

The tuning result is automatically written to the relevant parameter.

3 Preparing the mechanical system

As preparation for performing rotation tuning, remove machine couplings, and disable safety interlocks.

4 Execution of auto-tuning

1) Set the tuning method to the data part of object P004 and the rotation direction to bits 8 and 9.

The value of each bit is as follows.

| b15 | b14 | b13 | b12 | b11 | b10 | b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | REV | FWD | Data part | | | | | | | |

Select one of the following to the data part.

| Data part | Tuning method |
|---|---|
| 01 | Tune the motor parameters while stopped |
| 02 | Tune the motor parameters while rotating |
| 05 | Tune the motor %R1 and %X while stopped |

2) Tuning is started when a value is written to object P004. The time required for auto-tuning is approx. 5 to 40 seconds.
   To input the RUN command via the FW or RV terminals, change the setting of F002, and set only the data part in (1) above.
3) After (2) above is completed when the data part of P004 is 02Hex, acceleration is performed up to 50% of the rated speed and rotation tuning is started. When rotation tuning is completed, a deceleration stop is performed. The time required for this operation is approx. 10 seconds excluding the acceleration/deceleration time.
4) When the RUN command via the FW and RV terminals is selected according to the F002 = 1 setting, completion of tuning can be checked by the Tuning Progress (W180) (completion at 100%).
   After tuning is completed, turn the RUN command via the FW and RV terminals OFF. For details on how to execute auto-tuning by Sysmac Studio, refer to *Sysmac Studio Version 1 Drive Functions Operation Manual (Cat. No. I589)*.

***5*** Corrective action in case of an error

As unwanted tuning might cause hunting or other malfunctions or worsen operational accuracy, the inverter generates a tuning error (alarm code: 25 Hex) and discards tuning values when an abnormality is found in the tuning result.

When tuning ends in a tuning error (alarm code: 25 Hex), check the following.

- Is inverter output wiring open?
- Has the mechanical brake operated?
- Has the free-run command "FRS" turned ON?
- Are parameter settings correct?

For details on the tuning error (alarm code: 25 Hex), refer to *Tuning Error* on page 7-74.

## Tuning Error

The following table summarizes the causes of tuning errors.
Sub codes can be checked by the error sub code (X003). Individual alarms occur in addition to the following alarms when regular alarm detection is activated.

| Cause of tuning error | Er7 (25h) Error sub code | Cause and countermeasure |
|---|---|---|
| Tuning result abnormality | 1 (01h)<br>2 (02h)<br>3 (03h)<br>4 (04h)<br>5059 to 5065 (13C3h to 13C9h) | When unbalance between phases or a phase loss is detected, or when an open output or short-circuit causes the tuning result to be abnormally small or large<br>→Check that there is no error occurring in the wiring between the inverter and motor.<br>→When there is an electromagnetic contactor (MC) between the inverter and motor, check to see if the contact is open. |

| Cause of tuning error | Er7 (25h) Error sub code | Cause and countermeasure |
|---|---|---|
| Sequence abnormality | 7 (07h)<br>8 (08h)<br>9 (09h) | When RUN command OFF, forced stop “STOP” and free-run stop “FRS,” etc. are input during tuning<br>→Do not turn the RUN command OFF during tuning. |
| Overcurrent abnormality | 6 (06h)<br>10 (0Ah) | When an abnormally large current flows during tuning<br>→Check the state of the mechanical brake. Also, check if the motor can be mechanically rotated. |
| Tuning frequency abnormality (Only when P004 = 2) | 13 (0Dh) | When various limit operations occur during tuning, or when a limit is applied at the maximum output frequency or frequency limiter (upper limit)<br>→Change so that the limit value becomes 50% or higher of the base frequency. |
| Error occurrence | 15 (0Fh) | When an insufficient voltage state has occurred or an alarm has occurred<br>→For details on countermeasures for individual alarms, refer to *9-1 Alarm Display and Remedies* on page 9-2. |
| Acceleration time exceeded (Only when P004 = 2) | 18 (12h) | When 3x the set value of acceleration time in F007 is exceeded for the output frequency to reach 50% of the base frequency<br>→Increase the value of F007. |
| Control method error | 21 (15h) | Although the motor is rotated for magnetic pole position tuning when P030 = 0 or 3, when P004 = 1: Tune the motor parameters while stopped is performed at this setting<br>When P004 = 5: Tune the motor parameters while stopped is performed when F042 = 15<br>→Set to the correct combination. |
| Encoder rotation direction error | 27 (1Bh) | Motor rotation direction and encoder output do not match.<br>→Check the encoder wiring, and the phase sequence of AB or UVW phase.<br>→Invert the encoder direction either by reversing the encoder wiring connections or by using parameter d014. |
| Parameter Setting error | 5003 (138Bh) | When the rated impedance or rated inductance is outside the valid (reasonable) range expected for the motor capacity and specs.<br>→Check setting of F004, F005 and P003. |
| Inability to calculate magnetic pole position | 5005 (138Dh) | PM motor only<br>When P030 = 1 or 3 is set: When the salient pole ratio of the motor inductance is small<br>When P030 = 2 is set: When there is no magnetic saturation characteristic of the motor<br>→When P030 = 1, change P087 to a small value. Note, however, that in the case of motors that are difficult to magnetically saturate, tuning is sometimes impossible.<br>→When P030 = 2 or 3, set P030 = 0, and adjust while increasing F024 in stages in increments between about 0.5 to 5.0 s until rotation tuning no longer fails. |
| Insufficient magnetic saturation | 5056 (13C0h) | PM motor only : When the magnetic saturation characteristic of the motor is small and the magnetic pole position cannot be distinguished<br>→Increase the value of P087 in stages taking about 120% as the upper limit. When there is no apparent effect, set P030 = 0 or 3, and set to about F024 = 0.5 to 5.0 s. |
| Excessive magnetic saturation | 5057 (13C1h) | PM motor only : When the magnetic saturation characteristic of the motor is large, and a large current flows for distinguishing the magnetic pole position, which is dangerous<br>→Set P087 to a small value. |

## 7-8-2 Online Tuning

When dynamic torque vector control or slip compensation control is adopted and operation is performed for a long time, motor constants change according to the rise in motor temperature. When motor constants change, the speed compensation amount of the motor changes, and this sometimes results in the motor speed deviating from the initial motor rotation speed. By enabling online tuning, the motor constants corresponding to the change in motor temperature are identified and fluctuation in motor speed is reduced.

Online tuning can be used in either of the following cases after having performed rotation tuning by auto-tuning.

- When 1st Drive Control Selection (F042)/2nd Drive Control Selection (A014) is set to “1: IM Dynamic torque vector control”
- When 1st Drive Control Selection (F042)/2nd Drive Control Selection (A014) is set to “0: IM V/f control,” and Slip compensation Function Selection (H442) is set to “1: Enable” and 1st Torque Boost Function Selection (E112)/2nd Torque Boost Function Selection (E113) is set to “1: Automatic torque boost”

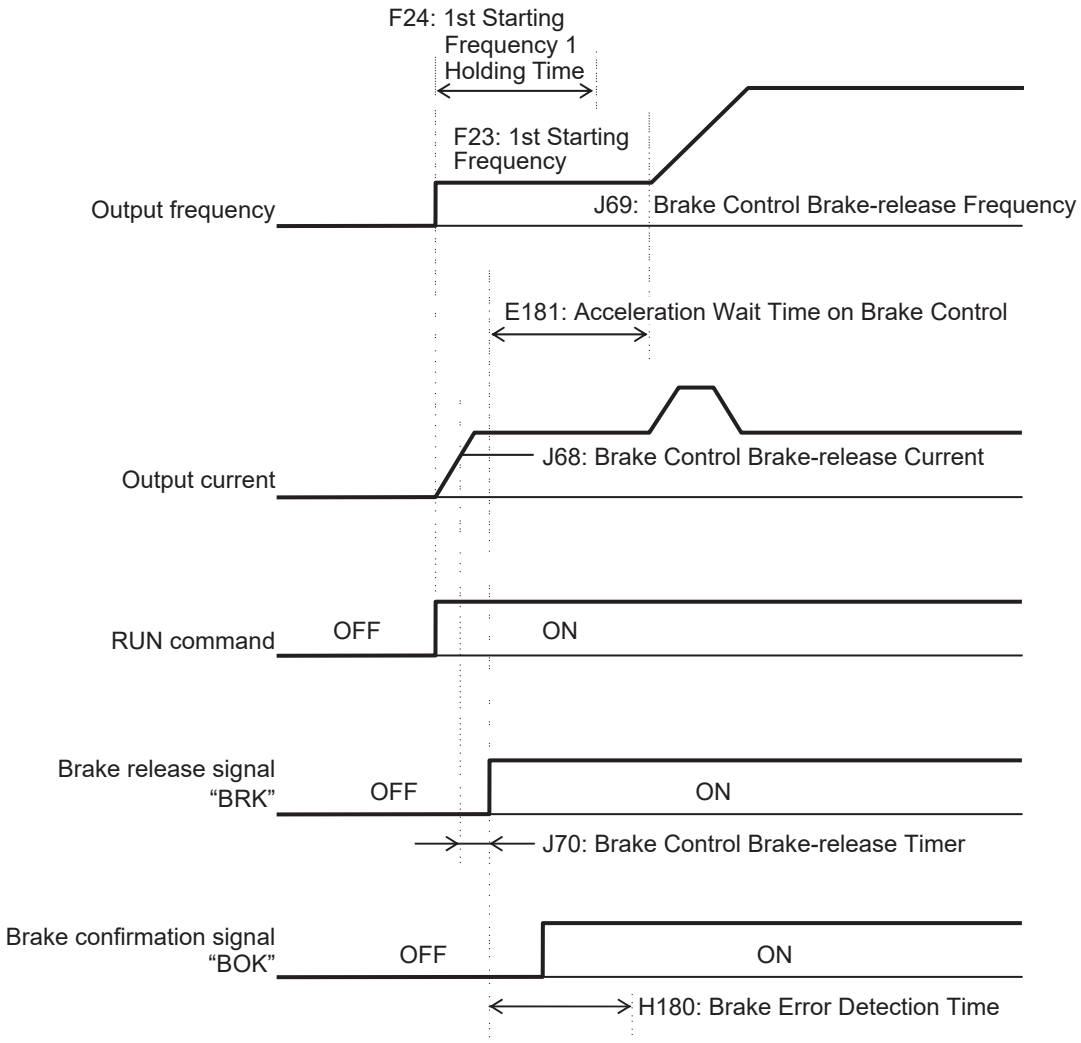
| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| P005 / A019 | 1st Online Tuning Function Selection / 2nd Online tuning Function Selection | 0: Disable<br>1: Enable | 0 | - |

# 7-9 Brake control function

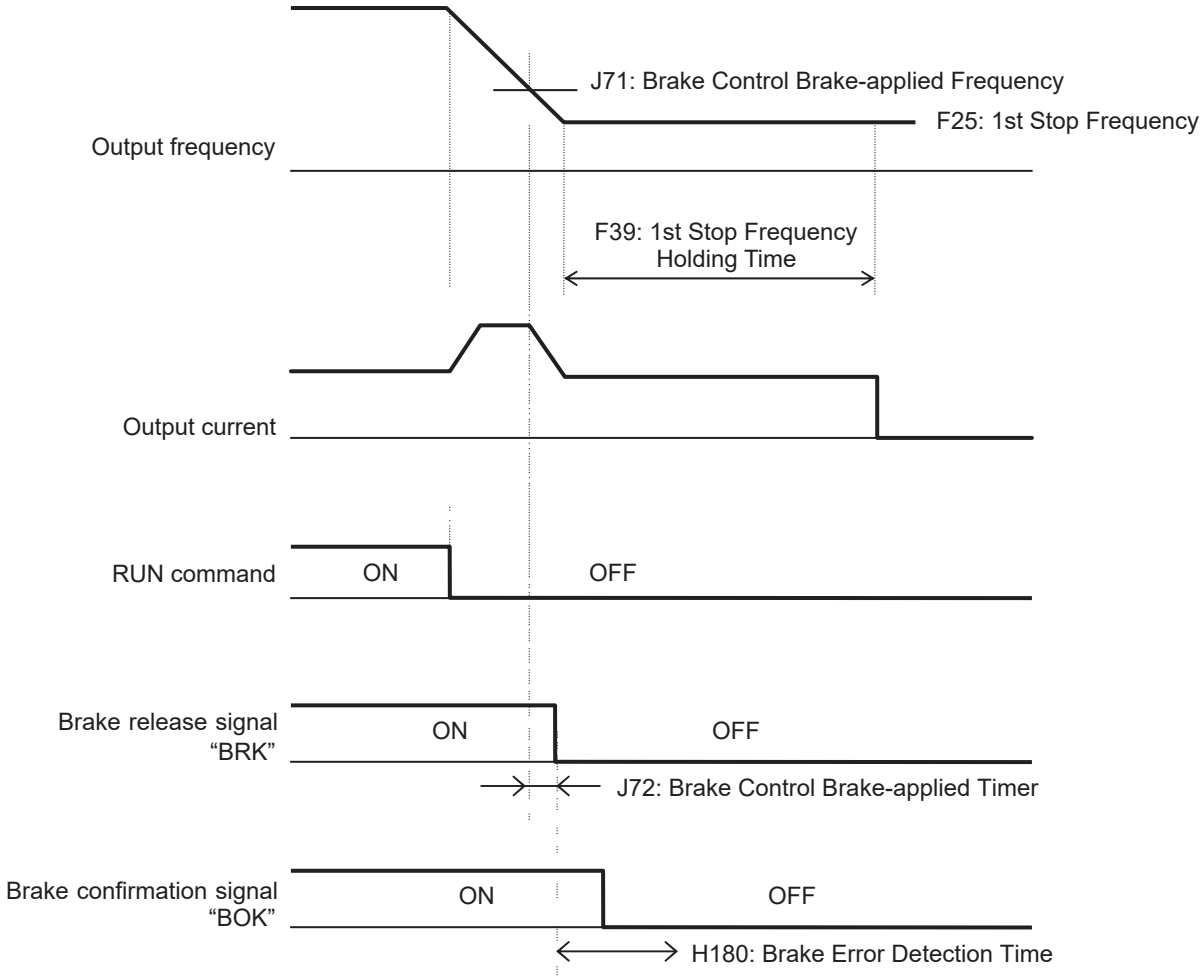
The 3G3M1 Series Inverter has a built-in brake control function for an elevating system, for example. Use this function to control the external brake used in an elevating system, for example, from the inverter.
The brake control function can be used independently of the 1st Drive Control Selection (F042)/2nd Drive Control Selection (A014) setting.

## 7-9-1 Operation Sequence of Brake Control Function

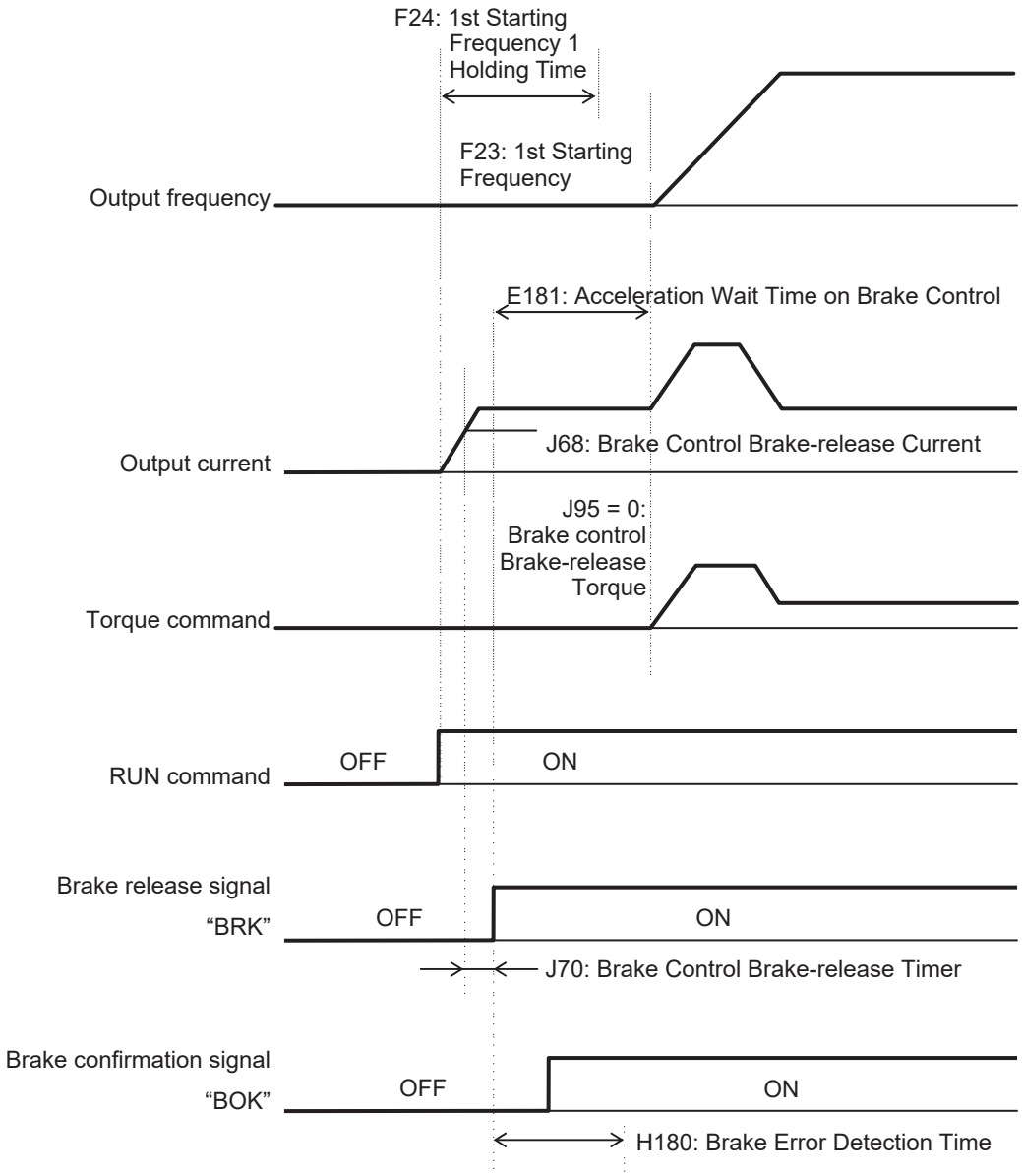
The description of operation sequence of brake control function is shown below.



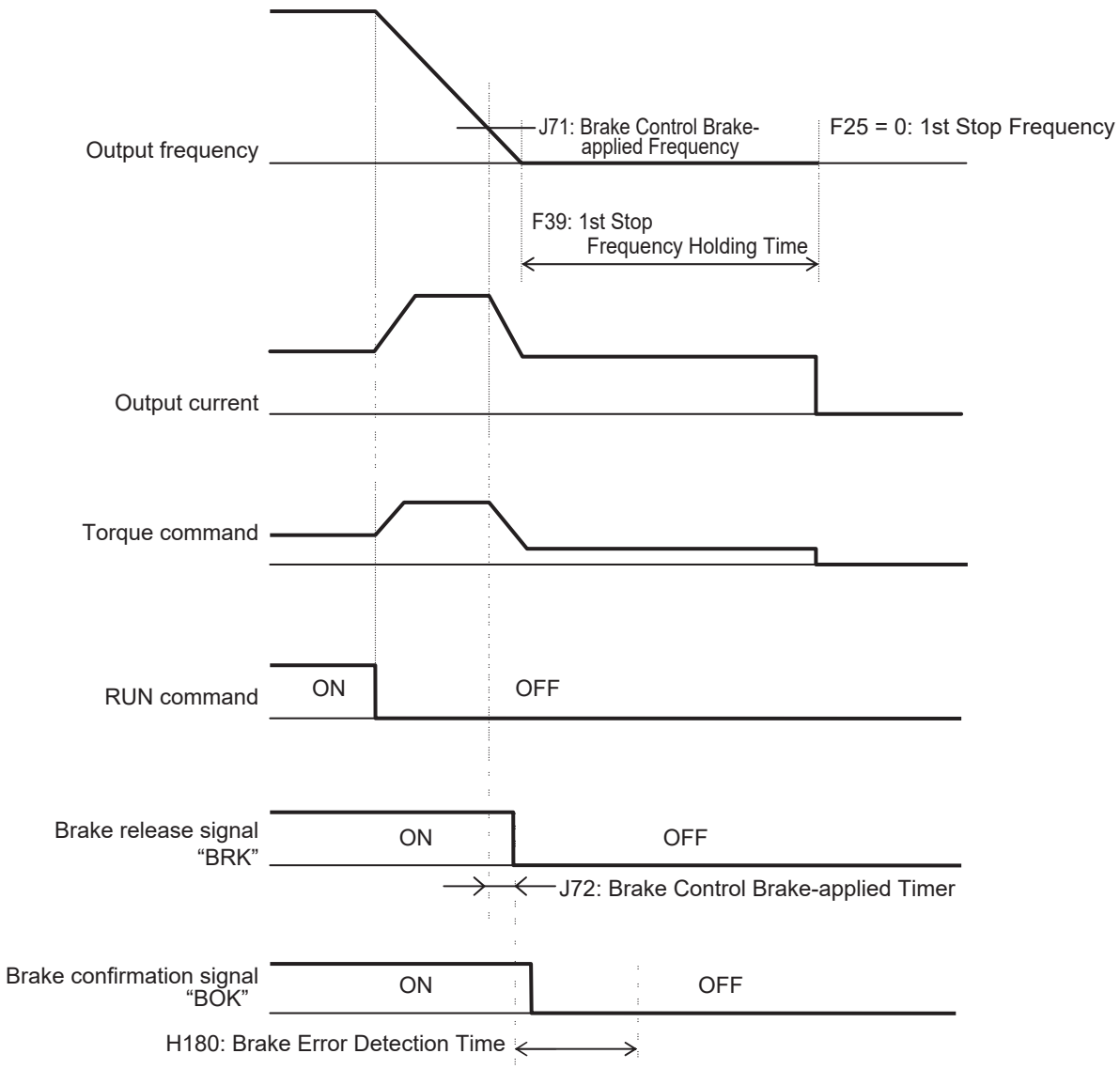

V/f control Operation time chart at startup




V/f control Operation time chart at stop




Vector control Operation time chart at startup




Vector control Operation time chart at stop

**Note** The above sequence chart shows an example where one of Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099) is set to "65: BOK (brake confirmation signal)."

## At acceleration

1. When the RUN command is input, the inverter starts output.
2. When both the output current and output frequency (in V/f control) and the output current and torque command (in vector control) reach the brake signal release level (J068, J069, J095), the inverter waits for the time set at Brake Control Brake-release Timer (J070) and then outputs the brake release signal (E020, E027 = 57: BRK).
3. After the brake release signal is output, the inverter waits for input of the brake confirmation sig- nal (E001 to E005, E098, E099 = 65: BOK) for the time set at Brake Error Detection Time (H180).
   If the brake confirmation signal is not input within the time set at H180, the inverter sets the output terminal and outputs the brake error signal (E020, E027 = 182: BER) and detects the brake error (alarm code: 24).

4. After the brake release signal is input (brake is released), the inverter waits for the time set at Acceleration Wait Time on Brake Control (E181), and performs acceleration again up to the set frequency.

### At deceleration

1. When the RUN command turns OFF, the inverter decelerates to the Brake Control Brake-applied Frequency (J071), waits for the time set at Brake Control Brake-applied Timer (J072), and turns OFF the brake release signal (E020, E027 = 57: BRK).
2. After the brake release signal is turned OFF, the inverter waits for the brake confirmation signal (E001 to E005, E098, E099 = 65: BOK) for the time set at Brake Error Detection Time (H180) to turn OFF.
   If the brake confirmation signal does not turn OFF within the time set at H180, the inverter outputs the brake error signal (E020, E027 = 182: BER) and detects the brake error (alarm code: 24).
3. After the brake confirmation signal turns OFF (after applying the brake), when the inverter arrives at the stop frequency, it waits for the time set at 1st Stop Frequency Holding Time (F039) and decelerates again to an output frequency of 0 Hz.

## 7-9-2 Brake Control Function Settings

To enable the brake control function, allocate “57: BRK (brake release)” to the multifunction output terminal.
The brake control function can be used independently of the 1st Drive Control Selection (F042)/2nd Drive Control Selection (A014) setting.
In the 3G3M1 Series, you can combine this function with the position control.
For details on how to combine this function with position control, refer to *7-7-16 Brake Control during Position Control* on page 7-62.

- Allocate the following output to Output Terminal [DO1] Function Selection (E020) or Output Terminal [ROA, ROB] Function Selection (E027).

  Brake control output : “57: BRK (brake release)”
  Brake error output : “182: BER (brake error)”
- As required, allocate “65: BOK (brake confirmation)” to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099) to use this function.
- According to your system, set the parameters used for the operation sequence.
- To generate high torque at startup, it is recommended to use the torque bias function. For details on the torque bias function, refer to *7-6-2 Torque Bias Function Settings* on page 7-33.
- Set a frequency higher than Brake Control Brake-release Frequency (J069). If the set frequency is equal to or lower than the J069 value, the inverter will detect an overload because the brake cannot be released.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| J070 | Brake Control Brake-release Timer | 0.000 to 5.000 | 1.000 | s |
| E181 | Acceleration Wait Time on Brake Control | 0.00 to 5.00 | 0.00 | s |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F039 | 1st Stop Frequency Holding Time | 0.00 to 10.00 | 0.00 | s |
| H180 | Brake Error Detection Time | 0.00 to 10.00 | 1.00 | s |
| J069 | Brake Control Brake-release Frequency*1 | 0.0 to 25.0 | 1.0 | Hz |
| J068 | Brake Control Brake-release Current*2 | 0.00 to 300.00<br>Set the motor rated torque as 100%. | 100.00 | % |
| J071 | Brake Control Brake-applied Frequency*1 | 0.0 to 25.0 | 1.0 | Hz |
| J072 | Brake Control Brake-applied Timer | 0.000 to 5.000 | 1.000 | Hz |
| J095 | Brake control Brake-release Torque | 0.00 to 300.00<br>Set the motor rated torque as 100%. | 100.00 | % |
| J096 | Brake Control Operation Selection | 0 to 31 (Decimal)<br>(Enabled only in vector control with speed sensor) | 0 | - |
| | bit 0: Target operation speed | 0: Speed detection value | 0 | - |
| | | 1: Speed command value | | |
| | | Selection of speed information used for braking judgment | | |
| | bit 4: Braking condition selection | 0: RUN command OFF disabled | 0 | - |
| | | 1: RUN command OFF enabled | | |
| | bit 6: Operation selection during position control stop | 0: BRK OFF | 0 | - |
| | | 1: BRK ON | | |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 65: BOK (brake confirmation) | - | - |
| E020 | Output Terminal [DO1] Function Selection | 57: BRK (brake release) | - | - |
| E027 | Output Terminal [ROA, ROB] Function Selection | 182: BER (brake error) | | |

*1. Set this to a value larger than 1st Starting Frequency (F023).

*2. Note that, if the set value is too low, the inverter may not output a sufficient torque when the brake is released.

# 7-10 Peripheral speed constant control

In winding systems such as wire drawing machines and spinning machines, the outer diameter of the wind-up roll increases due to the amount of material being wound onto the roll and the actual wind-up speed increases when winding is continued at a constant shaft speed. To maintain the wind-up speed at the outer periphery at a constant speed, a speed sensor is used to detect the wind-up speed, and the speed of the motor shaft is controlled so that the wind-up speed is kept constant.

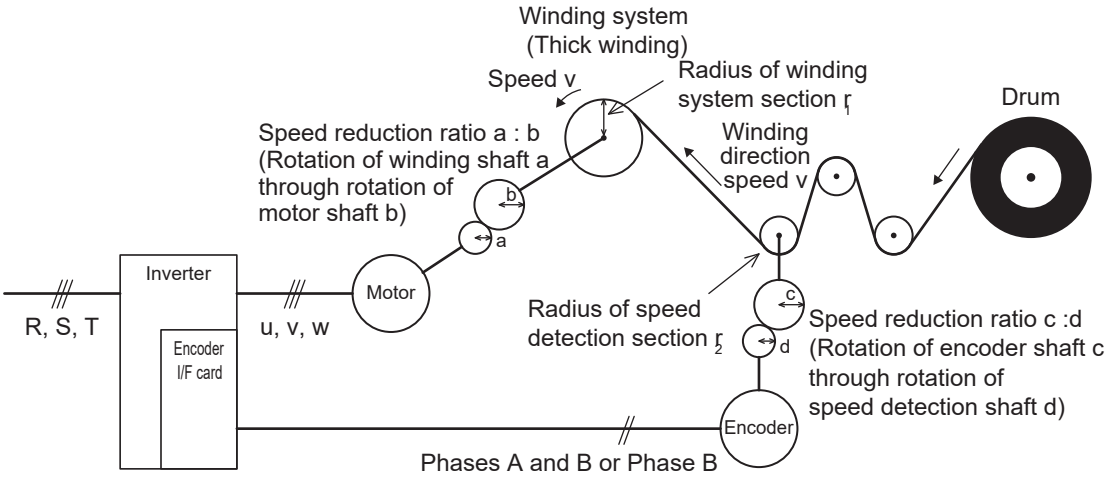
## 7-10-1 Line Speed Control Settings

Set enable/disable status for line speed control.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d041 | Special Control Selection | 1: Line speed control with speed sensor | 0 | - |
| d015 | Input Terminal [PIA][PIB] Encoder Pulse Resolution | 20 to 60000 | 1024 | Pulse |
| d016 | Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator | 1 to 32767 | 1 | - |
| d017 | Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator | 1 to 32767 | 1 | - |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 70: Line speed control cancellation<br>71: Line speed control frequency memory | - | - |

### Machine Configuration and Settings

The following parameters must be set when the mechanical system of a winder is configured as shown in the figure below.




- Speed reduction ratio of motor shaft to winding shaft: a:b

- Speed reduction ratio of speed detection shaft to encoder shaft: c:d
- Radius of winding system section before winding: r1 [m]
- Radius of speed detection section: r2 [m]

| Parameter No. | Function name | Description |
|---|---|---|
| d015 | Input Terminal [PIA][PIB] Encoder Pulse Resolution | Set the number of encoder pulses in hexadecimal [P/R] |
| d016 | Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator | Speed reduction ratio of overall mechanical system<br>$\frac{K_2}{K_1} = \frac{r_2}{r_1} \times \frac{b}{a} \times \frac{d}{c} = \frac{3014Hex\text{-}12Hex}{3014Hex\text{-}11Hex}$ |
| d017 | Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator | Set denominator coefficient (K1 = r1 × a × c) of d016 = speed reduction ratio<br>Set numerator coefficient (K2 = r2 × b × d) of d017 = speed reduction ratio |

## Line speed control cancellation

Line speed control can be canceled by the “Hz/LSC” signal. When line speed control is canceled, frequency compensation by PI arithmetic calculation is set to zero. As a result, thick winding compensation is no longer carried out and winding speed increases. Use this feature to temporarily stop control, for example, to correct thread breakage.

| Hz/LSC | Function |
|---|---|
| OFF | Line speed control enabled (According to d041) |
| ON | Line speed control canceled (V/f control, thick winding compensation OFF) |

## Line speed control frequency memory

The frequency reference that was executed can be saved to memory. By doing so, startup is performed from the saved frequency at a restart so that the peripheral speed is kept constant.

| LSC-HLD | Function |
|---|---|
| OFF | Disabled (save operation not performed) |
| ON | Enabled (frequency reference after thick winding compensation is saved) |

## Digital Setting

Set as follows to set the peripheral speed (feed speed) digitally in m/min.

| Parameter No. | Function name | Description |
|---|---|---|
| E48 | LED monitor<br>(Speed monitor item) | 5: Feed speed |

| Parameter No. | Function name | Description |
|---|---|---|
| E050 | 1st Frequency Conversion Coefficient | $K_S = \frac{240\pi \times a \times r_1}{p \times b}$<br>$K_S$: 1st Frequency Conversion Coefficient (3005Hex-33Hex)<br>p: Number of motor poles<br>a, b: Motor shaft - Winding shaft speed reduction ratio (Rotation of winding shaft a occurs when the motor shaft b rotates)<br>r1: Radius of winding system (Initial value before winding) (m) |

## Analog Setting

To set the peripheral speed (feed speed) by analog input, set analog input (0% to 100%) by the following formula.

$$\text{Analog input (\%)} = \frac{p \times b \times 100}{240\pi \times r1 \times a \times fmax} \times V$$

V: Peripheral speed (line speed) (m/min), fmax: 1st Maximum Output Frequency (F003)

## Adjustment

Just like regular speed control, the speed command filter, speed detection filter, P gain, integral time, and other parameters of the speed control system that controls peripheral speed to a constant speed must adjusted.

| Parameter No. | Function name | Description |
|---|---|---|
| d001 | Speed Control 1 Speed Command Filter | Increase the filter constant when overshooting in response to changes in the speed command is large. |
| d002 | Speed Control 1 Speed Detection Filter | Set a large filter constant to increase gain when the speed detection signal contains ripple and the gain of speed control cannot be raised. |
| d003 | Speed Control 1 P Proportional Gain | When running a motor at a speed in which hunting occurs, lower the gain. When response is slow, increase the gain. |
| d004 | Speed Control 1 I Integral Time | When response is slow, shorten the integral time. |

# 7-11 Torque limit function

## 7-11-1 Torque Limit Function Settings

The torque limit function is for limiting the output torque of the motor.

- With the torque limit function, the following torque limit values are applied according to torque limit switching 1 and 2, analog voltage and operation state allocated to 1st Drive Control Selection (F042)/2nd Drive Control Selection (A014), Torque Limit Operation Selection (H075) and multifunction input.

| Control Method | Torque Limit Operation Selection H075 | Multi-function Input | | Analog input | Operation state | Torque limit value to be applied |
|---|---|---|---|---|---|---|
| | | TRQ1 | TRQ2 | | | |
| V/f control | - | OFF | - | Available*1 | Power running*2 | Analog input |
| | | | | | Regeneration*2 | |
| | | | | Not available | Power running | F040 |
| | | | | | Regeneration | F041 |
| | | ON | | - | Power running | E016 |
| | | | | | Regeneration | E017 |
| Vector control | 0: Four quadrants independent | - | - | Available | 1st quadrant | Analog input |
| | | | | Not available | | F040 |
| | | | | - | 2nd quadrant | F041 |
| | | | | | 3rd quadrant | E016 |
| | | | | | 4th quadrant | E017 |
| | 1: Four quadrants identical | OFF | OFF | Available | - | Analog input |
| | | | | Not available | | F040 |
| | | ON | OFF | - | | F041 |
| | | OFF | ON | | | E016 |
| | | ON | ON | | | E017 |

*1. To enable analog input, set “7: Analog torque limiter” to Input Terminal [AI1] Function Selection (E061).

*2. Power running indicates the 1st and 3rd quadrants, and regeneration indicates the 2nd and 4th quadrants.

- Setting “184: TL (torque limit enabled)” to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099) enables the torque limit function only when the TL is input.
  When this terminal is reset, the torque limit setting is disabled and the inverter uses the maximum value (300%) as the torque limit value.

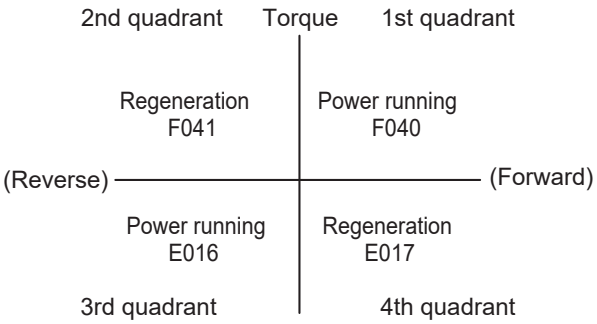
When the torque limit enabled (TL) function is not allocated to a multifunction input terminal, the torque limit function is enabled at all times.

- The torque limit function regards the motor rated torque as 100%.
- When “132: TRQ (Torque limited)” is set to Output Terminal [DO1] Function Selection (E020) or Output Terminal [ROA, ROB] Function Selection (E027), the torque limit function can be checked to see if it is activated by the status of the torque limited signal.
- To enable the torque limit value by analog voltage, set “7: Analog torque limiter” to Input Terminal [AI1] Function Selection (E061). Analog inputs 0 to 10 V are equivalent to torque limit values 0% to 300%. The torque limit value set by analog input is enabled in all operation modes.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F040 | Torque Limit 1 (power running) | 0 to 300 (In four quadrants, forward driving) | 300 | % |
| F041 | Torque Limit 2 (regeneration) | 0 to 300 (In four quadrants, reverse regeneration) | | |
| E016 | Torque Limit 3 (power running) | 0 to 300 (In four quadrants, reverse driving) | | |
| E017 | Torque Limit 4 (regeneration) | 0 to 300 (In four quadrants, forward regeneration) | | |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 14: TRQ1 (Torque limit switching 1)<br>184: TL (Torque control enabled)<br>185: TRQ2 (Torque limit switching 2) | - | - |
| E020 | Output Terminal [DO1] Function Selection | 132: TRQ (Torque limited) | - | - |
| E027 | Output Terminal [ROA, ROB] Function Selection | | | |
| E061 | Input Terminal [AI1] Function Selection | 7: Analog torque limiter | - | - |
| H074 | Torque Limit Function Selection | 0: Torque limit<br>1: Torque current limit | 1 | - |
| H075 | Torque Limit Operation Selection | 0: Four quadrants independent | 0 | - |
| | | 1: Four quadrants identical | | |
| H076 | Frequency Rising Limit for Torque Limit | 0.0 to 590.0 | 5.0 | Hz |

## Details of Four Quadrant Independent (H075 = 0)

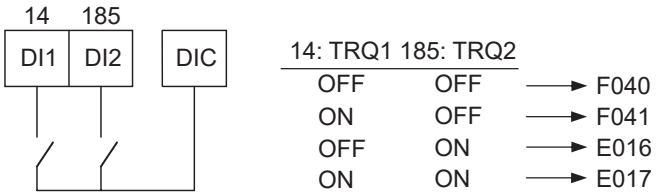
The torque limit (F040, F041, E016, E017) when “0: Four quadrant independent” is selected at Torque Limit Operation Selection (H075) is as shown in the figure below.




### Details of Four Quadrant Identical (H075 = 1)

When “1: Four quadrants identical” is selected at Torque Limit Operation Selection (H075), the torque limit value (F040, F041, E016, E017) that is switched by torque limit switching 1 and 2 allocated to multifunction input terminals is set as shown in the figure below.

Exam- ple When torque limit switching 1 (14: TRQ1) is allocated to multifunction input terminal DI1 and torque limit switching 2 (185: TRQ2) is allocated to multifunction input terminal DI2




### Details of Torque Limiter (H074 = 0)

This parameter limits the torque to a fixed value.

### Details of Frequency Rising Limit for Torque Limit (H076)

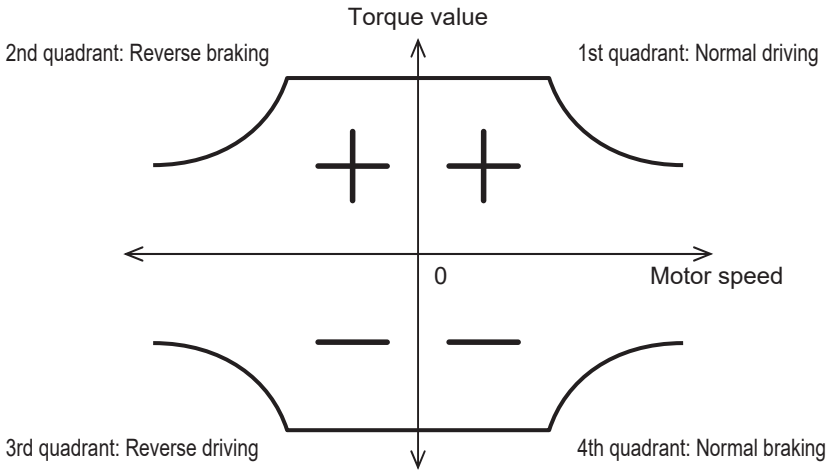
When a load is applied on the regeneration side, the actual speed of the motor is pulled to the load side to become faster than the output frequency of the inverter. When this state continues, the voltage at both ends of the main circuit capacity rises, and an overvoltage is detected and results in the inverter tripping. To avoid a trip, the overvoltage is averted by increasing the output frequency to more than the actual frequency reference. However, at this time, this torque limiter functions to apply a limit to how far the frequency rises.

## 7-11-2 Torque Monitor

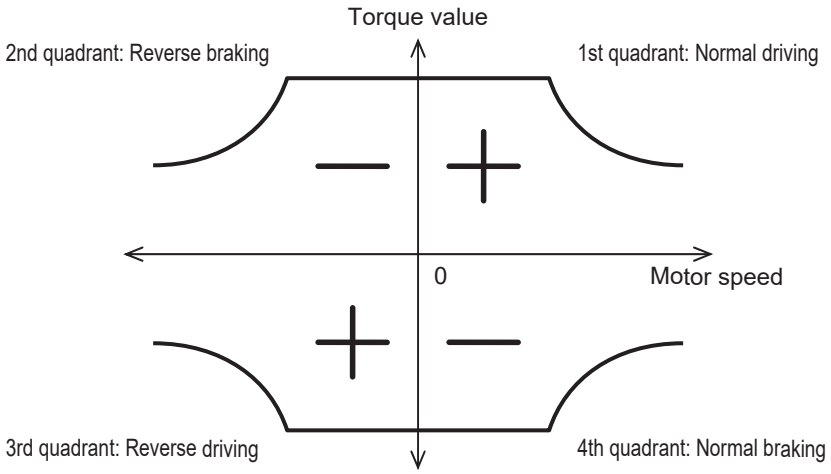
In the torque calculation value of V/f control and the torque command value in vector control, the torque polarity is generally + for drive and - for braking. When the rotational direction changes from forward rotation to reverse rotation in elevator loads or similar applications, the polarity also is reversed as torque changes from drive to braking.

When Sysmac Studio is connected to trace torque data, continuous data can no longer be acquired as the polity of the torque command value also changes interlocked with the speed polarity. The continuity of torque data can be ensured as forward drive and reverse braking is handled as + polarity and forward braking and reverse drive is handled as - polarity by setting 0 to Torque Command Monitor Polarity Selection (E049).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E049 | Torque Command Monitor Polarity Selection | 0: Torque polarity<br>1: Plus for driving Minus for braking | 1 | - |




E49 = 0 (Torque polarity)




E49 = 1 (+ driving, - braking)

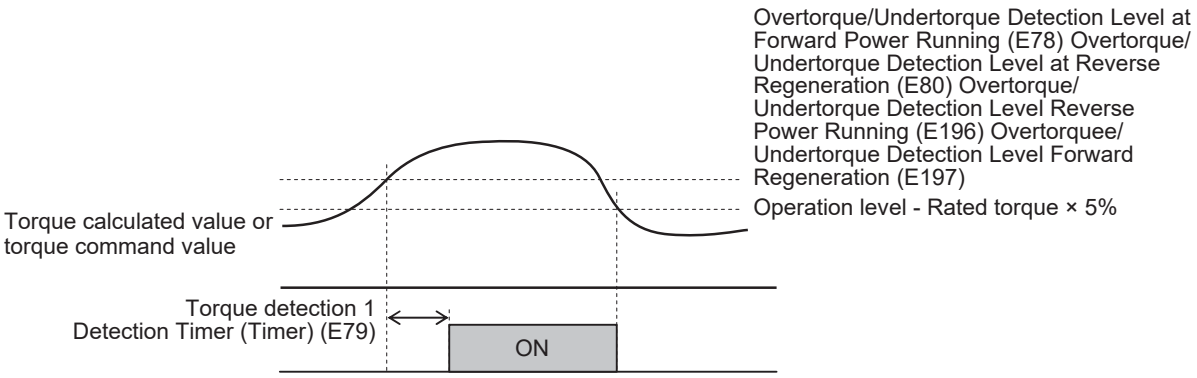
# 7-12 Overtorque/Undertorque Function

## 7-12-1 Overtorque/Undertorque Function Settings

Use this function to detect that the estimated motor output torque value exceeded the set level and output the overtorque signal.

- To enable detection of the overtorque state, allocated “46: OTQ (Over/under torque signal) (NO contact)” to Output Terminal [DO1] Function Selection (E020) or Output Terminal [ROA, ROB] Function Selection (E027). Detection of the undertorque state also can be enabled by allocating “1046: OTQ (Over/under torque signal) (NC contact).”
- The overtorque/undertorque ON signal is output when the torque value calculated by the inverter or the torque command value is at the set level of torque detection (operation level) or higher, and continues for the set time of torque command detection (timer time) or longer. The overtorque/undertorque signal is turned OFF when the torque calculation value becomes “operation level - 5% of the motor rated torque or lower.”
- The operation level can be set separately to each of the four quadrants, and the state at acceleration/deceleration and constant speed also can be selected.
- For calculating the overtorque and undertorque levels in this function, the motor rated torque is taken to be 100%.
- Use this function to detect the brake release signal of an elevator, or if the load applied to the load machine is abnormally high.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 | Output Terminal [DO1] Function Selection | 46: OTQ (Overtorque)<br>1046: OTQ (Undertorque) | - | - |
| E027 | Output Terminal [ROA, ROB] Function Selection | | | |
| E078 | Overtorque/Undertorque Detection Level at Forward Power Running | 0 to 300 | 100 | % |
| E080 | Overtorque/Undertorque Detection Level at Reverse Regeneration | 0 to 300 | 100 | % |
| E196 | Overtorque/Undertorque Detection Level Reverse Power Running | 0 to 300 | 100 | % |
| E197 | Overtorquee/Undertorque Detection Level Forward Regeneration | 0 to 300 | 100 | % |
| E079 | Torque detection 1 Detection Timer | 0.01 to 600.00 | 10.00 | s |
| E198 | Overtorque/Undertorque Detection Condition Selection | 0: Output during acceleration/deceleration and constant-speed operation<br>1: Output only during constant-speed operation | 1 | s |


Overtorque/Undertorque Detection Level at Forward Power Running (E78) Overtorque/ Undertorque Detection Level at Reverse Regeneration (E80) Overtorque/ Undertorque Detection Level Reverse Power Running (E196) Overtorquee/ Undertorque Detection Level Forward Regeneration (E197)
Operation level - Rated torque × 5%
Torque calculated value or torque command value
Torque detection 1 Detection Timer (Timer) (E79)
ON

# 8

# Other Functions

This section describes the details of miscelaneous functions.



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# 8-1 Status Monitors

This section describes the output frequency, fault monitor during trip, and other monitor functions of the inverter.

## 8-1-1 Operation Monitor

| Parameter No. | Item | Range | Display item |
|---|---|---|---|
| W003 | Output Frequency Monitor before Slip Compensation | 0.00 to 590.00 [Hz] | Output frequency 1 (before slip compensation) is displayed in increments of 0.01 Hz. |
| W115 | Output Frequency After Slip Compensation | 0.00 to 590.00 [Hz] | Output frequency 2 (after slip compensation) is displayed in increments of 0.01 Hz. |
| W005 | Output Current Monitor | 0.00 to 655.3 [A] | Output current effective value is displayed in increments of 0.01 A.<br>A current value of 100 A or higher is displayed in increments of 0.1 A. |
| W006 | Output Voltage Monitor | 0.0 to 999.0 [V] | The output voltage command value is displayed in increments of 0.1 V.<br>However, the display value changes in increments of 1.0 V. |
| W007 | Output Torque Monitor | -400 to 400 [%] | The torque calculated value, torque command value and torque current command value are displayed in increments of 1%.<br>• Rated motor torque ratio of torque calculated value in the case of V/f control and dynamic torque vector control<br>• Speed control mode of vector control: Rated motor torque ratio of speed control output (after torque bias)<br>• When the torque command is used in the torque control mode of vector control: Rated motor torque ratio of torque command value<br>• When the torque current command is used in the torque control mode of vector control: Rated motor current ratio of torque current command value |
| W002 | Frequency Reference Monitor | 0.00 to 590.00 [Hz] | Displays the set frequency in increments of 0.01 Hz. |

| Parameter No. | Item | Range | Display item |
|---|---|---|---|
| W001 | Running Status 1 Monitor | 0000Hex to FFFFHex | The operation status is displayed by a four-digit hexadecimal.<br>0000 to FFFF hex<br>Bit15: BUSY (During function code data writing)<br>Bit14: -<br>Bit13: -<br>Bit12: RL (Communications effective)<br>Bit11: ALM (Alarm relay)<br>Bit10: DEC (During deceleration)<br>Bit9: ACC (During acceleration)<br>Bit8: IL (During current limiting)<br>Bit7: VL (During voltage limiting)<br>Bit6: TL (Torque limiting)<br>Bit5: NUV; Main circuit DC voltage established<br>Bit4: BRK (During braking)<br>Bit3: INT (Inverter shut down)<br>Bit2: EXT; During DC braking or during pre-exciting<br>Bit1: REV (During reverse operation)<br>Bit0: FWD (During forward operation) |
| W110 | Motor Speed | 0.00 to 99990 [r/min] | The rotation speed is displayed as “output frequency (Hz) × 120/Number of motor poles".<br>• Value converted from the V/f control and frequency before dynamic torque vector control slip compensation based on the number of poles<br>• V/f with speed sensor, vector with speed sensor: Motor speed detection value<br>• Vector without speed sensor: Motor rotation speed estimated value |
| W111 | Load Shaft Speed | 0.00 to 99990 [m/min] | The load speed is calculated by multiplying the output frequency by (1st Frequency Conversion Coefficient (E050) / Display Coefficient 1 for Transport Time / Auxiliary Display Coefficient 1 for Speed Monitor (E039)) and displayed.<br>Load speed = Output frequency × (E050 / E039) |
| W011 | PID Process Command (After Scale Transformation) | -999 to 9990 | The PID command value is converted using PID Control Maximum Scale (J106) and PID Control Minimum Scale (J107) and displayed.<br>Display value = (PID process command (%)/100) × (Display maximum value - Display minimum value) + Display minimum value |
| W012 | PID Feedback Value Monitor | -999 to 9990 | The PID feedback value is converted using PID Control Maximum Scale (J106) and PID Control Minimum Scale (J107) and displayed.<br>Display value = (PID feedback value (%)/100) × (Display maximum value - Display minimum value) + Display minimum value<br>Even when the PID function is disabled, W012 displays the input PID feedback value. |

| Parameter No. | Item | Range | Display item |
|---|---|---|---|
| W013 | Torque Limit Value A Monitor | -300 to 300 [%] | The selected torque limit set value of the rated motor torque ratio is displayed in increments of 1%.<br>During V/f control, the power running torque limit is displayed in A and the regenerative torque limit is displayed in B.<br>During vector control and four quadrants independent (H075 = 0), the 1st/3rd quadrant torque limit is displayed in A and the 2nd/4th quadrant torque limit is displayed in B. 1st and 3rd, and 2nd and 4th are switched depending on forward rotation or reverse rotation.<br>During vector control and four quadrants identical (H075 = 1), the same value is displayed in A and B.<br>The torque limit is selected by the torque limit function. (Reference: *7-11 Torque limit function* on page 7-86) |
| W014 | Torque Limit Value B Monitor | | |
| W015 | Ratio value Monitor | 0.00 to 200.0 [%] | A ratio set value of 1.00 time selected via analog input is displayed as 100%.<br>W015 displays the input ratio set value even when no ratio set value is selected for analog input. |
| W010 | Feed Speed | 0.00 to 99990 [m/min] | The feed speed is calculated by multiplying the output frequency by (1st Frequency Conversion Coefficient (E050) / Display Coefficient 1 for Transport Time / Auxiliary Display Coefficient 1 for Speed Monitor (E039)) and displayed.<br>Feed speed = Output frequency × (E050 / E039) |
| W144, W145 | TargetPosition Monitor (MSB), TargetPosition Monitor (LSB) | -2147483648 to 2147483647 (80000000h to 7FFFFFFFh)<br>(MSB: -32768 to 32767,<br>LSB: 0 to 65535) | The target stop position user value (hexadecimal) is displayed in upper bytes/lower bytes. |
| W142, W143 | Feedback Current Position Monitor (MSB), Feedback Current Position Monitor (LSB) | | The current position is displayed in upper bytes/lower bytes. |
| W146, W147 | Position Deviation Monitor (MSB), Position Deviation Monitor (LSB) | | The position deviation is displayed in upper bytes/lower bytes. |
| W152 | Touch Probe Status | 0000 hex to FFFF hex (Hexadecimal) | Bit0: Touch probe 1 Enb<br>Bit1: Touch probe 1 PLc<br>Bit8: Touch probe 2 Enb<br>Bit9: Touch probe 2 PLc<br>Other than the above: Reserved |
| W032 | PID Output Monitor | -150 to 150.0 [%] | The PID output value is displayed in increments of 0.01%. (The maximum frequency is 100%.)<br>If PID control is disabled, W032 displays 0. |

| Parameter No. | Item | Range | Display item |
|---|---|---|---|
| W026 | Magnetic Flux Command Value | 0 to 999 [%] | The flux command value is displayed in increments of 1%.<br>The magnetic flux command calculated by vector control is displayed. 0 is displayed for other than vector control.<br>In the case of an induction motor (IM), the magnetic flux that is generated when a current equivalent to the no-load current flows is displayed on the monitor as 100%.<br>In the case of a synchronous motor (PM), the magnetic flux equivalent to the PM Motor Induced Voltage (P063) is displayed on the monitor as 100%. |
| M074 | Running Status 2 Monitor | 0000Hex to FFFFHex | The operation status is displayed by a four-digit hexadecimal.<br>0000 to FFFF hex<br>Bit15: Motor type (1: PM motor / 0: Induction motor)<br>Bit14: During EN circuit diagnosis<br>Bit7: During speed control (1 during control)<br>Bit5 Bit4: Select motor<br>00: 1st motor<br>01: 2nd motor<br>10: Reserved<br>11: Reserved<br>Bit3 to Bit0: Control method<br>0000: V/f control without slip compensation 0001: Dynamic torque vector control<br>0010: V/f control with slip compensation<br>0011: V/f control with speed sensor<br>0100: Dynamic torque vector control with speed sensor<br>0101: Vector control without speed sensor<br>0110: Vector control with speed sensor<br>0111: Torque control (Vector control without speed sensor)<br>1000: Torque control (Vector control with speed sensor) |
| W116 | PG Feedback Value | 0.00 to 590.0 [Hz] | The value obtained by converting the PG feedback value to frequency is displayed in Hz. |
| W118 | Torque Bias Monitor | -999 to 999 | Displays the torque bias command value selected by Torque Bias Function Selection (H154), Select torque bias 1 (60: TB1) terminal or Select torque bias 2 (61: TB2) terminal. (Displayed in % with respect to the rated motor torque) |
| W153 | Pulse Input Rate for A/B Phase of Reference Side | -327.68 to 327.67 [p/s] | The pulse rate entered in the AB phase of the PG used as the input function selection command (reference) side is displayed. (in increments of 0.01 [kp/s]) |
| W154 | Pulse Input Rate for Z Phase of Reference Side | 0 to 16000 [p/s] | The pulse rate entered in the Z phase of the PG used as the input function selection command (reference) side is displayed. |

| Parameter No. | Item | Range | Display item |
|---|---|---|---|
| W155 | Pulse Input Rate for A/B Phase of Feedback Side | -327.68 to 327.67 [p/s] | The pulse rate entered in the AB phase of the PG used as the return (follower) side is displayed. (in increments of 0.01 [kp/s]) |
| W156 | Pulse Input Rate for Z Phase of Feedback Side | 0 to 16000 [p/s] | The pulse rate entered in the Z phase of the PG used as the return (follower) side is displayed. |

## Operation Status 1 Monitor [M014]

The operation status displays the status allocated to each bit by a four-digit hexadecimal.
The allocation for 0 to 15 bits of the operation status is described in the table below.

| Bit | Symbol | Description |
|---|---|---|
| 15 | BUSY | During parameter code data writing |
| 14 | WR | Fixed to 0 |
| 13 | | Fixed to 0 |
| 12 | RL | Communications effective (the condition when the RUN command is issued from communication, or when the set frequency is referenced) |
| 11 | ALM | Alarm occurrence |
| 10 | DEC | During deceleration |
| 9 | ACC | During acceleration |
| 8 | IL | During current limiting |
| 7 | VL | During voltage limiting |
| 6 | TL | Torque limiting |
| 5 | NUV | Main Circuit DC Voltage > Undervoltage level |
| 4 | BRK | During braking |
| 3 | INT | Inverter output is being intercepted |
| 2 | EXT | Direct DC braking |
| 1 | REV | During reverse operation |
| 0 | FWD | During forward operation |

## Running Status 2 Monitor [M074]

The operation status 2 displays the status allocated to each bit by a four-digit hexadecimal.
The allocation for 0 to 15 bits of the operation status is described in the table below.

| Bit | Symbol | Description |
|---|---|---|
| 15 | - | Synchronous motor drive |
| 14 | - | During EN circuit diagnosis |
| 13 | - | Not used |
| 12 | - | |
| 11 | - | |
| 10 | - | |
| 9 | - | |
| 8 | - | |
| 7 | - | During speed control (torque control) |
| 6 | - | Not used |

| Bit | Symbol | Description |
|---|---|---|
| 5 | - | Motor selection<br>00: 1st motor<br>01: 2nd motor |
| 4 | - | |
| 3 | - | Control Method<br>0000: V/f control without slip compensation<br>0001: Dynamic torque vector control<br>0010: V/f control with slip compensation<br>0011: V/f control with speed sensor<br>0100: Dynamic torque vector control with speed sensor<br>0101: Vector control without speed sensor<br>0110: Vector control with speed sensor<br>1011: Torque control (vector control with speed sensor) |
| 2 | - | |
| 1 | - | |
| 0 | - | |

## 8-1-2 I/O check

| Parameter No. | Item | Range | Display item |
|---|---|---|---|
| W040, W041 | Input Terminal Monitor, Output Signal Monitor | 0000 hex to FFFF hex | Displays the ON/OFF status of the input terminals [DI1] to [DI7], output terminals [DO1], [ROA, ROB] and the [EN1] and [EN2] terminals. |
| W042, W043 | Communications Input Signal Monitor, Communications Control Output Signal Monitor | 0000 hex to FFFF hex | Displays the ON/OFF status of the input terminals [DI1] to [DI7], [EN1], [EN2], RST (reset command), REV (reverse command), FWD (forward command) and the output terminals [DO1], [ROA, ROB] instructed via communication based on RS-485. |
| W044 | Input Terminal [AI1] Input Voltage Monitor | 0.0 to 12.0 [V] | The input voltage of the analog input terminal [AI1] is displayed in increments of 0.1 V. |
| W055 | Pulse Input (A/B Phase [PIA][PIB]) | -327.68 to 327.67 [p/s] | The pulse rate entered in the pulse input terminal [PIA] [PIB] is displayed. (in increments of 0.01 [kp/s])<br>Displayed without quad edge evaluation regardless of the pulse format. |
| W056 | Pulse Input (Z Phase [PIB]) | 0 to 16000 [p/s] | The pulse rate entered in the pulse input terminal [PIZ] is displayed. |
| X097 | Input Input Terminal [PTC] Input Voltage | -12.0 to 12.0 [V] | The thermistor input terminal [PTC] input voltage is displayed in increments of 0.1 V.<br>*Since this item is shared with other terminal functions, “999” is displayed when it is disabled due to switching by the hardware SW. |

### Digital Input/Output Terminal Monitor [W040, W041]

The status of I/O allocated to each bit for the digital input/output terminal monitor is indicated by a four-digit hexadecimal.
The allocation for 0 to 15 bits of the terminal I/O status is described in the table below.

Input Terminal Monitor [W040]

| Bit | Symbol | Description |
|---|---|---|
| 15 | - | Not used |
| 14 | - | |
| 13 | - | |
| 12 | EN2 | 1 by input |
| 11 | EN1 | |
| 10 | - | Not used |
| 9 | - | |
| 8 | - | |
| 7 | - | |
| 6 | DI5 | 1 by input |
| 5 | DI4 | |
| 4 | DI3 | |
| 3 | DI2 | |
| 2 | DI1 | |
| 1 | DI7 | |
| 0 | DI6 | |

Output Signal Monitor [W041]

| Bit | Symbol | Description |
|---|---|---|
| 15 | - | Not used |
| 14 | - | |
| 13 | - | |
| 12 | - | |
| 11 | - | |
| 10 | - | |
| 9 | ROA, ROB | 1 by output |
| 8 | - | Not used |
| 7 | - | |
| 6 | - | |
| 5 | - | |
| 4 | - | |
| 3 | - | |
| 2 | - | |
| 1 | - | |
| 0 | DO1 | 1 by output |

## Communications Control Signal (Input/Output) Monitor [W042, W043]

The status of I/O by communication allocated to each bit for the communications control signal (input/output) monitor is indicated by a four-digit hexadecimal.
The allocation for 0 to 15 bits of the terminal I/O status is described in the table below.

Communications Input Signal Monitor [W042]

| Bit | Symbol | Description |
|---|---|---|
| 15 | RST | 1 by input |
| 14 | DI7 | |
| 13 | DI6 | |
| 12 | | Not used |
| 11 | | |
| 10 | | |
| 9 | | |
| 8 | | |
| 7 | | |
| 6 | DI5 | 1 by input |
| 5 | DI4 | |
| 4 | DI3 | |
| 3 | DI2 | |
| 2 | DI1 | |
| 1 | REV | |
| 0 | FWD | |

Communications Control Output Signal Monitor (W043)

| Bit | Symbol | Description |
|---|---|---|
| 15 | - | Not used |
| 14 | - | |
| 13 | - | |
| 12 | - | |
| 11 | - | |
| 10 | - | |
| 9 | ROA, ROB | 1 by output |
| 8 | - | Not used |
| 7 | - | |
| 6 | - | |
| 5 | - | |
| 4 | - | |
| 3 | - | |
| 2 | - | |
| 1 | - | |
| 0 | DO1 | 1 by output |

## 8-1-3 Maintenance Information

| Parameter No. | Item | Range | Display item |
|---|---|---|---|
| W070 | Total Power ON Time Monitor | 0 to 655350 hours | The cumulative operation time (the time when the main power supply is ON) of the inverter is displayed.<br>Measurement range: 0 to 655350 hours<br>If 655350 hours is exceeded, the accumulation operation stops. |

| Parameter No. | Item | Range | Display item |
|---|---|---|---|
| W071 | Main circuit DC voltage Monitor | 0.0 to 999.0 [V] | Although the Main Circuit DC Voltage of the inverter is displayed in increments of 0.1 V, the data changes in increments of 1 V. |
| W072 | Internal Air Highest Temperature | 20 to 125 [°C] | The maximum value of the internal air temperature for each hour is displayed in increments of 1 degree.<br>Display unit: °C (for 20°C and below, 20°C is displayed.)<br>Since there is no internal air temperature sensor in 15 kW and lower models, W072 displays 0. |
| W073 | Heat Sink Maximum Temperature | 20 to 125 [°C] | The maximum value of the cooling fin temperature for each hour is displayed.<br>Display unit: °C (for 20℃ and below, 20℃ is displayed.) |
| W074 | Maximum Effective Current Value | 0.00 to 999.9 [A] | The maximum effective current value for each hour is displayed. |
| W075 | Main Circuit Capacitor's Capacitor Monitor | 0.0 to 100.0 [%] | The factory default value of the current main circuit capacitor's capacitor is displayed as 100.0%. |
| W067 | Cumulative Run Time of Capacitors on Printed Circuit Boards | 0 to 9999 [x10h] | The time obtained by multiplying the coefficient based on the ambient temperature conditions with the cumulative time during which voltage is applied to the electrolytic capacitors on printed circuit boards is displayed as the cumulative operation time.<br>Measurement range: 0 to 99990 hours<br>If 99990 hours is exceeded, the accumulation operation stops.<br>For details, refer to *8-8-10 Capacitor Life Warning Signal (WAC)* on page 8-89. |
| W068 | Cumulative Run Time of Cooling Fan | 0 to 9999 [x10h] | The cumulative time when the cooling fan was operating is displayed.<br>Counting is not performed when the Cooling Fan Function Selection (Object H006) is enabled and the cooling fan has stopped.<br>Measurement range: 0 to 99990 hours<br>If 99990 hours is exceeded, the accumulation operation stops. |
| W078 | Number of Startups | 0 to 65530 | The number of operations of the 1st motor (number of times the RUN command for the inverter is turned ON) is calculated and displayed.<br>If 65530 operations is exceeded, the value returns to 0 and the calculation continues. |

| Parameter No. | Item | Range | Display item |
|---|---|---|---|
| W081 | Integrated Power Monitor | 0.000 to 9999 [100kWh] | The integrating electric power consumption is displayed. 0.1 kWh to 999,900 kWh is displayed for 0.001 to 9999, with 1 = 100 kWh. The value returns to 0 at 1,000,000 kWh.<br>The integrated electric power consumption and the integrated electric power data can be reset by setting Display Coefficient for Integrated Power (E051) to “0.000.” If 999,900 kWh is exceeded, the value returns to 0. Integration is not performed when 0.000 is still set. |
| W082 | Data Used Integrating Electric Power | 0.001 to 9999 | The integrated electric power consumption (1.000 = 100 kWh) × Display Coefficient for Integrated Power (E051) is displayed as the integrated electric power data.<br>The setting range of Display Coefficient for Integrated Power (E051) is 0.000 to 9999. Display unit: None<br>If 9999 is exceeded, the accumulation operation stops.<br>The decimal point position moves depending on the size of the integrated electric power data, and the display resolution changes. The integrated electric power data can be reset by setting E051 to “0.000.” Integration is not performed when 0.000 is still set. |
| W087 | Inverter ROM Version 1 Main | 0 to 59999 | The version of the inverter ROM1 is displayed. |
| W088 | Inverter ROM Version 2 Sub | 0 to 59999 | The version of the inverter ROM2 is displayed. |
| Z040 | 1st Cumulative Run Time | 0 to 9999 [x10h] | The cumulative time of the 1st motor run time is displayed.<br>Measurement range: 0 to 99990 hours<br>If 99990 hours is exceeded, the value returns to 0 and the calculation continues. |
| M061 | Inverter Internal Air Temperature Monitor (Real-time value) | 20.0 to 125.0 [°C] | The current internal temperature of the inverter is displayed. Although the display is in increments of 0.1°C, the data changes in increments of 1°C.<br>Display unit: °C<br>Since there is no internal air temperature sensor in 15 kW and lower models, “--------” is displayed. 0 is displayed in M061. |
| M062 | Fin Temperature Monitor (Real-time value) | 20.0 to 125.0 [°C] | The current temperature of the cooling fin inside the inverter is displayed. Although the display is in increments of 0.1°C, the data changes in increments of 1°C.<br>Display unit: °C |

| Parameter No. | Item | Range | Display item |
|---|---|---|---|
| M076 | Service Life of Main Circuit Capacitor Elapsed Time | 0 to 6553 [10h] | The time during which voltage is applied to the electrolytic capacitor of the main circuit is displayed as the cumulative elapsed time. The capacity of the electrolytic capacitor of the main circuit is measured when the main power supply is OFF, and the elapsed time is corrected. Measurement range: 0 to 65530 hours If 65530 hours is exceeded, the accumulation operation stops. |
| M077 | Service Life of Main Circuit Capacitor Remaining Time | 0 to 6553 [10h] | The time remaining until the service life of the electrolytic capacitor of the main circuit is displayed. |
| Z041 | 2nd Cumulative Run Time of motor | 0 to 9999 [x10h] | The cumulative time of the 2nd motor run time is displayed. |
| M081 | 1st Remaining Time before the Next Motor Maintenance | 0 to 9999 [x10h] | The time until the next maintenance is displayed. The value obtained by subtracting the cumulative motor run time from 1st Motor Maintenance Interval (H078) is displayed. (This function is available only for the 1st motor) Display: 0 to 99990 |
| Z044 | 2nd Number of Startups | 0 to 65530 | The number of operations of the 2nd motor (number of times the RUN command for the inverter is turned ON) is accumulated. |
| M085 | 1st Remaining Startup Times before the Next Motor Maintenance | 0 to 65530 | The number of startups until the next maintenance is displayed. The value obtained by subtracting the number of startups from 1st Preset Startup Count for Motor Maintenance (H079) is displayed. (This function is available only for the 1st motor) |

| Parameter No. | Item | Range | Display item |
|---|---|---|---|
| M086 | Latest Light Alarm Factor | 00 hex to FF hex | The contents of the minor alarm that occurred recently, the last to third last time are displayed by a code.<br>0 to 254 (00 hex to FE hex)<br>0(0x00): No alarm<br>17(0x11): OH1; Heat sink overheat<br>18(0x12): OH2; External alarm input<br>19(0x13): OH3; Inverter internal overheat<br>22(0x16): dbH; Braking resistor overheat<br>23(0x17): OL1; Motor 1 overload (electronic thermal overload relay)<br>24(0x18): OL2; Motor 2 overload (electronic thermal overload relay)<br>34(0x22): Er4; Option card communications error<br>35(0x23): Er5; Option card error<br>47(0x2F): ErE; Following error (excessive speed deviation)<br>53(0x35): ErP; RS-485 communications error (Option card)<br>56(0x38): Ero; Position control error<br>58(0x3A): CoF PID feedback disconnection detected<br>100(0x64): FAL; Detect DC fan lock<br>101(0x65): OL; Motor overload early warning<br>102(0x66): OH; Heat sink overheat early warning<br>103(0x67): LiF; Lifetime alarm<br>104(0x68): rEF; Reference loss<br>105(0x69): Pid; PID alarm<br>106(0x6A): UTL; Low output torque detection<br>107(0x6B): PTC PTC thermistor activated<br>108(0x6C): rTE; Inverter life (Cumulative run time)<br>109(0x6D): CnT; Inverter life (Number of start-ups) |
| M087 | Light Alarm Factor Last | | |
| M088 | Light Alarm Factor 2nd Last | | |
| M089 | Light Alarm Factor 3rd Last | | |
| W161 | Braking Resistor Thermal Monitor | 0.0 to 100.0% | The percentage of the electronic thermal calculated value for motor protection at the current moment is displayed. If the percentage reaches 100.0%, the dBH alarm occurs. |
| M059 | Motor Electronic Thermal Monitor | 0.0 to 100.0% | The percentage of the electronic thermal calculated value for motor protection at the current moment is displayed. If the percentage reaches 100.0%, the OL1 (1st motor overload) or OL2 (2nd motor overload) (depending on whether the 1st control or 2nd control is selected) occurs. |
| W179 | Total RUN Time Monitor | 0 to 655350 hours | The cumulative time of the inverter RUN state is displayed.<br>Measurement range: 0 to 655350 hours<br>If 655350 hours is exceeded, the accumulation operation stops. |

## 8-1-4 Alarm information

| Parameter No. | Item | Range | Display item |
|---|---|---|---|
| **1 Latest alarm** | | | |
| X020 | Latest Alarm Info. Output Frequency | 0.00 to 99.99, 100.0 to 590.0 [Hz] | The output frequency before slip compensation is displayed in increments of 0.01 Hz. A value of 100.0 Hz or higher is displayed in increments of 0.1 Hz. |
| X021 | Latest Alarm Info. Output Current | 0.00 to 99.99, 100.0 to 655.3 [A] | The output current is displayed. A current value of 100.0A or higher is displayed in increments of 0.1 A. Display unit: A (Ampere) |
| X022 | Latest Alarm Info. Output Voltage | 0 to 999 [V] | The output voltage is displayed.<br>Display unit: V (Volt) |
| X023 | Latest Alarm Info. Torque Monitor | -400 to 400 [%] | The torque calculated value is displayed. |
| X024 | Latest Alarm Info. Frequency Command | 0.00 to 99.99, 100.0 to 590.0 [Hz] | The set frequency is displayed. |
| X025 | Latest Alarm Info. Running Status 1 | 0000Hex to FFFF Hex | The operation status is displayed by a four-digit hexadecimal.<br>0000 to FFFF hex<br>Bit 15: BUSY (During function code data writing)<br>Bit14: -<br>Bit13: -<br>Bit12: RL (Communications effective)<br>Bit11: ALM (Alarm relay)<br>Bit10: DEC (During deceleration)<br>Bit9: ACC (During acceleration)<br>Bit8: IL (During current limiting)<br>Bit7: VL (During voltage limiting)<br>Bit6: TL (Torque limiting)<br>bit5: NUV (Main circuit DC voltage established)<br>Bit4: BRK (During braking)<br>Bit3: INT (Inverter shut down)<br>Bit2: EXT; During DC braking or during pre-exciting<br>Bit1: REV (During reverse operation)<br>Bit0: FWD (During forward operation) |
| X026 | Latest Alarm Info. Cumulative Ope. time | 0 to 655,350 hours | The cumulative inverter run time (the time when the main power supply is ON) when an error occurs is displayed. |
| X027 | Latest Alarm Info. Number of Startups | 0 to 65530 | The number of operations of the motor selected when an alarm occurred (number of times the RUN command for the inverter is turned ON) is accumulated. |
| X028 | Latest Alarm Info. Main Circuit DC Voltage | 0.0 to 999.0 [V] | The Main Circuit DC Voltage of the inverter is displayed. |
| X029 | Latest Alarm Info. Internal Air Temperature | 20 to 125 [°C] | The internal air temperature during the occurrence of an alarm is recorded and displayed. For 20°C and below, 20°C is displayed.<br>Display unit: °C |

| Parameter No. | Item | Range | Display item |
|---|---|---|---|
| X030 | Latest Alarm Info. Heat Sink Temperature | 20 to 125 [°C] | The heat sink temperature during the occurrence of an alarm is recorded and displayed. For 20°C and below, 20°C is displayed.<br>Display unit: °C |
| X031 | Latest Alarm Info. Input Terminal (Hexadecimal display) | 0000Hex to FFFF Hex | The final command value of the terminal block input signal when an alarm occurs is displayed by a four-digit hexadecimal.<br>The display format is the same as the expression of I/O check. (Refer to *8-1-2 I/O check* on page 8-8.) |
| X032 | Latest Alarm Info. Output Terminal (Hexadecimal display) | 0000Hex to FFFF Hex | The final command value of the terminal block output signal when an alarm occurs is displayed by a four-digit hexadecimal.<br>The display format is the same as the expression of I/O check. (Refer to *8-1-2 I/O check* on page 8-8.) |
| X001 | Latest Multiple Alarm1 | Alarm code display | Simultaneously occurring alarm code (1st) when a main alarm occurred or while it is occurring |
| X002 | Latest Multiple Alarm2 | Alarm code display | Simultaneously occurring alarm code (2nd) when a main alarm occurred or while it is occurring |
| X033 | Latest Alarm Info. Input Terminal via Communication (Hexadecimal display) | 0000Hex to FFFF Hex | The final command value of the communication input signal when an alarm occurs is displayed by a four-digit hexadecimal. |
| X034 | Latest Alarm Info. Output Terminal via Communication (Hexadecimal display) | 0000Hex to FFFF Hex | The final command value of the communication output signal when an alarm occurs is displayed by a four-digit hexadecimal. |
| X003 | Latest Alarm Sub Code 1 | 0 to 9999 | An auxiliary code for the alarm factors is displayed. |
| X036 | Latest Alarm Info. Running Status 2 | 0000Hex to FFFF Hex | The running status 2 is displayed by a four-digit hexadecimal.<br>0000 to FFFF hex<br>Bit15: Motor type (1: PM motor / 0: Induction motor)<br>Bit14: During EN circuit diagnosis<br>Bit7: During speed control (1 during control)<br>Bit5 Bit4: Select motor<br>00: 1st motor<br>01: 2nd motor<br>10: Reserved<br>11: Reserved<br>Bit3 to Bit0: Control method<br>0000: V/F control without slip compensation 0001: Dynamic torque vector control<br>0010: V/F control with slip compensation<br>0011: V/F control with speed sensor<br>0100: Dynamic torque vector control with speed sensor<br>0101: Vector control without speed sensor<br>0110: Vector control with speed sensor<br>0111: Torque control (Vector control without speed sensor)<br>1000: Torque control (Vector control with speed sensor) |

| Parameter No. | Item | Range | Display item |
|---|---|---|---|
| X037 | Latest Alarm Info. Speed Detection | B1E0(-fmax) to 4E20(fmax) | The speed detection value is displayed.<br>The speed detection value with ±maximum frequency = ±20000 expressed in hexadecimal is displayed in increments of ±0.01 Hz. |
| X038 | Latest Alarm Info. Running Status 3 | 0000Hex to FFFF Hex | The running status 3 is displayed by a four-digit hexadecimal.<br>0000 to FFFF hex<br>Bit15: ---<br>Bit14: OL (Overload warning)<br>Bit13: LOC (Light load detection signal)<br>Bit12: OL2 (Overload warning 2)<br>Bit11: OLP (Overload prevention controlling)<br>Bit10: LIFE (Lifetime alarm)<br>Bit9: OHF (Fin Overheat warning)<br>Bit8: TRY (During retry)<br>Bit7: FAN (Fan operation signal)<br>Bit6: REF (RUN command source)<br>Bit5: THM (Thermal warning)<br>Bit4: IPF (During restart after instantaneous power failure)<br>Bit3: SETM (2nd motor selection)<br>Bit2: IRDY (Operation ready signal)<br>Bit1: FDT1 (Over set frequency arrival signal 1)<br>Bit0: FAR1 (Frequency arrival signal 1 (constant speed)) |
| X004 | Latest Multiple Alarm Sub Code 2 | 0 to 9999 | The sub code when multiple alarms occurred is displayed. |
| X108 | Latest Alarm Info. Cumulative Running Time | 0 to 655,350 hours | The cumulative time of the inverter RUN state is displayed. |
| X049 | Fault Counter | 0 to 65535 | The number of times the inverter trips is displayed.<br>The number of times is saved in the EEPROM when the power is turned OFF.<br>Counting is performed from 0 to 65535, and if 65535 times is exceeded, the accumulation operation stops.<br>By setting “7: Clear alarm history” to Data Initialization (H003), the value is cleared to 0. |
| **2 The last alarm** | | | |
| X060 | Last Info. Alarm Info. Output Frequency | 0.00 to 99.99, 100.0 to 590.0 [Hz] | The output frequency before slip compensation is displayed in increments of 0.01 Hz. A value of 100.0 Hz or higher is displayed in increments of 0.1 Hz. |
| X061 | Last Alarm Info. Output Current | 0.00 to 99.99, 100.0 to 655.3 [A] | The output current is displayed. A current value of 100.0A or higher is displayed in increments of 0.1 A.<br>Display unit: A (Ampere) |
| X065 | Last Alarm Info. Running Status | 0000Hex to FFFF Hex | The operation status is displayed by a four-digit hexadecimal. |
| X066 | Last Alarm Info. Cumulative Ope. Time | 0 to 655,350 hours | The number of operations of the motor (number of times the RUN command for the inverter is turned ON) is calculated and displayed. |
| X068 | Last Alarm Info. Main Circuit DC Voltage | 0.0 to 999.0 [V] | The Main Circuit DC Voltage of the inverter is displayed. |

| Parameter No. | Item | Range | Display item |
|---|---|---|---|
| X118 | Last Alarm Info. Cumulative Running Time | 0 to 655,350 hours | The cumulative time of the inverter RUN state is displayed. |
| **3 Second last alarm** | | | |
| Z000 | Second Last Alarm Info. Output Frequency | 0.00 to 99.99, 100.0 to 590.0 [Hz] | The output frequency before slip compensation is displayed in increments of 0.01 Hz. A value of 100.0 Hz or higher is displayed in increments of 0.1 Hz. |
| Z001 | Second Last Alarm Info. Output Current | 0.00 to 99.99, 100.0 to 655.3 [A] | The output current is displayed. A current value of 100.0A or higher is displayed in increments of 0.1 A. Display unit: A (Ampere) |
| Z005 | Second Last Alarm Info. Running Status | 0000Hex to FFFF Hex | The operation status is displayed by a four-digit hexadecimal. |
| Z006 | Second Last Alarm Info. Cumulative Ope. Time | 0 to 655,350 hours | The number of operations of the motor (number of times the RUN command for the inverter is turned ON) is calculated and displayed. |
| Z008 | Second Last Alarm Info. Main Circuit DC Voltage | 0.0 to 999.0 [V] | The Main Circuit DC Voltage of the inverter is displayed. |
| X128 | Second last Alarm Info. Cumulative Running Time | 0 to 655,350 hours | The cumulative time of the inverter RUN state is displayed. |
| **4 Third last alarm** | | | |
| Z050 | Third Last Alarm Info. Output Frequency | 0.00 to 99.99, 100.0 to 590.0 [Hz] | The output frequency before slip compensation is displayed in increments of 0.01 Hz. A value of 100.0 Hz or higher is displayed in increments of 0.1 Hz. |
| Z051 | Third Last Alarm Info. Output Current | 0.00 to 99.99, 100.0 to 655.3 [A] | The output current is displayed. A current value of 100.0A or higher is displayed in increments of 0.1 A. Display unit: A (Ampere) |
| Z055 | Third Last Alarm Info. Running Status | 0000Hex to FFFF Hex | The operation status is displayed by a four-digit hexadecimal. |
| Z056 | Third Last Alarm Info. Cumulative Ope. Time | 0 to 655,350 hours | The number of operations of the motor (number of times the RUN command for the inverter is turned ON) is calculated and displayed. |
| Z058 | Third Last Alarm Info. Main Circuit DC Voltage | 0.0 to 999.0 [V] | The Main Circuit DC Voltage of the inverter is displayed. |
| X138 | Third last Alarm Info. Cumulative Running Time | 0 to 655,350 hours | The cumulative time of the inverter RUN state is displayed. |
| **5 Fourth last alarm** | | | |
| X141 | Fourth last Alarm Info. Output Frequency | 0.00 to 99.99, 100.0 to 590.0 [Hz] | The output frequency before slip compensation is displayed in increments of 0.01 Hz. A value of 100.0 Hz or higher is displayed in increments of 0.1 Hz. |
| X142 | Fourth last Alarm Info. Output Current | 0.00 to 99.99, 100.0 to 655.3 [A] | The output current is displayed. A current value of 100.0A or higher is displayed in increments of 0.1 A. Display unit: A (Ampere) |
| X149 | Fourth Last Alarm Info. Running Status | 0000Hex to FFFF Hex | The operation status is displayed by a four-digit hexadecimal. |
| X143 | Fourth Last Alarm Info. Cumulative Ope. time | 0 to 655,350 hours | The number of operations of the motor (number of times the RUN command for the inverter is turned ON) is calculated and displayed. |

| Parameter No. | Item | Range | Display item |
|---|---|---|---|
| X144 | Fourth Last Alarm Info. Main Circuit DC Voltage | 0.0 to 999.0 [V] | The Main Circuit DC Voltage of the inverter is displayed. |
| X148 | Fourth Last Alarm Info. Cumulative Running Time | 0 to 655,350 hours | The cumulative time of the inverter RUN state is displayed. |
| **6 Fifth last alarm** | | | |
| X151 | Fifth Last Alarm Info. Output Frequency | 0.00 to 99.99, 100.0 to 590.0 [Hz] | The output frequency before slip compensation is displayed in increments of 0.01 Hz. A value of 100.0 Hz or higher is displayed in increments of 0.1 Hz. |
| X152 | Fifth Last Alarm Info. Output Current | 0.00 to 99.99, 100.0 to 655.3 [A] | The output current is displayed. A current value of 100.0A or higher is displayed in increments of 0.1 A. Display unit: A (Ampere) |
| X159 | Fifth Last Alarm Info. Running Status | 0000Hex to FFFF Hex | The operation status is displayed by a four-digit hexadecimal. |
| X153 | Fifth Last Alarm Info. Cumulative Ope. Time | 0 to 655,350 hours | The number of operations of the motor (number of times the RUN command for the inverter is turned ON) is calculated and displayed. |
| X154 | Fifth last Alarm Info. Main Circuit DC Voltage | 0.0 to 999.0 [V] | The Main Circuit DC Voltage of the inverter is displayed. |
| X158 | Fifth last Alarm Info. Cumulative Running time | 0 to 655,350 hours | The cumulative time of the inverter RUN state is displayed. |

## Running Status 3 Monitor [M070]

The operation status 3 displays the status allocated to each bit by a four-digit hexadecimal.
The allocation for 0 to 15 bits of the operation status is described in the table below.

| Bit | Symbol | Description |
|---|---|---|
| 15 | - | Fixed to 0 |
| 14 | ID2 | Current detection 2 |
| 13 | IDL | Low current detection |
| 12 | ID | Current detection |
| 11 | OLP | Overload prevention controlling |
| 10 | LIFE | Lifetime alarm |
| 9 | OH | Heat sink overheat early warning |
| 8 | TRY | During retry |
| 7 | FAN | Fan operation signal |
| 6 | KP | During touch panel operation |
| 5 | OL | Motor overload early warning |
| 4 | IPF | During restart after instantaneous power failure |
| 3 | SWM2 | Motor 2 selection |
| 2 | RDY | During operation preparation |
| 1 | FDT | Frequency detection |
| 0 | FAR | Frequency arrival |

## 8-1-5 Inverter Identification

Use this function to identify the Model Name and Serial Number of the inverter through communication. Each parameter represents two ASCII characters and is expressed by combining multiple parameters.The character code table is as follows.

| Hex | _0 | _1 | _2 | _3 | _4 | _5 | _6 | _7 | _8 | _9 | _A | _B | _C | _D | _E | _F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2_ | | ! | " | # | $ | % | & | ' | ( | ) | * | + | , | - | . | / |
| 3_ | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | : | ; | < | = | > | ? |
| 4_ | @ | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
| 5_ | P | Q | R | S | T | U | V | W | X | Y | Z | [ | \ | ] | ^ | _ |
| 6_ | √ | a | b | c | d | e | f | g | h | i | j | k | l | m | n | o |
| 7_ | p | q | r | s | t | u | v | w | x | y | z | { | \| | } | ~ | Ω |

The square root symbol (√) would be the backtick or grave accent (`) in proper ASCII code
The omega letter (Ω) would be the (DEL) non-printable control character
The rest of characters correspond to the common ASCII code standard

**Example condition**

Model name: 3G3M1-A4075-EMP Serial number: W12A123A0579AA

**Model Name**

| Parameter | W250 | | W251 | | W252 | | W253 | | W254 | | W255 | | W256 | | W257 | | W258 W259 W260 W261 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Character | 3 | G | 3 | M | 1 | - | A | 4 | 0 | 7 | 5 | - | E | M | P | *1 | *1 |
| Data | 0x3347 | | 0x334D | | 0x312D | | 0x4134 | | 0x3037 | | 0x352D | | 0x454D | | 0x5020 | | 0x2020 |

Note: *1: Unused areas respond blank space (0x20).

**Serial Number**

| Parameter | W262 | | W263 | | W264 | | W265 | | W266 | | W267 | | W268 | | W269 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Character | W | 1 | 2 | A | 1 | 2 | 3 | A | 0 | 5 | 7 | 9 | A | A | *1 |
| Data | 0x5731 | | 0x3241 | | 0x3132 | | 0x3341 | | 0x3035 | | 0x3739 | | 0x4141 | | 0x2020 |

Note: *1: Unused areas respond blank space (0x20).

## Identification Related Monitors

Monitors related with the identification function

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | Format 16bit 32bit | R/W |
|---|---|---|---|---|---|---|---|
| M023 | 50DAh<br>--- | Model code | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFF h | 0 | • | 17<br>--- | RO |

| param | Address 16/32bit LSW MSW | Function name | Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W |
|---|---|---|---|---|---|---|---|
| M024 | 50DBh<br>--- | Capacity code | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0.10 to 22.00 | 5.50 | ● | 11<br>--- | RO |
| M123 | 51A6h<br>--- | Model code 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh<br>0121h (289) (3G3M1-STD)<br>0141h (321) (3G3M1-ECT)<br>0171h (369) (3G3M1-EMP) | 0 | ● | 99<br>--- | RO |
| W250 | 5456h<br>--- | Model name 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | ● | 1<br>--- | RO |
| W251 | 5457h<br>--- | Model name 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | ● | 1<br>--- | RO |
| W252 | 5458h<br>--- | Model name 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | ● | 1<br>--- | RO |
| W253 | 5459h<br>--- | Model name 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | ● | 1<br>--- | RO |
| W254 | 545Ah<br>--- | Model name 5 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | ● | 1<br>--- | RO |
| W255 | 545Bh<br>--- | Model name 6 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | ● | 1<br>--- | RO |
| W256 | 545Ch<br>--- | Model name 7 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | ● | 1<br>--- | RO |
| W257 | 545Dh<br>--- | Model name 8 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | ● | 1<br>--- | RO |
| W258 | 545Eh<br>--- | Model name 9 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | ● | 1<br>--- | RO |
| W259 | 545Fh<br>--- | Model name 10 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | ● | 1<br>--- | RO |
| W260 | 5460h<br>--- | Model name 11 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | ● | 1<br>--- | RO |

| param | Address 16/32bit LSW MSW | Function name | RefImage Range | Def. data | EMP Map | For-mat 16bit 32bit | R/W |
|---|---|---|---|---|---|---|---|
| W261 | 5461h<br>--- | Model name 12 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | • | 1<br>--- | RO |
| W262 | 5462h<br>--- | Serial number 1 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | • | 1<br>--- | RO |
| W263 | 5463h<br>--- | Serial number 2 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | • | 1<br>--- | RO |
| W264 | 5464h<br>--- | Serial number 3 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | • | 1<br>--- | RO |
| W265 | 5465h<br>--- | Serial number 4 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | • | 1<br>--- | RO |
| W266 | 5466h<br>--- | Serial number 5 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | • | 1<br>--- | RO |
| W267 | 5467h<br>--- | Serial number 6 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | • | 1<br>--- | RO |
| W268 | 5468h<br>--- | Serial number 7 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | • | 1<br>--- | RO |
| W269 | 5469h<br>--- | Serial number 8 | V/f DTV PG V/f PG DTV<br>SLV PGV PM SLV PM PGV<br>0000 to FFFFh | 0 | • | 1<br>--- | RO |

# 8-2 Multifunction Input/Output Functions List

This section describes the input/output signals of the inverter.

## 8-2-1 Multifunction Input Selection

By assigning functions to Input Terminals [DI1] through [DI7] using Function Selection parameters (E001 to E005, E098, E099), the designated functions can be activated. However, "98: FW (Forward Run/Stop)" and "99: RV (Reverse Run/Stop)" can only be assigned to Input Terminal [DI6] (E098) or Input Terminal [DI7] (E099).

To switch the input terminals [DI1] to [DI7] from normally open (NO) to normally closed (NC) contacts, add 1000 to the corresponding function's set data. By default, "6: STP (3-wire stop)," "9: EXT (External trip)," "23: ATR (Torque command input permission)," and "30: STOP (Force to stop)" are configured as NC contacts. These can be changed to NO contacts by adding 1000 to the set data.

If the same function is assigned to multiple multifunction input terminals, the function is considered ON if any of the assigned terminals, except for those listed below, is activated.

Exceptions: If all terminals assigned to "9: EXT (External trip)," "30: STOP (Force to stop)," "38: ROK (Run command permission)," "98: FW (Forward Run/Stop)," or "99: RV (Reverse Run/Stop)" are ON, the function will be treated as ON.

Input and output terminals can also be controlled remotely via communication by configuring the Support Tool Link Function (y099). When communication-based operation is enabled (y099 = 2 or 3), the input terminal functions can be operated through communication. The handling of commands via communication differs depending on the specific function assigned to each terminal.

For details on the behavior when communication-based operation is enabled (y099 = 2, 3), refer to the "Communication function" column in the table below. The meanings of the symbols are explained thereafter.

- OR: Handled as ON when whichever of signals wired to the input terminal or commands instructed by Operation command (S006) are ON.
- AND: Handled as ON when both signals wired to the input terminal and commands instructed by Operation command (S006) are ON.
- Term: Changes cannot be made by the communications function

| Parameter No. | Data NO / NC | Description | | Comm. function | Reference item | Page |
|---|---|---|---|---|---|---|
| E001 to E005, E098, E099 | 0 / 1000 | CF1: | Multi-step frequency setting binary 1 | OR | Multi-step speed operation function | page 6-50 |
| | 1 / 1001 | CF2: | Multi-step frequency setting binary 2 | OR | | |
| | 2 / 1002 | CF3: | Multi-step frequency setting binary 3 | OR | | |
| | 3 / 1003 | CF4: | Multi-step frequency setting binary 4 | OR | | |
| | 4 / 1004 | RT1: | Select ACC/DEC time (2 steps) | OR | 2-step acceleration/ deceleration function<br>2-step acceleration/ deceleration | page 6-37 |
| | 5 / 1005 | RT2: | Select ACC/DEC time (4 steps) | OR | | page 6-57 |
| | 6 / 1006 | STP: | 3-wire stop: NC contact | OR | 3-wire input function | page 6-49 |
| | 7 / 1007 | FRS: | Free-run stop | OR | Free-run stop | page 8-52 |
| | 8 / 1008 | RS: | Reset | OR | Reset<br>Reset (RS) | page 6-42<br>page 6-57 |
| | 1009 / 9 | EXT: | External trip: NC contact | AND | External trip | page 8-81 |
| | 10 / 1010 | JG: | Jogging | OR | Jogging | page 6-52 |
| | 12 / 1012 | SET: | Set 2nd control | OR | 2nd control function | page 6-45 |
| | 13 / - | DB: | External DC injection braking | OR | Direct current braking | page 8-55 |
| | 14 / 1014 | TRQ1: | Torque limit switching 1 | OR | Torque limit function | page 7-86 |
| | 15 / - | CS: | Commercial switch | OR | Commercial switch | page 8-129 |
| | 16 / - | SW60: | Commercial switch (60Hz) | OR | | |
| | 17 / 1017 | UP: | UP/DWN function accelerated | OR | Remote operation function | page 8-110 |
| | 18 / 1018 | DWN: | UP/DWN function decelerated | OR | | |
| | 19 / 1019 | Do not set. | | OR | - | - |
| | 20 / 1020 | PID: | PID enabled/disabled | OR | PID function | page 8-113 |
| | 21 / 1021 | IVS: | Switch normal/ inverse operation | OR | | |

| Parameter No. | Data NO / NC | Description | | Comm. function | Reference item | Page |
|---|---|---|---|---|---|---|
| E001 to E005, E098, E099 | 22 / 1022 | IL: | Interlock | OR | Restart after Momentary Power Failure | page 8-41 |
| | 23 / 1023 | ATR: | Torque command input permission: NC contact | OR | Torque control | page 7-31 |
| | 25 / 1025 | U-DI: | Universal DI | OR | Universal Terminal | page 8-144 |
| | 26 / 1026 | STM: | Enable auto search for idling motor speed at starting | OR | Restart after Momentary Power Failure | page 8-41 |
| | 1030 /30 | STOP: | Force to stop: NC contact | AND | Forced Stop | page 8-141 |
| | 32 / 1032 | EXITE: | Pre-excite | OR | Pre-excite | page 8-139 |
| | 33 / 1033 | PIDC: | PID integral reset | OR | PID function | page 8-113 |
| | 34 / 1034 | PID-HLD: | Hold PID integral component | OR | | |
| | 35 / 1035 | Do not set.(standard model function) | | -- | - | - |
| | 38 / 1038 | ROK: | Permission of Run command | OR | Permission of RUN Command | page 8-108 |
| | 42 / 1042 | ORL: | Zero return limit signal | OR | Position control | page 7-36 |
| | 44 / 1044 | Do not set.(standard model function) | | -- | - | - |
| | 46 / 1046 | OLS: | Enable overload stop | OR | Overload Stop Function | page 8-141 |
| | 47 / 1047 | LOCK: | Servo lock command | OR | Servo Lock | page 8-136 |
| | 58 / 1058 | UDC: | UP/DWN function data clear | OR | Remote operation function | page 8-110 |
| | 59 / 1059 | BATRY: | Enable battery-driven operation | OR | Battery Operation Enable Command (BATRY) | page 8-143 |
| | 60 / 1060 | TB1: | Select torque bias 1 | OR | Torque bias function | page 7-33 |
| | 61 / 1061 | TB2: | Select torque bias 2 | OR | | |
| | 62 / 1062 | H-TB: | Hold torque bias | OR | | |
| | 65 / 1065 | BOK: | Brake confirmation | OR | Brake control function | page 7-77 |
| | 70 / 1070 | Hz/LSC: | Cancel line speed control | OR | Cancel line speed control | page 7-84 |

| Parameter No. | Data NO / NC | Description | | Comm. function | Reference item | Page |
|---|---|---|---|---|---|---|
| E001 to E005, E098, E099 | 71 / 1071 | LSC-HLD: | Hold line speed control frequency in the memory | OR | Hold line speed control frequency in the memory | page 7-84 |
| | 72 / 1072 | CRUN-M1: | Count the run time of commercial power-driven motor 1 | OR | Commercial switch | page 8-129 |
| | 73 / 1073 | CRUN-M2: | Count the run time of commercial power-driven motor 2 | OR | | |
| | 76 / 1076 | DROOP: | Select droop control | OR | Droop Control | page 8-137 |
| | 78 / 1078 | MPRM1: | Select speed control parameter 1 | OR | Speed Control Settings | page 7-26 |
| | 79 / 1079 | MPRM2: | Select speed control parameter 2 | OR | | |
| | 80 / 1080 | Do not set. | | OR | - | - |
| | 81 / 1081 | Do not set. | | OR | - | - |
| | 82 / 1082 | AR-CCL: | Cancel anti-regenerative control | OR | Overvoltage Suppression Function during Deceleration | page 8-79 |
| | 84 / 1084 | LAC: | Acceleration and deceleration time cancel | OR | Acceleration/deceleration time setting | page 8-136 |
| | 85 / 1085 | AHD: | Analog command held | OR | Retention of analog command function | page 8-40 |
| | 94 / - | FJOG: | Run forward with Jogging | OR | Jogging (JG) | page 6-52 |
| | 95 / - | RJOG: | Run reverse with Jogging | OR | | |
| | 97 / 1097 | F/R: | 3-wire forward/ reverse | OR | 3-wire input function | page 6-49 |
| | 98 / - | FW: | Forward Run/Stop*1 | OR | RUN command selection Forward RUN Command (FW) and Reverse RUN Command (RV) | page 6-22 page 6-48 |
| | 99 / - | RV: | Reverse Run/Stop*2 | OR | | |
| | 100 / - | no: | No function assigned | - | | |
| | 119/ 1119 | P-SEL: | Proportional operation of speed regulator | OR | Position control | page 7-36 |

| Parameter No. | Data NO / NC | Description | | Comm. function | Reference item | Page |
|---|---|---|---|---|---|---|
| E001 to E005, E098, E099 | 121 / 1121 | MI1: | General-Purpose input 1 | OR | Universal DI activation | page 8-144 |
| | 122 / 1122 | MI2: | General-Purpose input 2 | OR | | |
| | 123 / 1123 | MI3: | General-Purpose input 3 | OR | | |
| | 124 / 1124 | MI4: | General-Purpose input 4 | OR | | |
| | 125 / 1125 | MI5: | General-Purpose input 5 | OR | | |
| | 126 / 1126 | MI6: | General-Purpose input 6 | OR | | |
| | 127 / 1127 | MI7: | General-Purpose input 7 | OR | | |
| | 134 /--- | FMS | Fire Mode | OR | Fire Mode | |
| | 135 / 1135 | ABS/INC: | Relative / absolute position command | OR | Positioning data | page 7-43 |
| | 136 / 1136 | ORT: | Orientation command | OR | Orientation | page 7-53 |
| | 137 / 1137 | SPD: | Speed control/position control switching | OR | Position control | page 7-36 |
| | 138 / 1138 | ORG: | Zero return startup signal | OR | | |
| | 139 / 1139 | FOT: | Forward driving stop | AND | Overtravel (OT) | page 7-46 |
| | 140 / 1140 | ROT: | Reverse driving stop | AND | | |
| | 141 / 1141 | PCLR: | Position clear command | OR | Clearing of position | page 7-52 |
| | 142 / 1142 | PSET: | Position preset command | OR | Position preset | page 7-53 |
| | 144 / 1144 | POS-SET: | Target position update command | OR | Positioning data | page 7-43 |
| | 145 / 1145 | CP1: | Position command selection 1 | OR | | |
| | 146 / 1146 | CP2: | Position command selection 2 | OR | | |
| | 147 / 1147 | CP3: | Position command selection 3 | OR | | |
| | 159 / 1159 | 2CH: | 2-step acceleration/ deceleration | OR | 2-step acceleration/ deceleration function<br>2-step acceleration/ deceleration | page 6-37<br>page 6-57 |
| | 160 / 1160 | Do not set. | | OR | - | - |
| | 161 / 1161 | ADD: | Frequency addition | OR | Frequency Addition Function | page 8-109 |
| | 162 / 1162 | F-TM: | Forced terminal block | Term | Forced terminal block function | page 8-71 |

| Parameter No. | Data NO / NC | Description | | Comm. function | Reference item | Page |
|---|---|---|---|---|---|---|
| E001 to E005, E098, E099 | 163 / 1163 | HLD: | Retain output frequency | OR | Acceleration/Deceleration Stop Function | page 6-35 |
| | 164 / 1164 | KHC: | Integrated power clear | OR | Integrated power clear (KHC) | page 8-102 |
| | 165 / 1165 | UDP: | UP/DOWN Reference Preset | OR | UP/DOWN Reference Preset (UDP) | page 8-110 |
| | 166 / 1166 | RSTR: | Enable restore mode | OR | - | page 3-22 |
| | 171 / 1171 | PID-SS1: | PID control multi-stage command 1 | OR | PID function | page 8-113 |
| | 172 / 1172 | PID-SS2: | PID control multi-stage command 2 | OR | | |
| | 173 / 1173 | SF1: | Multi-step frequency setting bit 1 | OR | Multi-step speed operation function | page 6-50 |
| | 174 / 1174 | SF2: | Multi-step frequency setting bit 2 | OR | | |
| | 175 / 1175 | SF3: | Multi-step frequency setting bit 3 | OR | | |
| | 176 / 1176 | SF4: | Multi-step frequency setting bit 4 | OR | | |
| | 177 / 1177 | SF5: | Multi-step frequency setting bit 5 | OR | | |
| | 178 / 1178 | SF6: | Multi-step frequency setting bit 6 | OR | Multi-step speed operation function | page 6-50 |
| | 179 / 1179 | SF7: | Multi-step frequency setting bit 7 | OR | | |
| | 184 / 1184 | TL: | Torque limit enabled | OR | Torque limit function | page 7-86 |
| | 185 / 1185 | TRQ2: | Torque limit switching 2 | OR | | |
| | 186 / 1186 | USP: | Unattended start protection | OR | Unattended start protection | page 8-51 |
| | 187 / 1187 | EXT1: | External Latch Input 1*2 | Term | Touch Probe (Latch) Function | page 7-66 |
| | 188 / 1188 | EXT2: | External Latch Input 2*2 | Term | | |

*1. Forward rotation and reverse rotation can be allocated only to the DI6 and DI7 terminals.
*2. External latch input 1 and external latch input 2 can be allocated only to DI1 and DI2.

## 8-2-2 Multifunction Output Selection

The following functions can be allocated to Output Terminal [DO1] Function Selection (E020) and Output Terminal [ROA, ROB] Function Selection (E027). The multifunction output terminal DO1 is open collector output, and the multifunction relay output terminals ROA/B/C are relay outputs.
By setting data in which 1000 is added to the set data of the following functions that are to be used, it is possible to switch the multifunction output terminals DO1 and ROA/B/C from an NO contact input to an NC contact input.

| Parameter No. | Data NO / NC | Description | | Reference item | Page |
|---|---|---|---|---|---|
| E020, E027 | 0 / 1000 | RUN: | Run Signal | Run Signal | page 6-59 |
| | 1 / 1001 | FAR1: | Frequency arrival signal 1 (constant speed) | Constant speed arrival signal | page 6-60 |
| | 2 / 1002 | FAR2: | Over set frequency arrival signal 1 | Frequency arrival signal | page 8-82 |
| | 3 / 1003 | UV: | Signal during undervoltage | Restart after Momentary Power Failure | page 8-44 |
| | 4 / 1004 | B/D: | Detected torque polarity | Torque control | page 7-31 |
| | 5 / 1005 | IOL: | Inverter output limiting | Inverter output limiting | page 8-97 |
| | 6 / 1006 | IPF: | Auto-restarting after momentary power failure | Restart after Momentary Power Failure | page 8-44 |
| | 7 / 1007 | THM: | Thermal warning | Electronic Thermal Warning | page 6-21 |
| | 8 / 1008 | Do not set. | | - | - |
| | 10 / 1010 | IRDY: | Operation ready signal | Operation ready completion signal | page 6-59 |
| | 15 / 1015 | AX: | Switch MC on the input power lines (for inverter input-side electromagnetic contactor) | Switch MC on the input power lines | page 8-98 |
| | 16 / 1016 | TU: | Pattern operation stage transition | Pattern Operation Function Selection | page 6-28 |
| | 17 / 1017 | TO: | Pattern operation cycle completed | Pattern Operation Function Selection | |
| | 18 / 1018 | Do not set. | | Pattern Operation Function Selection | |
| | 19 / 1019 | Do not set. | | Pattern Operation Function Selection | |
| | 20 / 1020 | Do not set. | | Pattern Operation Function Selection | |
| | 21 / 1021 | FAR2: | Frequency arrival signal 2 | Frequency arrival signal | page 8-82 |
| | 22 / 1022 | IOL2: | Inverter output limiting with delay | Inverter output limiting | page 8-97 |
| | 25 / 1025 | FAN: | Cooling fan in operation | Cooling FAN Control Method Selection | page 8-91 |
| | 26 / 1026 | TRY: | Auto-resetting | Trip Retry Operation | page 8-49 |
| | 27 / 1027 | Reserved | | | page 8-144 |
| | 28 / 1028 | OHF: | Fin overheat warning | Cooling fin overheat warning | page 8-94 |
| | 29 / 1029 | SY: | Synchronization completed | Simultaneous Start Synchronized Run Operation | - |
| | 30 / 1030 | LIFE: | Lifetime alarm | Lifetime alarm (LIFE) | page 8-93 |

| Parameter No. | Data NO / NC | Description | | Reference item | Page |
|---|---|---|---|---|---|
| E020, E027 | 31 / 1031 | FDT2: | Over set frequency arrival signal 2 | Frequency arrival signal | page 8-82 |
| | 33 / 1033 | REFOFF: | Reference loss detected | Frequency Reference | page 6-24 |
| | 35 / 1035 | RUN2: | Inverter outputting | Run Signal | page 6-59 |
| | 36 / 1036 | OLP: | Overload prevention controlling | Overload Limit/Overload Warning | page 8-76 |
| | 37 / 1037 | OL2: | Overload warning 2 | | |
| | 38 / 1038 | OL: | Overload warning | | |
| | 41 / 1041 | LOC: | Light load detection signal | Light load detection signal | page 8-94 |
| | 42 / 1042 | OD: | Excessive PID deviation | PID function | page 8-113 |
| | 43 / 1043 | PID-CTL: | Under PID control | PID function | |
| | 44 / 1044 | PID-STP: | Under sleep mode of PID control | PID function | |
| | 46 / 1046 | OTQ: | Overtorque | Overtorque/undertorque | page 7-90 |
| | 48 / 1048 | SWM1: | 1st motor in operation | 1st control under selection signal | page 8-96 |
| | 49 / 1049 | SETM: | 2nd motor in operation | 2nd control under selection signal | |
| | 52 / 1052 | FWR: | Forward run signal | Forward run signal | page 6-59 |
| | 53 / 1053 | RVR: | Reverse run signal | Reverse run signal | page 6-60 |
| | 54 / 1054 | Do not set. | | - | - |
| | 56 / 1056 | MOH: | Motor overheat detected by thermistor | Thermistor Trip Function | page 8-81 |
| | 57 / 1057 | BRK: | Brake release | Brake control function | page 7-77 |
| | 59 / 1059 | AIIDc: | Analog AI2 (All) disconnection detection | Window comparator | page 8-95 |
| | 70 / 1070 | ZS: | 0 Hz signal | 0 Hz detection function | page 6-61 |
| | 71 / 1071 | DSAG: | Speed agreement | Motor control method with speed sensor | page 7-11 |
| | 72 / 1072 | FAR3: | Frequency arrival signal 3 | Frequency arrival signal | page 8-82 |
| | 76 / 1076 | DSE: | Excessive speed deviation | Motor control method with speed sensor | page 7-11 |
| | 77 / 1077 | U-EDC: | Low DC link bus voltage detection | Low DC link bus voltage detection | page 8-97 |

| Parameter No. | Data NO / NC | Description | | Reference item | Page |
|---|---|---|---|---|---|
| E020, E027 | 79 / 1079 | IPF2: | During decelerating at momentary power failure | Restart after Momentary Power Failure | page 8-48 |
| | 82 / 1082 | POK: | Position ready | Position control | page 7-36 |
| | 84 / 1084 | MNT: | Maintenance timer counted up | Maintenance monitor | page 8-86 |
| | 87 / 1087 | FAR1FDT1: | Frequency match detection | Frequency arrival signal | page 8-82 |
| | 89 / 1089 | PTD: | Pole tuning done | Synchronous motor (PM) | page 7-24 |
| | 90 / 1090 | Do not set. | | - | - |
| | 91 / 1091 | Do not set. | | - | - |
| | 92 / 1092 | Do not set. | | - | - |
| | 93 / 1093 | Do not set. | | - | - |
| | 95 / 1095 | Do not set. | | - | - |
| | 98 / 1098 | L-ALM: | Minor alarm | Minor alarm list | page 8-99 |
| | 99 / 1099 | AL: | Alarm output | Alarm list | page 6-61 |
| | 101 / 1101 | DECF: | EN circuit failure detected | Safety function (Set by the EDM selector switch) | page 8-62 |
| | 102 / 1102 | EDM: | STO (Safe Torque Off) Performance Monitor | | |
| | 105 / 1105 | DBAL: | Braking transistor broken | Braking transistor broken (DBAL) | page 8-91 |
| | 111 / 1111 | MO1 | | General-Purpose Output 1 | - |
| | 112 / 1112 | MO2 | | General-Purpose Output 2 | - |
| | 113 / 1113 | MO3 | | General-Purpose Output 3 | - |
| | 114 / 1114 | MO4 | | General-Purpose Output 4 | - |
| | 115 / 1115 | MO5 | | General-Purpose Output 5 | - |
| | 116 / 1116 | MO6 | | General-Purpose Output 6 | - |
| | 117 / 1117 | MO7 | | General-Purpose Output 7 | - |
| | 118 / 1118 | MO8 | | General-Purpose Output 8 | - |
| | 119 / 1119 | MO9 | | General-Purpose Output 9 | - |
| | 120 / 1120 | MO10 | | General-Purpose Output 10 | - |

| Parameter No. | Data NO / NC | Description | | Reference item | Page |
|---|---|---|---|---|---|
| E020, E027 | 132 / 1132 | TRQ: | Torque limit | Torque limit function | page 7-86 |
| | 151 / 1151 | OT-OUT: | Overtravel detection | Over-travel | page 7-46 |
| | 152 / 1152 | STOP-OUT: | Forced stop detection | Forced Stop | page 8-141 |
| | 182 / 1182 | BER: | Brake error | Brake control function | page 7-77 |
| | 183 / 1183 | FDT3: | Set-frequency-only arrival signal | Frequency arrival signal | page 8-82 |
| | 185 / 1185 | FDT4: | Set-frequency-only arrival signal 2 | | |
| | 186 / 1186 | FBV: | PID FB status output | PID function | page 8-113 |
| | 187 / 1187 | FR: | Starting contact signal | Starting contact signal | page 8-94 |
| | 188 / 1188 | Do not set. | | - | - |
| | 206 / 1206 | LOG1: | Logic operation output 1 | Logical operation function | page 8-87 |
| | 207 / 1207 | LOG2: | Logic operation output 2 | | |
| | 208 / 1208 | LOG3: | Logic operation output 3 | | |
| | 209 / 1209 | Do not set. | | - | - |
| | 236 / 1236 | ONT: | Power ON time over | RUN time/Power ON time over | page 8-86 |
| | 237 / 1237 | RNT: | RUN time over | | |
| | 238 / 1238 | AI1Dc: | Analog AI1 disconnection detection | Window comparator | page 8-95 |
| | 239 / 1239 | AIVDc: | Analog AI2 (AIV) disconnection detection | | |
| | 240 / 1240 | WAC: | Capacitor life warning signal | Capacitor life warning signal | page 8-89 |
| | 241 / 1241 | WAF: | Cooling fan life warning signal | Cooling fan life warning signal | page 8-91 |

# 8-3 Analog I/O Settings

This section describes the analog I/O signal settings for this inverter.

## 8-3-1 Analog Input (Function Selection)

This inverter has an analog input terminal [AI1] with voltage input.

Analog input terminal [AI1] 0 to 10V, -10 to 10V

- For details on analog input adjustment, refer to *8-3-2 Analog Input Adjustment Function* on page 8-35.
- One function is allocated to the analog input terminal [AI1]. One input cannot be used simultaneous- ly for another function.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E061 | Input Terminal [AI1] Function Selection | 0: Frequency command<br>1: Auxiliary frequency setting 1 2: Auxiliary frequency setting 2<br>3: PID command *1<br>5: PID feedback<br>6: Ratio setting<br>7: Analog torque limiter<br>9: Torque bias *1<br>10: Torque command *1<br>11: Torque current command *1 17: Speed limit for forward rotation 18: Speed limit for reverse rotation 20: Analog signal input monitor 21: PID feed forward | 0 | - |
| C035 | Input Terminal [AI1] Polarity Selection | 0: Bipolar<br>1: Unipolar | 1 | - |

*1. When using PID process command 1, torque bias, torque reference value and torque current command value with analog input terminals, configure parameters for selecting commands of each function in addition to Input Terminal [AI1] Function Selection (E061). When both are set to analog input, analog input signal is treated as a command.

### Analog Input Extended Function Selection (E061)

By setting Input Terminal [AI1] Function Selection (E061), the following functions can be allocated to each of the analog input terminals.

| E061 data | Function | Description |
|---|---|---|
| 0 | None | - |
| 1 | Auxiliary frequency setting 1 | An auxiliary frequency input added to 1st Frequency Reference Selection (F001). Not added to other than the 1st frequency reference (such as the 2nd frequency reference, multi-step frequency reference, etc.). 100%/Full scale |

| E061 data | Function | Description |
|---|---|---|
| 2 | Auxiliary frequency setting 2 | An auxiliary frequency input added to all frequency settings. Added to frequency setting 1, frequency setting 2, multistep frequency, etc. 100%/Full scale |
| 3 | PID command | Enter the command source for the temperature, pressure, etc. in PID control. It is also necessary to set PID Control PID Command Selection (J002). |
| 5 | PID feedback | Enter the feedback for the temperature, pressure, etc. in PID control. Set “0: Analog input” at PID Control Feedback Selection (E119). 100%/Full scale |
| 6 | Ratio setting | The ratio setting is used for the constant line speed control by diameter calculation of the winding machine and the ratio operation of multiple units, and is therefore calculated as percentage in the last frequency reference.<br>100%/Full scale |
| 7 | Analog torque limiter | Used when the analog input is used as torque limit instead of Torque Limit 1 (F040).<br>200%/Full scale |
| 9 | Torque bias | The analog input is used as the torque bias value. Set “2: Analog input” at Torque Bias Function Selection (H154).<br>200%/Full scale |
| 10 | Torque Reference | During torque control, the analog input is used as the torque command. Set “2: Torque current command input” or “3: Torque command input” at Torque Control Operate Selection (H018) and “0: Analog input” at Torque Reference Selection (H332). |
| 11 | Torque Current Command | During torque control, the analog input is used as the torque current command. Set “2: Torque current command input” or “3: Torque command input” at Torque Control Operate Selection (H018) and “0: Analog input” at Torque Reference Selection (H332). |
| 17 | Speed limit for forward rotation | The analog input is used as the output frequency limit value. Analog input 100% is equivalent to Maximum Output Frequency (F003/A001). When using this function, the concomitant use of Over Speed Detection Level (d035) is recommended. |
| 18 | Speed limit for reverse rotation | |
| 20 | Analog Input Monitor | By connecting analog signals to the inverter, the display coefficient can be used to convert and display analog signals as temperature, pressure and other physical quantities via communications.<br>100%/Full scale |
| 21 | PID feed forward | Enter the feedforward such as the temperature, pressure, etc. in PID control. Set “1: Input terminal [AI1]” to PID Control PID Feedforward Selection for Process Control (E121).<br>100%/Full scale |

## Using an Analog Input in Command System Parameters

- When using analog input terminals by the following functions, configure parameters for selecting the commands of each function in addition to Input Terminal [AI1] Function Selection (E061). When both are set to analog input, analog input signal is treated as a command.

| Function | Command setting | E061 data | Reference |
|---|---|---|---|
| Frequency Reference | 1st Frequency Reference Selection (F001)/2nd Frequency Reference Selection (C030) = “1: Analog voltage input (input terminal [AI1])” | 0: Frequency reference | page 6-24 |
| Torque Reference | Torque Control Operate Selection (H018) = “3: Torque command input”<br>Torque Reference Selection (H332) = “0: Analog input” | 10: Torque command | page 7-31 |
| Torque Current Command | Torque Control Operate Selection (H018) = “2: Torque current command input”<br>Torque Reference Selection (H332) = “0: Analog input” | 11: Torque current command value | page 7-31 |
| Torque bias | Torque Bias Function Selection (H154) = “2: Analog input” | 9: Torque bias | page 7-33 |
| PID command | PID Control PID Command Selection (J002)= “1: Analog input” | 3: PID command | page 8-113 |
| PID feedback | PID Control Feedback Selection (E119)= “0: Analog input” | 5: PID feedback | page 8-113 |

## 8-3-2 Analog Input Adjustment Function

This function adjusts the offset, bias and gain of the analog input terminals [AI1].

- The analog input terminal [AI1] has a voltage input only.
- Select the polarity (C035) of the analog signal to input and set the input range of the analog signal.
- Add the value set at Offset (C031) to the analog input value, and adjust for shift of the offset.
- Set the bias (command) (F018/C055) and gain (command) (C032), and convert the analog signal to digital value and adjust the resulting signal. Adjust the base point of bias (command) and gain (command) at bias (analog input) (C050/C056) and gain (analog input) (C034).
- Filters (C033) can be set to remove noise.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| C035 | Input Terminal [AI1] Polarity Selection | 0: Bipolar<br>1: Unipolar | 1 | - |
| C031 | Input Terminal [AI1] Offset | -5.0 to 5.0 | 0.0 | % |
| C033 | Input Terminal [AI1] Filter | 0.00 to 5.00 | 0.05 | s |
| C032 | Input Terminal [AI1] Gain (Command) | 0.00 to 400.00 | 100.00 | % |
| C034 | Input Terminal [AI1] Gain (Analog Input) | 0.00 to 100.00 | 100.00 | % |
| **Bias adjustment on 1st frequency reference** | | | | |
| F018 | Input Terminal [AI1, AI2] Bias for 1st Frequency Command | -100.00 to 100.00 | 0.00 | % |
| C050 | Input Terminal [AI1, AI2] Bias Analog Input for 1st Frequency Command | 0.00 to 100.00 | 0.00 | % |
| **Bias adjustment on 2nd frequency reference** | | | | |
| C055 | Input Terminal [AI1] Bias (Command) | -200.00 to 200.00 | 0.00 | % |
| C056 | Input Terminal [AI1] Bias (Analog Input) | 0.00 to 100.00 | 0.00 | % |

## Polarity Selection (C035)

Set the input range of analog input voltage.

| Input Terminal [AI1] Polarity Selection (C035) data | Function | Description |
|---|---|---|
| 0 | Bipolar (-10 to 10 V) | When analog signals are changed to digital values after application of bias, values less than 0% are enabled as minus values. |
| 1 | Unipolar (0 to 10 V) | When analog signals are changed to digital values after application of bias, values less than 0% are limited at 0%. |

## Offset (C031)

Set an offset with respect to the analog input voltage. It is also possible to correct the offset of signals from external equipment.

## Filter (C033)

Set the filter time constant with respect to the analog input voltage. As response slows down when a large time constant is set, take the response speed of the equipment into consideration when determining the time constant. When noise causes the input voltage to fluctuate, increase the time constant.

## Scaling of Analog Input Signal

The relationship between analog input signals and digital values for each individual analog input range is as follows.

| Analog input range | Input value | Digital value (%) | Gain/bias setting value |
|---|---|---|---|
| 0 to 10V | 0<br>10V | 0%<br>100% | Gain reference value 100% (factory default value)<br>Gain 100% (factory default value)<br>Bias reference value 100% (factory default value)<br>Bias 0% (factory default value) |
| -10 to 10V | -10<br>0<br>+10V | -100%<br>0%<br>100% | Gain reference value 100% (factory default value)<br>Gain 100% (factory default value)<br>Bias reference value 100% (factory default value)<br>Bias 0% (factory default value) |

Analog input signals 0% to 100% are converted at the following full scale, and used by the corresponding functions.

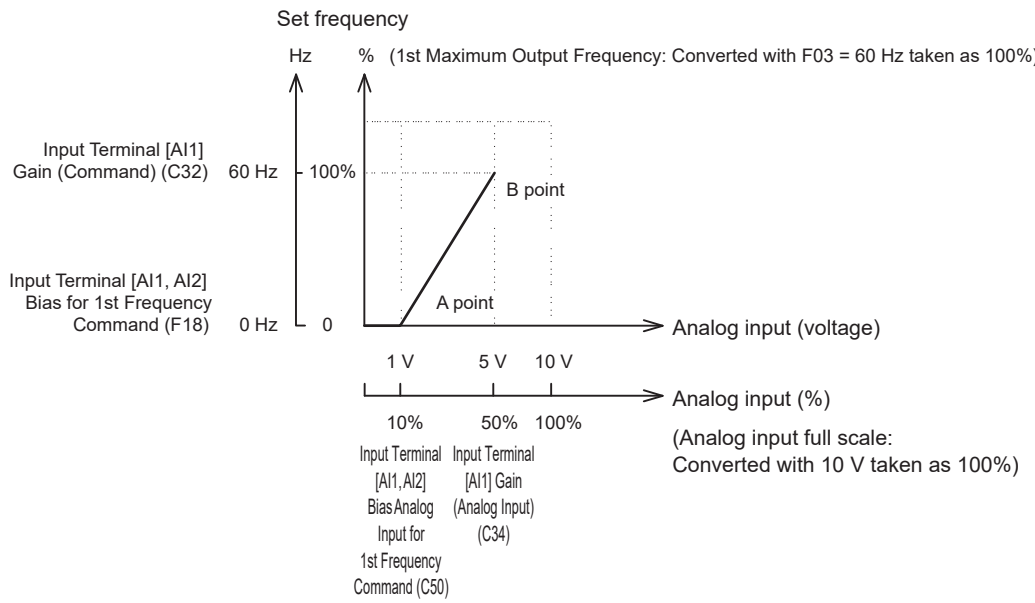
| Input Terminal [AI1] Function Selection (E061) data | Function | Full scale |
|---|---|---|
| 0 | Frequency Reference | 0 to maximum output frequency [Hz] |
| 1 | Auxiliary frequency setting 1 | Same as above (same as “0: Frequency reference”) |

| Input Terminal [AI1] Function Selection (E061) data | Function | Full scale |
|---|---|---|
| 2 | Auxiliary frequency setting 2 | Same as above (same as “0: Frequency reference”) |
| 3 | PID command | Input Terminal [AI1] Analog Input Adjustment Minimum Scale (C060) to Input Terminal [AI1] Analog Input Adjustment Maximum Scale (C059) |
| 5 | PID feedback | Same as above (same as “3: PID command”) |
| 6 | Ratio setting | 0 to 100% |
| 7 | Analog torque limiter | 0 to 200% |
| 9 | Torque bias | Same as above (same as “7: Analog torque limiter”) |
| 10 | Torque Reference | 0 to 200% |
| 11 | Torque Current Command | Same as above (same as “10: Torque command”) |
| 17 | Speed limit for forward rotation | 0 to maximum output frequency [Hz] |
| 18 | Speed limit for reverse rotation | Same as above (same as “17: Speed limit for forward rotation”) |
| 20 | For analog input display | (Same as “3: PID command”) |
| 21 | PID feed forward | (Same as “3: PID command”) |

## Gain/Bias

When setting gain and bias, take the maximum frequency required for your application to be 100%. When setting the bias base point and gain base point data, take full scale of analog input (10 V) to be 100%.
Even if an analog input is unipolar, the frequency setting can be set as bipolar by setting bias as a negative value.

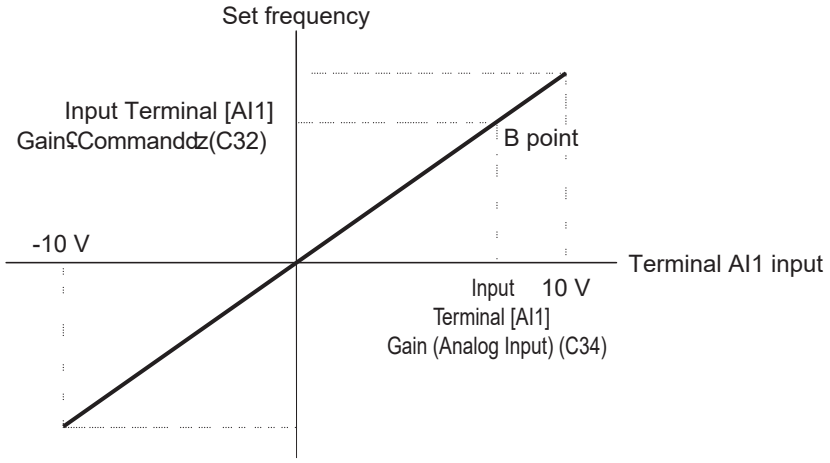
Example) When setting the set frequency 0 to 60 Hz by analog input AI1 1 to 5 V (1st Maximum Output Frequency (F003) = 60 Hz)



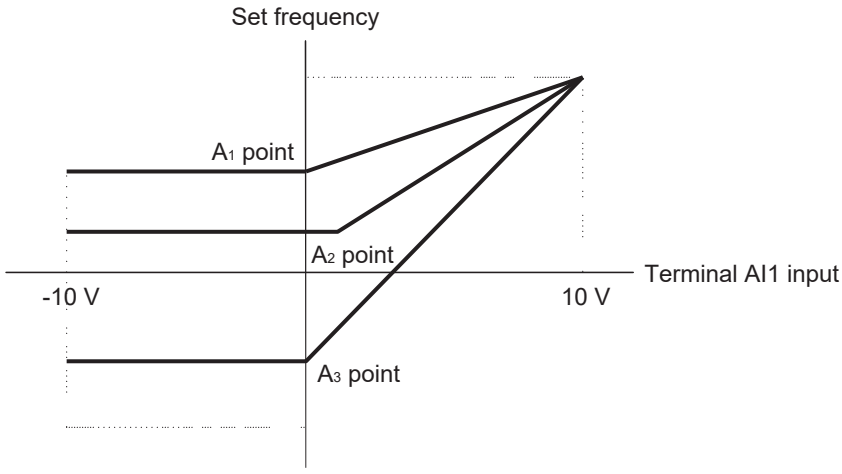
To take the frequency reference to be 0 Hz when the analog input is 1 V, set Input Terminal [AI1] Bias for 1st Frequency Command (F018) to 0%. At this time, as 1 V becomes the bias base point and 1 V is equivalent to 10% of full scale 10 V of terminal AI1, set Input Terminal [AI1, AI2] Bias Analog Input for 1st Frequency Command (C050) to 10%.

(B point)
To take the frequency reference to be the maximum frequency when the analog input is 5 V, set Input Terminal [AI1] Gain (Command) (C032) to 100%. At this time, as 5 V becomes the gain base point and 5 V is equivalent to 50% of full scale 10 V of input terminal [AI1], set Input Terminal [AI1] Gain (Analog Input) (C034) to 50%.

Input terminal [AI1] can be used with bipolar inputs (-10 V to 10 V) by setting Input Terminal [AI1] Polarity Selection (C035) to “0.”
When Input Terminal [AI1] Bias for 1st Frequency Command (F018) and Input Terminal [AI1] Bias Analog Input for 1st Frequency Command (C050) are both set to “0,” the command becomes symmetrically inverted as shown in the figure below.



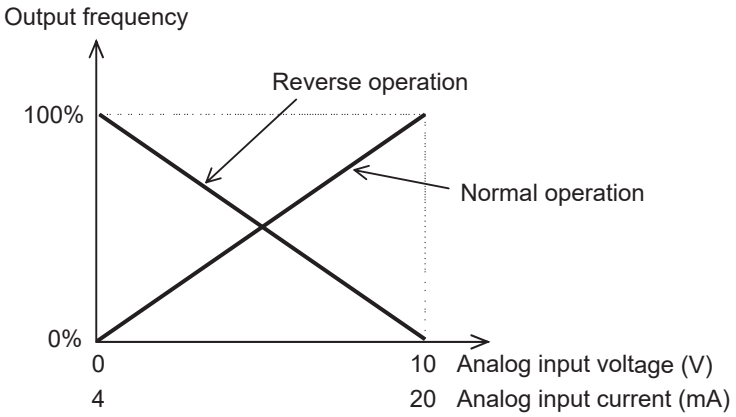

When Input Terminal [AI1] Bias for 1st Frequency Command (F018) and Input Terminal [AI1] Bias Analog Input for 1st Frequency Command (C050) are set to an arbitrary value (e.g. points A1, A2, A3), each of the values are limited by bias values as shown in the figure below.



## Normal and Inverse Operations

Normal operation and inverse operation of the analog frequency reference can be switched by the IVS terminal

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| C053 | Input Terminal [AI1, AI2] Normal/Inverse Operation for 1st Frequency Command | 0: Normal<br>1: Inverse | 0 | - |
| C054 | Input Terminal [AI1, AI2] Normal/Inverse Operation for 2nd Frequency Command | 0: Normal<br>1: Inverse | 0 | - |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 21: IVS (Switch normal / inverse operation) | - | - |




- Switching of Normal/Inverse is performed by the combination of Input Terminal [AI1] Normal/Inverse Operation for 1st Frequency Command (C053)/Input Terminal [AI1] Normal/Inverse Operation for 2nd Frequency Command (C054) and the Normal/Inverse switching “IVS” signal. Operation is as shown in the following table.

| C053/C054 data | Input signal “IVS” | Operation |
|---|---|---|
| 0: Normal | OFF | Normal operation |
| 0: Normal | ON | Reverse operation |
| 1: Inverse | OFF | Reverse operation |
| 1: Inverse | ON | Normal operation |

Input Terminal [AI1] Normal/Inverse Operation for 1st Frequency Command (C053)/Input Terminal [AI1, AI2] Normal/Inverse Operation for 2nd Frequency Command (C054) are enabled when analog input is selected as the frequency reference at 1st Frequency Reference Selection (F001)/2nd Frequency Reference Selection (C030). In UP/DOWN control, normal/inverse operation cannot be selected.

## 8-3-3 Analog Input Filter

Use it to set an input filter for voltage or current input when using an external analog signal to input the frequency reference. The analog input filter is effective in removing noise from the analog input circuit.

Increasing the set value results in a slow response. This is the filter time constant for a sett value of 0.00 to 5.00 (s).

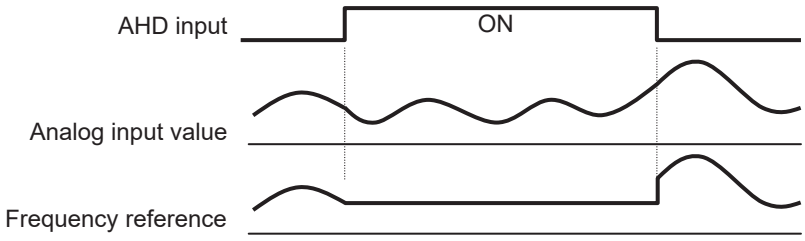
| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| C033 | Input Terminal [AI1] Filter | 0.00 to 5.00 s | 0.05 | s |

## 8-3-4 Analog Command Hold Function (AHD)

Use this function to hold the frequency reference, PID command, etc. instructed by analog input. While the AHD terminal is ON, the capture result of the analog input [AI1] terminal is held. Since the analog input value is held, this function can be used regardless of the usage purpose of the analog inputs.

If the power is turned ON, or if the reset terminal (8: RS) is turned from ON to OFF with the AHD terminal ON, the last held data is made available.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| | | | | |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 85: AHD (Analog command held) | - | - |



# 8-4 Restart Functions

This section describes the restart-related functions and their operations.

## 8-4-1 Restart Settings

- Whether or not to perform an auto search start during restart is determined based on the setting of Motor Starting Mode Auto Search Function Selection (H009). If auto search start is not to be performed, the inverter restarts from the starting frequency as in normal operation.
- If “0: Disable” is set at Motor Starting Mode Auto Search Function Selection (H009), then Power Interruption Restart Wait Time (H013) is ignored, and restart is performed from 0 Hz.
- If “2: Enable at normal start and restart after momentary power failure” is selected for Motor Starting Mode Auto Search Function Selection (H009), auto search restart is performed even when the power is turned ON again.
- Motor Starting Mode Auto Search Function Selection (H009) is a parameter that is used in V/f control (including dynamic torque vector control). Motor Starting Mode Auto Search in Speed Sensor less Vector Control (d067) is used during vector control without sped sensor.
- When vector control with speed sensor is used, restart is performed from the speed detected by the speed sensor regardless of Motor Starting Mode Auto Search Function Selection (H009).
- When using V/f control with speed sensor (including dynamic torque vector control with speed sensor), Motor Starting Mode Auto Search Function Selection (H009) is followed.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H009 | Motor Starting Mode Auto Search Function Selection | 0: Disable<br>1: Enable (Only at restart after momentary power failure)<br>2: Enable (At normal start and restart after momentary power failure) | 0 | - |
| d067 | Motor Starting Mode Auto Search in Speed Sensor less Vector Control | | 1 | |

- The details of Starting Frequency Selection at Frequency Pull-in Restart (E152) are as follows.

| Set value | Description | Description |
|---|---|---|
| 0 | Frequency at which the power failure occurred | Pull-in from frequency when inverters output was shut off |
| 1 | Maximum frequency | Pull-in from maximum frequency |
| 2 | Set frequency | Pull-in from currently selected frequency reference |
| 3 | Starting frequency | Restart from starting frequency |

## 8-4-2 Restart after Momentary Power Failure

This function is used to set operation selection during restart after a momentary power failure.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F014 | Power Interruption Restart Mode Selection | 0: Immediately trip (Free run stop)<br>1: Trip after a recovery from power failure (Free run stop)<br>2: Trip after decelerate-to-stop<br>3: Continue to run<br>4: Restart at the frequency selected by (E152)<br>6: Decelerate-to-stop (w/o trip) | 1 | - |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 26: STM (Enable auto search for idling motor speed at starting)<br>22: IL (Interlock) | - | - |
| H009 | Motor Starting Mode Auto Search Function Selection | 0: Disable<br>1: Enable only at restart after momentary power failure<br>2: Enable at normal start and restart after momentary power failure | 0 | - |
| d067 | Motor Starting Mode Auto Search in Speed Sensor less Vector Control | | 1 | - |
| H016 | Allowable Time for Power Interruption Restart | 0.0 to 30.0<br>999: Auto judgment | 32767 | s |
| H013 | Power Interruption Restart Wait Time | 0.1 to 100.0 | 0.5 | s |
| H014 | DecelerationSetting During Current Limit for Restart Mode after Power Interruption | 0.00: Selected deceleration time<br>0.01 to 100.00<br>999: According to current limiter | 32767 | Hz/s |
| H015 | Continuous Running Voltage Level | 200 to 300 (200 V class series)<br>400 to 600 (400 V class series) | 235 | V |
| H049 | Auto Search Delay Time 1 for Starting Characteristic | 0.0 to 10.0 | 0 | s |
| H046 | Auto Search Delay Time 2 for Starting Mode | 0.1 to 100.0 | 1.0 | s |
| H092 | Continuous Running at the Momentary Power Failure P Proportional Gain | 0.000 to 10.000<br>999: Auto | 32767 | - |
| H093 | Continuous Running at the Momentary Power Failure Integral Time | 0.010 to 10.000<br>999: Auto | 32767 | s |
| E152 | Starting Frequency Selection at Frequency Pull-in Restart | 0: Frequency at which the power failure occurred<br>1: Maximum output frequency<br>2: Frequency reference<br>3: Starting frequency | 3 | - |

## Restart Mode after Power Interruption Operation Selection (H014)

<table>
<tr><th rowspan="2">F014 data</th><th colspan="2">Operation details</th></tr>
<tr><th>Without auto search</th><th>With auto search*1</th></tr>
<tr><td>0: Immediately trip</td><td colspan="2">If a momentary power failure occurs while the inverter is operating and an undervoltage is detected in the Main Circuit DC Voltage of the inverter, the undervoltage alarm LU is output at that time, the inverter output is cut off and the motor enters the free-run state.</td></tr>
<tr><td>1: Trip after a recovery from power failure</td><td colspan="2">If a momentary power failure occurs while the inverter is operating and an undervoltage is detected in the Main Circuit DC Voltage of the inverter, the inverter output is cut off at that time and the motor enters the free-run state, but no undervoltage alarm is generated. During power restoration from a momentary power failure, an undervoltage alarm LU is output.</td></tr>
<tr><td>2: Trip after decelerate-to-stop</td><td colspan="2">If a momentary power failure occurs while the inverter is operating and the Main Circuit DC Voltage of the inverter falls below the continuous running level, the deceleration stop control is started. During deceleration stop control, the kinetic energy of the moment of inertia of the load is regenerated due to deceleration, and the deceleration operation continues.<br>After the deceleration stop, the LU alarm is output.</td></tr>
<tr><td rowspan="2">3: Continue to run</td><td colspan="2">If a momentary power failure occurs while the inverter is operating and the Main Circuit DC Voltage of the inverter falls below the continuous running level, the operation continuation control is started. During continuous running control, the kinetic energy of the moment of inertia of the load is regenerated due to deceleration, and the operation continues and power restoration is awaited. If the energy to be regenerated is low and an undervoltage is detected, the inverter output is cut off, and the motor falls in a free-run state.</td></tr>
<tr><td>If the RUN command is input during power restoration, restart is performed from the pull-in frequency. Select the pull-in frequency at Starting Frequency Selection at Frequency Pull-in Restart (E152).</td><td>If the RUN command is input during power restoration, auto search is performed, the motor speed is estimated, and restart is performed from the frequency.</td></tr>
<tr><td rowspan="2">4: Restart based on pull-in frequency</td><td colspan="2">If a momentary power failure occurs while the inverter is operating and an undervoltage is detected in the Main Circuit DC Voltage of the inverter, the inverter output is cut off and the motor enters the free-run state.</td></tr>
<tr><td>If the RUN command is input during power restoration, restart is performed from the pull-in frequency. Select the pull-in frequency at Starting Frequency Selection at Frequency Pull-in Restart (E152).</td><td>If the RUN command is input during power restoration, auto search is performed, the motor speed is estimated, and restart is performed from the frequency.</td></tr>
<tr><td>6: Decelerate-to-stop (w/o trip)</td><td colspan="2">If a momentary power failure occurs while the inverter is operating and the Main Circuit DC Voltage of the inverter falls below the continuous running level, the deceleration stop control is started. During deceleration stop control, the kinetic energy of the moment of inertia of the load is regenerated due to deceleration, and the deceleration operation continues. An alarm does not occur after a deceleration stop.<br>If the RUN command turns OFF in the deceleration stop state, the deceleration stop state is canceled, and the operation can be performed when the RUN command turns ON the next time.</td></tr>
</table>

*1. With auto search is selected when Enable auto search for idling motor speed at starting “STM” is ON, or Motor Starting Mode Auto Search Function Selection (H009/d067) = 1 or 2.
When a motor control method with speed sensor is selected, restart is performed from the motor speed detected by the speed sensor. In the case of a motor control method without speed sensor, restart is performed from the estimated speed.

**Additional Information**

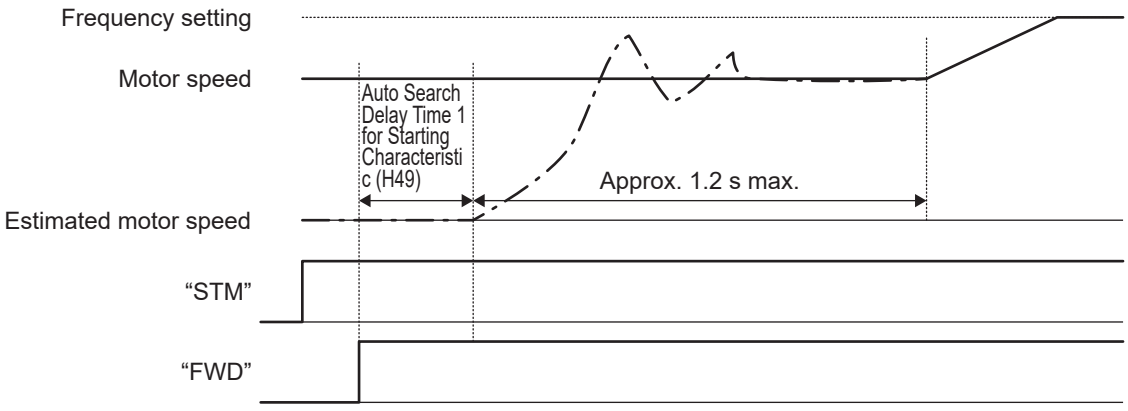
When using vector control without speed sensor, do not use restarting from the pull-in frequency (Starting Frequency Selection at Frequency Pull-in Restart (E152)). If you select starting from pull-in frequency, normal start may not be performed, or the device may be damaged.

## Startup characteristics selection STM

Allocate “26: STM (Enable auto search for idling motor speed at starting)” to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099).
This function is used to select whether or not to perform the auto search operation (auto search without stopping the motor during idling) when the inverter is started by turning the STM terminal ON or OFF.

| Startup characteristics selection STM | Operation |
|---|---|
| OFF | Auto search disabled |
| ON | Auto search enabled |

By a startup with auto search enabled, the speed at startup will be searched (for a maximum of approx. 1.2 seconds) as an auto search without stopping the motor during idling is performed. After a speed search, acceleration is performed up to the set acceleration time.

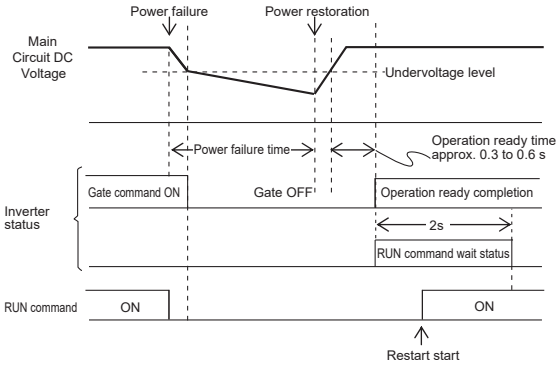



At a startup as a result of the RUN command turning ON, the auto search is started after a delay by the time set at Auto Search Delay Time 1 for Starting Characteristic (H049). When control of a motor is alternately switched between two inverters, and the motor is started by an auto search after a free run during switching, the RUN command does not need to be issued in a timely manner by setting Auto Search Delay Time 1 for Starting Characteristic (H049).

## Restart Mode after Momentary Power Failure (Basic Operation: Without Auto Search Setting)

When the inverter detects that the Main Circuit DC Voltage has dropped below the undervoltage level during operation, it judges a momentary power failure.
After the restoration of power, the inverter is set to the operation ready completion state once the initial charging time has elapsed. During a momentary power failure, the power of the external circuit (such

as a relay circuit) controlling the inverter also declines and the RUN command may also turn OFF. Therefore, when the operation ready state is complete, the inverter waits for two seconds for the RUN command to be input. If the input of the RUN command is confirmed within two seconds, the inverter starts restarting according to Power Interruption Restart Mode Selection (H014). If the RUN command is not input, the restart mode after momentary power failure is canceled, and startup is performed from the normal starting frequency.




During power restoration, the inverter waits for two seconds for the RUN command to be input, but if the time period set at Allowable Time for Power Interruption Restart (H016) elapses after power failure is judged, the two-second long RUN command input waiting state is canceled, and normal startup is performed.

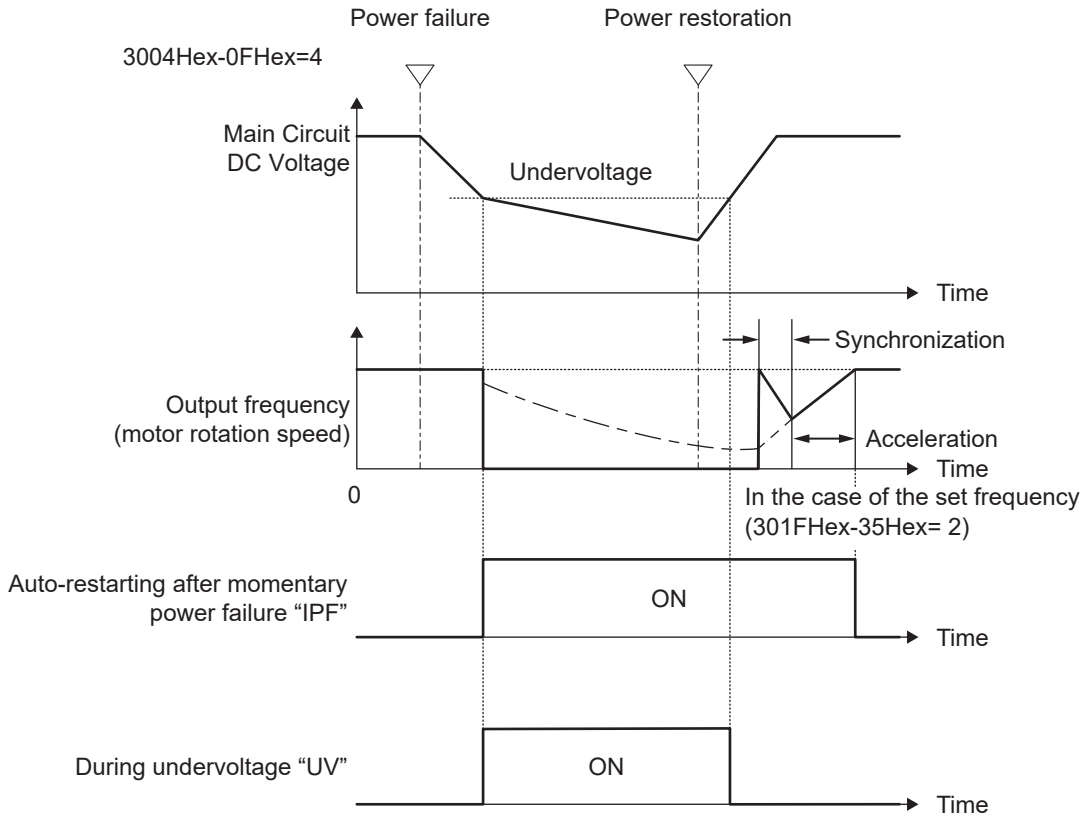
If the free-run command “FRS” is input during a power failure, Free Run Stop Restart Operation Selection (H441) is set, and when the RUN command is input, startup is performed from the normal starting frequency.

As a measure against difficulty in bringing down the Main Circuit DC Voltage during momentary power failure, if “22: IL (Interlock)” is allocated to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099), the momentary power failure can be detected accurately.

| Input signal IL | Meaning |
|---|---|
| OFF | Momentary power failure not occurred |
| ON | Momentary power failure occurred (Restart after momentary power failure enabled) |

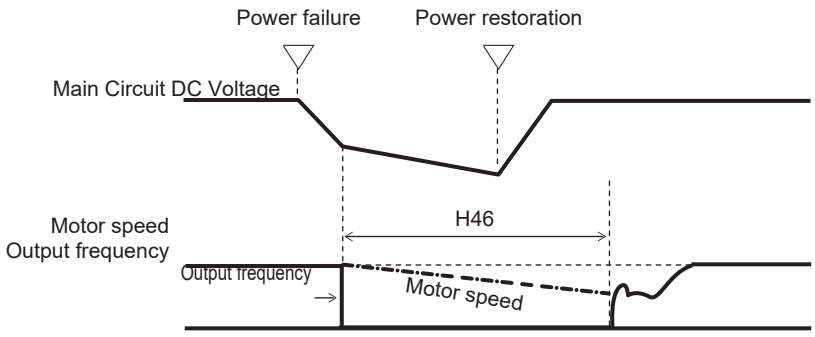
When the motor speed drops during momentary power failure and startup is performed from the frequency prior to the momentary power failure after the power is restored, the current limitation function is activated, and the output frequency of the inverter declines automatically. When the output frequency and the motor rotation speed are synchronous, acceleration is performed up to the original output frequency.

However, the momentary overcurrent limitation must be enabled (Instantaneous Overcurrent Limiting Function Selection (H012) = 1) for the synchronous pull-in of the motor.



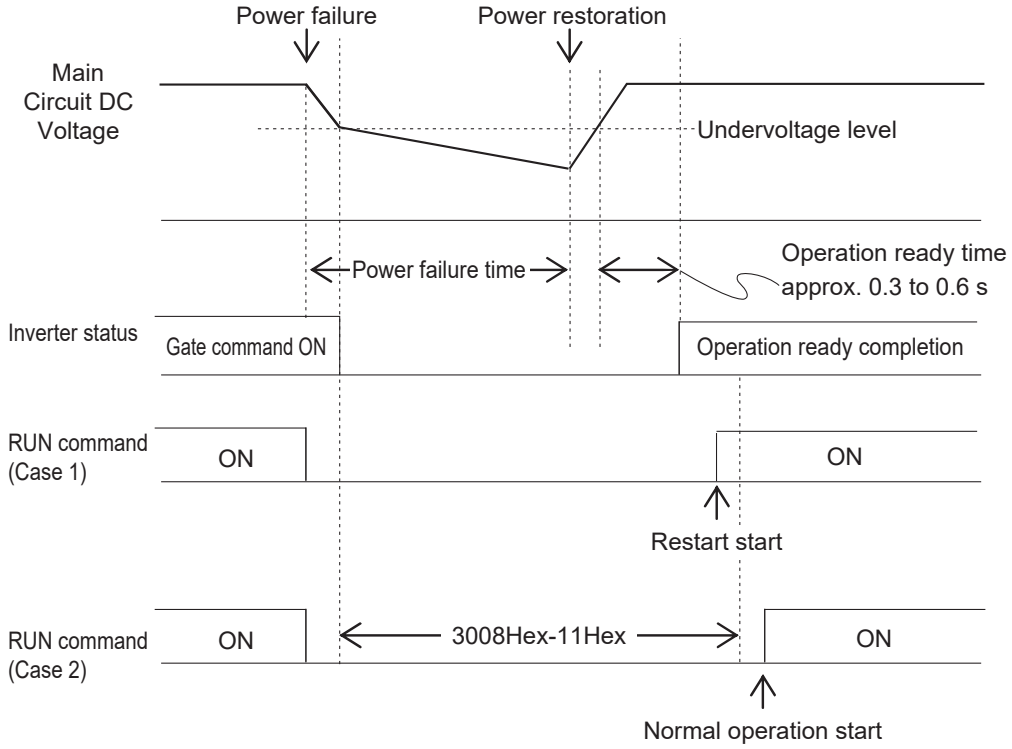

## Restart Mode after Momentary Power Failure (Basic Operation: With Auto Search Setting)

The auto search operation does not operate normally if residual voltage is remaining in the motor. Therefore, it is necessary to secure time for the residual voltage to dissipate.
The required time for restart after momentary power failure is secured by Auto Search Delay Time 2 for Starting Mode (H046).



## Allowable Time for Power Interruption Restart (H016)

Set the maximum time from when a momentary power failure (undervoltage level) occurs until a restart is performed (setting range: 0.0 to 30.0 s). If the setting range is exceeded, the restart after momentary power failure is not performed, and operation is performed by turning ON the power again.




If Allowable Time for Power Interruption Restart (H016) is set to “999,” restart after momentary power failure is performed until the Main Circuit DC Voltage drops down to the allowable voltage for restart after momentary power failure, and once it becomes equal to or below the allowable voltage for restart after momentary power failure, it is judged that the power supply is cut off, the restart after momentary power failure is not performed, and the operation is performed by turning the power ON again.

| Power supply system | Allowable voltage for restart after momentary power failure |
|---|---|
| 200 V | 50 V |
| 400 V | 100 V |

## Power Interruption Restart Wait Time (H013)

Set the time from after the occurrence of momentary power failure until the inverter restarts (Auto Search Delay Time 2 for Starting Mode (H046) is used during auto search setting). If the inverter is started in a state when the residual voltage of the motor is high, the inrush current may increase, there may be a temporary regeneration, and an overvoltage alarm may occur. For safety, adjust Power Interruption Restart Wait Time (H013) so that restart is performed after the residual voltage becomes low to an extent.

## Deceleration Setting During Current Limit for Restart Mode after Power Interruption (H014)

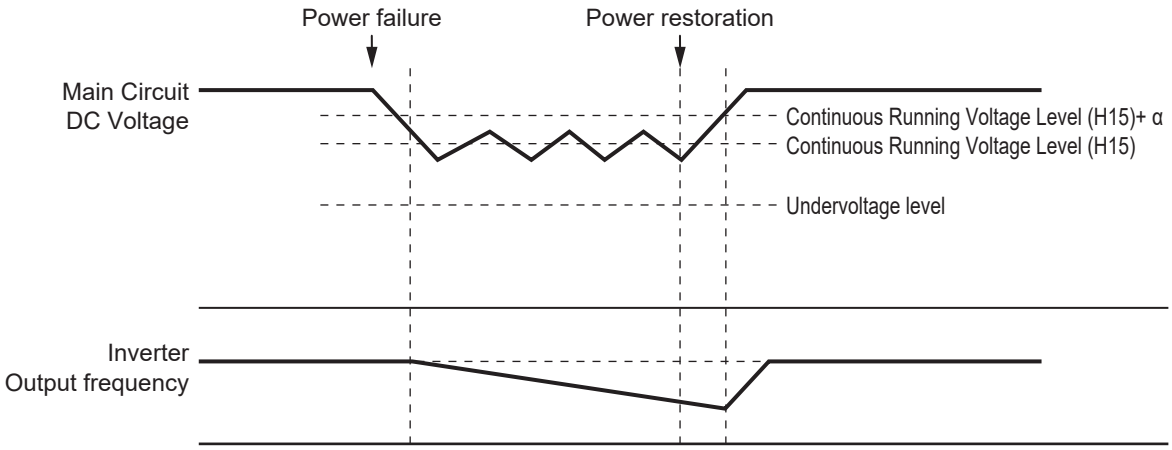
During restart after a momentary power failure, if the output frequency of the inverter and the rotation speed of the motor are not in sync, an overcurrent flows and current limitation is activated. If a current limitation is detected, the output frequency is automatically lowered to be in sync with the motor rotation speed. At Deceleration Setting During Current Limit for Restart Mode after Power Interruption (H014), set the gradient (frequency fall rate (Hz/s)) for lowering the output frequency.

| H014 data | Output frequency lowering operation |
|---|---|
| 0.00 | Falls at the selected deceleration time. |
| 0.01 to 100.00 Hz/s | Falls at the fall rate set at Deceleration Setting During Current Limit for Restart Mode after Power Interruption (H014). |
| 999 | Falls in accordance with the PI controller of the current limitation process (the PI constant is a fixed value inside the inverter). |

## Continuous Running Voltage Level (H015)

- Deceleration stop during momentary power failure
  If “Trip after decelerate-to-stop (Power Interruption Restart Mode Selection (H014) = 2)” or “Decelerate-to-stop(w/o trip) (Deceleration Setting During Current Limit for Restart Mode after Power Interruption (H014) = 6)” is selected at the Power Interruption Restart (mode selection), then at the moment a momentary power failure occurs while the inverter is operating and the Main Circuit DC Voltage of the inverter falls below the continuous running level, the deceleration stop control is started. Adjust the Main Circuit DC Voltage level at which to start the deceleration stop control at Continuous Running Voltage Level (H015). During deceleration stop control, deceleration is performed while controlling the Main Circuit DC Voltage at a constant level with a PI controller. The P (Proportional) and I (Integral) of the PI controller are adjusted by Continuous Running at the Momentary Power Failure P Proportional Gain (H092) and Continuous Running at the Momentary Power Failure Integral Time (H093), respectively.

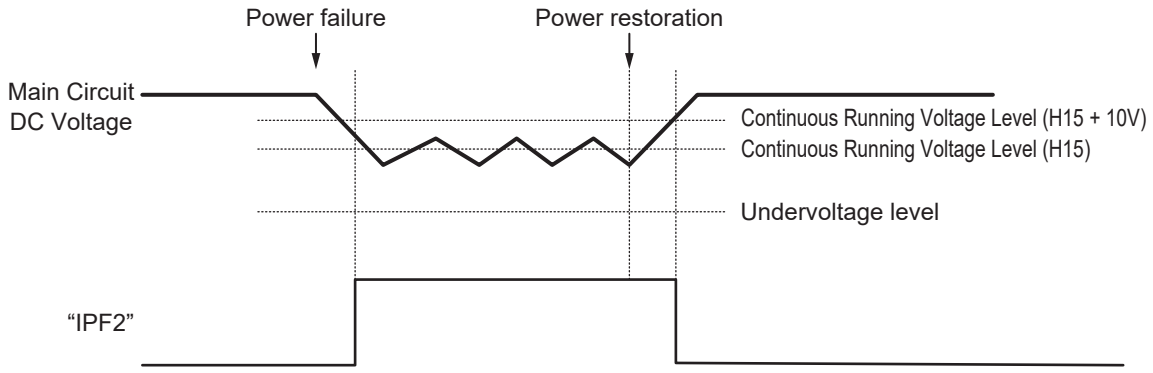
- Continuous running
  If “Continue to run (Deceleration Setting During Current Limit for Restart Mode after Power Interruption (H014) = 3)” is selected at the Power Interruption Restart (mode selection), then at the moment a momentary power failure occurs while the inverter is operating and the Main Circuit DC Voltage of the inverter falls below the continuous running level, the operation continuation control is started. Adjust the continuous running level at which to start the continuous running control at Continuous Running Voltage Level (H015). During continuous running control, the operation is continued while controlling the Main Circuit DC Voltage at a constant level with a PI controller.




| Power supply system | α | |
|---|---|---|
| | 22 kW max. | 30 kw min. |
| 200 V | 5 V | 10 V |
| 400 V | 10V | 20 V |

- During decelerating at momentary power failure “IPF2”
  This parameter turns ON when Deceleration Setting During Current Limit for Restart Mode after Power Interruption (H014) is 2 or 3, and the Main Circuit DC Voltage falls below Continuous Running Voltage Level (H015) and the continuous running state is established. This parameter turns OFF when power restores and the Main Circuit DC Voltage becomes “the voltage set at Continuous Running Voltage Level (H015) +10 V or higher.”
  This parameter turns ON even when Deceleration Setting During Current Limit for Restart Mode after Power Interruption (H014) is 4 or 5 and the Main Circuit DC Voltage falls below the undervoltage level. This parameter turns OFF when the DC link bus voltage reaches “the undervoltage level +10 V or higher.”

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 79: IPF2 (During decelerating at momentary power failure) | - | - |




## 8-4-3 Trip Retry Operation

This function is used to set the operation selection to restart during overvoltage or overcurrent.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E139 | Overvoltage/Overcurrent Restart Function Selection | 0: Trip immediately<br>4: Restart at the frequency selected by E152 | 0 | - |
| H004 | Retry Count at Trip | 0: Disable<br>1 to 20: Number of retries | 0 | - |
| H005 | Retry Standby Time at Trip | 0.5 to 20.0 | 5 | s |
| E020/E027 | Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection | 26: TRY (Auto-resetting) | - | - |

## Overvoltage/Overcurrent Restart Function Selection (E139)

| E139 data | Operation details | |
|---|---|---|
| | Without auto search | With auto search*1 |
| 0: Trip | An alarm is output when an overvoltage or overcurrent is detected, the inverter output is cut off, and the motor falls in a free-run state. | |
| 4: Restart based on pull-in frequency | If an overvoltage or overcurrent is detected, the inverter output is cut off, and the motor falls in a free-run state. | |
| | During recovery from overvoltage or overcurrent, restart is performed from the pull-in frequency. Select the pull-in frequency at Starting Frequency Selection at Frequency Pull-in Restart (E152). | During recovery from overvoltage or overcurrent, auto search is performed, the motor speed is estimated, and restart is performed from the frequency. |

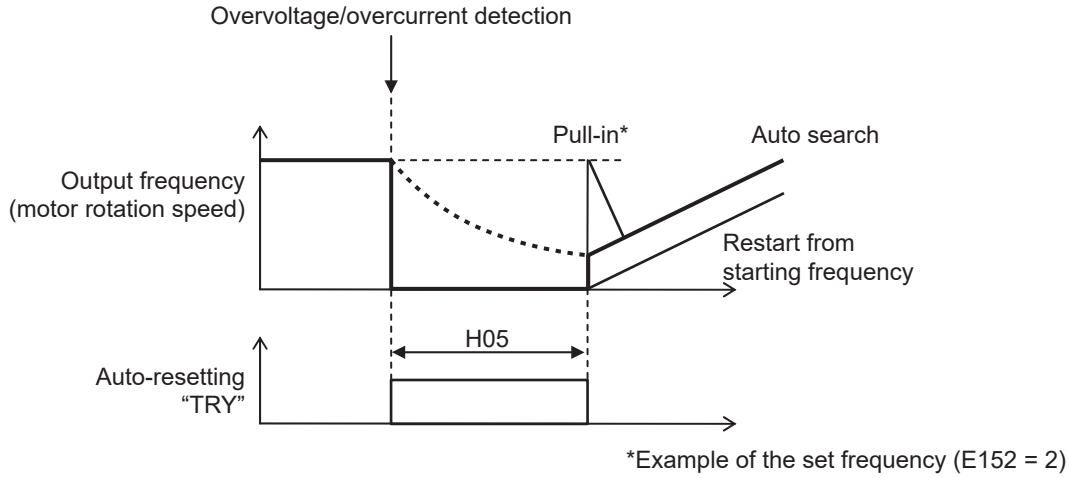
*1. With auto search is Enable auto search for idling motor speed at starting “STM” is ON, or H009(d067) = 1 or 2.
When a motor control method with speed sensor is selected, restart is performed from the motor speed detected by the speed sensor. In the case of a motor control method without speed sensor, restart is performed from the estimated speed.



**Additional Information**

When using vector control without speed sensor, do not use restarting from the pull-in frequency (Starting Frequency Selection at Frequency Pull-in Restart (E152)). If you select starting from pull-in frequency, normal start may not be performed, or the device may be damaged.

Use the retry function to recover from overvoltage or overcurrent.
(H004: Retry Count at Trip, H005: Retry Standby Time at Trip) As for the starting method, the settings in E139 is applied.



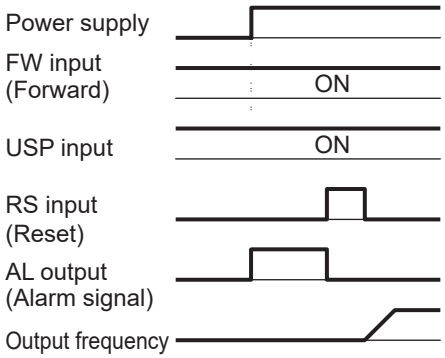

## 8-4-4 Unattended Start Protection (USP Terminal)

- Use this function to have the inverter trip if the power supply is turned ON with the RUN command ON in the inverter.
- When the RUN command is ON and multifunction input “USP” is ON when the power is ON, a run operation error (alarm code: 24, sub code: 30) is generated
- When the run operation error is reset with the RUN command still ON, operation is started regardless of the ON/OFF setting of “USP.” (Example 1)
- If the RUN command turns ON after the power supply is turned ON, the inverter operates normally. (Example 2)
- Allocate “186: USP (Unattended start protection)” to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099).
- Power recovery restart prevention based on USP input is enabled only for a RUN command from the terminal block.

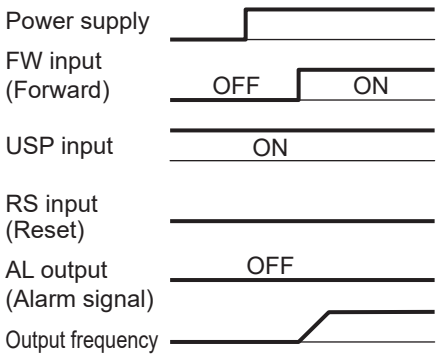
| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 186: USP (Unattended start protection) | - | - |

The operation of the unattended start protection is shown below.

(Example 1) Power ON with RUN command ON (Reset with Reset (RS))




(Example 2) RUN command after power ON (Normal operation)



## Using the unattended start protection and the Start Check Function in Combination

- When used in combination with the start check function (H096 = 2, 3), a run operation error (alarm code: 24, sub code: 5) is generated by the start check function, and this is given priority. For this reason, to cancel the run operation error, turn the RUN command OFF and then perform a reset operation.
- For details on the start check function, refer to *8-7-3 Start Check Function (H096)* on page 8-74.

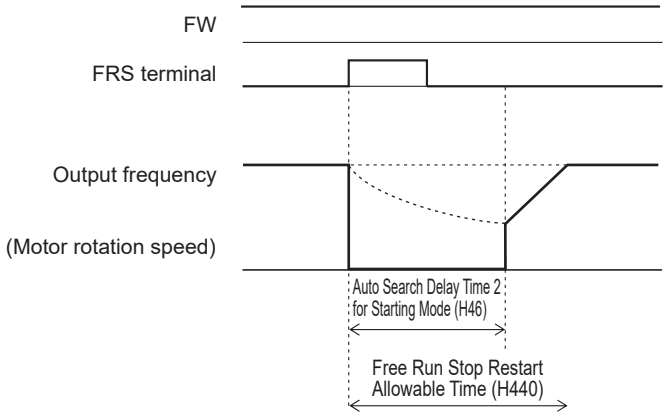
## 8-4-5 Free Run Restart

- A restart is performed when the operation state is returned to while in a free-run state.
- A free-run restart is performed by the restart operation selected at Free Run Stop Restart Operation Selection (H011) when “1: Free run stop” is selected at Stop Selection (H441) and the RUN com- mand is turned ON while in a free-run state or when the free-run command (7: FRS) terminal is set to OFF and the free-run state is canceled.
- For details on a restart after a momentary power failure, refer to *8-4-2 Restart after Momentary Pow- er Failure* on page 8-41.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H441 | Free Run Stop Restart Operation Selection | 1: Starting with matching frequency<br>2: Starting with active matching frequency | 2 | - |
| H013 | Power Interruption Restart Wait Time | 0.1 to 100.0 | 0.5 | s |
| H046 | Auto Search Delay Time 2 for Starting Mode | 0.1 to 100.0 | 1.0 | s |
| F023/A012 | 1st Starting Frequency/2nd Starting Frequency | 0.0 to 60.0 | 0.5 | Hz |
| H014 | Deceleration Setting During Current Limit for Restart Mode after Power Interruption | 0.00: Selected deceleration time<br>0.01 to 100.00<br>999: According to current limiter | 32767 | Hz/s |
| E152 | Starting Frequency Selection at Frequency Pull-in Restart | 0: Frequency at which the power failure occurred<br>1: Maximum output frequency<br>2: Frequency reference<br>3: Starting frequency | 3 | - |
| H440 | Free Run Stop Restart Allowable Time | 0.0 to 30.0 | 30.0 | s |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 7: FRS (Free-run stop)<br>26: STM (Enable auto search for idling motor speed at starting) | - | - |

## Auto Search Restart (H441 = 1)

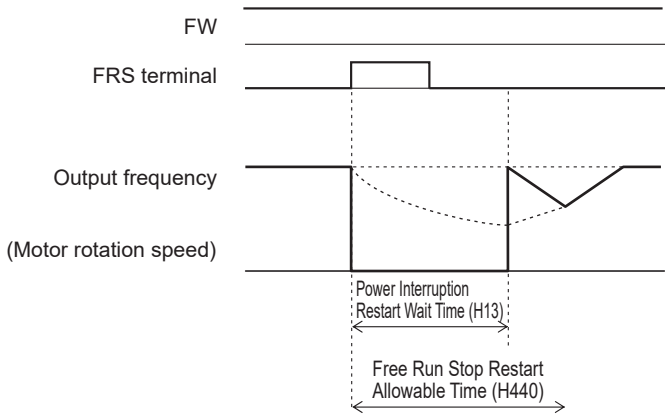
- Auto search restart causes the inverter to anticipate the frequency from the voltage between the mo- tor terminals in a free-run state and restart matched to that frequency. If the anticipated frequency is not sufficient, the inverter restarts from 1st Starting Frequency (F023)/2nd Starting Frequency (A012).
- With the RUN command ON, when the free-run state is canceled after the Auto Search Delay Time 2 for Starting Mode (H046) has elapsed since the free-run state, the auto search restart is started.
- The restart is performed at the starting frequency when Free Run Stop Restart Allowable Time (H440) is set shorter than Auto Search Delay Time 2 for Starting Mode (H046).
- The examples below assume that the FRS terminal is used.
- When the anticipated frequency exceeds the Maximum Output Frequency (F003/A001) or the Frequency Upper Limit (F015/E117), auto search restart is not performed, and the restart is performed using the maximum frequency or the Frequency Upper Limit (F015/E117), whichever is lower.



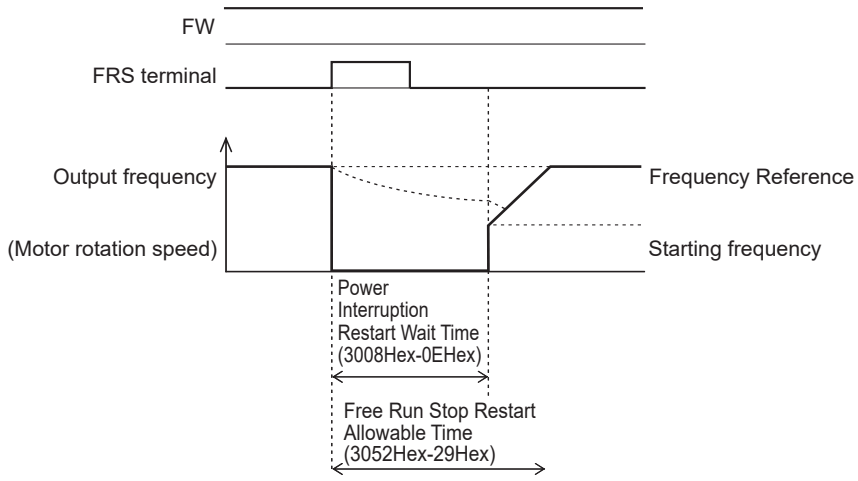

## Frequency Pull-in Restart (H441 = 2:Active Match)

- A frequency pull-in restart refers to the method of performing acceleration again to restart when the frequency reference is output to the motor in a free-run state, and the frequency reference is decelerated by current limit until there is no longer a current limit. This enables a smooth restart independent of the voltage between motor terminals. Use this setting when the inverter is in free-run state for a long time due to a large load inertia.

- With the RUN command ON, when the free-run state is canceled after the Power Interruption Restart Wait Time (H013) has elapsed since the free-run state, the frequency selected by Starting Frequency Selection at Frequency Pull-in Restart (E152) is output and the frequency pull-in restart is performed.
- The examples below assume that the FRS terminal is used.
  Example) When Starting Frequency Selection at Frequency Pull-in Restart (E152) = “0: Frequency at which the power failure occurred”




Example) When Starting Frequency Selection at Frequency Pull-in Restart (E152) = “3: Starting frequency”



# 8-5 DC Injection Braking Function

This section describes the DC injection braking function.

## 8-5-1 DC Injection Braking (DB)

Use this function to have the motor apply DC injection braking according to the load.
For an induction motor, this function allows braking with no feedback of regenerated energy to the inverter. However, for a PM motor, consider to take measures against overvoltage because even the DC injection braking function allows regenerated energy to be fed back to the inverter.
DC injection braking can be controlled with one of the following three methods:

- Setting “13: DB (External DC injection braking)” to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099), and turning ON/OFF the terminal to which the external DC injection braking function is allocated.
- Setting DC Injection Braking Selection (E114) and then setting appropriate function parameters.
- Setting DC Injection Braking Selection (E114) and controlling the motor only by comparison via the frequency set in the DC Injection Braking Frequency parameter.

Note, however that the use of DC injection braking may not cause the motor to stop due to the moment of inertia of the motor load.
DC injection braking is disabled when the torque control, position control and servo lock is enabled.

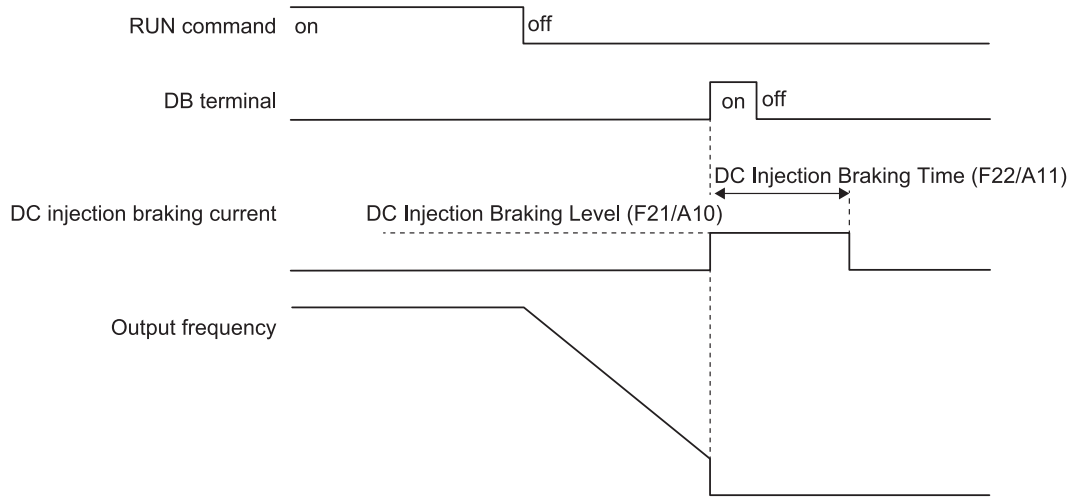
| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E114 | DC Injection Braking Selection | 0: External DC injection braking<br>1: External DC injection braking / setting frequency<br>2: Setting frequency | 0 | - |
| F020 / A009 | 1st DC Injection Braking Start Frequency / 2nd DC Injection Braking Start Frequency | 0.0 to 60.0 | 0.0 | Hz |
| F021 / A010 | 1st DC Injection Braking Level / 2nd DC Injection Braking Level | 0 to 100 (HHD mode)<br>0 to 80 (HND/HD mode)<br>0 to 60 (ND mode)<br>Based on inverter rated current | 0 | % |
| F022 / A011 | 1st DC Injection Braking Time / 2nd DC Injection Braking Time | 0.00: Disable<br>0.01 to 30.00 | 0.00 | s |
| H095 | DC Injection Braking Start Characteristic Selection | 0: Slow response<br>1: Quick response | 1 | - |
| E115 | External DC Injection Braking Edge / Level Selection | 0: Edge operation<br>1: Level operation | 1 | - |
| H195 | DC Injection Braking Startup Time | 0.00: Disable<br>0.01 to 30.00<br>Only motor 1 is effective | 0 | s |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 13: DB (External DC injection braking) | - | - |

- When operation is started, DC injection braking operation is canceled and normal operation is started.

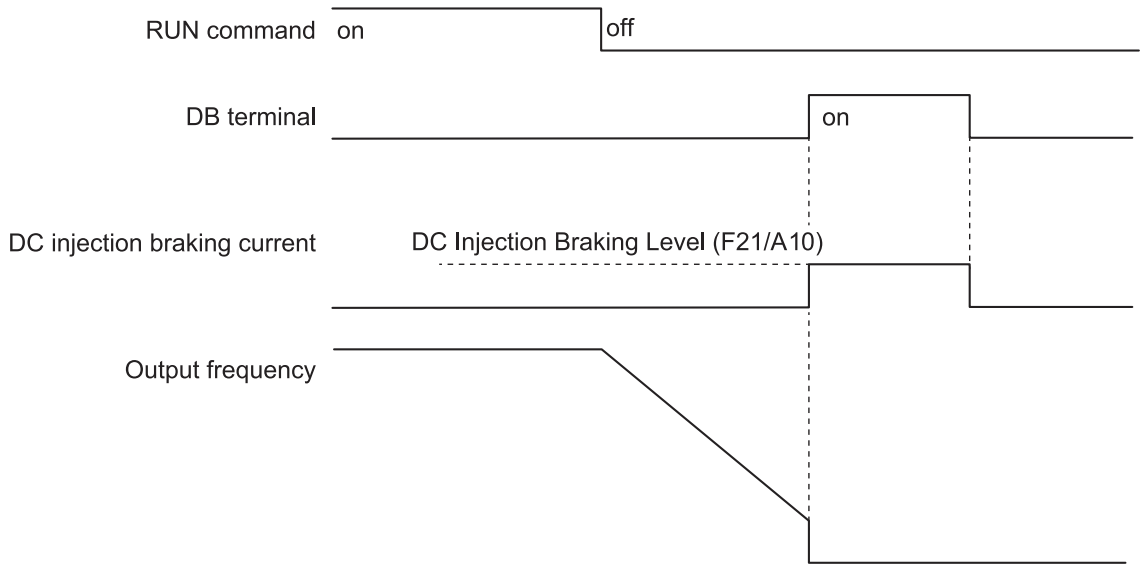
- If the RUN command is turned ON during DC injection braking, DC injection braking is canceled and normal operation is started.

## DC Injection Braking by DB Terminal (E114= “0: External Terminal,” “1: External DC Injection Braking/Setting Frequency”)

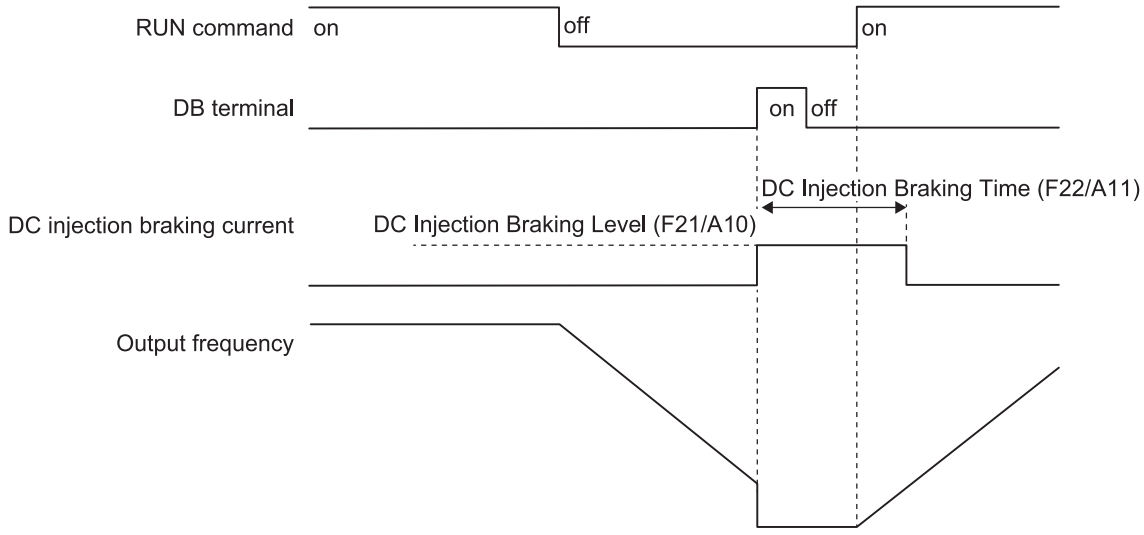
- DC injection braking can be applied by the DB terminal (13: External DC injection braking). Set “13: DB (External DC injection braking)” to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099).
- When “2: Setting frequency” is selected for DC Injection Braking Selection (E114), DC injection braking by DB terminal (13: External DC injection braking) is disabled.
- When “1: External DC injection braking/setting frequency” is selected for DC Injection Braking Selection (E114), this setting is given priority over DC injection braking by DC Injection Braking Start Frequency (F020/A009).
- When “0: Edge operation” is selected for External DC Injection Braking Edge/Level Selection (E115), DC injection braking operates only for the time period set in the DC Injection Braking Time (F022/A011) from the rising edge of the DB terminal.



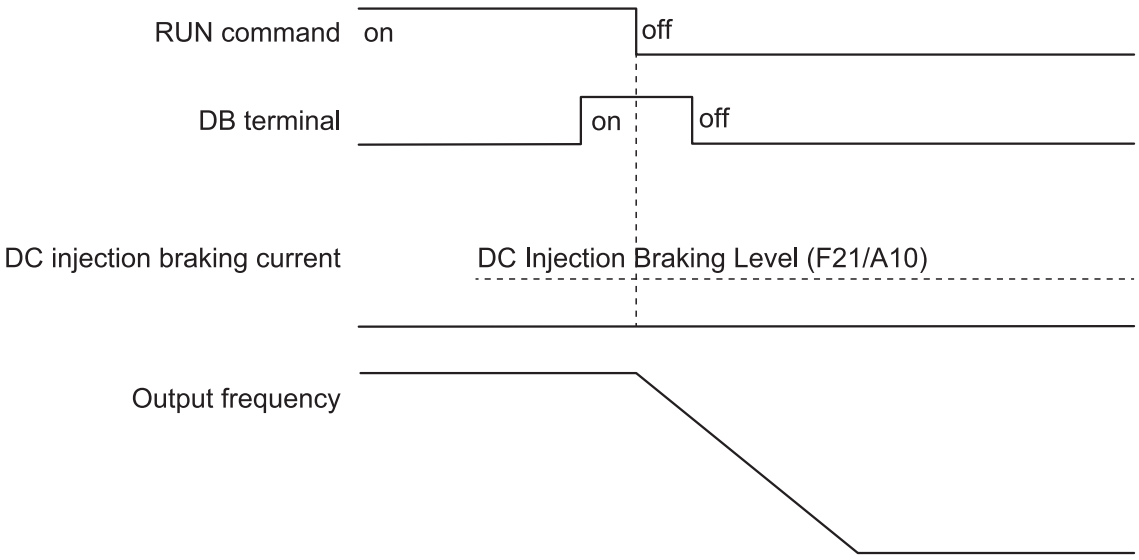

- When “1: Level operation” is selected for External DC Injection Braking Edge/Level Selection (E115), DC injection braking operates while the DB terminal (13: External DC injection braking) is ON.




- When the RUN command is ON, run operation is given priority. Even if the DB terminal is turned ON while the RUN command is ON, DC injection braking is not started. If the RUN command is turned ON during DC injection braking, DC injection braking is stopped and operation is started.

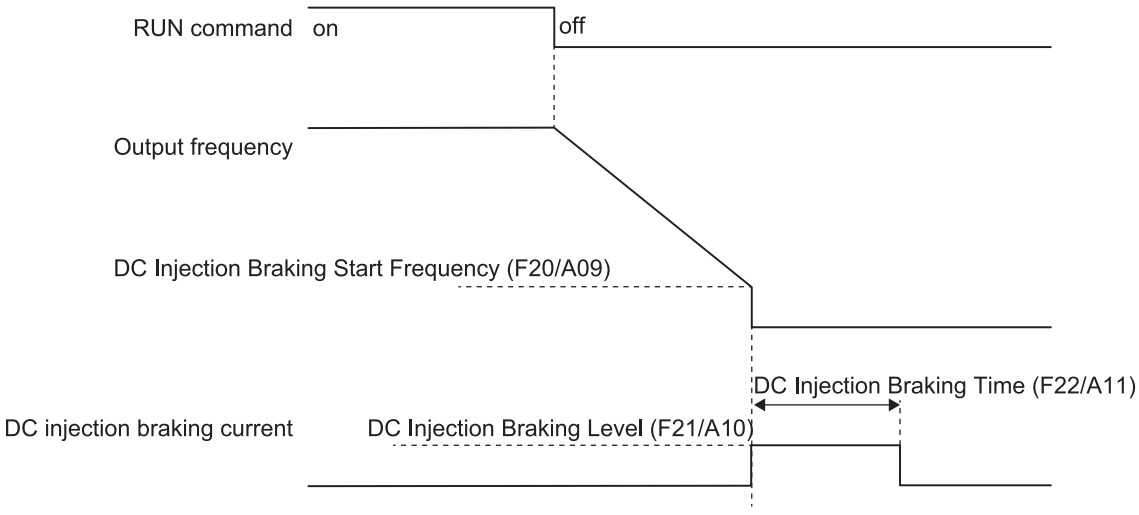



Also, the DB terminal turns ON while the RUN command is ON, thereafter, even if the RUN command turns OFF, the DC injection braking does not start.




## DC Injection Braking Start at Output Frequency (E114= “1: External DC Injection Braking/Setting Frequency”)

- During a deceleration stop, DC injection braking is performed for the period set at the DC Injection Braking Time (F020/A009) from the time that the output frequency reaches or falls below the DC Injection Braking Start Frequency (F022/A011). However, if the Stop Frequency (F025) is higher than the DC Injection Braking Start Frequency (F020/A009), DC injection braking is started from the time the output frequency reaches the Stop Frequency (F025), and is performed for the period of DC Injection Braking Time (F022/A011).

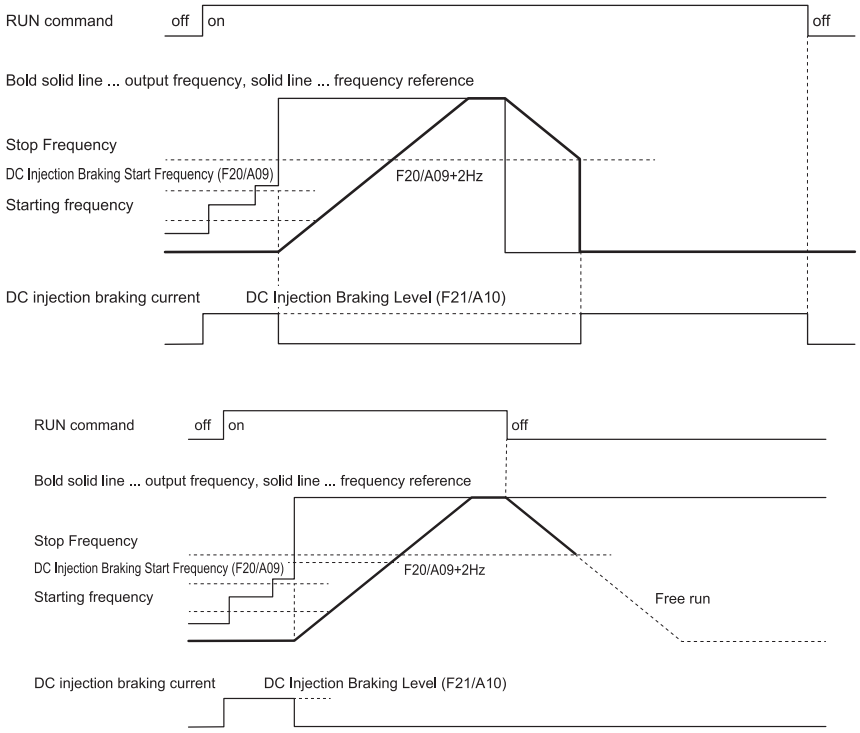



## DC Injection Braking Start at Frequency Reference and Output Frequency (E114 = “2: Setting Frequency”)

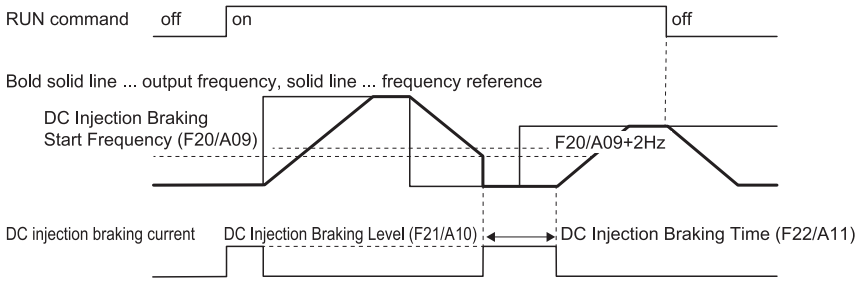
- Use this method to control DC injection braking only by changing the set frequency (frequency refer- ence). DC injection braking by DB terminal is disabled. The DC injection braking during startup by the settings of DC Injection Braking Startup Time (H195) is also disabled.

- DC injection braking is started for the period of DC Injection Braking Time (F022/A011) from the time that both the frequency reference and the output frequency reach or fall below the DC Injection Braking Start Frequency (F020/A009). However, if the Stop Frequency (F025) is higher than the DC Injection Braking Start Frequency (F020/A009), DC injection braking is started from the time the output frequency reaches the Stop Frequency (F025), and is performed for the period of DC Injection Braking Time (F022/A011).

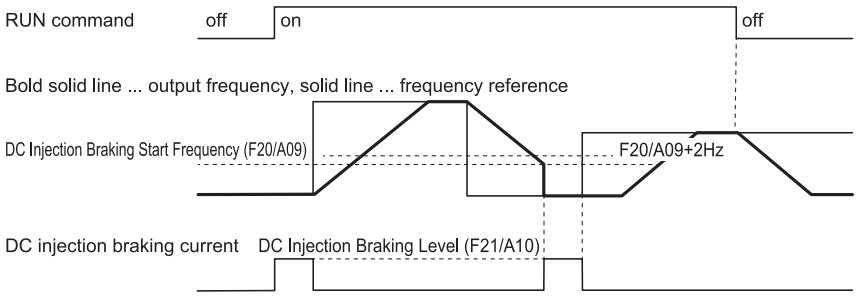
- If, during DC injection braking, the set frequency becomes higher than the DC Injection Braking Frequency (F020/A009) + 2 Hz, the Starting Frequency (F023/A012) or the maximum value set in the Stop Frequency (F025/A063), the inverter cancels DC injection braking and returns to normal operation. DC injection braking is also canceled when the RUN command is OFF.




- When “0: Edge operation” is selected for External DC Injection Braking Edge/Level Selection (E115), DC injection braking operates for the period set at the DC Injection Braking Time (F022/A011) after the conditions to start DC injection braking are established.



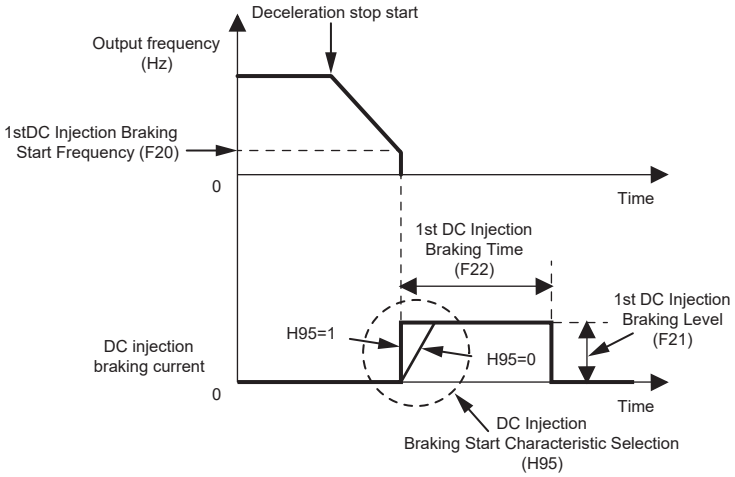

- When “1: Level operation” is selected for External DC Injection Braking Edge/Level Selection (E115), DC injection braking operates while the conditions to start DC injection braking are established.




## DC Injection Braking Start Characteristic Selection (H095)

You can select the rise characteristics for DC braking.

| H95 data | Characteristics |
|---|---|
| 0 | Slow response. The rise of the DC breaking current is increased gently. |
| 1 | Quick response. The rise of the DC breaking current is increased momentarily up to the braking level. |



# 8-6 Safety Function

The safety function stops the motor by signals from the safety controller.
This section provides a functional outline of the safety function, examples of operation and examples of connections.

## 8-6-1 Overview of Safety Function

The safety function is designed so that the safety stop function of category 0 (uncontrolled stop) is used to meet the safety standards of PL-e under ISO 13849-1.
The safe torque OFF (STO) function cuts off the motor current and stops the motor by input signals from the safety controller.
When the STO function is activated, the servo driver turns servo ready output (READY) OFF to set the inverter to the safety state.
The M1 Series Inverter EtherNet type has the following STO function.

- STO function by safety input signal

### Safety Functions

| Function | Standard |
|---|---|
| STO (Safe Torque Off) | EN/IEC 61800-5-2 |

### Response Time

| Experimental Response times | | Remarks |
|---|---|---|
| STO (via signal line) response time | 50 ms or lower | Time from when the SF1/SF2 signal state changes to STO up to when power to the motor is cut off |
| EDM response time | 50 ms | Time from when the SF1/SF2 signal state changes to ON up to when the EDM signal state changes to ON |

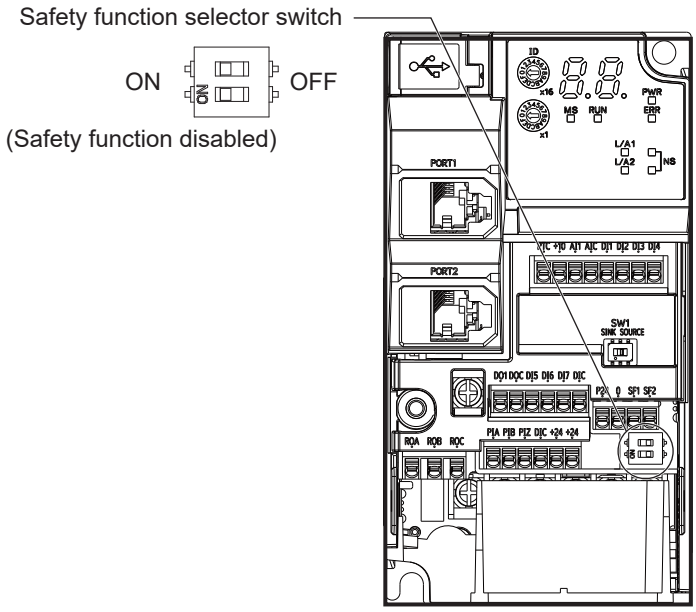
### Safety Related Parameters

| Parameter | Value | Standard |
|---|---|---|
| PL | e | EN/ISO 13849-1 |
| Cat | 3 | |
| MTTFd | >62 years | |
| DCavg | Medium | |

| Parameter | | Value | Value | Standard |
|---|---|---|---|---|
| SIL | | 3 | 3 | EN/IEC 61508-1 to -7<br>EN/IEC 61800-5-2 |
| HFT | | 1 | 1 | |
| SFF | | >90% | >90% | |
| STO Function by Safe Input Signal | PFH | $3.00 \times 10^{-9}$ | $3.00 \times 10^{-9}$ | |
| | PFD | $4.00 \times 10^{-5}$ | $2.00 \times 10^{-5}$ | |
| | Mission time | 20 years | 10 years | |

## 8-6-2 Safety Function Settings

Turn OFF the safety function selector switch SW9 when the inverter power supply is turned OFF.
Set SW9 to enabled (OFF) or disabled (ON) so that both sides are at the same position at all times.




Turn both OFF to use the safety function. Turn both ON to not use the safety function.
When only one is ON, the logic of the SF1 and SF2 signals no longer matches and this causes an EN circuit failure (alarm code: 39).

## 8-6-3 STO Function by Safety Input Signal

The safety input function allows the inverter output when current flows in both the terminals [SF1] and [SF2]. When the safety input function is activated, in compliance with the safety standards described in *8-6-1 Overview of Safety Function* on page 8-61, the output transistor operation of the inverter is stopped safely (by shutting off its output). As a result, the motor stops with free run.

- It takes 50 ms or shorter from when the safety input is input till when the inverter shuts off the output.
- St is displayed on the data display.

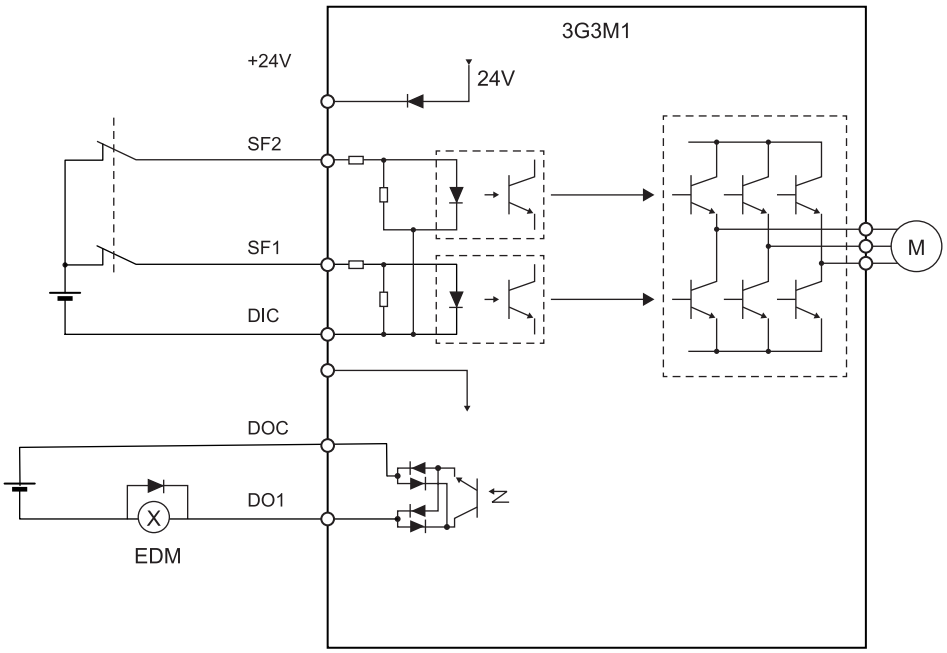
Perform wiring with reference to the wiring example to meet the applicable safety standards. Be sure to use both the safety input [SF1] and [SF2] terminals and configure a system that turns OFF both of the [SF1] and [SF2] terminals when the safety function is activated.
If the inverter detects that either the [SF1] or [SF2] terminal is OFF, the safety function is activated and the inverter shuts off the output.

- The STO (Safe Torque Off) Performance Monitor (102: EDM) turns ON when the inverter detects that both of the [SF1] and [SF2] terminal signals turn OFF and shuts off the output. If the EDM output does not turn ON even when the inverter shuts off the output by the safety function, check the [SF1] and [SF2] terminal input circuits and the EDM detection circuit.
- The EN circuit failure detected (101: DECF) turns ON when an error occurs in the circuit that detects that the SF terminal is OFF.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 101: DECF (EN circuit failure detected)<br>102: EDM (STO (Safe Torque Off) Performance Monitor) | - | - |

## Wiring Example

Wiring example when EDM is enabled (for compliance with ISO13849-1 PL-e)




## System Configuration Example

To attain CAT.3, PL e/SIL3 as an overall system that uses the 3G3M1 Series, a PL e/SIL3 device must at least be combined into the system.

Test pulse that is input to safety input terminals [SF1] and [SF2] from an external device must be 1 ms or less.

The following shows an example of a safety interlock that is combined with the 3G3M1 Series.

| Model | Applicable standard for system configuration | Certification authority |
|---|---|---|
| G9SP | EN ISO13849-1 PL-e Cat4<br>(IEC61508 SIL3) | TÜV Rheinland |

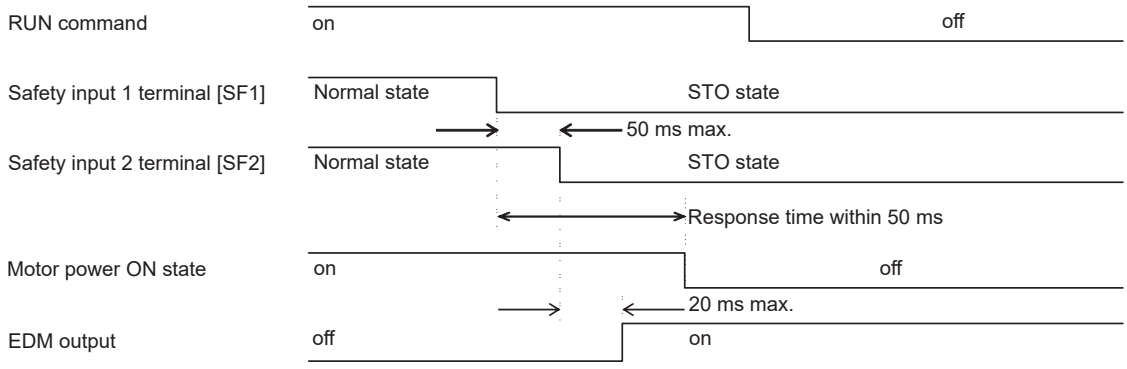
## Periodic Inspection (STO)

The redundancy circuit is configured so that when the safety function is activated, the inverter shuts off its output if current no longer flows to either the safety input terminal [SF1] or [SF2]. Therefore, the inverter must be periodically inspected to ensure that there is no defect in the [SF1] and [SF2] terminal wirings so that redundancy is not lost to ensure reliable operation. Be sure to perform periodical inspection at least once in three months.
In periodic inspection, inspect the statuses shown in the table below.

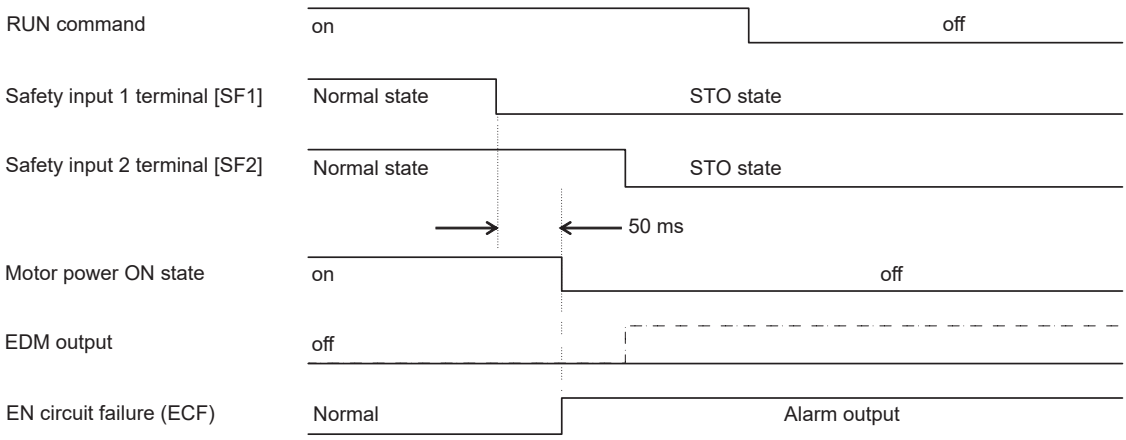
| Signal | | Status 1 | Status 2 | Status 3 | Status 4 |
|---|---|---|---|---|---|
| Input | SF1 | OFF | ON | OFF | ON |
| | SF2 | OFF | OFF | ON | ON |
| Output | EDM | ON | OFF | OFF | OFF |
| | Output to motor | Shut off | Shut off | Shut off | Output enabled |
| Alarm | | None | ECF | ECF | None |

## Timing of transition to safety status

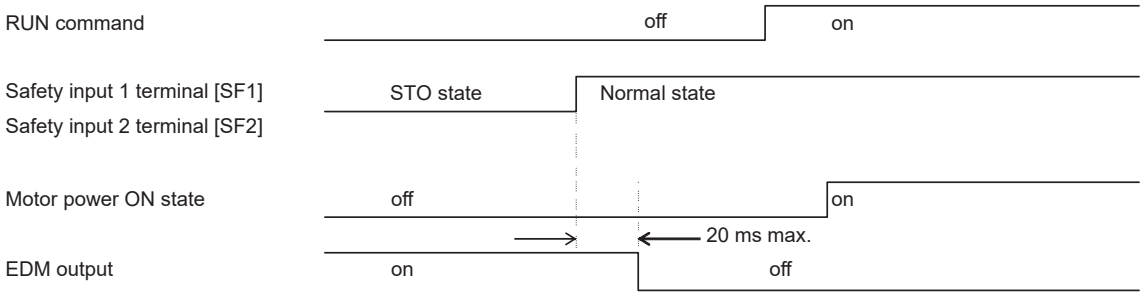
When one of safety input terminals [SF1] and [SF2] turns OFF and then both terminals turn OFF within 50 ms, control transitions to the STO state.




When one of terminals [SF1] and [SF2] turns OFF and then both terminals do not turn OFF within 50 ms, EN circuit failure (alarm code: ECF) is generated.




When terminals [SF1] and [SF2] are turned ON from an STO state, control returns from the STO state.




- To ensure that the safety function works normally, evaluate the entire safety system on every possible risk factor.
- The safety function is not intended to shut off the input or to isolate the output electrically. Be sure to shut off the input power supply to the inverter before attempting installation or maintenance.
- For the safety function, always use a cable length of 20 m or shorter.
- To restart the inverter after the safety function is activated, follow the steps below. Be sure to turn OFF the RUN command before you reset the safety equipment. Resetting the host safety equipment with the RUN command ON may cause the inverter to restart suddenly.
  1. Turn OFF the RUN command.
  2. Release the emergency stop switch.
  3. Reset the host safety equipment.
  4. After resetting the safety equipment, make sure that the inputs of the [SF1] and [SF2] terminals of the inverter are ON.
  5. Turn ON the RUN command to restart the inverter.
- Setting of the start check function is recommended to prevent sudden operation.
- It takes 50 ms or shorter from when the safety input is input till when the inverter shuts off the output.
- Install the inverter in a control panel with an enclosure rating of IP54 or higher.
- If minute pulses are to be input to terminals [SF1] and [SF2] based on the diagnosis of the safety PLC, ensure that the pulse width is less than 1 ms.
- The logical mismatch between the [SF1] and [SF2] terminals based on the signal delay must be within 50 ms. If it exceeds 50 ms, an EN circuit failure (alarm code: 39) is output.

# 8-7 Functions Related to Operations

## 8-7-1 Forced Terminal Block Function (F-TM)

If other than the control circuit terminal block is selected for 1st Frequency Reference Selection (F001)/2nd Frequency Reference Selection (C030) and 1st RUN Command Selection (F002)/2nd RUN Command Selection (E102), use this function to forcibly enable the operations from the control circuit terminal block by turning the input terminal ON/OFF.

If “162: F-TM (Forced terminal block)” is allocated to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099), the operation is performed from the frequency reference source and RUN command source selected by 1st Frequency Reference Selection (F001)/2nd Frequency Reference Selection (C030) and 1st RUN Command Selection (F002)/2nd RUN Command Selection (E102) if the F-TM terminal has been canceled, and the operation is performed forcibly by the frequency reference and the RUN command from the control circuit terminal block if there is an input.
If the forced terminal block function is enabled during operation, the RUN command is canceled and the inverter output stops.

If input is performed simultaneously with the OPE terminal (35: Forced operator), the forced operator is given priority.
The frequency reference for the forced terminal block function is the frequency reference based on the input terminal [AI1].
The RUN command for the forced terminal block function is the FW terminal and the RV terminal allocated to the input terminal. If the FW terminal and RV terminal are not allocated to the input terminal, it becomes impossible to perform operation.
The forced terminal block function is given priority in the case of frequency reference than the multi-step speed reference.

When the start check function is set to enabled, the start check function is executed when the F-TM terminal (162: Forced terminal block) is turned ON. (For details on the start check function, refer to *8-7-3 Start Check Function (H096)* on page 8-74.)

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 162: F-TM (Forced terminal block) | - | - |
| Related function | | 1st Frequency Reference Selection (F001)<br>2nd Frequency Reference Selection (C030)<br>1st RUN Command Selection (F002)<br>2nd RUN Command Selection (E102) | | |

## 8-7-2 Password Function

This is a function for completely or partially obscuring the parameters set in the inverter.
The set values of all parameters can be protected by two types of passwords as rewriting prohibited. While password 1 enables the selection of the protection operation, password 2 disables the disclosure and changing of all parameters.

Pay sufficient attention to the use of password as once a password is set, it cannot be changed or deleted.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H197 | User password 1 Mode selection | 0: All parameters cannot be changed<br>1: Those other than favorite parameters cannot be displayed or changed<br>2: Do not use | 0 | - |
| H198 | User Password 1 Setting / Verification | 0000 to FFFF Hex | 0000 | - |
| H099 | Password 2 Setting / Verification | 0000 to FFFF Hex | 0000 | - |
| H199 | User Password 1 Setting | 0: Disable<br>1: Protected | 0 | - |

## Password Protection

By setting a password (four digit in hexadecimal) at User Password 1 Setting/Verification (H198) and setting 1 at User Password 1 Setting (H199), the parameter is protected by password 1 (protection against rewriting).
Select the parameters targeted for protection at User password 1 Mode selection (H197).

- When “0” is set to User password 1 Mode selection (H197), the values of all parameters cannot be rewritten.
- When “1” is set to User password 1 Mode selection (H197), parameters other than those registered as favorite parameters cannot be read or written.

With password 2, the set value of all parameters can be protected against reading and rewriting regardless of the selection in User password 1 Mode selection (H197).
The following parameters are not protected by passwords 1 and 2.

◆ Communication commands and communication monitors Parameter group S, M, W, X, Z

By setting a password at Password 2 Setting/Verification (H099) and setting 1 to User Password 1 Setting (H199)), the parameter is protected by password 2 (protection against reading or writing).

As for parameters for which reading or writing is prohibited, it is not possible to write set values and also to read the set values.

If a parameter is protected by password 1 and the password set to User Password 1 Setting/Verification (H198) is entered again, the protected state is canceled. If password 2 is also set simultaneously, password 2 must be canceled beforehand at Password 2 Setting/Verification (H099).

If the value of the password entered to User Password 1 Setting/Verification (H198) or Password 2 Setting/Verification (H099) to cancel the protection status is wrong, the protection status cannot be temporarily canceled, and, when five retries to enter the password are continuously wrong, a password cancellation error (alarm code: FD) is generated.
In the password cancellation error status, User Password 1 Setting/Verification (H198) or Password 2 Setting/Verification (H099) cannot be entered. (The inverter can be operated)

To cancel the password cancellation error, either turn the inverter power supply OFF then back ON again, or wait for 20 minutes.

## Enabling/Disabling Conditions

The password is enabled when a value other than 0 is set in User Password 1 Setting/Verification (H198) and Password 2 Setting/Verification (H099).
From the viewpoint of ensuring security, to make sure that only the person who sets the password can change or delete it, a password cannot be disabled (password deletion) once it has been enabled. Moreover, a password cannot be changed.
However, the password is deleted by initializing the inverter itself, and password protection is disabled.

## How To Use the Password Function

Perform the following operations to use the password function.

**Setting a password from a password not set status**
When a hexadecimal 4-digit password is entered to one or both of User Password 1 Setting/Verification (H198) and Password 2 Setting/Verification (H099), the password is set and it is in protection cancellation state.
To use user password 1, select the target to be protected at User password 1 Mode selection (H197).
Note that once a password is set, it cannot be changed or deleted.

**Changing the protection cancellation state to the protected state**
The status of a password changes to the protection state by setting 1 at User Password 1 Setting (H199). The state also changes to the protection status after turning the inverter back ON again or after four hours have elapsed since the state was set to the protection cancellation state.
When user password 1 is set, the status of the target to be protected that is set at User password 1 Mode selection (H197) is rewriting prohibited.
When user password 2 is set, the status of all parameters is reading/writing prohibited.
When both two user passwords are set, priority is given to user password 2.

**Canceling the protection status (when only one of the user passwords is set)**
The password protection status can be canceled by entering the password from the protection status. When only one of user password 1 or user password 2 is set, the status of all protection is canceled by entering the set password.

**Canceling the protection status (when both two user passwords are set)**
When both two user passwords are set, begin entry with user password 2.
When user password 2 is canceled, the status changes to user password 1 protection status, and the status of the target to be protected selected at User password 1 Mode selection (H197) changes to protected. When user password 1 is canceled in this status, this means that all passwords will have been canceled.

## Cautions Regarding the Password Function

- 0000 cannot be set to passwords.
- Once a password is set, it cannot be changed or deleted.
- There is no way of checking a password once it is set. When you have forgotten a password, its protection status cannot be canceled. So, the inverter itself must be initialized. To perform initialization while in the protection status, this will be executed on condition that the inverter will be in the password cancellation error (FD) status. Enter a wrong password five times to set the invert to the password cancellation error status, and then perform initialization by Data Initialization (H003). At this time, only “1: Initialize all parameters” can be selected at Data Initialization (H003).

## Password Status Monitoring

Use these monitors to read the password status, including the setting and protection status

<table>
<tr><th>Param-eter</th><th>Name</th><th>Monitor data</th></tr>
<tr><td>W220</td><td>Password protection status 1</td><td>0x0000 to 0xFFFF<br>bit3-5: Password status<br><br><table><tr><th>bit5</th><th>bit4</th><th>bit3</th><th>Password status</th></tr><tr><td>0</td><td>0</td><td>0</td><td>No password setting</td></tr><tr><td>0</td><td>0</td><td>1</td><td>Password has been set, but the protection is temporarily canceled</td></tr><tr><td>0</td><td>1</td><td>0</td><td>Protected with password 1 (Password 2 is not set or temporarily canceled)</td></tr><tr><td>0</td><td>1</td><td>1</td><td>Protected with password 2</td></tr><tr><td>1</td><td>0</td><td>0</td><td>Inverter operation is locked due to a predetermined number of incorrect inputs</td></tr></table><br>Other bits: Reserved</td></tr>
<tr><td>W221</td><td>Password protection status 2</td><td>0x0000 to 0xFFFF<br>Upper byte: Reserved for other usage<br>Lower byte: Password protection status for public parameters<br>0x00: No password setting or password protection is temporarily canceled<br>0x01: Some or all public parameters are write-protected with a password<br>0x03: Some or all public parameters are read/write protected by password</td></tr>
</table>

## 8-7-3 Start Check Function (H096)

Select whether to enable or disable the start check function.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H096 | STOP Key Priority/ Start Check Function | 0 to 3<br>0: Disable STOP key priority, disable start check function<br>1: Enable STOP key priority, disable start check function<br>2: Disable STOP key priority, enable start check function<br>3: Enable STOP key priority, enable start check function | 0 | - |
| Related function | | Stop Selection (H011)<br>1st Acceleration Time 1 (F007)<br>2nd Acceleration Time 1 (E010)<br>1st Deceleration Time 1 (F008)<br>2nd Deceleration Time 1 (E011) | | |

## Start Check Function (H096 = “2,” “3”)

- The start check function checks the status of the RUN command at the following check timing and generates an error.
- When a RUN command is input, the inverter is not operated and a run operation error (24: sub codes 2 to 5) is generated. (For details on RUN command, refer to *6-4-1 RUN command selection* on page 6-22.)
- The content of sub codes 2 to 5 of a run operation error and the check timing are as follows.

| Sub code | Alarm sub code contents | Check timing |
|---|---|---|
| 2 | Start check function | When switching is performed on the SET terminal (12: Set 2nd control), OPE terminal (35: Forced operator) or F-TM terminal (162: Forced terminal block) |
| 3 | Start check function (when operation is permitted) | When the ROK terminal (38: Permission of Run command) is turned ON while the RUN command is ON |
| 4 | Start check function (at a reset power ON) | When the RS terminal (8: Reset) is turned ON |
| 5 | Start check function (at power restoration when power is turned ON) | When the power is turned ON |

- The check function is enabled even in the following status in which the RUN command is input and the RUN command is disabled.
  FRS terminal (7: Free-run stop) ON and RUN command ON
  ROK terminal (38: Permission of Run command) OFF and RUN command ON
  STO terminal status (EN terminal OFF) and RUN command ON
  FW terminal (98: Forward Run/Stop) ON and RV terminal (99: Reverse Run/Stop) ON

# 8-8 Functions Related to Protection, Warning and Various Output Signals

This section describes the protection functions such as warning signals.

## 8-8-1 Current Limit/Overload Prevention Control/Overload Warning

### Current limit

If the output current of the inverter becomes equal to or above the current limitation level, the output frequency is controlled to prevent the engine from stalling.

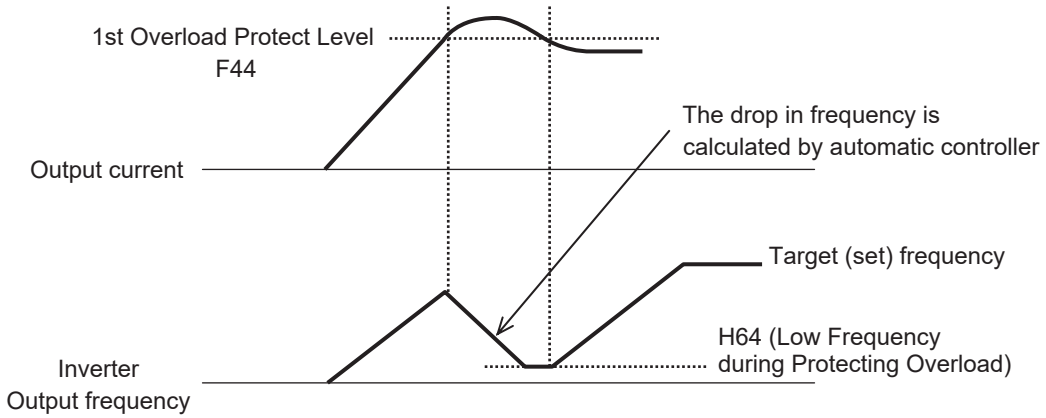
- It is enabled when “0: IM V/f control,” “1: IM Dynamic torque vector control without speed sensor,” “3: IM V/f control with speed sensor” or “4: IM Dynamic torque vector control with speed sensor” is selected for Drive Control Selection (F042/A014).

Select the operation of this function at 1st Overload Protect Function Selection (F043)/2nd Overload Protect Function Selection (E146).
At 1st Overload Protect Level (F044)/2nd Overload Protect Level (E147), set an operation level with the inverter rated output current value as 100%.

If this function is operated while the inverter is accelerating, the acceleration time becomes longer than the set time.
The lower limit value of the frequency when the current limitation is operated can be set at Low Frequency during Protecting Overload (H064), but generally, there is no need to change the settings. Besides current limitation, Low Frequency during Protecting Overload (H064) is also applicable to torque limitation and overload prevention control.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F043 / E146 | 1st Overload Protect Function Selection / 2nd Overload Protect Function Selection | 0: Disable (Current limiter does not work.)<br>1: Enable at constant speed (Disable during ACC/DEC)<br>2: Enable during ACC/ constant speed operation | 2 | - |
| F044/ E147 | 1st Overload Protect Level / 2nd Overload Protect Level | 20 to 200<br>(The data is interpreted as the rated output current of the inverter for 100%.) | 180 | % |
| H064 | Low Frequency during Protecting Overload | 0.0: Depends on F016/E118 (1st Frequency Lower Limit/2nd Frequency Lower Limit)<br>0.1 to 590.0 | 1.6 | Hz |

Example case where overload limit function is activated during acceleration (F043/E146 = 2)




## Overload Prevention Control

Set the rate of decline of the output frequency of overload prevention control. This function causes the inverter output frequency to drop before the cooling fin of the inverter overheats (alarm code: 11) or an overload trip occurs (alarm code: 19), and thus prevents tripping. This function is effective in equipment such as pumps where the load reduces with a drop in the output frequency, but it is necessary to continue with the operation even when the output frequency drops.
Allocating “36: OLP (Overload prevention controlling)” to Output Terminal [DO1] Function Selection (E020) and Output Terminal [ROA, ROB] Function Selection (E027) activates overload prevention control and indicates that the output frequency changes, and the signal “OLP” that turns ON during the overload prevention control is output.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H070 | Overload Prevention Control | 0.00: Depend on selected deceleration time<br>0.01 to 100.00 Hz/s<br>999: Cancel | 999 | Hz/s |
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 36: OLP (Overload prevention controlling) | - | - |
| Related function | | Output Terminal [DO1] ON Delay Time (H309) Output Terminal [DO1] OFF Delay Time (H310) Output Terminal [ROA, ROB] ON Delay Time (H313) Output Terminal [ROA, ROB] OFF Delay Time (H314) | | |

*1. Deceleration is performed according to the currently selected deceleration time by the SET, RT1 and RT2 terminals.
*2. The OFF delay becomes the time obtained by adding 0.1 s to Output Terminal[DO1] OFF Delay Time (H310) and Output Terminal [ROA, ROB] OFF Delay Time (H314).

## Overload Warning

The overload warning function causes the inverter to output an overload warning if the load is too large, before it detects an overload trip.

- This is useful to prevent mechanical damage to transfer machines, etc. due to overweighed loading, or stoppage of transfer lines due to an overload, through the use of the overload protection function of the inverter.
- To output this signal, allocate “38: OL (Overload warning)” or “37: OL2 (Overload warning 2)” to Output Terminal [DO1] Function Selection (E020) and Output Terminal [ROA, ROB] Function Selection (E027). (Two types of overload warning signals can be output.)
- When using “38: OL (Overload warning),” set the overload warning detection level and overload warning detection timer for each of 1st and 2nd control. When using “37: OL2 (Overload warning 2),” set Overload early warning 2 Level (OL2) (E034) and Overload early warning 2 Detection Timer (OL2) (E035) regardless of 1st and 2nd control.

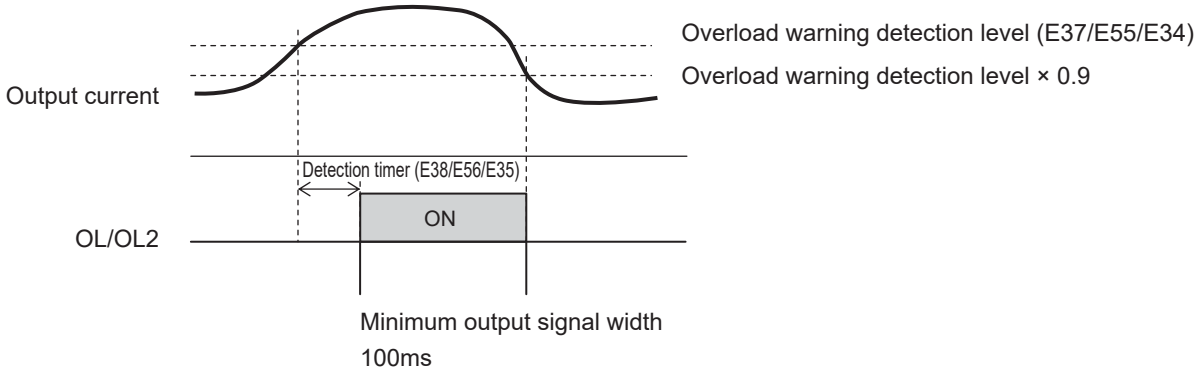
| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| **Common settings for OL and OL2** | | | | |
| E185 | Overload Warning Detection Condition Selection (OL1, OL2) | 0: Output during acceleration/deceleration and constant-speed operation<br>1: Output only during constant-speed operation | 1 | - |
| **Overload warning OL (Detection level and detection timer are set for each 1st and 2nd drive controls.)** | | | | |
| E037 | 1st Overload Early Warning Detection Level | 0.00: Disable 0.01 to 176.0<br># Setting range from 1% (HHD) to 200% (ND) of the rated inverter current. | 21.00 | A |
| E038 | 1st Overload Early Warning Detection Timer / Low Current detection level (OL, LOC) | 0.01 to 600.00 | 10.00 | s |
| E055 | 2nd Overload Warning Detection Level *1 | 0.00: Disable 0.01 to 176.0<br># Setting range from 1% (HHD) to 200% (ND) of the rated inverter current. | 21.00 | A |
| E056 | 2nd Overload Early Warning Detection Timer *1 | 0.01 to 600.00 | 10.00 | s |
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 38: OL (Overload warning) | - | - |
| **Overload warning OL2 (Common to 1st and 2nd drive controls.)** | | | | |
| E034 | Overload early warning 2 Level (OL2) | 0.00: Disable 0.01 to 176.0<br># Setting range from 1% (HHD) to 200% (ND) of the rated inverter current. | 21.00 | A |
| E035 | Overload early warning 2 Detection Timer (OL2) | 0.01 to 600.00 | 10.00 | s |
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 37: OL2 (Overload warning 2) | - | - |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| Related function | | Output Terminal [DO1] ON Delay Time (H309) Output Terminal [DO1] OFF Delay Time (H310) Output Terminal [ROA, ROB] ON Delay Time (H313) Output Terminal [ROA, ROB] OFF Delay Time (H314) | | |

*1. To enable switching to the 1st and 2nd control, allocate “12: SET (Set 2nd control)” to either of input terminal [DI1] to [DI7].

*2. The OFF delay becomes the time obtained by adding 0.1 s to Output Terminal[DO1] OFF Delay Time (H310) and Output Terminal [ROA, ROB] OFF Delay Time (H314).

- Overload warning has a hysteresis characteristic of operation level ×10%. The minimum output signal width of the signal is 100 ms.




## 8-8-2 Anti-regenerative Control Function

- This function controls the output frequency to suppress regenerative energy and avoid overvoltage tripping.
- The action of this function can be selected at Anti-regenerative Control Function Selection (H069).
- This function is temporarily disabled when the AR-CCL terminal is turned ON.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H069 | Anti-regenerative Control Function Selection | 0: Disable<br>2: Torque limit control with forced stop after three times deceleration time has passed<br>3: Main Circuit DC Voltage control with forced stop after three times deceleration time has passed 4: Torque limit control without forced stop<br>5: Main Circuit DC Voltage control without force-to-stop | 0 | - |
| H114 | Anti-regenerative Control Level | 0.0 to 50.0<br>999: Auto | 999 | % |
| H076 | Frequency Rising Limit for Torque Limit | 0.0 to 590.0 | 5.0 | Hz |
| Related function | | Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099) = "82 (AR-CCL: Cancel anti-regenerative control)" | | |

- Anti-regenerative control sometimes increases the deceleration time.

- When the braking unit is connected, do not use anti-regenerative control. Anti-regenerative control sometimes acts simultaneously with operation of the braking unit and the deceleration time is not as set.
- When the deceleration time is too short, the Main Circuit DC Voltage of the inverter sometimes rises quickly and anti-regenerative control cannot keep up. In instances like this, set a longer deceleration time.

### Torque Limit (H069 = 2, 4)

- A feature is that response is high and an overvoltage trip is less likely to occur even by an impact load. The frequency control value can be adjusted by Anti-regenerative Control Level (H114), and, when the Anti-regenerative Control Level (H114) is increased, frequency control increases.
- This is enabled during acceleration, constant speed and deceleration.
- The output frequency is controlled until braking torque reaches almost 0 (zero).
- Although Anti-regenerative Control Level (H114) can be adjusted, normally adjustment is not required.
- When the output frequency is limited, an overvoltage trip sometimes is generated as anti-regenerative control is limited. Anti-regenerative capability can be improved by setting a larger Frequency Rising Limit for Torque Limit (H076).

### Main Circuit DC Voltage Control (H069 = 3, 5)

- This is enabled only at deceleration.
- When the main circuit intermediate voltage exceeds limitation level, the output frequency is controlled so that the main circuit intermediate voltage is lowered.
- The regeneration capacity of an inverter can be made use of to shorten the deceleration time.
- When “Main Circuit DC Voltage control with forced stop after three times deceleration time has passed” has been set, anti-regenerative control is suspended and the motor is stopped according to the selected deceleration time when a time three times of the currently selected deceleration time elapses after the RUN command is turned OFF. Use this function when the load state causes the output frequency to rise by anti-regenerative control and the motor does not stop.

## 8-8-3 Instantaneous Overcurrent Limitation

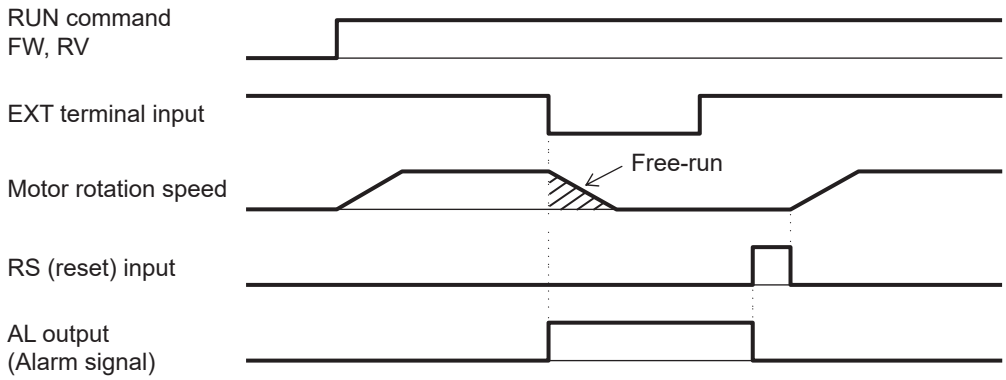
- This function is used to select whether to perform the current limitation process (a process where the inverter output is momentarily turned OFF to suppress an increase in the current, and the output frequency is operated) or overcurrent tripping when the output current of the inverter becomes equal to or above the instantaneous overcurrent limitation level.
- If the torque generated by the motor is temporarily reduced due to the current limitation process, and a failure occurs for the use of the equipment or machinery, it is necessary to perform overcurrent tripping and use a mechanical brake.
- During instantaneous current limitation operation, Inverter output limiting signal (5: IOL), (22: IOL2) is output.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H012 | Instantaneous Overcurrent Limiting Function Selection | 0: Disable<br>1: Enable | 1 | - |
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 5: IOL (Inverter output limiting)<br>22: IOL2 (Inverter output limiting with delay) | - | - |

## 8-8-4 External Trip (EXT)

Use this signal to have the inverter trip via an error signal generated by a peripheral system. To do so, allocate “9: EXT (External trip)” to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099).
When the EXT terminal turns OFF, the inverter trips and generates the external alarm (alarm code: 12), and shuts off its output.
Once the inverter trips and generates the external alarm (alarm code: 12), the trip status will not be reset even if the error signal from external equipment is reset (the EXT terminal is turned ON). In this case, perform the reset operation or cycle the power supply to reset the trip. For details on a reset operation, refer to *Reset* on page 6-57.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 9: EXT (External trip) | - | - |




If the RUN command is being input when the alarm is cleared by a reset after a trip, operation is started in accordance with the frequency reference. To prevent operation from being started unintentionally, set the start check function to enabled. For details on the start check function, refer to *8-7-3 Start Check Function (H096)* on page 8-74.

## 8-8-5 Thermistor Trip Function

You can provide thermal protection for external equipment such as a motor by connecting a thermistor installed on it to the inverter and enabling this function.

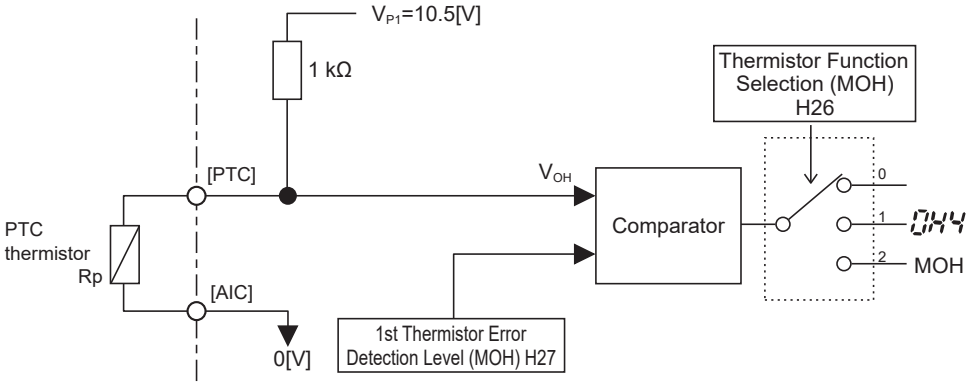
| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H026 | Thermistor Function Selection (MOH) | 0: Disable<br>1: PTC (Inverter immediately trips with OH4 displayed)<br>2: PTC (Inverter issues output signal MOH and continues to run) | 0 | - |
| H027 | 1st Thermistor Error Detection Level (MOH) | 0.00 to 5.00 | 1.60 | V |
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 56: MOH (Motor overheat detected by thermistor) *1 | - | - |
| Related function | | Output Terminal [DO1] ON Delay Time (H309) Output Terminal [DO1] OFF Delay Time (H310) Output Terminal [ROA, ROB] ON Delay Time (H313) Output Terminal [ROA, ROB] OFF Delay Time (H314) | | |

*1. The OFF delay of the Motor overheat detected by thermistor (56: MOH) terminal becomes the time obtained by adding 0.1 s to Output Terminal[DO1] OFF Delay Time (H310) and Output Terminal [ROA, ROB] ON Delay Time (H314).

Connect a PTC thermistor between the [PTC] terminal and the [AIC] terminal. If, as a result of the resistance value of the connected PTC thermistor, the internal power supply is divided, and the voltage between the [PTC] terminal and the [AIC] terminal exceeds 1st Thermistor Error Detection Level (MOH) (H027), operation set at Thermistor Function Selection (MOH) (H026) is performed. Take thermistor error into consideration when setting the 1st Thermistor Error Detection Level (MOH) (H027). If the resistance value of a PTC thermistor at the protection temperature is considered as $R_p$, the operation level $V_{OH}$ is calculated by the formula below.

$$V_{OH} = \frac{R_p}{1000 + R_p} \times 10.5(V)$$

See below for the block part of the operation.




## 8-8-6 Frequency Arrival Signal (FAR1 to 3, FDT1 to 4, FAR1FDT1)

The inverter outputs the frequency arrival signal when the output frequency reaches the set level.

Allocate “1: FAR1 (Frequency arrival signal 1 (constant speed)),” “2: FDT1 (Over set frequency arrival signal 1),” “21: FAR2 (Frequency arrival signal 2),” “31: FDT2 (Over set frequency arrival signal 2),” “72: FAR3 (Frequency arrival signal 3),” “87: FAR1FDT1 (Frequency match detection),” “183: FDT3 (Set-frequency-only arrival signal),” or “185: FDT4 (Set-frequency-only arrival signal 2)” to Output Terminal [DO1] Function Selection (E020) and Output Terminal [ROA, ROB] Function Selection (E027).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 1: FAR1 (Frequency arrival signal 1 (constant speed))<br>2: FDT1 (Over set frequency arrival signal 1)<br>21: FAR2 (Frequency arrival signal 2)<br>31: FDT2 (Over set frequency arrival signal 2)<br>72: FAR3 (Frequency arrival signal 3)<br>87: FAR1FDT1 (Frequency match detection)<br>183: FDT3 (Set-frequency-only arrival signal)<br>185: FDT4 (Set-frequency-only arrival signal 2) | - | - |
| E029 | Frequency Arrival 2 ON Timer | 0.01 to 10.00 | 0.10 | s |
| E030 | Frequency Arrival Detection Width (FAR1/FAR2/FAR3/FDT3/FDT4) | 0.0 to 10.0 | 2.5 | Hz |
| E031 | Frequency Detection Level1 (FDT1/ FDT3) | 0.0 to 590.0 | 60.0 | Hz |
| E032 | Frequency Detection Hysteresis Width (FDT1/ FDT2) | 0.0 to 590.0 | 1.0 | Hz |
| E036 | Frequency Detection Level 2 (FDT2/ FDT4) | 0.0 to 590.0 | 60.0 | Hz |

## Frequency Arrival Signal (Constant Speed) (E020, E027 = 1: FAR1, 21: FAR2, 72: FAR3)

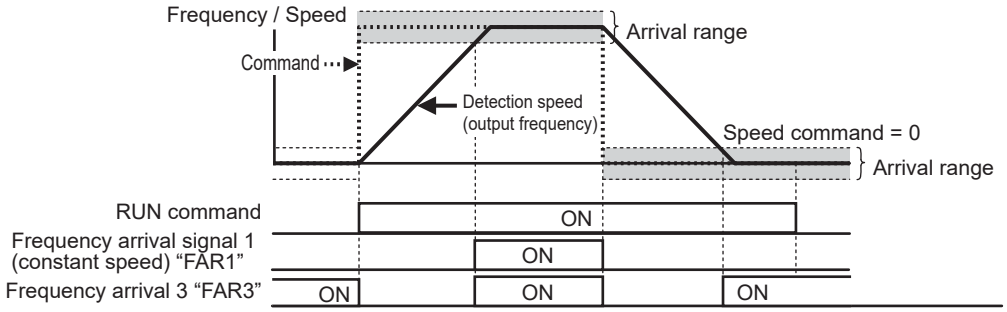
FAR1, FAR2 and FAR3 turn ON when the output frequency falls within the set frequency ± Frequency Arrival Detection Width (E030), and turn OFF when the output frequency falls outside the Frequency Arrival Detection Width (E030). In addition to FAR1 signal functions, the Frequency Arrival 2 ON Timer (E029) can be set to the FAR2 signal.

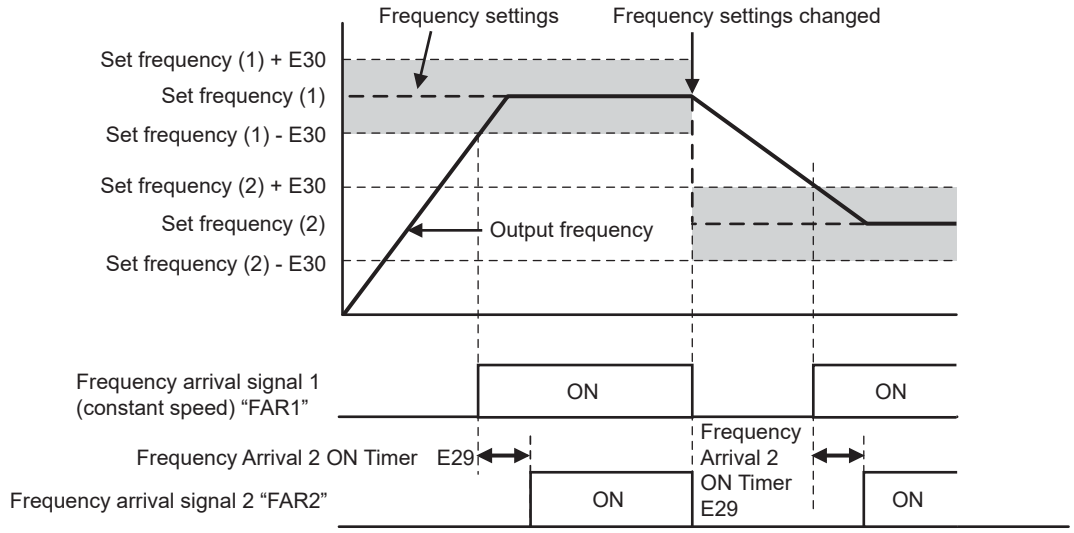
Also, operation when the RUN command is OFF differs between FAR1, FAR2 and FAR3 as follows.

FAR1, FAR2: The signal is always OFF when the RUN command is OFF or the speed command is 0.

FAR3: The signal is turned ON when the output frequency is within 0 ± frequency arrival detection range while the frequency reference is considered to be 0 with the RUN command being OFF.

| Name | Output signal | E020, E027 allocated data | Operation level | Detection range | Remarks |
|---|---|---|---|---|---|
| Frequency arrival signal 1 (constant speed) | FAR1 | 1 | Set frequency | Frequency Arrival Detection Width (E030) | OFF when the RUN command is OFF |
| Frequency arrival signal 2 (constant speed) | FAR2 | 21 | | | OFF when the RUN command is OFF |
| Frequency arrival signal 3 (constant speed) | FAR3 | 72 | | | When the RUN command is OFF, the frequency reference is treated and processed as 0 |

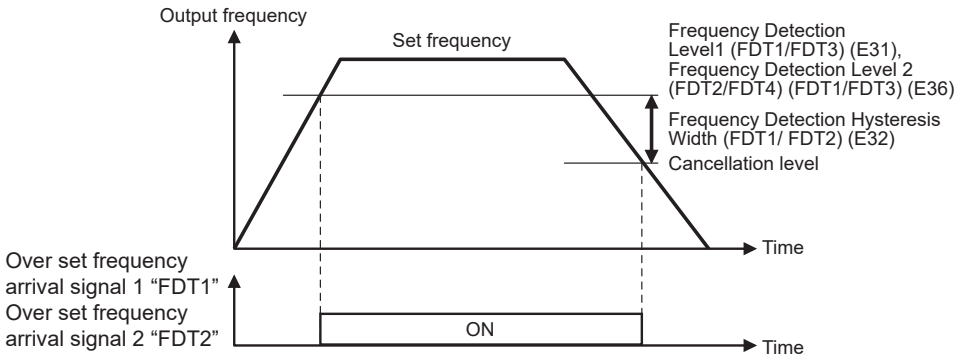



## Over Set Frequency Arrival Signal (E020, E027 = 2: FDT1, 31:FDT2)

An ON signal is output when the output frequency becomes equal to or higher than Frequency Detection Level (E031/E036), and the signal is turned OFF when the frequency falls below Frequency Detection Hysteresis Width (E032).

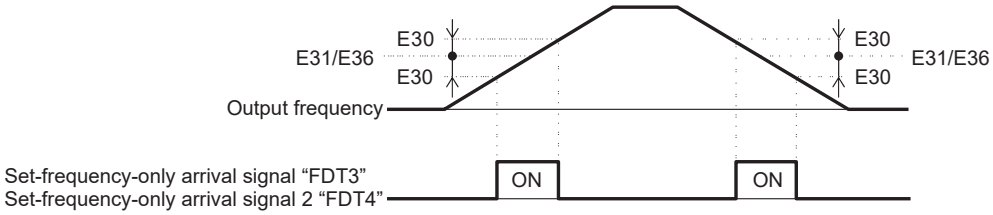
| Name | Output signal | E020, E027 allocated data | Operation level | Hysteresis width |
|---|---|---|---|---|
| | | | Range: 0.0 to 500.0Hz | Range: 0.0 to 500.0Hz |
| Over set frequency arrival signal 1 | FDT1 | 2 | E031 | E032 |
| Over set frequency arrival signal 2 | FDT2 | 31 | E036 | |




## Set-Frequency-Only Arrival Signal (E020, E027 = 183: FDT3, 185: FDT4)

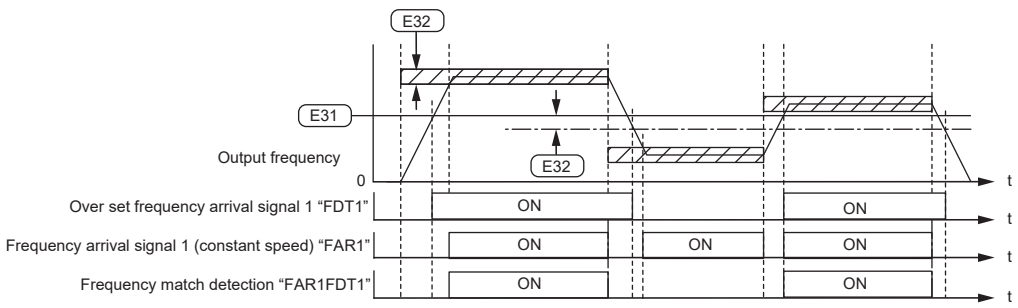
An ON signal is output when the output frequency is within the range of Frequency Detection Level (E031/E036), and the signal is turned OFF when the output frequency is out of range.

| Name | Output signal | E020, E027 allocated data | Operation level<br>Range: 0.0 to 500.0Hz | Hysteresis width<br>Range: 0.0 to 500.0Hz |
|---|---|---|---|---|
| Set-frequency-only arrival signal | FDT3 | 2 | E031 | E030 |
| Set-frequency-only arrival signal 2 | FDT4 | 31 | E036 | E030 |




## Frequency Match Detection (E020, E027 = 87: FAR1FDT1)

This is an AND composite signal of FAR1 and FDT1, which turns ON when both the conditions are established.



## 8-8-7 Power ON Time Over / RUN Time (ONT/RNT)

- If the total RUN time and power ON time of the inverter main circuit exceeds the time set at RUN Time Over (RNT)/Power ON Time Over (ONT) Detection Level (E154), the inverter will output the RUN time over/Power ON time over (RNT/ONT) signal.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E154 | RUN time over (RNT)/Power ON time over (ONT) Detection Level | 0 to 9999 | 0 | 10h |
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 237: RNT (RUN time over)<br>236: ONT (Power ON time over) | - | - |
| Related function | | Cumulative Operation Time (M020)<br>Total RUN Time Monitor (W179) | | |

### Power ON Time Over (236: ONT)

- Allocate “236: ONT” to Output Terminal [DO1] Function Selection (E020) and Output Terminal [ROA, ROB] Function Selection (E027).
- The power ON time of the inverter's main circuit is counted and output to Cumulative Operation Time (M020). When RUN Time Over (RNT)/Power ON Time Over (ONT) Detection Level (E154) elapses, the ONT terminal (236: Power ON time over) turns ON.

### RUN time over (238: RNT)

- Allocate “238: RNT” to Output Terminal [DO1] Function Selection (E020) and Output Terminal [ROA, ROB] Function Selection (E027).
- Time is measured during inverter operation (inverter output signal (35: RUN2) is ON) and the result is output to Total RUN Time Monitor (W179). When RUN Time Over (RNT)/Power ON Time Over (ONT) Detection Level (E154) elapses, RNT terminal (237: RUN time over) turns ON.

## 8-8-8 Maintenance monitor

The Maintenance timer counted up (MNT) signal is output when the cumulative operation time for motor 1 exceeds the preset time, or when the number of startups for motor 1 exceeds the preset number of times.

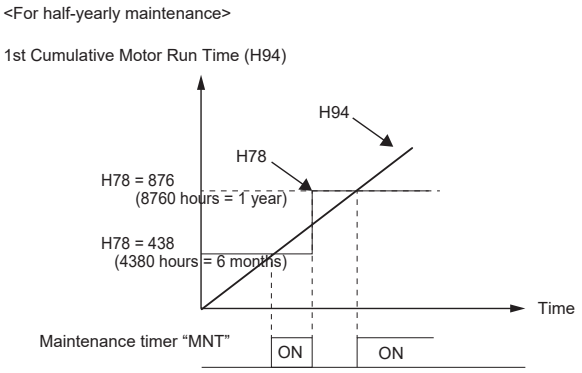
| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H078 | 1st Motor Maintenance Interval | 0: Disable<br>1 to 9999 (in 10 hours) | 8760 | Hours |
| H094 / A051 | 1st Cumulative Motor Run Time / 2nd Cumulative Motor Run Time | 0 to 9999 (in 10 hours) | 0 | Hours |
| H079 | 1st Preset Startup Count for Motor Maintenance | 0: Disable<br>1 to 65,535 | 0 | - |
| H044 / A052 | 1st Startup Count for Motor / 2nd Startup Counter for Motor | 0 to 65,535 | 0 | - |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 84: MNT (Maintenance timer counted up) | - | - |

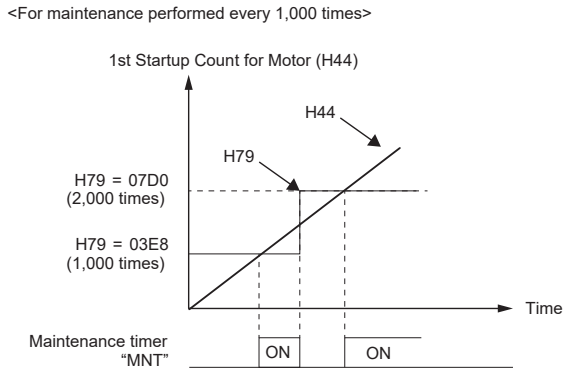
## Maintenance Timer counted up (E020, E027 = 84: MNT)

Allocate “84: MNT (Maintenance timer counted up)” to Output Terminal [DO1] Function Selection (E020) and Output Terminal [ROA, ROB] Function Selection (E027).
The signal is output when 1st Startup Count for Motor (H044) reaches the value set at 1st Preset Startup Count for Motor Maintenance (H079), or 1st Cumulative Motor Run Time (H094) reaches the value set at 1st Motor Maintenance Interval (H078).
This function is exclusively for the 1st control. The maintenance timer signal is not output even if 2nd Cumulative Motor Run Time (A051)/2nd Startup Counter for Motor (A052) exceeds the set time period or set number of times.

<For half-yearly maintenance>



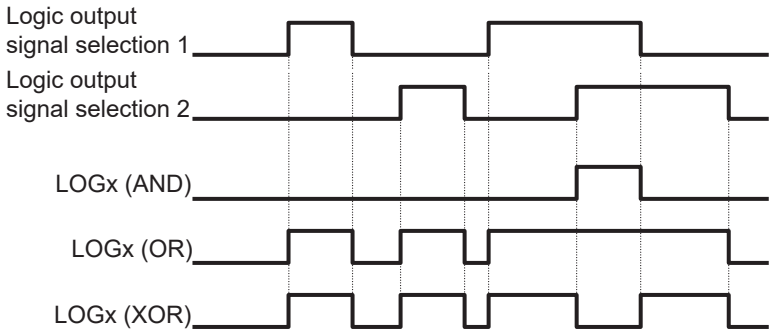

<For maintenance performed every 1,000 times>




When the maintenance time is reached, or when the set number of startups for maintenance is reached, again set a numeric value to 1st Motor Maintenance Interval (H078) or 1st Preset Startup Count for Motor Maintenance (H079) to reset the output signal, and restart the measurement of the time period or the number of startups.

## 8-8-9 Logic Operation Output Signal (LOG1 to LOG3)

Logical operations (AND, OR, XOR) are performed on signals that can be allocated to output terminals [DO1] and [ROA, ROB], and the result can be output from output terminals. Set “206: LOG1 (Logic operation output 1),” “207: LOG2 (Logic operation output 2),” or “208: LOG3 (Logic operation output 3)” to Output Terminal [DO1] Function Selection (E020) and Output Terminal [ROA, ROB] Function Selection (E027). However, “206: LOG1 (Logic operation output 1)” to “208: LOG3 (Logic operation output 3)” cannot be selected for the operation target data.



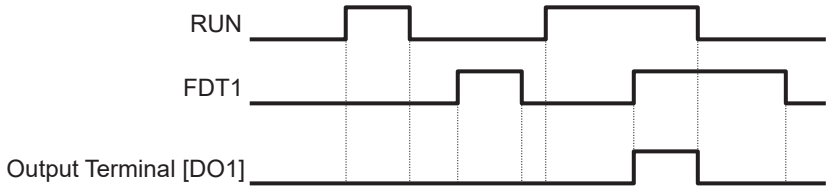

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H315 / H318 / H321 | Logical Expression 1 Operation Target 1 / Logical Expression 2 Operation Target 1 / Logical Expression 3 Operation Target 1 | 0 to 241: Same as the options for E020 (Except 206 to 208: LOG1 to LOG3) | 0 | - |
| H316 / H319 / H322 | Logical Expression 1 Operation Target 2 / Logical Expression 2 Operation Target 2 / Logical Expression 3 Operation Target 2 | | 0 | - |
| H317 / H320 / H323 | Logical Expression 1 Logical Operator / Logical Expression 2 Logical Operator / Logical Expression 3 Logical Operator | 0: AND<br>1: OR<br>2: XOR | 0 | - |
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 206: LOG1 (Logic operation output 1)<br>207: LOG2 (Logic operation output 2)<br>208: LOG3 (Logic operation output 3) | --- | - |

Each logic operation output signal requires different parameter settings.
Set the necessary parameters according to the table below.

| Selected signal | Logic output signal selection 1 | Logic output signal selection 2 | Operator selection |
|---|---|---|---|
| 206: Logic operation output 1 (LOG1) | H315 | H316 | H317 |
| 207: Logic operation output 2 (LOG2) | H318 | H319 | H320 |
| 208: Logic operation output 3 (LOG3) | H321 | H322 | H323 |

(Example) To output the result of the AND operation between Run Signal (0: RUN) and Over set frequency arrival signal 1 (2: FDT1) to the multifunction output terminal [DO1] as a Logic operation output 1 (LOG1).

Output Terminal [DO1] Function Selection (E020): 206 (LOG1)
Logical Expression 1 Operation Target 1 (H315): 0 (RUN)
Logical Expression 1 Operation Target 2 (H316): 2 (FDT1)
Logical Expression 1 Logical Operator (H317): 0 (AND)




## 8-8-10 Capacitor Life Warning Signal (WAC)

Use this signal to determine the life expectancy of the internal capacitor based on the inverter's internal temperature, conduction time, and the capacity of the capacitor.

By turning bit 4 of Protection/Maintenance Function Mode Selection (H098) ON, the service life of the capacitor is judged to have reached its end when any one of the following conditions is satisfied, and WAC (Capacitor life warning signal) is turned ON.

- The capacity of the capacitor becomes 85 % or below the factory default value.
- The conduction time exceeds 61,000 hours (7 years) in all models of the HND mode "A2022/037, A4022/040, AB002-022" and ND mode.
- The conduction time exceeds 87,000 hours (10 years) in models other than the above.

The capacity of the capacitor can be monitored by Main Circuit Capacitor's Capacitor Monitor (W075), and the conduction time by Cumulative Run Time of Electrolytic Capacitors on PC Board (M076). This function is set based on *A-8 Smoothing Capacitor Life Curve* on page A-282.
The time until the service life of the main circuit capacitor is reached (in 10 hours) is displayed in Service Life of Main Circuit Capacitor Remaining Time (H077).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H098 | Protection/Maintenance Function Mode Selection | Bit 4: Judge main circuit capacitor life<br>0: Disable<br>1: Enable | - | - |
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 240: WAC (Capacitor life warning signal) | - | - |

### Method for Comparing the Main Circuit Capacitor's Capacity and the Default Value during Shipment from Factory

When bit 3 = 0 at Protection/Maintenance Function Mode Selection (H098), follow the measurement procedure below to measure the capacitance of the main circuit capacitor when the power supply is cut off, and compare the value with the default value at the time of shipment from the factory. The measurement result is displayed as a percentage (%) with respect to the default value at the time of shipment from the factory.

**Capacity measurement procedure**

1. To compare with the default value measured at the time of shipment from the factory, return the state of the actual product to the state during shipment from the factory.
   - If another inverter is connected to the main circuit terminals P(+) and N(-) via a DC bus line, disconnect it. A DC reactor (option), even if connected, need not be removed.
   - Remove the wires of the control power auxiliary inputs (R0, T0).
   - Turn OFF all digital inputs (DI1 to DI7) of the control circuit terminals.
   - Make the setting to ensure that the transistor output (DO1) and relay output (ROA, ROB) do not turn ON.
   - If the setting is made to perform logical inversion of the transistor output and relay output, the output turns ON even when the inverter is not running. In such a case, change the setting.
   - Ensure an ambient temperature of 25℃±10°C.
2. Turn ON the main power supply.
3. Make sure the cooling fan is operating and the inverter is in a stopped state.
4. When the main power supply is cut off, the measurement of the capacity of the main circuit capacitor starts automatically.
5. Once the display on the LED is cleared, again turn ON the main power supply.
6. Check Main Circuit Capacitor's Capacitor Monitor (W075).

## Method of Measuring the Capacity of the Main Circuit Capacitor when Power Supply is Cut Off during Normal Operation

The capacity of the main circuit capacitor in the normal operation state is measured automatically when the power supply is cut off, if bit 3 = 1 at Protection/Maintenance Function Mode Selection (H098).
To perform this measurement, it is necessary to measure the reference capacitor capacity according to the measurement procedure below.

| Parameter No. | Function name | Description |
|---|---|---|
| H042 | Main Circuit Capacitor Service Life Coefficient (Measurement Value) | • Measurement value when the capacity of the main cir- cuit capacitor is measured<br>• Start the default value measurement mode during nor- mal operation (0000)<br>• Measurement failure (0001) |
| H047 | Main Circuit Capacitor Service Life Coefficient (Initial Value) | • Default value of the main circuit capacitor<br>• Start the default value measurement mode during normal operation (0000)<br>• Measurement failure (0001) |

When a part is replaced, it is necessary to clear or replace the data at Main Circuit Capacitor Service Life Coefficient (Measurement Value) (H042) and Main Circuit Capacitor Service Life Coefficient (Initial Value) (H047).

**Reference capacity measurement procedure**

1. Change Protection/Maintenance Function Mode Selection (H098) to user measurement value standard (bit 3 = 1).

2. Stop the inverter.
3. Set the inverter to a state when the power supply is cut off during normal operation.
4. Set Main Circuit Capacitor Service Life Coefficient (Measurement Value) (H042) and Main Circuit Capacitor Service Life Coefficient (Initial Value) (H047) to 0000, respectively.
5. Cut off the power supply to the inverter (the operation described below is executed automatically when the power is cut off).
   Measure the discharge time of the main circuit capacitor and save it to Main Circuit Capacitor Service Life Coefficient (Initial Value) (H047).
   The measurement conditions for main circuit capacitor are detected automatically, and the conditions are saved.
6. Turn ON the inverter power supply again.
   Make sure Main Circuit Capacitor Service Life Coefficient (Measurement Value) (H042) and Main Circuit Capacitor Service Life Coefficient (Initial Value) (H047) are correct.
   Make sure Main Circuit Capacitor's Capacitor Monitor (W075) is 100%.
   If measurement fails, 0001 is set respectively at Main Circuit Capacitor Service Life Coefficient (Measurement Value) (H042) and Main Circuit Capacitor Service Life Coefficient (Initial Value) (H047). Remove the cause of the failure and perform measurement again.
   If the conditions described above are satisfied when the power supply is cut off the next time, the discharge time of the main circuit capacitor is measured automatically. Periodically check Main Circuit Capacitor's Capacitor Monitor (W075).

- A large measurement error may occur in the measurement method described above. If life estimation is performed in this mode, return the judgment standard for the service life of the main circuit capacitor in Protection/Maintenance Function Mode Selection (H098) to the factory default standard, perform the measurement again under the factory default conditions, and check the service life.

## 8-8-11 Braking Transistor Broken (DBAL)

Use this signal to determine the life expectancy of the internal capacitor based on the inverter's internal temperature, conduction time, and the capacity of the capacitor.

When bit 6 = 1 at Protection/Maintenance Function Mode Selection (H098), an error in the built-in braking transistor is detected, the inverter is topped, and the braking transistor error (alarm code: 3B) is displayed.
When bit 6 = 0 at Protection/Maintenance Function Mode Selection (H098), the braking transistor is not used and an alarm does not occur.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 105: DBAL (Braking transistor broken) | - | - |

## 8-8-12 Cooling FAN Control Method Selection

To extend the life of the cooling fan and reduce the noise from the cooling fan, the cooling fan can be stopped according to the internal temperature of the inverter when there is no motor output.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H006 | Cooling Fan Function Selection | 0: Always Fan ON<br>1: ON/OFF control effective<br>2: ON/OFF control effective; according to only internal temperature. | 0 | - |
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 25: FAN (Cooling fan in operation) | - | - |

- When Cooling Fan Function Selection (H006) is set to “1: ON/OFF control effective,” the cooling fan operates during motor output, and, when the motor is stopped, the cooling fan operates until the internal temperature of the inverter is at a fixed value or less.
- It is possible to output the fan run status to a digital output by allocating “25: FAN (Cooling fan in operation)” to Output Terminal [DO1] Function Selection (E020), Output Terminal [DO2] Function Selection (E021) and Output Terminal [ROA, ROB] Function Selection (E027). This allows running an external fan or appropriate cooling system.
- When Cooling Fan Function Selection (H006) is set to “2: ON/OFF control effective; according to only internal temperature,” the cooling fan operates when the inverter's heatsink temperature is above the cooling fan ON level and stops when it is below the cooling fan OFF level. This will reduce the operation time of the fan, and therefore reduce acoustic noise in the surroundings of the drive.

**Precautions for Safe Use**

If cooling fan control is enabled as "Control according to only internal temperature" by H006=2 (to reduce acoustic noise due to fan operation), inverter lifetime may be reduced because operation can temporary fall out of specs in heavy load or strong acceleration applications due to thermal inertias. Warranty may be void if thermal stress is diagnosed during repair analysis (as usual). There is no additional safety risk to persons as soon as installation and operation procedures are followed.

## 8-8-13 Cooling Fan Life Warning Signal (WAF)

The number of hours of operation of the cooling fan is counted. The cooling fan is judged to have reached the end of its life when it exceeds 87,000 hours (10 years) of operation, and WAF (Cooling fan life warning signal) is turned ON.

The operation time of the cooling fan can be monitored by Cumulative Run Time of Cooling Fan (H043). When the cooling fan is replaced, the cumulative run time can be cleared by setting 0.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 241: WAF (Cooling fan life warning signal) | - | - |
| H043 | Cumulative Run Time of Cooling Fan | 0 to 9999 (in 10 hours) | 0 | 10h |

## 8-8-14 Life Alarm (LIFE)

For models with a main circuit capacitor, cooling fan, and inverter capacity of 18.5 kW or more, if any of the capacitors including electrolytic capacitors exceeds the life judgment standard, the LIFE terminal (30: Lifetime alarm) is turned ON. In addition, the lifetime alarm (alarm code: 67) can be output as a minor alarm. For details, refer to *8-8-23 Minor Alarm Selection* on page 8-99.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection | 30: LIFE (Lifetime alarm) | - | - |

| Detection target | Detection method | Individual output terminal*1 | Monitor No. | Remarks |
|---|---|---|---|---|
| Main circuit capacitor | Measure the discharge time of the main circuit capacitor when the main power supply is shut off and calculate the capacity of the main circuit capacitor.<br>It is judged that the end of life has been reached when capacity has reached 85% of the factory default capacitor capacity or the main circuit capacitor capacity (pre-measured at startup) in a user normal operation state. | WAC terminal (240: WAC) | Main Circuit Capacitor's Capacitor Monitor (W075) | Adjustment is possible (For details, refer to *8-8-10 Capacitor Life Warning Signal (WAC)* on page 8-89.)<br>Can be disabled by Protection/Maintenance Function Mode Selection (H098). |
| | The time during which voltage is applied to the main circuit capacitor (the time during which the main power supply is ON) is counted. Also, the time is corrected by measuring the capacity of the main circuit capacitor. When the operation time exceeds 87,000 hours (10 years)*2, it is judged that the end of life has reached. | | • Elapsed time Service Life of Main Circuit Capacitor Elapsed Time (M076)<br>• Remaining time Service Life of Main Circuit Capacitor Remaining Time (M077) | Can be reset by Service Life of Main Circuit Capacitor Remaining Time (H077). |
| Electrolytic capacitor | The time during which voltage is applied to the electrolytic capacitor is counted. Also, the elapsed time is corrected by the ambient temperature.<br>When the operation time exceeds 87,000 hours (10 years), it is judged that the end of life has reached. | - | Cumulative Run Time of Capacitors on Printed Circuit Boards (W067) | Can be reset by Cumulative Run Time of Electrolytic capacitor (H048). |
| Cooling fan | The time during which the cooling fan is operating is counted.<br>When the operation time exceeds 87,000 hours (10 years), it is judged that the end of life has reached. | WAF terminal (241: WAF) | Cumulative Run Time of Cooling Fan (W068) | Can be reset by Cumulative Run Time of Cooling Fan (H043). |

*1. Select by output terminal function selection.

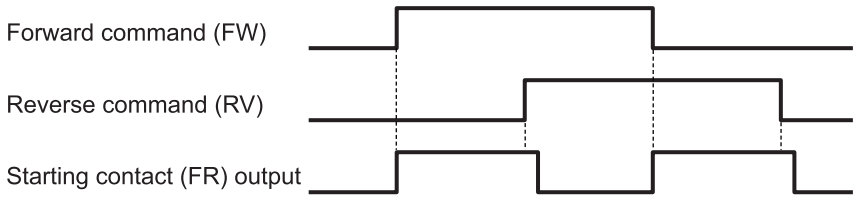
*2. With specifications and models shown below, the life is 61,000 hours (7 years) according to Load Mode Selection (F080).

HND mode: A2022/037, A4022/040, AB002-022
ND mode: All models

## 8-8-15 Starting Contact Signal (FR)

The starting contact signal is output for the duration that the FW terminal or RV terminal is being input. The inverter will stop if the FW and RV terminals are input simultaneously, and the FR terminal (187: Starting contact signal) turns OFF.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 187: FR (Starting contact signal) | - | - |




## 8-8-16 Cooling Fin Overheat Warning (OHF)

This function monitors the temperature of the cooling fin of the inverter and turns the cooling fin overheat warning signal ON/OFF according to the conditions below.

- When the cooling fin overheat warning signal is OFF
  The cooling fin overheat warning signal turns ON when the cooling fin temperature is overheat trip temperature - 5°C or above.
- When the cooling fin overheat warning signal is ON
  The cooling fin overheat warning signal turns OFF when the cooling fin temperature is overheat trip temperature - 8°C or below.
- When the cooling fin temperature is the overheat trip temperature or above, cooling fin overheat oc- curs (alarm code: 11).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 28: OHF (Fin overheat warning) | - | - |

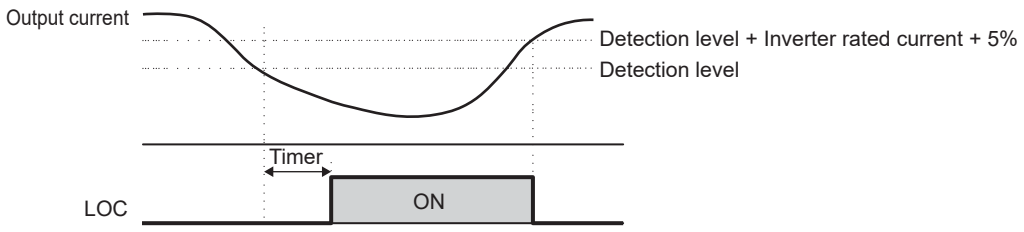
## 8-8-17 Low Current Signal (LOC)

This Light load detection signal (LOC) is output when the output current falls to or below 1st Overload Early Warning Detection Level (E037).
At Low Current Detection Condition Selection (LOC) (E184), select whether to have the inverter output this signal constantly during run or only during constant speed operation.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E037 | 1st Overload Early Warning Detection Level | 0.00: Disable 0.01 to 176.0<br># Setting range from 1% (HHD) to 200% (ND) of the rated inverter current. | 21.00 | A |
| E038 | 1st Overload Early Warning Detection Timer / Low Current detection level (OL, LOC) | 0.01 to 600.00 | 10.00 | s |
| E184 | Low Current Detection Condition Selection (LOC) | 0: Output during acceleration/deceleration and constant-speed operation<br>1: Output only during constant-speed operation*1 | - | - |
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 41: LOC (Light load detection signal) *2 | - | - |
| Related function | | Output Terminal [DO1] ON Delay Time (H309) Output Terminal [DO1] OFF Delay Time (H310) Output Terminal [ROA, ROB] ON Delay Time (H313) Output Terminal [ROA, ROB] OFF Delay Time (H314) | | |

*1. If analog input (F001/C030 = 1) is selected for 1st Frequency Reference Selection (F001)/2nd Frequency Reference Selection (C030), the signal may not be judged as a constant speed depending on the sampling condition. In this case, set E184 = 0 (Output during acceleration/deceleration and constant-speed operation), or increase the value set in the Input Terminal [AI1] Filter (C033).

*2. The OFF delay becomes the time obtained by adding 0.1 s to Output Terminal [DO1] OFF Delay Time (H310) and Output Terminal [ROA, ROB] OFF Delay Time (H314).

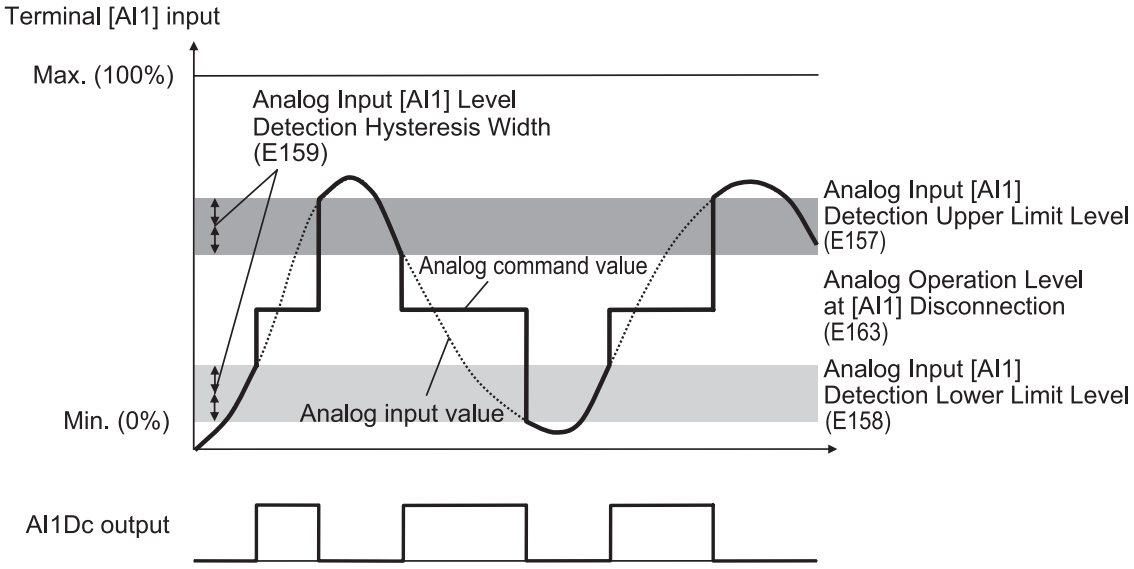



## 8-8-18 Window Comparator/Disconnection Detection (AI1Dc)

The window comparator signal is output when the input value of the analog input terminal [AI1] is between the upper and lower limit level of the window comparator. It is useful for monitoring the analog input at a level to detect disconnection or other faults.

Set the detection upper limit level by Analog Input [AI1] Detection Upper Limit Level (E157), detection lower limit level by Analog Input [AI1] Detection Lower Limit Level (E158) and detection hysteresis width by Analog Input [AI1] Level Detection Hysteresis Width (E159).

Analog operation level at AI1Dc output can be set to any value by Analog Operation Level at [AI1] Disconnection (E163). When set to 999, the analog input value will be used as is.




| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E157 | Analog Input [AI1] Detection Upper Limit Level | 0 to 100 | 100 | % |
| E158 | Analog Input [AI1] Detection Lower Limit Level | 0 to 100 | 0 | % |
| E159 | Analog Input [AI1] Level Detection Hysteresis Width | 0 to 100 | 0 | % |
| E163 | Analog Operation Level at [AI1] Disconnection | -100 to 100<br>999: Disable | 999 | % |
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 238: AI1Dc (Analog AI1 disconnection detection) | - | - |

**Note** Set the upper and lower limit level settings for the window comparator function as a percentage [%] of the 10 V input voltage rather than making the start and end settings for analog input.

**Additional Information**

When using this signal for disconnection detection, set the disconnection detection level to Analog Input [AI1] Detection Upper Limit Level (E157).
(During normal operation, range exceeding the upper limit value is used. If the range falls below the lower limit value, a disconnection will be detected.)

## 8-8-19 2nd Control Selection Signal (SETM/SWM1)

The SETM signal is output when the SET terminal (12: Set 2nd control) of multifunction input is ON and the 2nd control has been selected. If the SET terminal is OFF and the 1st control has been selected, the SWM1 signal is output.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 48: SWM1 (1st motor in operation)<br>49: SETM (2nd motor in operation) | - | - |

## 8-8-20 Inverter Output Limiting (IOL, IOL2)

This signal is output when the inverter is performing one of the limitation operations described below. (Minimum output signal width 100 ms)
The signal is output when the limitation operation in “22: IOL2 (Inverter output limiting with delay)” continues for 20 ms or longer.

- Torque limit operation
  Torque Limit 1/2/3/4 (F040/F041/E016/E017)
- Current limitation operation by software
  Overload Protect Function Selection (F043/E146) Overload Protect Level (F044/E147)
- Current limitation operation by hardware
  Instantaneous Overcurrent Limiting Function Selection (H012)
- Anti-regenerative control
  Anti-regenerative Control Function Selection (H069)
- Overload Stop Function
  Overload Stop Mode Selection (J065)

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 5: IOL (Inverter output limiting)<br>22: IOL2 (Inverter output limiting with delay) | - | - |
| Related function | | Output Terminal [DO1] ON Delay Time (H309) Output Terminal [DO1] OFF Delay Time (H310) Output Terminal [ROA, ROB] ON Delay Time (H313) Output Terminal [ROA, ROB] OFF Delay Time (H314) | | |

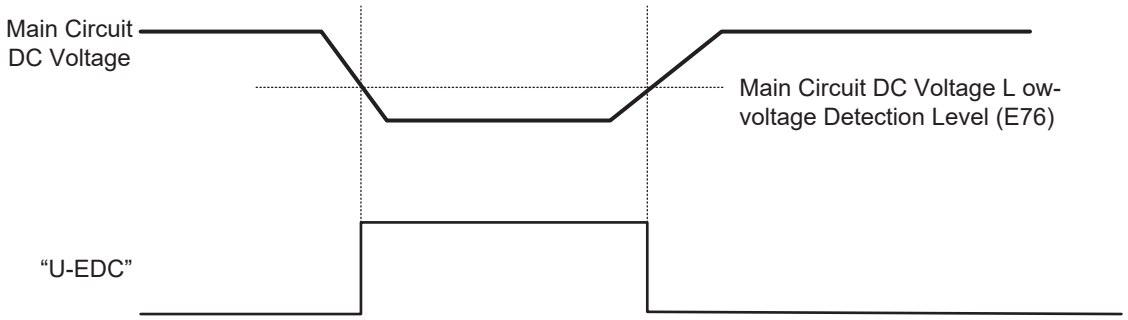
The OFF delay becomes the time obtained by adding 0.1 s to Output Terminal [DO1] OFF Delay Time (H310) and Output Terminal [ROA, ROB] OFF Delay Time (H314).

- When the IOL signal or the ILO2 signal is ON, the output frequency of the inverter is automatically controlled by the limitation processes described above, and thus, the set frequency may not be achieved.

## 8-8-21 Low DC link bus voltage detection (U-EDC)

This signal turns ON when the Main Circuit DC Voltage becomes equal to or below Main Circuit DC Voltage low-voltage detection level (E076), and turns OFF when it becomes above the Main Circuit DC Voltage low-voltage detection level (E076).

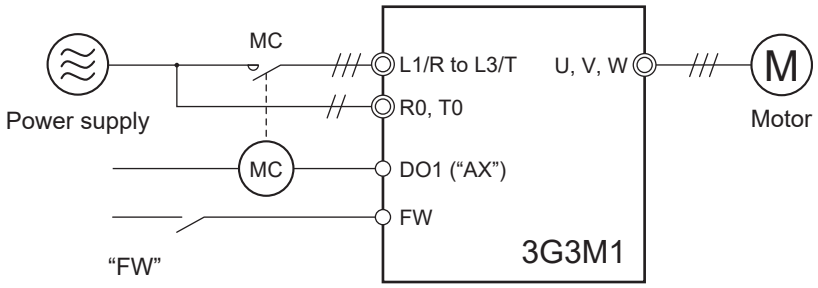
| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E076 | Main Circuit DC Voltage Low-voltage Detection Level | 200 to 400V (200V series)<br>400 to 800V (400V series) | 235 | V |
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 77: U-EDC (Low DC link bus voltage detection) | - | - |

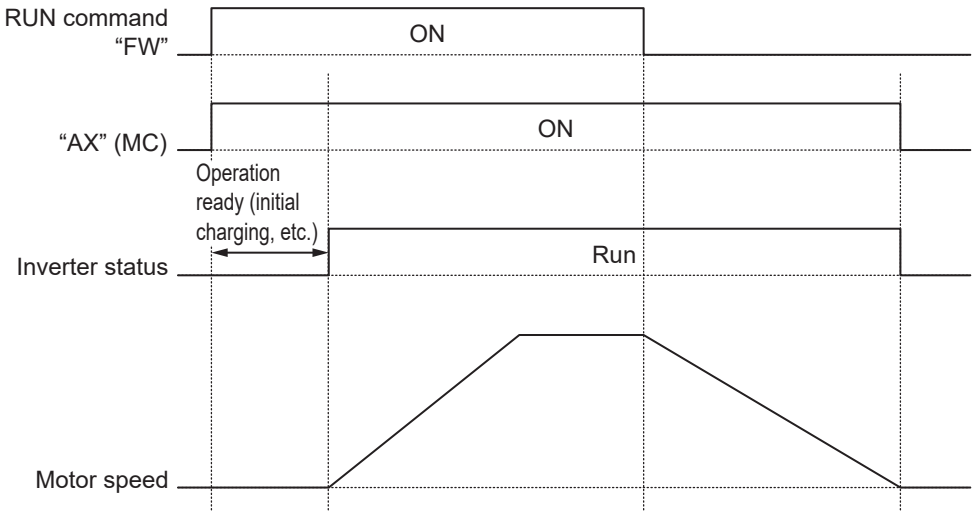



## 8-8-22 AX Terminal Function (AX)

This function is used to control the electromagnetic contactor (MC) at the inverter input side in association with the RUN command. It turns ON when the RUN command is input. When the stop command is input, this function turns OFF after the inverter undergoes a deceleration stop. This function turns OFF momentarily when the free run command is input and an alarm is generated. “AX” can be selected at a capacity of 18.5kW or more of auxiliary power supply.
Connect the power supply directly between R0 and T0.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 15: AX (Switch MC on the input power lines) | - | - |






## 8-8-23 Minor Alarm Selection

When various error states are detected, this function enables continuation of operation without tripping the inverter if they are minor errors. When this is selected, the alarm becomes a minor alarm. The contents of the minor alarm can be selected at Light Alarm Selection 1 (H81)/Light Alarm Selection 2 (H82).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H081 | Light Alarm Selection 1 | 0000 to FFFF | 0 | - |
| H082 | Light Alarm Selection 2 | 0000 to FFFF | 0 | - |

### Precautions for Correct Use

Overheat protection (alarm code: 11, 13, 46) protects by overheat protection (alarm code: 19) of the inverter that cannot ultimately be turned into a minor alarm. When Motor Electronic Thermal (alarm code: 17, 18), Braking Resistor Thermal (alarm code: 16) and External Alarm (alarm code: 12) are turned into minor alarms, there is the risk of motors and other external devices burning depending on setting and method of use.

### Alarms That Can Be Changed to Minor Alarms

The following alarms can be changed to minor alarms.

| Alarm code hex | Name | Overview |
|---|---|---|
| 11 (0H1) | Cooling fin overheating | The cooling fin temperature has risen to the trip level. |
| 12 (0H2) | External trip | An error has occurred in a peripheral equipment, and the external trip “EXT” signal has turned ON. |
| 13 (0H3) | Inverter internal overheating | The internal temperature of the inverter has risen abnormally. |
| 46 (0H6) | Inrush current prevention resistor | The temperature of the inrush current prevention resistor has risen abnormally due to frequently turning the power supply ON/OFF. |
| 16 (dbH) | Braking resistor overheating | The estimated temperature of the braking resistor coil has risen above the permissible temperature. |

| Alarm code hex | Name | Overview |
|---|---|---|
| 17,18 (0L1,0L2) | Motor 1, 2 overload | The motor temperature is calculated from the output current of the inverter, and the motor temperature has reached the trip level. |
| 23 (ER5) | EtherNet communications error | EtherNet communications error occurs one or more times |
| 2F (ErE) | Speed mismatch (Excessive speed deviation) | The deviation in the speed adjuster (deviation between the speed command and speed estimated value/detected speed) continued for more than the set time (d022) outside the set range (d021). |
| 38 (Ero) | Position control error | During a servo lock, the position error becomes four rotations or more by motor shaft conversion due to insufficient gain of the position control system |

## Minor Alarm Selectable Events

The following events can be set to minor alarms.

| Alarm code | Name | Overview |
|---|---|---|
| 65 (0L) | Motor overload early warning | Early warning before the occurrence of motor overload alarm. |
| 66 (0H) | Cooling fin overheating early warning | Early warning before the occurrence of cooling fin overheat tripping. |
| 67 (LiF) | Lifetime alarm | Any one of the main circuit capacitor used in the inverter, the capacitors on the printed circuit board, and the cooling fan has reached the end of its life |
| 68 (rEF) | Reference loss | The analog frequency reference is disconnected. |
| 69 (PiD) | PID warning output | Warning related to PID control (Absolute value warning/ Deviation warning). |
| 6A (UTL) | Low output torque detection | The output torque continued to be below the low torque detection level for more than the time set in the timer. |
| 6B (PTC) | Motor overheat detected by thermistor (PTC) | Temperature detection by the PTC thermistor of the motor. |
| 6C (rTE) | Inverter life (Cumulative operation time of motor) | The cumulative operation time of motor has reached the set maintenance time. |
| 6D (CnT) | Inverter life (Number of startups) | The number of startups has reached the set number of maintenance. |

## Method of selecting light alarm causes

The causes of the light alarm that can be selected are allocated to 0 to 15 bits as shown below, and are set and displayed in hexadecimals. By setting the bit corresponding to the cause to be selected to 1, the concerned cause can be treated as a light alarm.

Light Alarm Selection 1 (H081)

| Bit | Alarm code | Description | Bit | Alarm code | Description |
|---|---|---|---|---|---|
| 15 | 46 (0H6) | Inrush current prevention resistor overheat | 7 | - | - |
| 14 | - | - | 6 | 18 (0L2) | Motor 2 overload |
| 13 | - | - | 5 | 17 (0L1) | Motor 1 overload |
| 12 | - | - | 4 | 16 (dbH) | Braking resistor overheating |

| Bit | Alarm code | Description | Bit | Alarm code | Description |
|---|---|---|---|---|---|
| 11 | 23 (Er5) | EtherNet communications error | 3 | - | - |
| 10 | - | - | 2 | 13 (0H3) | Inverter internal overheating |
| 9 | - | - | 1 | 12 (0H2) | External trip |
| 8 | - | - | 0 | 11 (0H1) | Cooling fin overheating |

Light Alarm Selection 2 (H082)

| Bit | Alarm code | Description | Bit | Alarm code | Description |
|---|---|---|---|---|---|
| 15 | - | - | 7 | 67 (LiF) | Lifetime alarm |
| 14 | - | - | 6 | 66 (0H) | Cooling fin overheating early warning |
| 13 | 6D (CnT) | Inverter life (Number of startups) | 5 | 65 (0L) | Motor overload early warning |
| 12 | 6C (rTE) | Inverter life (Cumulative run time) | 4 | - | - |
| 11 | 6B (PTC) | PTC thermistor activated | 3 | - | - |
| 10 | 6A (UTL) | Low output torque detection | 2 | 38 (Ero) | Position control error |
| 9 | 69 (PiD) | PID warning output | 1 | 34 (d0) | Excessive Positional Deviation |
| 8 | 68 (rEF) | Reference loss | 0 | 2F (ErE) | Speed mismatch (Excessive speed deviation) |

(Example) When “Motor 1 overload” or “Cooling fin overheat” is selected at Light Alarm Selection 1 (H081)

| Bit | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alarm code | | 46 | - | - | - | 23 | - | - | - | - | 18 | 17 | 16 | - | 13 | 12 | 11 |
| Display example | Binary | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| | Hexadecimal | 0 | | | | 0 | | | | 2 | | | | 1 | | | |

The input of light alarm selection must be made by converting a binary 4 bits unit to hexadecimal. The conversion table is shown below.

| Binary | | | | Hexadecimal | Binary | | | | Hexadecimal |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 8 |
| 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 9 |
| 0 | 0 | 1 | 0 | 2 | 1 | 0 | 1 | 0 | A |
| 0 | 0 | 1 | 1 | 3 | 1 | 0 | 1 | 1 | b |
| 0 | 1 | 0 | 0 | 4 | 1 | 1 | 0 | 0 | C |
| 0 | 1 | 0 | 1 | 5 | 1 | 1 | 0 | 1 | d |
| 0 | 1 | 1 | 0 | 6 | 1 | 1 | 1 | 0 | E |
| 0 | 1 | 1 | 1 | 7 | 1 | 1 | 1 | 1 | F |

### Minor alarm L-ALM Signal

If “98: L-ALM (Minor alarm)” is allocated to Output Terminal [DO1] Function Selection (E020) and Output Terminal [ROA, ROB] Function Selection (E027), the minor alarm “L-ALM” signal is output when the cause of a minor alarm occurs.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E020 / E027 | Output Terminal [DO1] Function Selection / Output Terminal [ROA, ROB] Function Selection | 98: L-ALM (Minor alarm) | - | - |

## 8-8-24 Input Phase Loss Protection / Output Phase Loss Protection

By setting Input Phase Loss Protection Function Selection (H411) and Output Phase Loss Protection Function Selection (H412), it is possible to set whether to continue with the operation or trip the inverter when an input loss or output loss is detected.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H411 | Input Phase Loss Protection Function Selection | 0: Disable (Continue to run)<br>1: Enable (Trip) | - | - |
| H412 | Output Phase Loss Protection Function Selection | | | |

- Input phase loss protection
  If excessive stress is generated on the main circuit devices as a result of the loss of the three-phase power supply input to the inverter or the unbalance between phases, it is detected and the input loss protection function (alarm code: 0B) is activated.
  If the load to be connected is light and a DC reactor has been connected, the stress on the main circuit devices is low. Therefore, even if there is an input loss or an unbalance between phases, the loss may not be detected.

- Output phase loss protection
  If an output loss is detected during the inverter operation, the output loss protection function (alarm code: 0B) is activated.
  In a configuration where an electromagnetic contactor is connected at the output side, if the electromagnetic contactor turns OFF during operation, the current of all phases becomes zero. In such a case, the output loss protection function is not activated.

## 8-8-25 Integrated power clear (KHC)

When the KHC terminal is turned ON, the integrated power is cleared to zero. Integrating operation is not performed while this terminal command is ON. To resume integrating operation, turn the KHC terminal OFF.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 164: KHC (Integrated power clear) | - | - |

# 8-9 Other Operation Functions

## 8-9-1 Carrier frequency

Use this function to change the carrier frequency output from the inverter in a PWM waveform.
Set a higher carrier frequency value to reduce the metallic noise from the motor.
However, this results in an increase in electrical noise or leakage current from the inverter.
By setting the level of Motor Sound Tone (F027), it may be possible to reduce the metallic noise generated by the motor. Motor Sound Tone (F027) is enabled if the setting of Carrier Frequency (F026) is 7 kHz or below.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F026 | Carrier Frequency | 0: 0.75 kHz<br>1: 1 kHz<br>2: 2 kHz<br>3: 3 kHz<br>4: 4 kHz<br>5: 5 kHz<br>6: 6 kHz<br>7: 7 kHz<br>8: 8 kHz<br>9: 9 kHz<br>10: 10 kHz<br>11: 11 kHz<br>12: 12 kHz<br>13: 13 kHz<br>14: 14 kHz<br>15: 15 kHz<br>16: 16 kHz | 2 | kHz |
| F027 | Motor Sound Tone | 0: Level 0 (Disable)<br>1: Level 1<br>2: Level 2<br>3: Level 3 | 0 | - |
| Related function | | Carrier Frequency Automatic Reduction Function Selection (E165) | | |

- Derating of the output current may be required depending on the installation environment or the setting of Carrier Frequency (F026). For derating in each inverter model, refer to *A-7 Derating Table* on page A-276.
  Set the output current value to be derated as electronic thermal level.
  This setting, however, is unnecessary if the electronic thermal level is already set to the derating value or lower.
  For details on the electronic thermal function, refer to *6-3-3 Motor Electronic Thermal Function* on page 6-18.
- Depending on the motor, the effect of Motor Sound Tone (F027) may be less. If the level of Motor Sound Tone (F027) is increased too much, the output current may become disordered, and the machine vibrations or noise may increase.

## 8-9-2 Automatic Carrier Frequency Reduction

Use this function to reduce the carrier frequency automatically as the output current and the cooling fin temperature increase.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E165 | Carrier Frequency Automatic Reduction Function Selection | 0: Disable<br>1: Enable | 1 | - |
| Related function | | Carrier Frequency (F026) | | |

- When this function is enabled, overheating or overload trips sometimes can be avoided.

## 8-9-3 Silent Inverter Operation (Fixed Carrier Frequency)

Use this function to reduce the acoustic noise while working in low output frequency range. When this function is enabled, the Carrier Frequency (F026) prevails in the whole output frequency range, reducing the acoustic noise typical at lower speeds

**Silent Inverter Operation Selector**

| Parameter No. | Function name | Data | Defaultdata |
|---|---|---|---|
| H413 | Silent inverter operation | 0: Normal operation (default)<br>1: Silent operation | 0 |
| Related function | | F026 (carrier frequency), E165 (automatic carrier reduction) | |

- The carrier reduction function (E165) due to overheating will not work

## Derating characteristics

- When silent inverter operation mode is used (H413 parameter set to 1), inverter capacity is reduced to 1/3 of rated inverter power at high carrier values (F026=15 or 16kHz) in certain capacities (details below).
- Using Silent Inverter Operation requires to design the machine and application which load specifications do not exceed below.

| Type | HHD spec | | HND spec | |
|---|---|---|---|---|
| | F026=15 | F026=16 | F026=15 | F026=16 |
| 3G3M1-A2037 or smaller | 45% | 45% | 40% | 35% |
| 3G3M1-A2055 or bigger | 55% | 50% | 55% | 50% |
| 3G3M1-A4040 or smaller | 30% | 30% | 30% | 30% |
| 3G3M1-A4055 or bigger | 40% | 40% | 35% | 30% |
| 3G3M1-AB022 or smaller | 45% | 40% | 30% | 30% |
| 3G3M1-AB037 | 55% | 50% | - | - |

**Precautions for Safe Use**

- Warranty may be void if thermal stress is diagnosed in repair analysis

## 8-9-4 Starting Frequency and Stop Frequency

Set the frequency for starting inverter output when the RUN signal is turned ON, and the frequency for stopping the inverter output when the RUN signal is turned OFF.

### Starting frequency

- During V/f control (Drive Control Selection (F042/A014) = 0, 3)
  When the inverter operation is started, the output frequency starts from the starting frequency. Set the starting frequency to enable securing sufficient starting torque. It is also possible to set the Starting Frequency Holding Time (F024/A062).
- During vector control (Drive Control Selection (F042/A014) = 1, 4, 5, 6, 15, 16)
  When the inverter is started, the speed starts from zero, and acceleration is performed up to the starting frequency in accordance with the set acceleration time and acceleration pattern. After the starting frequency holding time has elapsed, acceleration is again performed to the frequency instructed in accordance with the acceleration time.

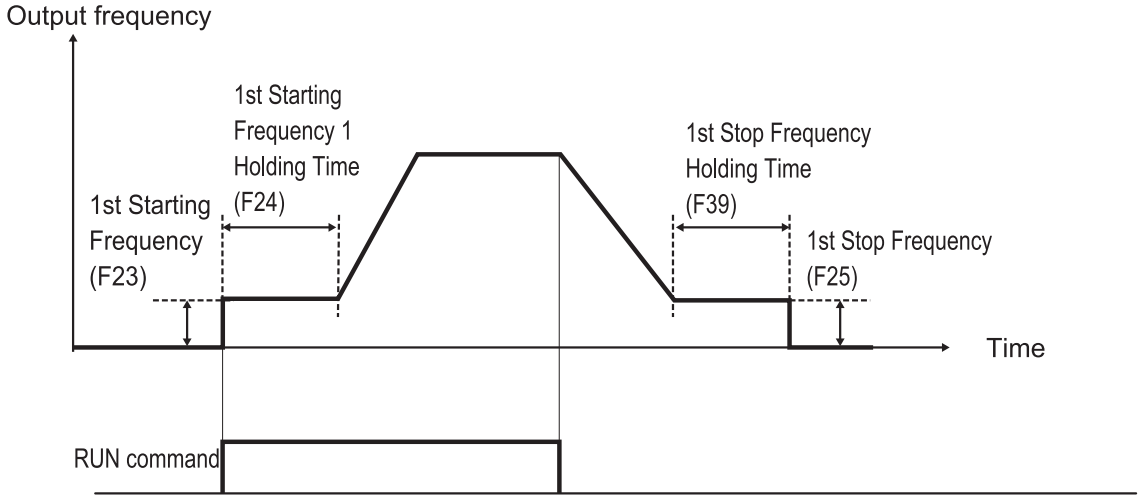
| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F023 | 1st Starting Frequency | 0.0 to 60.0 | 0.5 | Hz |
| F024 | 1st Starting Frequency 1 Holding Time | 0.00 to 10.00 | 0.00 | s |
| A012 | 2nd Starting Frequency | 0.0 to 60.0 | 0.5 | Hz |
| A062 | 2nd Starting Frequency Holding Time | 0.00 to 10.00 | 0.00 | s |

### Stop Frequency

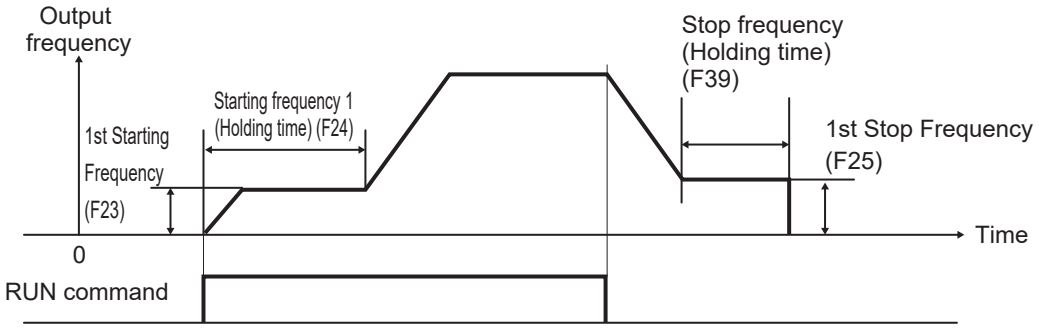
- During V/f control (Drive Control Selection (F042/A014) = 0, 3)
  The inverter output is cut off at the time the output frequency reaches the stop frequency. It is also possible to set the stop frequency (holding time).
- During vector control (Drive Control Selection (F042/A014) = 1, 4, 5, 6, 15, 16)
  The speed detection value/speed estimated value or the speed command reaches the stop frequency, and the stop frequency holding time elapses, and then inverter output is cut off.
  Select the speed detection value/speed estimated value or the speed command at Stop Frequency Detection Method Selection (F038/A064).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F025 | 1st Stop Frequency | 0.0 to 60.0 | 0.2 | Hz |
| F038 | 1st Stop Frequency Detection Method Selection | 0: Detected/Estimated speed<br>1: Reference speed | 0 | - |
| F039 | 1st Stop Frequency Holding Time | 0.00 to 10.00 | 0.00 | s |
| A063 | 2nd Stop Frequency | 0.0 to 60.0 | 0.2 | Hz |
| A064 | 2nd Stop Frequency Detection Method Selection | 0: Detected/Estimated speed<br>1: Reference speed | 0 | - |
| A065 | 2nd Stop Frequency Holding Time | 0.00 to 10.00 | 0.00 | s |

### During V/f control (Drive Control Selection (F042/A014) = 0, 3)




### During Vector Control (Drive Control Selection (F042/A014) = 1, 4, 5, 6, 15, 16)




## 8-9-5 Zero Speed Control

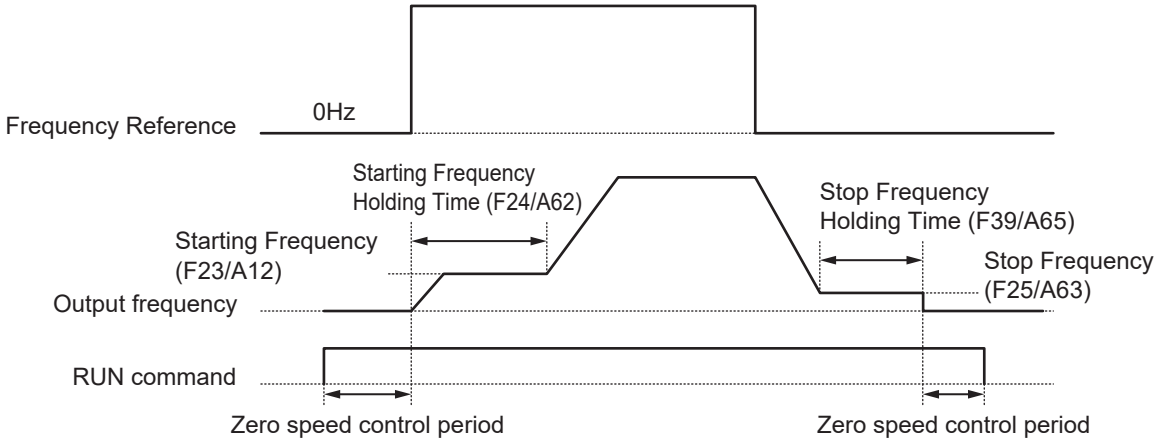
Zero speed control keeps the frequency reference motor speed at 0 (zero).

- This is enabled when “5: IM Vector control without speed sensor,” “6: IM Vector control with speed sensor” or “16: PM Vector control with speed and pole position sensor” is set to Drive Control Selection (F042/A014). As this control is enabled only in speed control, set it to ON (speed control) when the speed control/position control switching terminal (137: SPD) is allocated.
- Zero speed control is executed at a startup and stop, and enable/disable is selected at Zero Speed Control (d024).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d024 | Zero Speed Control | 0: Disable at startup, enable at stop<br>1: Enable at startup, enable at stop<br>2: Disable at startup, disable at stop | 0 | - |
| Related function | | Drive Control Selection (F042/A014), Starting Frequency (F023/A012), Stop Frequency (F025/A063), Starting Frequency Holding Time (F024/A062), Stop Frequency Holding Time (F039/A065) | | |

- When zero speed control is enabled, it is executed when the RUN command is ON and the frequency reference is less than the starting frequency and less than the stop frequency. Note, however, that when the starting frequency and stop frequency are 0.0 Hz, zero speed control is executed with the speed command set to 0.00 Hz.

The following shows the time chart during vector control when “1: Enable at startup, enable at stop” is set to Zero Speed Control (d024). With vector control, acceleration is performed in accordance with the acceleration time up to the starting frequency.




## 8-9-6 Frequency Jump Function

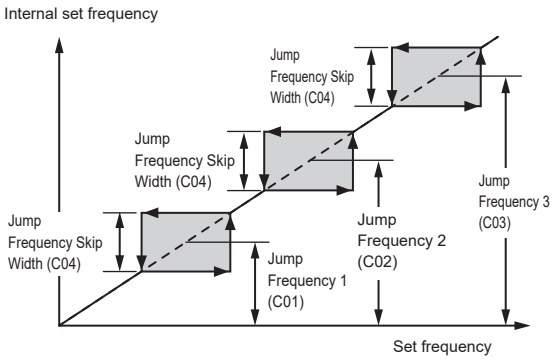
Use this function to avoid the resonant point of the load machine during operation. Three points can be set for the jump frequency range.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| C001 / C002 / C003 | Jump Frequency 1 / Jump Frequency 2 / Jump Frequency 3 | 0.0 to 590.0<br>Set the center frequency of the frequency skip width to be jumped.*1 | 0.0 | Hz |
| C004 | Jump Frequency Skip Width | 0.0 to 30.0<br>Set the skip width of the frequency to be jumped. | 3.0 | Hz |

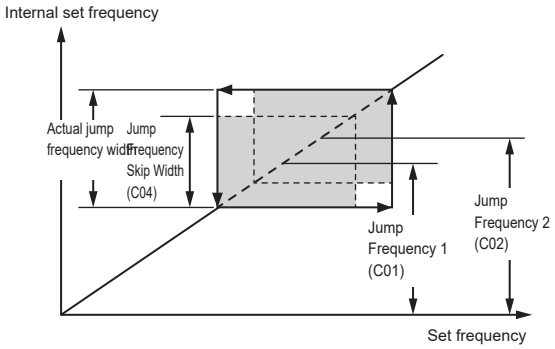
*1. This function is disabled when 0 Hz is set.

If the jump frequency is set to avoid steady operation within the jump frequency range, the setting of the frequency reference within the jump frequency range operates as described below.

- When the set frequency is increased and the set frequency enters the jump frequency band, the internal set frequency is kept constant at the lower limit of the jump frequency band. If the set frequency exceeds the upper limit of the jump frequency band, the internal set frequency reaches the value of the set frequency. When the set frequency is reduced, the opposite relationship to that during increase is realized.




- If two or more jump frequency ranges overlap each other, the lower limit value and the upper limit value of the overlapped jump frequency become the lower limit and upper limit frequencies of the actual jump frequency range.




During acceleration and deceleration, the output frequency changes continuously in accordance with the acceleration/deceleration time.
Although the jump frequency can be set at three locations, the jump frequency width is common at the three locations.

## 8-9-7 RUN Direction Limit Selection

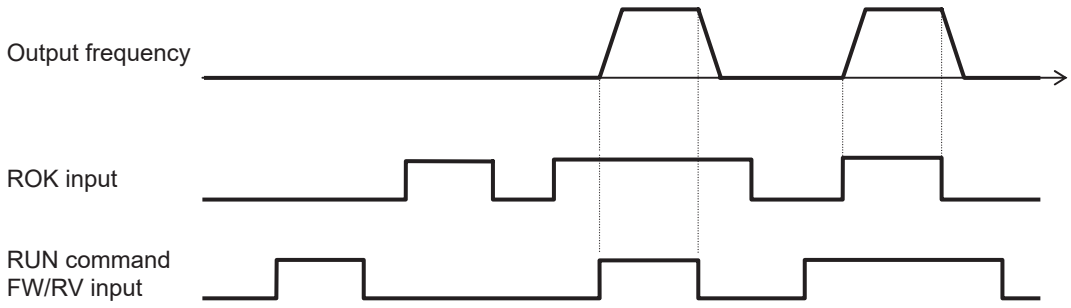
This function limits the rotation direction of the motor output.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H008 | Reverse Rotation Prevention Function | 0: Disable<br>1: Reverse rotation inhibited<br>2: Forward rotation inhibited | 0 | - |

## 8-9-8 Permission of RUN Command

The RUN command is not accepted while the Permission of Run command is OFF.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 38: ROK (Permission of Run command) | - | - |




## 8-9-9 Frequency Calculation Function

When “13: Calculation result” is set to Frequency Reference Selection (F001/C030), two frequency references are calculated.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F001 / C030 | 1st Frequency Reference Selection / 2nd Frequency Reference Selection | 13: Calculation result | 0 | - |
| E131 | Frequency Calculation Operation Target 1 | 1: Voltage input to terminal [AI1]<br>5: Pulse train input<br>7: EtherNet | 1 | - |
| E132 | Frequency Calculation Operation Target 2 | | 2 | - |
| E133 | Frequency Calculation Operator Selection | 0: Addition (E131 + E132) 1: Subtraction (E131 - E132)<br>2: Multiplication (E131 × E132) | 0 | - |

**Note 1.** The same setting can be made in E131/E132.

**Note 2.** If the calculation results exceed 1st Maximum Output Frequency (F003)/2nd Maximum Output Frequency (A001), the limit is set at the maximum frequency. Similarly, if the calculation results are below 0.0 Hz, the limit is set at 0.0 Hz.

## 8-9-10 Frequency Addition Function

Use this function to add or subtract the value set in Frequency Addition Amount (E134) to or from the selected frequency reference.

If “161: ADD” is not allocated to the multifunction input terminal, or if the ADD terminal is ON, add or subtract Frequency Addition Amount (E134). If the ADD terminal is turned OFF, the addition or subtraction of Frequency Addition Amount (E134) is canceled, and the inverter returns to the status of the selected frequency reference.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E134 | Frequency Addition Amount | 0.00 to 590.00 | 0.00 | Hz |
| E135 | Frequency Addition Sign Selection | 0: Frequency command + (E134)<br>1: Frequency command - (E134) | 0 | - |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 161: ADD (Frequency addition) | - | - |

**Note 1.** If the sign of the frequency reference changes (from (-) to (+), or from (+) to (-)) as a result of the calculation, the rotation direction is reversed.

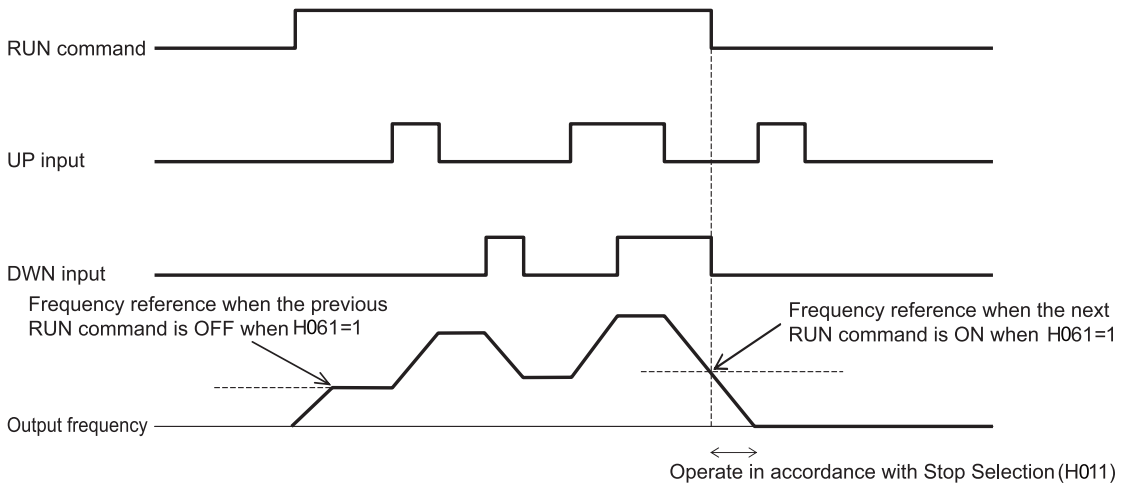
**Note 2.** When the PID function is used, this function is enabled even for the PID target value. The value is added in increments of 0.01% where the Frequency Addition Amount (E134) with respect to the target PID value is taken to be 100%. At this time, if a value larger than 100.0 is set, the limit is set at 100.0.

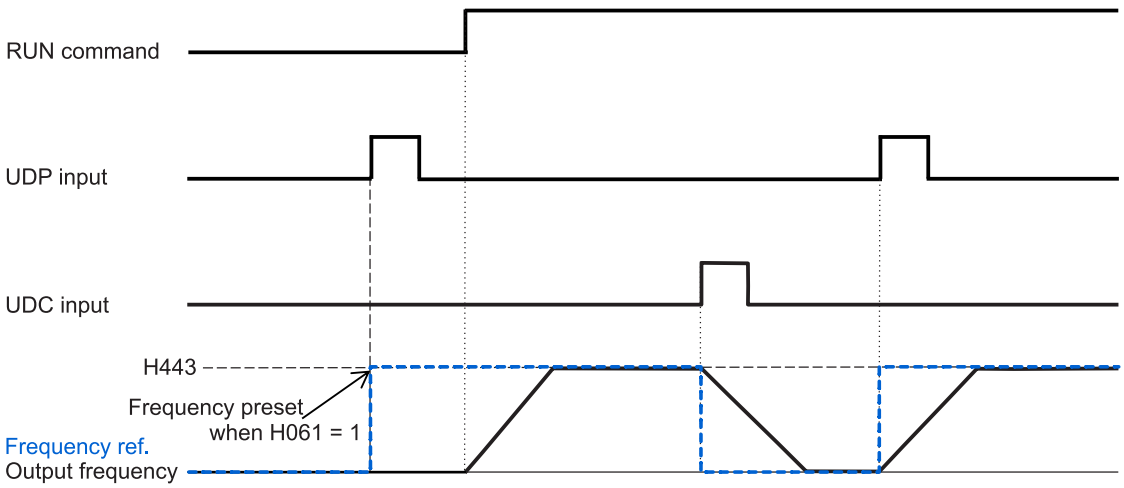
## 8-9-11 UP/DOWN control

Use this function to change the inverter output frequency via the multifunction input terminals UP and DWN.

| Parameter No. | Function name | Data | Default data |
|---|---|---|---|
| F001 / C030 | 1st Frequency Reference Selection / 2nd Frequency Reference Selection | 7: UP/DOWN control | 0/2 |
| H061 | UP/DOWN Control Initial Value Selection | 0: 0.00Hz<br>1: Last UP/DOWN command value | 1 |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 17: UP (UP/DWN function accelerated)<br>18: DWN (UP/DWN function decelerated)<br>58: UDC (UP/DWN Setpoint CLEAR)<br>165: UDP (UP/DWN Setpoint preset | - |
| H443 | UP/DOWN control (Preset frequency) | 0.00 to 590.00Hz | 0.00Hz |

- When the RUN command is turned ON, the frequency reference when the previous RUN command is OFF is output. To operate from 0 Hz when the RUN command is ON, set UP/DOWN Control Initial Value Selection (H061) to 0.
- Commands from the UP and DWN terminals are enabled only when the RUN command is ON. The frequency reference is added when the UP terminal is ON. The frequency reference is subtracted when the DWN terminal is ON. Addition and subtraction of the frequency reference is stopped when both are ON. When either of the terminals is OFF, the frequency reference is added or subtracted according to the command from the ON terminal.






- The frequency reference operates in accordance with the acceleration/deceleration time and acceleration/deceleration pattern (refer to *6-6-2 Acceleration/Deceleration Pattern* on page 6-34) that is adopted during operation.
- When the UDC terminal turns ON, the frequency reference is set to 0 Hz and a deceleration stop is performed. The UDC terminal is enabled and the frequency reference becomes 0 Hz also when the UP terminal or DWN terminal is ON. When the UDC terminal is turned OFF during a deceleration stop, the frequency reference is operated from 0 Hz in accordance with the UP terminal or DWN terminal.
- When the UDP terminal turns ON, the frequency reference is set to H443 value.When the UDP terminal turns ON while H061 = 1 and RUN command is OFF, the RUN command will start with H443 frequency preset.
- UDP, UDC, and UP/DWN terminal commands priority is shown below: UDC > UDP > UP or DWN

**Additional Information**

When 0: Other than linear acceleration/deceleration, 1: S-curve acceleration/deceleration, 2: S-curve acceleration/deceleration (Arbitrary) and 3: Curve acceleration/deceleration is selected at Acceleration/Deceleration Pattern Selection (H007), the output frequency changes for a while even if the “UP” terminal and “DWN” terminal are turned OFF.

## 8-9-12 AVR

This is a function for automatically correcting the output voltage to the motor even if the inverter incoming voltage fluctuates.
This function is used to avoid a drop in the output torque of the motor or the overexcitation state.
Note, however, that the inverter cannot output voltage exceeding the incoming voltage to the inverter.

### AVR (Automatic Voltage Regulator) Function Setting

The AVR (automatic voltage regulator) function is set to enabled or disabled by 1st AVR Function Selection (E122)/2nd AVR Function Selection (E123).

- The voltage output in the motor is based on the voltage selected at 1st Rated Voltage at Base Frequency (F005)/2nd Rated Voltage at Base Frequency (A003).
  Note, however, that the inverter cannot output voltage exceeding the incoming voltage to the inverter.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E122 / E123 | 1st AVR Function Selection / 2nd AVR Function Selection | 0: Disable<br>1: Enable | 1 | - |
| F005 / A003 | 1st Rated Voltage at Base Frequency / 2nd Rated Voltage at Base Frequency | 80 to 240 V (200 V class)<br>160 to 500 V (400 V class) | 200 | V |

## 8-9-13 Overexcitation Control during Deceleration

Overexcitation control during deceleration is a function that decreases the regenerative energy to be fed back to the inverter by forcing the motor during deceleration to be in an overexcited state. It enables you to shorten the deceleration time without use of external braking resistors.
If, in spite of using this function, the operation cannot be performed at the target deceleration time, or if an overcurrent occurs, use the optional braking resistors.
Avoid frequent acceleration and deceleration as it may cause the motor to burn.
This function is enabled in V/f control, V/f control with speed sensor, and vector control with speed sensor. If Anti-regenerative Control Function Selection (H069) in the torque limit method is set to “2: Torque limit control with forced stop after three times deceleration time has passed” or “4: Torque limit control without forced stop,” this function is disabled.

- When using this function, set “1: Enable” to Over-Excitation Control Selection during Deceleration Function Selection (H071).
- By setting Magnetic Flux Level during Deceleration (d090) to higher than 100%, the overexcitation state of the motor is adjusted. Set this as a percentage with the set value of the 1st Rated Voltage at Base Frequency (F005)/2nd Rated Voltage at Base Frequency (A003) as 100%. When 100% is set, this function is disabled regardless of the setting of Over-Excitation Control Selection during Deceleration Function Selection (H074).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H071 | Over-Excitation Control Selection during Deceleration Function Selection | 0: Disable 1: Enable | 0 | - |
| F005 / A003 | 1st Rated Voltage at Base Frequency / 2nd Rated Voltage at Base Frequency | 80 to 240 V (200 V class series)<br>160 to 500 V (400 V class series) | 200 | V |
| d090 | Magnetic Flux Level during Deceleration | 100 to 300 | 120 | % |
| Related function | | Anti-regenerative Control Function Selection (H069) | | |

- Adjusting overexcitation control during deceleration
  Set Over-Excitation Control Selection during Deceleration Function Selection (H071) to “1: Enable,” and gradually keep increasing the set data of Magnetic Flux Level during Deceleration (d090) so as to approach the desired deceleration time. If, in spite of using this function, the operation cannot be

performed at the target deceleration time, or if an overcurrent occurs, use the external braking resistors.

## 8-9-14 PID Function

PID control detects the status (control amount) of the object to be controlled by a sensor, etc., and compares it with the target value (such as the temperature command). If there is a deviation during this time, operation is performed to set the deviation to zero. It is a closed loop control method that matches the control amount (feedback value) with the target value.
It is possible to perform process controls such as the flow rate control, pressure control, temperature control, etc., and speed controls such as the dancer control.
If PID control is enabled (PID Control Function Selection (J001) = 1 to 5), the frequency setting block switches to PID control block.
The PID function is disabled in the case of the torque control (refer to *7-6 Torque control* on page 7-31) and the position control (refer to *7-7 Position Control* on page 7-36).

| Parameter No. | Function name | Data | Default data |
|---|---|---|---|
| E119 | PID Control Feedback Selection | 0: Analog input<br>3: Pulse train input | 0 |
| E120 | PID Control PID Output Variable Range for Process Control | 0.0: Disable<br>0.1 to 100.0% | 0.0% |
| E121 | PID Control PID Feedforward Selection for Process Control | 0: Disable<br>1: Input terminal [AI1] | 0 |
| C059 | Input Terminal [AI1] Analog Input Adjustment Maximum Scale | -999.00 to 0.00 to 9,990.00 | 100.00 |
| C060 | Input Terminal [AI1] Analog Input Adjustment Minimum Scale | -999.00 to 0.00 to 9,990.00 | 0.00 |
| J001 | PID Control Function Selection | 0: Disable<br>1: Process normal operation 2: Process inverse operation 3: Dancer<br>4: Process normal operation, opposite operation available<br>5: Process inverse operation, opposite operation available | 0 |
| J002 | PID Control PID Command Selection | 1: Analog input<br>3: UP/DOWN control<br>4: EtherNet | 0 |
| J003 | PID Control P Proportional Gain | 0.000 to 30.000 | 0.1 |
| J004 | PID Control I Integral Time | 0.0 to 3600.0 | 0.0s |
| J005 | PID Control D Differential Time | 0.00 to 600.00s | 0.00s |
| J006 | PID Control Feedback Filter | 0.0 to 900.0s | 0.5s |
| J010 | PID Control Anti-reset Windup Width | 0 to 200%<br>Percentage of PID command | 200% |

| Parameter No. | Function name | Data | Default data |
|---|---|---|---|
| J011 | PID Control Select Warning Output Selection | 0: Warning from absolute value<br>1: Warning from absolute value with hold<br>2: Warning from absolute value with latch<br>3: Warning from absolute value with hold and latch<br>4: Warning from PID error<br>5: Warning from PID error with hold 6: Warning from PID error with latch 7: Warning from PID error with hold and latch | 0 |
| J012 | PID Control Upper Limit of Warning (AH) | -100 to 100% | 100% |
| J013 | PID Control Lower Limit of Warning (AL) | -100 to 100% | 0% |
| J015 | PID Control Sleep Frequency for Process Control | 0.0: Disable<br>1.0 to 590.0Hz | 0.0Hz |
| J016 | PID Control Sleep Timer for Process Control | 0 to 60s | 30s |
| J017 | PID Control Restart Frequency after Stopping for Process Control | 0.0 to 590.0Hz | 0.0Hz |
| J018 | PID Control PID Output Upper Limit | -150 to 150%<br>999: Depends on setting of F015 | (32767) |
| J019 | PID Control PID Output Lower Limit | -150 to 150%<br>999: Depends on setting of F016 | (32767) |
| J023 | PID Control Restart Feedback Deviation after Stopping for Process Control | 0.0 to 100.0% | 0.0% |
| J024 | PID Control Restart Delay Time after Stopping for Process Control | 0 to 3600s | 0s |
| J057 | PID Control Operator PID Reference Position for Dancer | -100 to 100% | 0% |
| J058 | PID Control PID Reference Position Detection Width for Dancer | 0: Disable switching PID constant<br>1 to 100% (Manually set value) | 0 |
| J059 | PID Control P Gain 2 | 0.000 to 30.000 | 0.1 |
| J060 | PID Control I Integral Time 2 | 0.0 to 3600.0s | 0.0s |
| J061 | PID Control D Differential Time 2 | 0.00 to 600.00s | 0.0s |
| J062 | PID Control Block Selection | Bit1: PID output ratio selection 0: Ratio to frequency command 1: Ratio to maximum frequency<br>Bit0: PID output polarity selection<br>0: Plus (Addition)<br>1: Minus (Subtraction) | 0 |
| J106 | PID Control Maximum Scale | -999.00 to 9990.00 | 100.00 |
| J107 | PID Control Minimum Scale | -999.00 to 9990.00 | 0.00 |
| J136 | PID Control Multistep PID Command 1 | -999.00 to 9990.00 | 0.00 |
| J137 | PID Control Multistep PID Command 2 | -999.00 to 9990.00 | 0.00 |
| J138 | PID Control Multistep PID Command 3 | -999.00 to 9990.00 | 0.00 |
| H438 | Feedback Value Comparison Signal Off Level | 0.0 to 100.0% | 100.0% |

| Parameter No. | Function name | Data | Default data |
|---|---|---|---|
| H439 | Feedback Value Comparison Signal On Level | 0.0 to 100.0% | 0.0% |
| H444 | UP/DOWN control (Preset PID command) | -999.00 to 9990.00 | 0.00 |
| S013 | PID Control PID Command via Communication | -32768 to 32767<br>-20000 = -100%, 20000 = 100% | 0 |
| S030 | PID Control Feedback Value via Communication | -32768 to 32767<br>-20000 = -100%, 20000 = 100% | 0 |
| M073 | PID Output Monitor | -32768 to 32767<br>-20000 = -100%, 20000 = 100% | 0 |
| M115 | PID Output Non Filter | -150.0 to 150.0% | 0.0% |
| W011 | PID Process Command | -999.00 to 9990.00 | 0.00 |
| W012 | PID Feedback Value Monitor | -999.00 to 9990.00 | 0.00 |
| W029 | Frequency and PID Command Source Monitor | 0: Operator (UP and DOWN keys)<br>1 : Analog Voltage Input (Input Terminal[AI1])<br>7: UP/DOWN control<br>10: Pattern operation / Timer Operation<br>13: Pulse train input or Frequency calculation<br>22: EtherNet<br>23: Support Tool<br>24: Multi-step Frequency<br>25: Jogging Frequency<br>30: PID Control Operator Process<br>31: PID Control Analog Process<br>33: PID Control UP/DOWN control 34: PID Control Communication Proc- ess<br>36: PID Control Multi-Step Terminal Process<br>255: Not Selected<br>Others : Reserved | 0 |
| W032 | PID Output Monitor | -150.00 to 150.00% | 0.00% |
| W131 | PID Control PID Deviation (After Scale Transformation) | -999.00 to 0.00 to 9990.00 | 0.00 |
| W132 | PID Control PID Deviation (No Scale Transformation) | -32768 to 32767<br>-20000 = -100%, 20000 = +100% | 0% |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 20: PID (PID enabled/disabled)<br>21: IVS (Switch normal/inverse operation)<br>33: PID-RST (PID integral reset)<br>34: PID-HLD (Hold PID integral component)<br>171: PID-SS1 (PID control multistage command 1)<br>172: PID-SS2 (PID control multistage command 2) | - |

| Parameter No. | Function name | Data | Default data |
|---|---|---|---|
| E020/E027 | Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection | 42: OD (Excessive PID deviation)<br>43: PID-CTL (Under PID control)<br>44: PID-STP (Under sleep mode of PID control)*2<br>186: FBV (PID FB status output) | - |
| E061 | Input Terminal [AI1] Function Selection | 21: PID feed forward | - |
| Related function | | Output Terminal [DO1] ON Delay Time (H309)<br>Output Terminal [DO1] OFF Delay Time (H310)<br>Output Terminal [ROA, ROB] ON Delay Time (H313)<br>Output Terminal [ROA, ROB] OFF Delay Time (H314) | |

*1. It can be referenced or set only from the communications function or Sysmac Studio.

*2. The OFF delay of the Under sleep mode of PID control (44: PID-STP) terminal becomes the time obtained by adding 0.1 s to Output Terminal[DO1] OFF Delay Time (H310) and Output Terminal [ROA, ROB] ON Delay Time (H314).

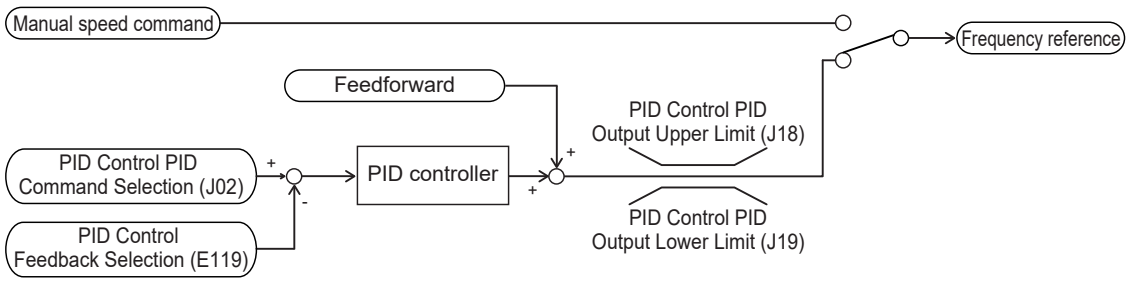
## PID Control Function Selection

PID control is enabled by setting other than 0 to PID Control Function Selection (J001).

- PID Control Function Selection (J001) = “1: Process normal operation,” “2: Process inverse operation”
  If the PID process control is performed and PID calculation results are negative, the frequency reference to the inverter is limited at 0 Hz.
- PID Control Function Selection (J001) = “4: Process normal operation, opposite operation available,” “5: Process inverse operation, opposite operation available”
  If the PID process control is performed and PID calculation results are negative, an opposite operation can be performed for the inverter. PID Control PID Output Variable Range for Process Control (E120) is disabled.
- PID Control Function Selection (J001) = “3: Dancer”
  PID dancer control is performed. Opposite operation can be done for dancer control.

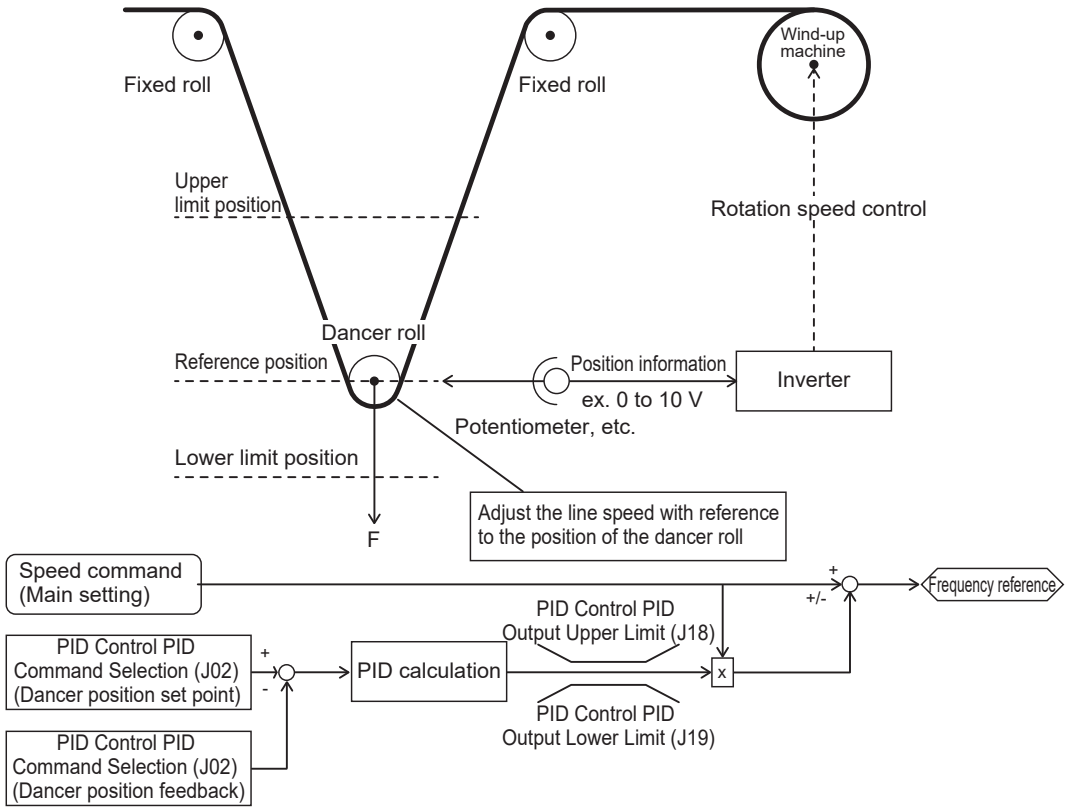
### Schematic block diagram of PID process control

When PID Control Function Selection (J001) = “1,” “2,” “4,” “5”



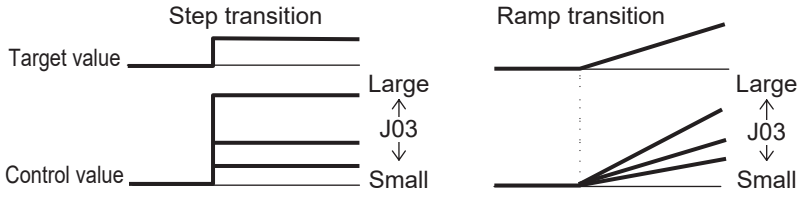

### Schematic block diagram of PID dancer control

When PID Control Function Selection (J001) = “3”

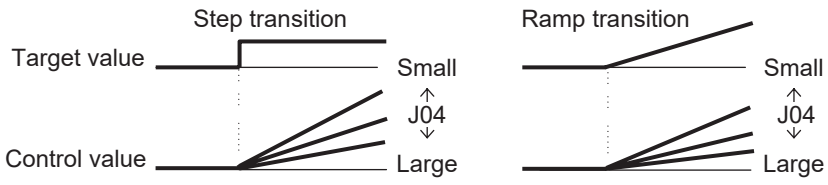



## PID Operation

1. P operation (PID Control P Proportional Gain (J003))
   In this operation, the operation amount is proportional to the deviation (difference between the target value and the current value).

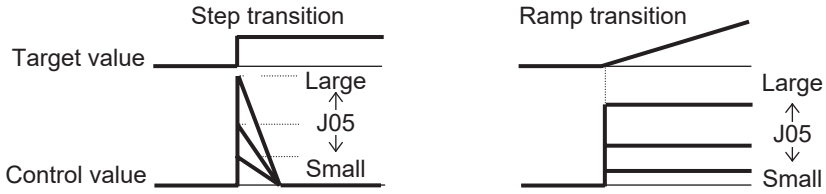



2. I operation (PID Control I Integral Time (J004))
   In this operation, the operation amount is proportional to the time integral value of the deviation. The P operation is less effective as the current value approaches the target value due to smaller deviation, taking a long time to reach the target value. The I operation compensates this disadvantage.




3. D operation (PID Control D Differential Time (J005))

In this operation, the operation amount is proportional to the percentage of change in the deviation. Because using only the PI operation is time-consuming, the D operation is used to effectively compensate for the disadvantage in responsiveness.




## PID Normal Operation/Reverse Operation

Since normal operation or reverse operation can be selected for the output of PID process control, the fluctuations in the motor rotation speed with respect to the deviation (difference between the command value and feedback value) can be set. Switching of normal operation and reverse operation by an external signal (21:IVS (Normal/Inverse switching)) is also possible.

## PID command

This command is used to select the means for setting the command values of PID control.

| J002 | Function |
|---|---|
| 1 | PID command 1 (Analog input: Terminal [AI1])<br>Setting based on the voltage value<br>(0 to ±10 VDC, PID 100% command/±10 VDC) input to the terminal [AI1]. |
| 3 | PID command by the UP/DOWN commands<br>With the UP command “UP” and the DOWN command “DOWN,” the PID control commands 0% to 100% can be set to a value obtained by conversion to a physical quantity by PID Control Minimum Scale (J107) and PID Control Maximum Scale (J106). It is also possible to CLEAR and PRESET this reference by using the UDC (58) and UDP(165) digital multifunction settings |
| 4 | Command by communication<br>Communication parameter (S013): Transmission data 20000d/100% PID command |

- PID command 1 by analog input (J002 = 1)
  The PID command value can be set arbitrarily by multiplying the gain with the voltage value input to the analog input (terminal [AI1]), and then adding the bias. Polarity selection, filtering and offset adjustment are also possible. In addition to the setting of J002, “3: PID command” must be selected for Input Terminal [AI1] Function Selection (E061).
- PID command by UP/DOWN control (J002 = 3)
  To configure PID command adjustment using UP/DOWN control, assign input terminal [DI1] to [DI7] to "17: UP (UP/DOWN function - increase)" and "18: DWN (UP/DOWN function - decrease)." When UP/DOWN control is selected as the PID command mode, activating the "UP" or "DWN" input will adjust the PID command value. The adjustment will occur proportionally within the defined range, from the maximum to the minimum scale.
- If “UDP” (Setting 165:UP/DOWN function data preset" to any multifunction digital input) is turned ON, the PID command value is preset to the H444 value.
- If “UDC” (Setting 58:UP/DOWN function data clear" to any multifunction digital input) is turned ON, the PID command value is reset to the minimum reference value.

| UP | DWN | Operation |
|---|---|---|
| OFF | OFF | The current command values of PID control are retained. |
| ON | OFF | The command values of PID control increase according to the change rate from 0.1%/0.1 s to 1%/0.1 s. |
| OFF | ON | The command values of PID control decrease according to the change rate from 0.1%/0.1 s to 1%/0.1 s. |
| ON | ON | The current command values of PID control are retained. |

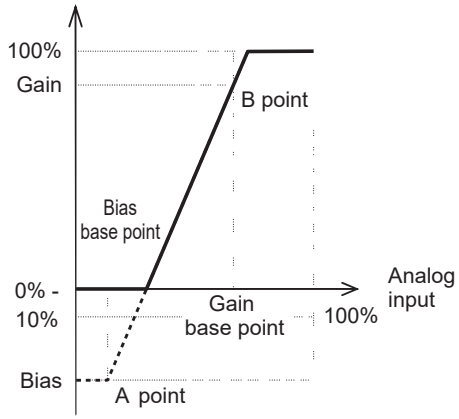
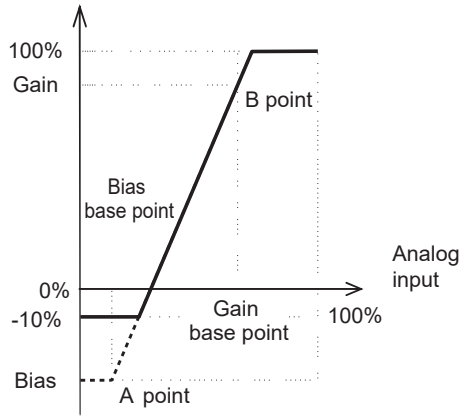
In the inverter, the PID control values set by the UP/DOWN control are maintained internally, and when the operation is resumed (including when the power is turned ON), the control is started from the previous PID command value.
When analog input is applied to the PID command value, the following gains, biases, filters and offsets are applicable.

| Input terminal | Input range | Bias | | Gain | | Polarity selection (Range selection) | Filter | Offset |
|---|---|---|---|---|---|---|---|---|
| | | Bias | Base point | Gain | Base point | | | |
| AI1 | 0 to +10V, -10 to +10V | C055 | C056 | C032 | C034 | C035 | C033 | C031 |

The following processing is performed during polarity selection C035.
C035: Set the input range of the AI1 terminal.

| C035 | Terminal input specifications |
|---|---|
| 0 | -10 to +10V, |
| 1 | 0 to +10V (A negative voltage is considered as 0V.) |

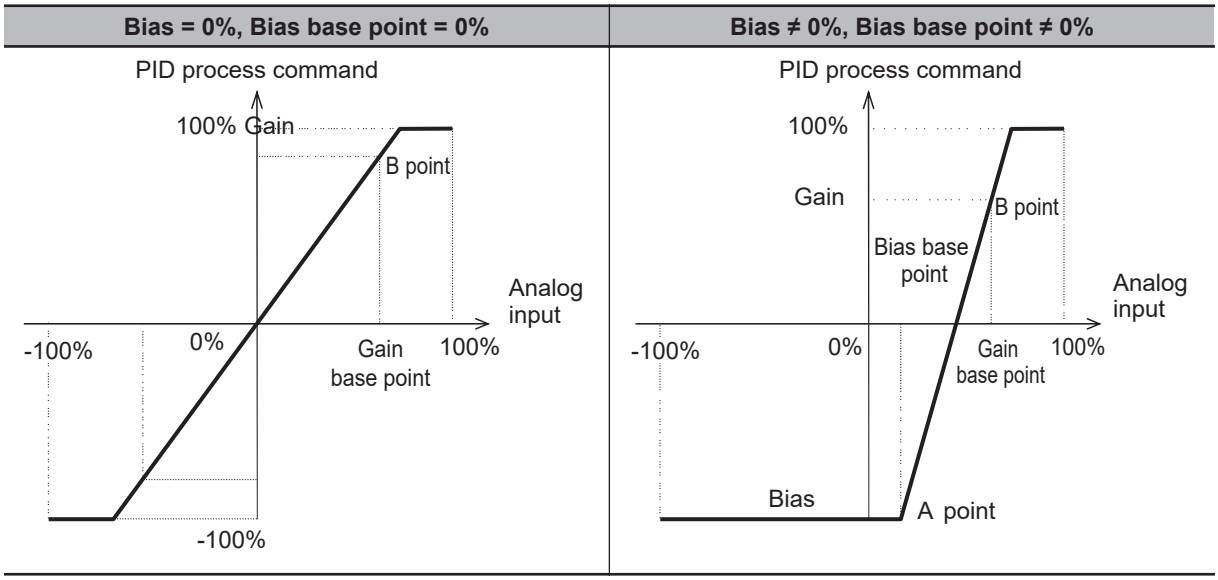
An example of PID process control is shown below.

| Used for unipolar | Used for bipolar |
|---|---|
| The value after conversion becomes 0% to 100% or more. | The value after conversion becomes -100% to 100% or more. |
|  |  |





An example of dancer control is shown below.




- PID command by communication (J002 = 4)
  Communication parameter (S013): Transmission data 20000d/100% PID command

## PID Control Feedback Selection (E119)

- E119 = 0: Analog input
  If “0: Analog input” is selected for PID Control Feedback Selection (E119), allocate “5: PID feedback value” to Input Terminal [AI1] Function Selection (E061). The analog input value is internally controlled as 0% to 100%. For details on analog input, refer to *8-3-1 Analog Input (Function Selection)* on page 8-33.

When analog input is applied to PID feedback, the following gains, biases, filters and offsets are applicable.

| Input terminal | Input range | Bias | | Gain | | Polarity selection (Range selection) | Filter | Offset |
|---|---|---|---|---|---|---|---|---|
| | | Bias | Base point | Gain | Base point | | | |
| AI1 | 0 to +10V, -10 to +10V | C055 | C056 | C032 | C034 | C035 | C033 | C031 |

- E119 = 3: Pulse train input
  If “3: Pulse train input” is set to PID Control Feedback Selection (E119), the inverter captures a value converted into a percentage with the maximum frequency as 100% where the pulse correction factor (J106/J107) is multiplied with the frequency value [kP/s] of the captured pulse train input.

$$f^* \text{ [Hz]} = Np \text{ [kp/S]} \times \frac{\text{Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator (3014Hex-12Hex)}}{\text{Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator (3014Hex-11Hex)}}$$

$$PV \text{ [\%]} = f^* \text{ [Hz]} \times \frac{100}{\text{Maximum output frequency [Hz]}}$$

PV [%]: PID feedback input

f* [Hz]: Frequency set value

Np [kp/s]: Entered input pulse frequency

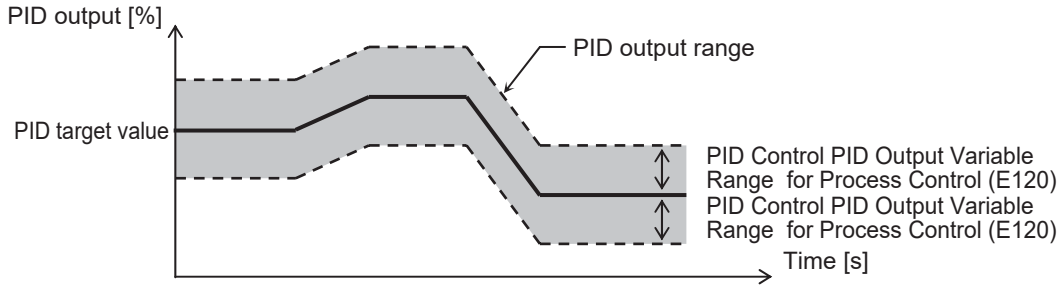
PV [%]: PID feedback input
f* [Hz]: Frequency set value
Np [kp/s]: Entered input pulse frequency

## Feedforward Selection

Feedforward is applied during PID process control. PID Control PID Feedforward Selection for Process Control (E121) If 1: Analog input terminal is selected for PID Control PID Feedforward Selection for Process Control (E121), allocate “21: PID feed forward” to Input Terminal [AI1] Function Selection (E061) as the setting for the terminal used in the feedforward signal. If not allocated, feedforward control is not performed.
Feedforward is disabled during dancer control.

## PID Variable Range

In the case of PID process control, the PID output is restricted to a variable range with reference to the target value.
When using this function, set PID Control PID Output Variable Range for Process Control (E120). Then, the output frequency will be limited to within a range of Target value ± (E120) with the maximum frequency as 100%.
The function is disabled when PID Control PID Output Variable Range for Process Control (E120) is 0.0. The function is also disabled when “4: Process normal operation, opposite operation available” or “5: Process inverse operation, opposite operation available” is set to PID Control Function Selection (J001).



## PID Reverse Output

If the PID calculation results are negative during regular PID control (J001 = 1, 2), the frequency reference to the inverter is limited at 0 Hz. If “4: Process normal operation, opposite operation available” or “5: Process inverse operation, opposite operation available” is set to PID Control Function Selection (J001), an opposite operation can be performed for the inverter if the PID calculation results are negative.
If 4 or 5 is set to PID Control Function Selection (J001), PID Control PID Output Variable Range for Process Control (E120) is disabled.

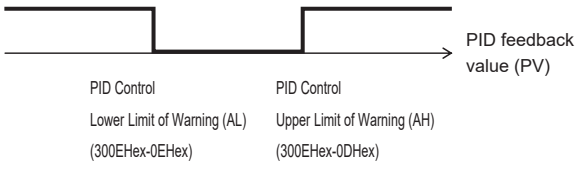
## PID Gain Adjustment

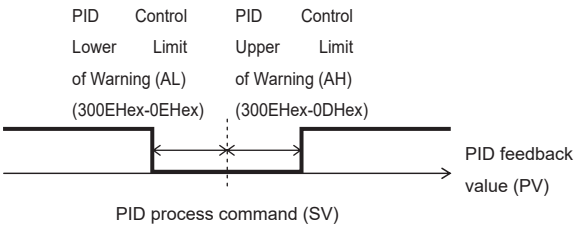
If the PID function does not provide a stable response, adjust each gain as described below depending on the state.

| State | Adjustment method |
|---|---|
| Changes in target value are not reflected quickly on feedback value. | Increase PID P Gain J003 |
| Changes are reflected quickly on feedback value, but not stable. | Decrease PID P Gain J003 |
| Target and feedback values do not match quickly. | Decrease PID I Gain J004 |
| Feedback value fluctuates unstably. | Increase PID I Gain J004 |
| Increasing PID P Gain does not improve response speed. | Increase PID D Gain J005 |
| Increasing PID P Gain results in fluctuating and unstable feedback value. | Decrease PID D Gain J005 |

## Excessive PID deviation (OD)

An absolute value warning or a deviation warning can be output in PID control. As a warning output, allocate “42: OD (Excessive PID deviation)” to Output Terminal [DO1] Function Selection (E020) and Output Terminal [ROA, ROB] Function Selection (E027).
At PID Control Select Warning Output Selection (J011), set the warning type, and at PID Control Upper Limit of Warning (AH) (J012) and PID Control Lower Limit of Warning (AL) (J013), set the upper limit value and lower limit value of the warning, respectively.

| J011 | Type | Description |
|---|---|---|
| 0 | Warning caused by process command value | “OD" is ON when PV < AL or AH < PV   |
| 1 | Warning from absolute value with hold | Same as above (with hold) |
| 2 | Warning from absolute value with latch | Same as above (with latch) |
| 3 | Warning from absolute value with hold and latch | Same as above (with hold and latch) |

| J011 | Type | Description |
|---|---|---|
| 4 | Warning caused by PID error value | "OD" is ON when PV < SV-AL, SV+AH < PV<br>  <br> |
| 5 | Warning from PID error with hold | Same as above (with hold) |
| 6 | Warning from PID error with latch | Same as above (with latch) |
| 7 | Warning from PID error with hold and latch | Same as above (with hold and latch) |

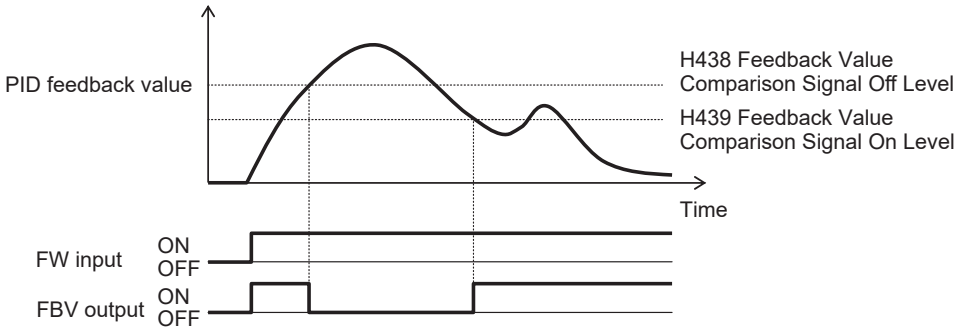
Hold function : When the power is turned ON, the warning output turns OFF even within the warning range. The warning output is enabled when it goes outside the warning range and then again enters the warning range.

Touch probe function : Once the warning output turns ON after entering the warning range, the warning output does not turn OFF even if it goes outside the range. To release the touch probe, turn ON the RS allocated to the multifunction input terminal.

- The OD terminal has an OFF delay of 0.1 s. The final OFF delay time becomes the time obtained by adding 0.1 s to Output Terminal [DO1] OFF Delay Time (H310) and Output Terminal [ROA, ROB] OFF Delay Time (H314).

## Feedback Comparison Signal

If PID feedback is outside the setting range, the signal is output to the multifunction output terminal. Allocate “186: FBV (PID FB status output)” to Output Terminal [DO1] Function Selection (E020) and Output Terminal [ROA, ROB] Function Selection (E027).
Set Feedback Value Comparison Signal Off Level (H438)/Feedback Value Comparison Signal On Level (H439) in units of percentage with 1st Maximum Output Frequency (F003)/2nd Maximum Output Frequency (A001) as 100%.



## PID Feedback Value Monitor (PID Feedback Value Monitor (W012))

The PID feedback value is converted to the control-target physical quantity (such as the temperature, pressure, etc.) using the data of PID Control Maximum Scale (J106) and PID Control Minimum Scale (J107).
Monitor value = (PID feedback value (%)/100) × (Maximum scale - Minimum scale) + Minimum scale

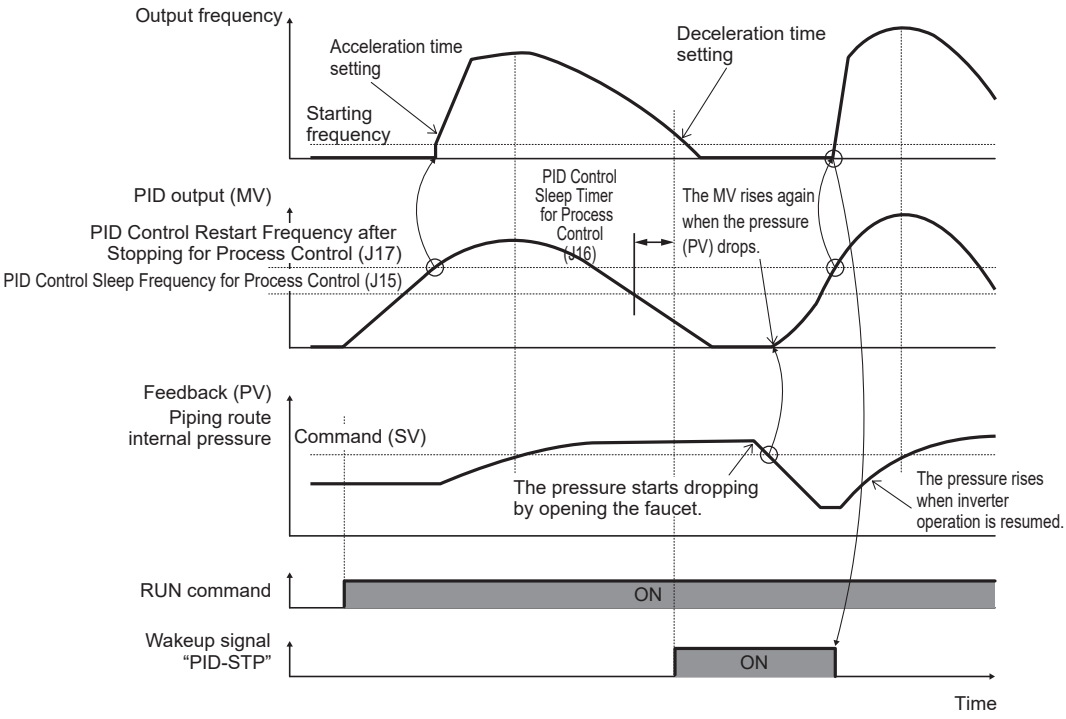
## PID Integral Reset (PIDC)

Use this function to clear the integral value of PID operation.
Allocate “33: PIDC (PID integral reset)” to Output Terminal [DO1] Function Selection (E020) and Output Terminal [ROA, ROB] Function Selection (E027).
The values are cleared each time the PIDC terminal is turned ON.
Never turn ON the PIDC terminal during the PID operation as overcurrent tripping may occur.
Be sure to deactivate the PID operation before turning ON the PIDC terminal.

## PID Sleep Function

In parameters J015 to J017, J023, J024, a sleep function for stopping the inverter when the discharge pressure rises and the discharge volume reduces during pump control is set. When the discharge pressure rises, the frequency set value of the output of PID controller drops, and the PID Control Sleep Timer for Process Control (J015) elapses at the PID Control Sleep Frequency for Process Control (J016) or below, the inverter decelerates and stops. However, PID control itself continues. When the discharge pressure falls, the frequency set value of the output of PID controller rises, and the PID Control Restart Frequency after Stopping for Process Control (J017) is exceeded, the inverter resumes operation. The restart conditions can be adjusted by PID Control Restart Feedback Deviation after Stopping for Process Control (J023) and PID Control Restart Delay Time after Stopping for Process Control (J024) based on the time and pressure variation.

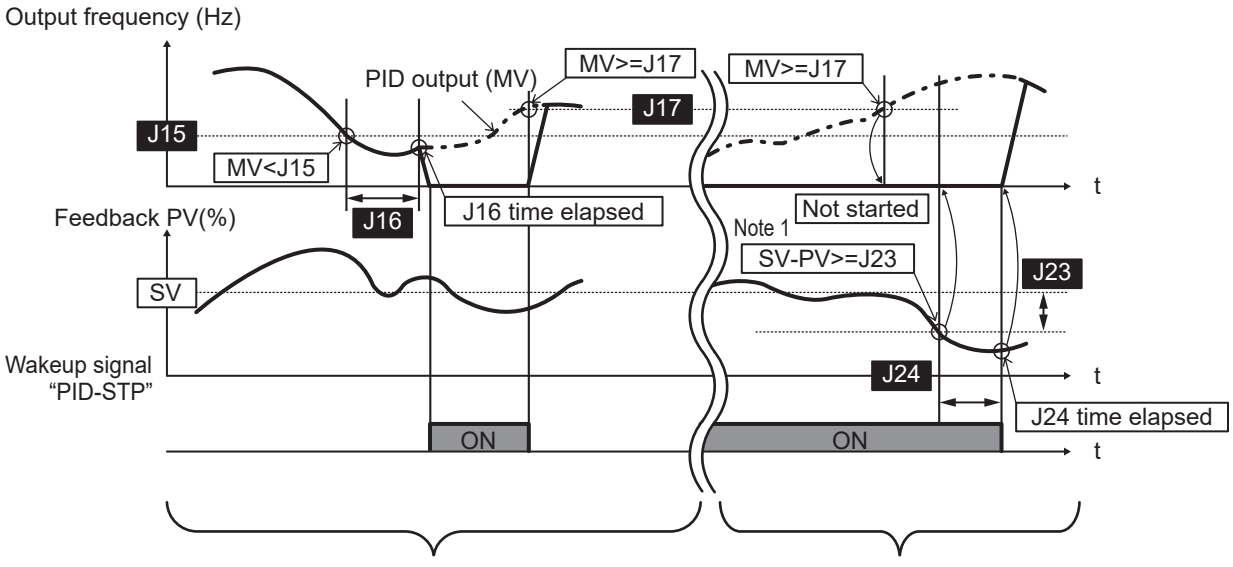
- PID Control Sleep Frequency for Process Control (J015) The sleep frequency is set.
- PID Control Sleep Timer for Process Control (J016)
  The time from when the PID output reaches or falls below the value set in PID Control Sleep Frequency for Process Control (J015) until the inverter starts deceleration stop is set.
- PID Control Restart Frequency after Stopping for Process Control (J017)
  The wakeup frequency is set. Set the wakeup frequency larger than PID Control Sleep Frequency for Process Control (J015). If the wakeup frequency is set smaller than the sleep frequency, the sleep frequency is ignored, and the sleep function operates when the PID output falls below the wakeup frequency set value.
- Allocating Under sleep mode of PID control “PID-STP” (Output Terminal [DO1] Function Selection (E020), Output Terminal [ROA, ROB] Function Selection (E027) = 44)
  PID wakeup “PID-STP" outputs an ON signal when the inverter stops by the sleep function during PID control. If a signal output indicating that the inverter is in a stopped state is required, it is necessary to allocate “PID-STP.”




• PID Control Restart Delay Time after Stopping for Process Control (J024)

The inverter restarts when both of the following conditions are satisfied.

1. The discharge pressure falls, the frequency reference value of the PID controller output rises, PID Control Restart Frequency after Stopping for Process Control (J017) is exceeded, and PID Control Restart Delay Time after Stopping for Process Control (J024) elapses.
2. The difference between SV (command value) and PV (feedback value) becomes more than PID Control Restart Feedback Deviation after Stopping for Process Control (J023), and the PID Control Restart Delay Time after Stopping for Process Control (J024) elapses.




Note 1

Normal operation: SV - PV ≥ J23

Reverse operation: SV - PV ≤ J23

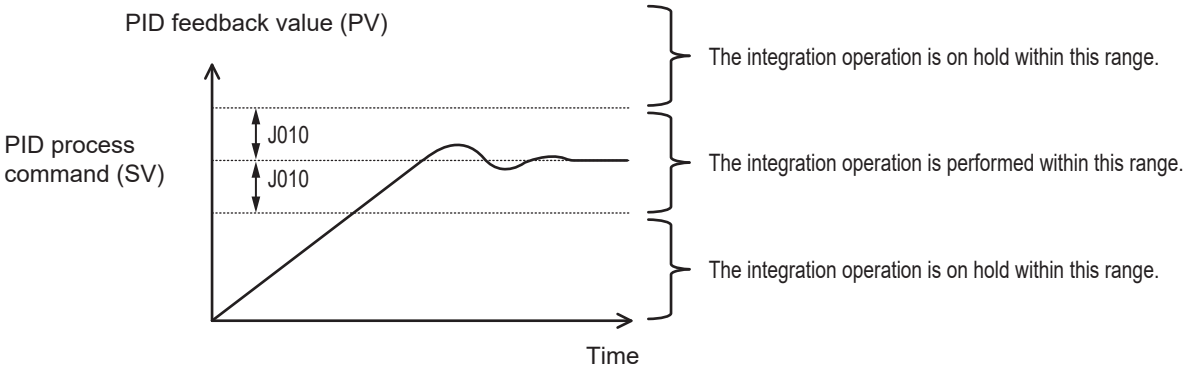
## Multistep PID Command

- Multistep PID Command 1 to 3 (J136, J137, J138)
  The PID command value can be applied by the multi-step command of digital input. To use this function, allocate “171: PID-SS1” and “172: PID-SS2” to Input Terminal [DI1] to [DI7] Function Selection (E001 to E005, E098, E099).

| PID-SS2 | PID-SS1 | PID Multi-step Command |
|---|---|---|
| OFF | OFF | Not selected |
| OFF | ON | J136: PID Control Multistep PID Command 1 Change range: -999.0 to 0.00 to 9990 |
| ON | OFF | J137: PID Control Multistep PID Command 2 Change range: -999.0 to 0.00 to 9990 |
| ON | ON | J138: PID Control Multistep PID Command 3 Change range: -999.0 to 0.00 to 9990 |

## Anti-reset Windup

- PID Control Anti-reset Windup Width (J010)
  Restrains overshooting during control by a PID controller. If the difference between the command and the feedback value is outside the range of the set value, the integrator holds the value and the integration operation is not performed.
  Data setting range: 0 to 200 (%)




## PID Output Limiter

It is possible to set a limiter for the upper limit and lower limit in the PID output exclusively for PID control. The limiter is disabled when PID cancellation “Hz/PID" is entered and operation is performed at the normal frequency setting.

- PID Control PID Output Upper Limit (J018)
  The upper limit value for the limiter of PID controller output is set in percentage. If the set value is specified as 999, the settings of 1st Frequency Upper Limit (F015) are followed.
- PID Control PID Output Lower Limit (J019)
  The lower limit value for the limiter of PID controller output is set in percentage. If the set value is specified as 999, the settings of 1st Frequency Lower Limit (F016) are followed.

## Setting Dancer Control

- PID Control PID Command via Communication (S013)
  When “4: EtherNet communication” is selected, the reference position during dancer control is set in the range of -100% to 100% to PID Control PID Command via Communication (S013).

- PID Control (Dancer control gain switching) (J058 to J061)
  When the position of the dancer roll (feedback) enters the “Dancer position set point ± PID Control PID Reference Position Detection Width for Dancer (J058),” the PID constant of the PID controller is switched from J003, J004 and J005 to J059, J060 and J061. It is possible to increase the gain and thus improve the responsiveness, and increase the accuracy.

  PID Control PID Reference Position Detection Width for Dancer (J058)
  Set in the range of 1% to 100%. If set to 0, switching of the PID constant is not performed.
  PID Control P Gain 2 (J059)
  PID Control I Integral Time 2 (J060)
  PID Control D Differential Time 2 (J061)
  Same as PID Control P Proportional Gain (J003), PID Control I Integral Time (J004) and PID Control D Differential Time (J005).

- PID Control Block Selection (J062)
  It is possible to select whether to add or subtract the output of the PID controller of dancer control to or from the main settings. It is also possible to select whether to perform control of the main settings by the output of the PID controller based on the ratio, or to perform correction based on the absolute value (Hz).

| J062 data | | | Block selection | |
|---|---|---|---|---|
| Decimal | bit 1 | bit 2 | Control amount | Operation on the main settings |
| 0 | 0 | 0 | Ratio control | Addition |
| 1 | 0 | 1 | Ratio control | Subtraction |
| 2 | 1 | 0 | Absolute value control | Addition |
| 3 | 1 | 1 | Absolute value control | Subtraction |

## Terminal Input Function

- PID control cancellation “PID” (20: PID enabled/disabled)
  When “PID enabled/disabled (20: PID)” is ON, switching occurs from PID control to manual frequency setting.

| Input signal “PID” | Function selected |
|---|---|
| OFF | PID control enabled |
| ON | PID control disabled (manual frequency setting) |

“PID (20: PID enabled/disabled)” OFF -> ON operation
If, during PID operation, the PID terminal is switched from OFF to ON and set to the PID canceled state, and Frequency Reference Selection (F001/C030) is set to “7: UP/DOWN control,” the output frequency is inherited (balanceless-bumpless). If PID control is set to “Opposite operation available”

(PID Control Function Selection (J001) = 4, 5), and PID output is in opposite operation, the output frequency of PID control is not inherited and becomes 0 Hz.

"PID (20: PID enabled/disabled)" ON -> OFF operation
When PID operation is restored by switching the PID terminal from ON to OFF during normal operation, and PID process control (J001 = 1, 2, 4, 5) is enabled, the output frequency during switching is inherited in the PID output (MV) (balanceless-bumpless), and shifted to PID control. When inverse operation is being performed due to a negative setting of the frequency reference during PID cancellation, and the PID control is set to "Opposite operation not available" (J001 = 1, 2), the absolute value of the output frequency is inherited in the PID output (MV), and switching occurs from reverse output to normal output.

- Normal/inverse operation switching "IVS"
  In modes in which process control is performed by the PID control function built into the inverter, PID control enable (operation based on PID controller) and PID control disable (operation based on the manual frequency setting) can be switched by the "PID (20: PID enabled/disabled)" terminal. Input Terminal [AI1] Normal/Inverse Operation for 1st Frequency Command and PID Control Function Selection (J001) can be combined with the Switch normal/inverse operation "IVS" signal on each operation, and determination of normal/inverse operation is performed as follows.

  When PID control is enabled: Normal/reverse operation of PID controller output (frequency setting)

| PID Control Function Selection (J001) | Input signal IVS | Operation |
|---|---|---|
| 1: Process normal operation<br>4: Process normal operation, opposite operation available | OFF | Normal operation |
| | ON | Reverse operation |
| 2: Process (inverse operation) 5: Process inverse operation, opposite operation available | OFF | Reverse operation |
| | ON | Normal operation |

When PID control is disabled: Normal/reverse operation of manual frequency setting

| Input Terminal [AI1, AI2] Normal/Inverse Operation for 1st Frequency Command (C053) | Input signal IVS | Operation |
|---|---|---|
| 0: Normal | - | Normal operation |
| 1: Inverse | - | Reverse operation |

**Additional Information**

When process control is performed by the PID control function built into the inverter, the Normal/Inverse switching "IVS" signal is used for switching normal/reverse operation of the output (frequency setting) of the PID controller, and is not used for normal/reverse operation switching in the manual frequency setting.

- PID differential/integral reset "PID-RST"
  When "PID-RST" is turned ON, the derivative terms and integration terms of the PID controller are reset.

- Hold PID integral component "PID-HLD"

When “PID-HLD” is turned ON, the integration terms of the PID controller are held.

## Terminal Output Function

- Under PID control "PID-CTL"
  When PID control is enabled and the RUN command is ON, the ON signal is output.

- During PID control, although control is in progress, the inverter may stop as a result of the sleep function. Even in such a case, the "PID-CTL" signal remains ON.



**Additional Information**

During PID control, although control is in progress, the inverter may stop as a result of the sleep function. Even in such a case, the "PID-CTL" signal remains ON.

## 8-9-15 Automatic Energy-saving Operation Function

This function automatically adjusts the inverter output power during constant speed operation to the minimum level. It is suitable for load with reduced torque characteristics, such as fans and pumps. To perform energy-saving operation using this function, set Energy-saving Operation Function Selec- tion (E124) to “1: Energy-saving operation.”
When the automatic energy-saving operation is enabled, it is possible to select Enable during running at constant speed, and Enable during running at constant speed and acceleration/deceleration with Auto Energy Saving Operation Condition Selection (H067).

Because this function controls the output power to the minimum necessary level, the motor may stall if the rapid load fluctuation, such as impact load, occurs, which may result in an overcurrent trip.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E124 | Energy-saving Operation Function Selection | 0: Normal operation<br>1: Energy-saving operation | 0 | - |
| H067 | Auto Energy Saving Operation Condition Selection | 0: Enable only at constant speed<br>1: Enable in all modes | 0 | - |

## 8-9-16 Commercial switch (CS)

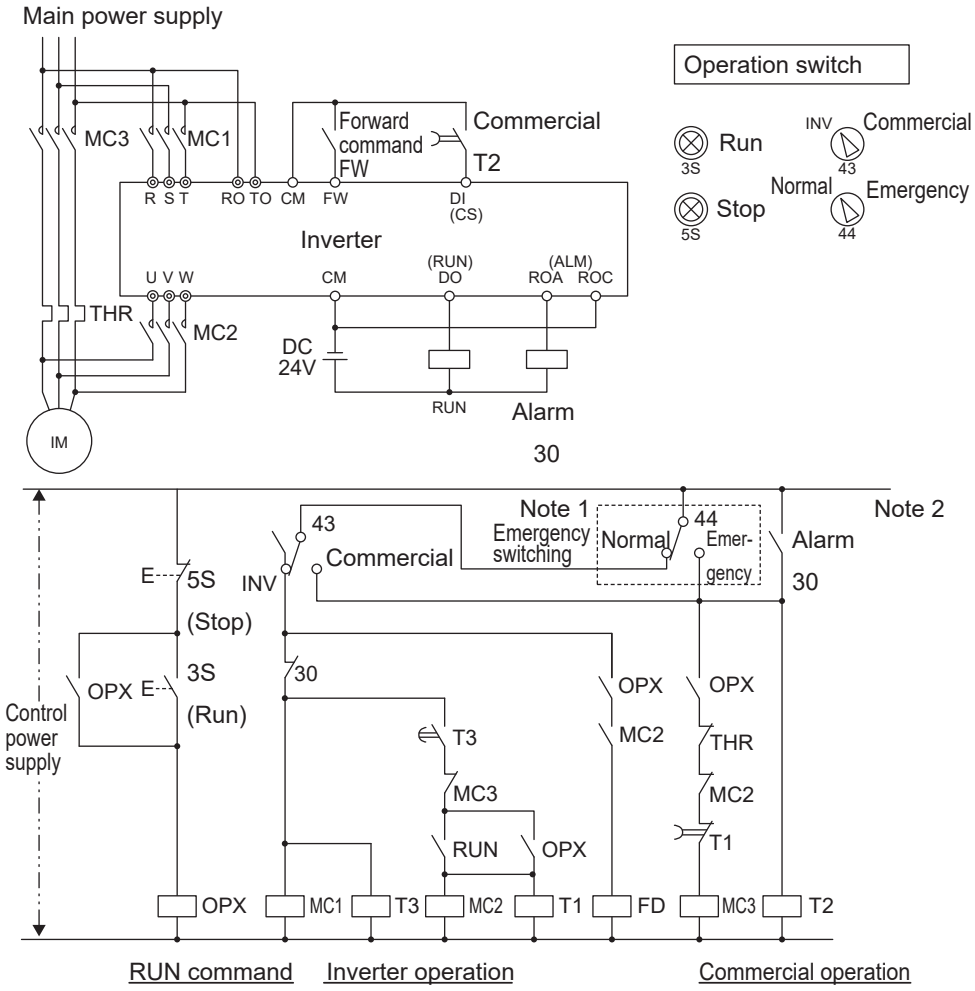
Commercial operation and inverter operation are switched by the “CS” terminal (15: Commercial switch).
When switching between commercial operation/inverter operation is performed in an external sequence, input the CS allocated to multifunction input in accordance with the operation chart below. Then, the inverter can be started from the commercial power supply frequency regardless of the set frequency of the inverter, and the motor during the commercial operation can be smoothly switched to inverter operation.
This function is enabled when Drive Control Selection (F042/A014) = “0, 1, 3, 4.”
When the power supply frequency is 50 Hz, use “15: CS” and when the power supply frequency is 60 Hz, use “16: SW60.”

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F042/A014 | 1st Drive Control Selection/2nd Drive Control Selection | 0: IM V/f control<br>1: IM Dynamic torque vector control<br>3: IM V/f control with speed sensor<br>4: IM Dynamic torque vector control with speed sensor | 0 | - |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 15: CS (Commercial switch)<br>16: SW60 (Commercial switch (60Hz)) | - | - |
| H013 | Power Interruption Restart Wait Time | 0.1 to 100.0 | 0.5 | s |

## Switching between Inverter Operation and Commercial Power Supply Operation

- Follow the sequence diagram given below to switch among the terminals MC1 to MC3, FW and CS, and switch from inverter operation to commercial power supply operation. When the CS terminal turns ON, the inverter shuts off its output and the motor falls in a free-run state.
- When the commercial switching signal “CS” or “SW60” is turned OFF, the operation switches to inverter operation from commercial power supply operation, and following the elapse of the Power Interruption Restart Wait Time (H013), the 50 Hz output starts when the signal during commercial 50 Hz selection turns OFF, and the 60 Hz output starts when the signal during commercial 60 Hz selection turns OFF. (Start of pull-in operation)
- If the output frequency is deviating from the motor rotation speed, perform adjustment of the output frequency during the pull-in operation based on the fall rate of restart after momentary power failure (H014).

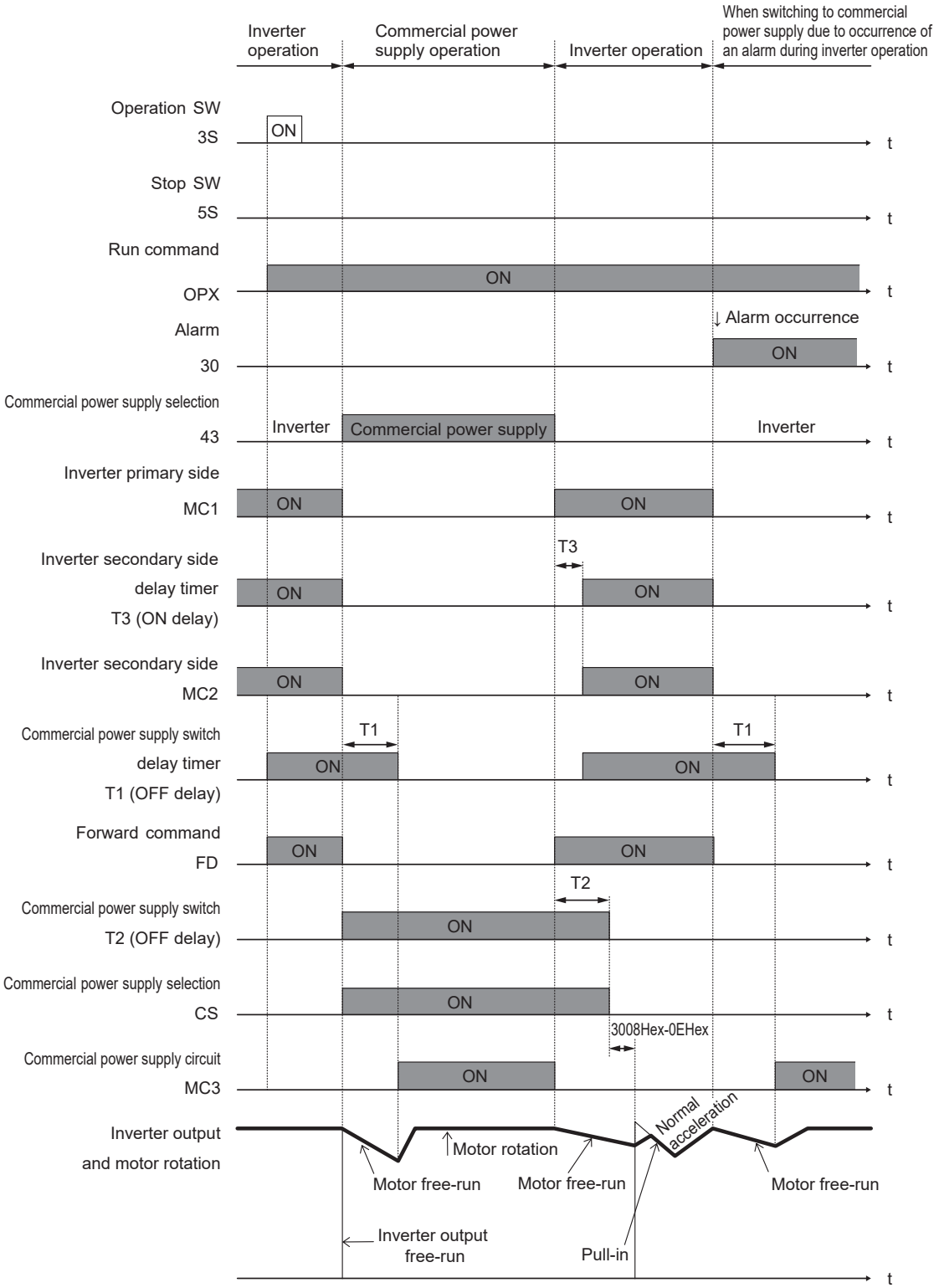
## Connection diagram for commercial switching operation




**Note 1.** Emergency switching
Manual switching performed when the sequence for switching to commercial power supply is not performed normally due to a major breakdown of the inverter.

**Note 2.** When an alarm is issued in the inverter, switching to commercial power supply occurs automatically.

### Timing diagram for commercial switching




## Input during Commercial Operation (CRUN-M1, CRUN-M2)

If operation is not performed by the inverter during the commercial switching operation, it is possible to integrate 1st Cumulative Motor Run Time (H094)/2nd Cumulative Motor Run Time (A051) by incorporating the auxiliary contact points of the electromagnetic contactor for commercial switching to CRUN-M1 and CRUN-M2 allocated to multifunction input as a digital signal.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 72: CRUN-M1 (Count the run time of commercial power-driven motor 1)<br>73: CRUN-M2 (Count the run time of commercial power-driven motor 2) | - | - |

## 8-9-17 Output current fluctuation damping

When the motor is driven, the output current of the inverter may fluctuate (current fluctuation) due to the motor characteristics or the backlash at the load machine side. This parameter increases the 1st Output Current Fluctuation Damping Gain (H080) and 2nd Output Current Fluctuation Damping Gain (A041) when the control function for suppressing such current fluctuation is to be adjusted.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H080/A041 | 1st Output Current Fluctuation Damping Gain/2nd Output Current Fluctuation Damping Gain | 0.00 to 1.00 | 0.20 | - |

- If inappropriate adjustments are made, the current fluctuation may increase. Therefore, do not change the factory default set values, unless required.

## 8-9-18 Pulse Train Frequency Input

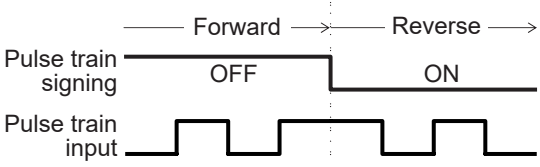
Pulse train input can be used for the frequency reference, operation target used for frequency reference and PID feedback value in PID control.

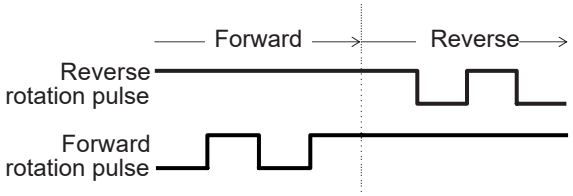
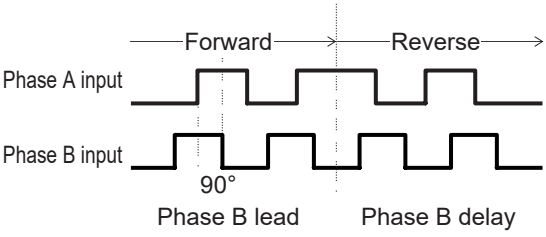
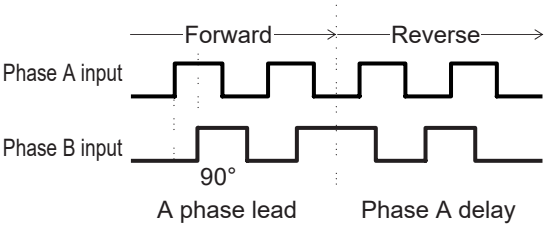
- To use pulse train input for the frequency reference, set Frequency Reference Selection (F001/C030) to “12: Pulse train input.”
- To use pulse train input for the operation target, set Frequency Reference Selection (F001/C030) to “13: Calculation result” and set Frequency Calculation Operation Target 1/2 (E131/E132) to “5: Pulse train frequency.”
- To use pulse train input for PID feedback, set PID Control Feedback Selection (E119) to “3: Pulse train input.”
- Pulse train input uses input terminals [PIA], [PIB] and [PIZ].

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| F001/C030 | 1st Frequency Reference Selection/2nd Frequency Reference Selection | 12: Pulse train input<br>13: Calculation result | 0/2 | - |
| E119 | PID Control Feedback Selection | 3: Pulse train input | 0 | - |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| d014 | Input Terminal [PIA][PIB] Pulse Input Format Selection | 0: Pulse train signing/pulse train input<br>1: Forward/reverse rotation pulse<br>2: Quadrature A/B signal (B phase lead)<br>3: Quadrature A/B signal (A phase lead) | 2 | - |
| d015 | Input Terminal [PIA][PIB] Encoder Pulse Resolution | 20 to 60000 | 1024 | pulse |
| d016 | Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator | 1 to 32767 | 1 | - |
| d017 | Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator | 1 to 32767 | 1 | - |
| d018 | Input Terminal [PIA][PIB] Pulse Train Filter Time Constant | 0.000 to 5.000 | 0.005 | s |
| W055 | Pulse Input (A/B Phase [PIA] [PIB]) | -327.68 to 327.67 | - | kp/s |
| W056 | Pulse Input (Z Phase [PIZ]) | 0 to 16000 | - | p/s |
| W139 | Pulse Train Frequency Monitor | -163.84 to 163.83 | - | % |
| Related function | | Frequency Calculation Operation Target 1 (E131)<br>Frequency Calculation Operation Target 2 (E132)<br>Frequency Addition Sign Selection (E135) | | |

- Pulse train input method (d014)
  By entering a pulse train in the input terminals [PIA] and [PIB] of the inverter control circuit, it is possible to make a frequency setting proportional to the frequency of the pulse. The pulse train input method is specified by the Input Terminal [PIA][PIB] Pulse Input Format Selection (d014). Input can be made in four types, namely the Pulse train signing/pulse train input, Forward and reverse pulse, and Quadrature A/B signal (A phase lead, B phase lead).

| d014 data | Target terminal | Pulse input method | Remarks |
|---|---|---|---|
| 0 | Input Terminal [PIA] | Pulse train signing | A speed command corresponding to the frequency of pulse train input is applied. Moreover, the polarity of the speed command can be set by the pulse train signing.<br>  |
| | Input Terminal [PIB] | Pulse train input | |

| d014 data | Target terminal | Pulse input method | Remarks |
|---|---|---|---|
| 1 | Input Terminal [PIA] | Forward rotation pulse | A speed command corresponding to the frequency of pulse train input is applied. If the input pulse is a forward rotation pulse, it results in straight polarity, and if the input pulse is a reverse rotation pulse, it results in reverse polarity.   |
| | Input Terminal [PIB] | Reverse rotation pulse | |
| 2 | Input Terminal [PIA] | Quadrature A/B signal (B phase lead) | A speed command with polarity is applied based on the phase difference and frequency, by two types of pulse signals having a 90° phase difference (B phase lead).   |
| | Input Terminal [PIB] | | |
| 3 | Input Terminal [PIA] | Quadrature A/B signal (A phase lead) | The polarity is reversed (A phase lead becomes forward rotation) when Input Terminal [PIA][PIB] Pulse Input Format Selection (d014) = 2. If the A phase and B phase are wired in the reverse order, the polarity can be corrected by setting Input Terminal [PIA][PIB] Pulse Input Format Selection (d014) = 3.   |
| | Input Terminal [PIB] | | |

- Input Terminal [PIA][PIB] Encoder Pulse Resolution (d015)
  Set the number of encoder pulses of pulse train input.

- Pulse scaling factor 1 (d016), Pulse scaling factor 2 (d017)
  Convert the pulse train input (kps) into the set frequency by Pulse Scaling Factor 1/Pulse Scaling Factor 2 (d016/d017).

$$f^* \text{ [Hz]} = Np \text{ [kp/S]} \times \frac{\text{Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator (3014Hex-12Hex)}}{\text{Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator (3014Hex-11Hex)}}$$

f* [Hz]: Frequency set value

Np [kp/s]: Entered input pulse frequency

- Filter time constant (d018)
  Set the filter time constant with respect to the pulse train input.

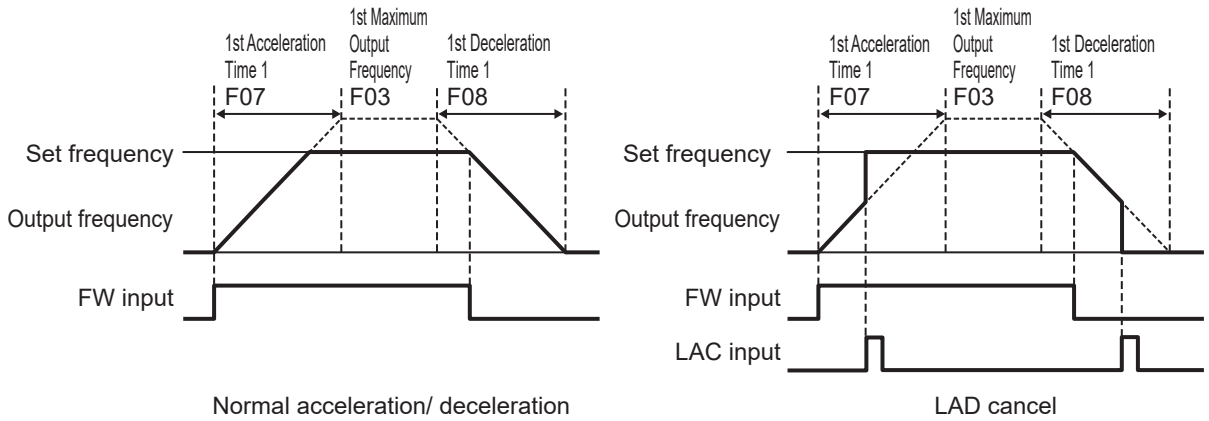
- PID feedback based on pulse train input (E119 = 3)
  Perform the same processing as the frequency setting process for the pulse train, and convert to the feedback value with the maximum frequency with respect to the frequency reference value of the result as 100%. When one of the following conditions is satisfied at the same time, pulse train input is used for both the set frequency and PID feedback.
  - Set “12: Pulse train input” to Frequency Reference Selection (F001/C030).
  - Set “13: Calculation result” to Frequency Reference Selection (F001/C030), and set “5: Pulse train frequency” to Frequency Calculation Operation Target 1/Frequency Calculation Operation Target 2 (E131/E132).

- Operation frequency input setting based on pulse train input (E131/E132 = 5)
  Perform the same processing as the frequency setting process for the pulse train, and set the frequency reference value of the result as the selection value of the operation frequency.

## 8-9-19 LAD Cancel Function

“LAD” is the function for calculating the acceleration/deceleration time. The LAD cancel function forcibly sets the acceleration/deceleration time to 0. When the LAC terminal is turned ON, the frequency acceleration/deceleration function (LAD) is disabled and the frequency reference is output momentarily.
This function is also applicable to the acceleration/deceleration during the jogging operation and the deceleration during forced stop.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 84: LAC (Acceleration and deceleration time cancel) | - | - |
| Related function | | F007, F008, E010 to E015 | | |




Normal acceleration/ deceleration

LAD cancel

## 8-9-20 Servo Lock Function

The servo lock function is used to control the position of the motor, and continue to retain the position even when an external force is applied.

It is enabled only during vector control with speed sensor. The servo lock function is enabled by turning the LOCK terminal ON.
If operation is stopped even with position control disabled (SPD terminal ON) when the servo lock is enabled, a deceleration is performed to the stop frequency, then position control is performed with the position where the output frequency becomes 0 taken as the target stop position, and then servo lock is performed.
The servo lock operates at a low speed, and therefore, if it is used by applying an external force over a long period of time, overheat protection may be activated.

Servo lock is started when all of the following conditions are satisfied.
- RUN command is OFF, or set frequency < stop frequency (F025)
- LOCK terminal ON
- ["0: Output frequency, Detected speed" is set for 1st Stop Frequency Detection Method Selection (F038) and speed detection value is Stop Frequency (FF025) or less] or ["1: Frequency reference" is selected for 1st Stop Frequency Detection Method Selection (F038) and frequency reference value is Stop Frequency (F025) or less]

Set the gain for the position control of the servo lock by Servo Lock Gain (J97). The behavior of stopping the inverter during a servo lock, and the axial holding force can be adjusted.
When setting smaller value to J97, the response is delayed, but the behavior becomes smoother and the axial holding force is reduced. When setting larger value, the response becomes faster, but hunting increases and the axial holding force also increases.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 47: LOCK (Servo lock command) | - | - |
| J097 | Servo Lock Gain | 0.000 to 9.999 | 0.010 | Time |
| J098 | Servo Lock Completion Timer | 0.000 to 1.000 | 0.1 | s |
| J099 | Servo Lock Completion Range | 0 to 9999 | 10 | Pulse |

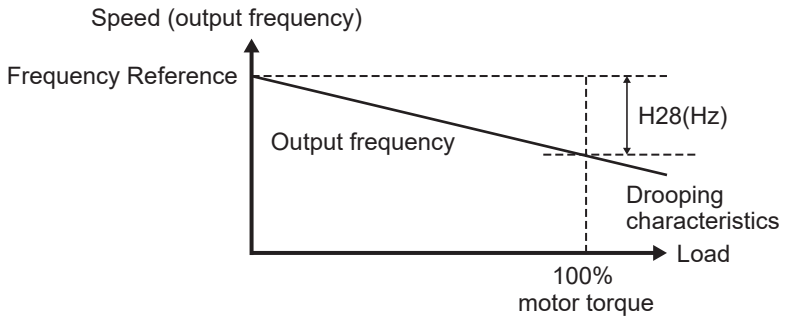
- When the servo lock command is ON, the voltage is output to the output terminals [U], [V] and [W] of the inverter even if the RUN command has not been turned ON.
- During a servo lock, if the position error becomes four rotations or more by motor shaft conversion, the position control error (alarm code: 38) is output.
- With the servo lock function, as control is started from the 1st Stop Frequency (F025) or less, adjust 1st Stop Frequency (F025) and Gain (J097) to satisfy the following formula:
  1st Stop Frequency (F025) < (4 × Gain (J097) × Maximum output frequency)
- If servo lock control is enabled, the stop frequency continuation operation and rotational direction limitation are disabled.

## 8-9-21 Droop Control

If a single mechanical system is driven by multiple motors, and there is a speed difference in each of the motors, a load unbalance occurs. Droop control is a function for ensuring load balance by providing drooping characteristics to the motor speed in response to an increase in load.

When the output torque is 100%, the output frequency is subtracted by the frequency set at Droop Control (H028), and when the output torque is 0%, the output frequency is subtracted as a percentage that is output according to the frequency reference in accordance with the torque actually being output by the inverter (Output Torque Monitor (W007)).
The set value of Droop Control (H028) is around the rated slip frequency of the applicable motor.
To enable droop control, turn the DROOP terminal ON.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H028 | Droop Control | -60.0 to 0.0 | 0.0 | Hz |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 76: DROOP (Select droop control) | - | - |



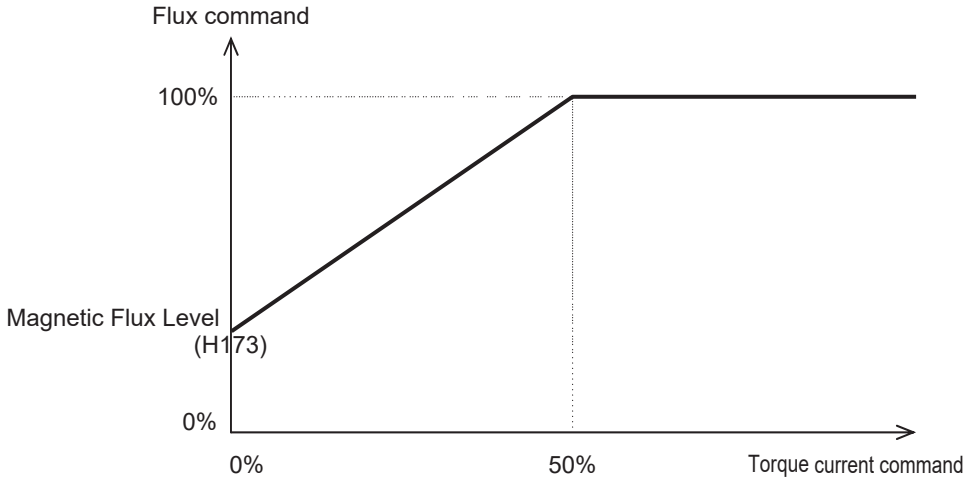

- When using droop control, be sure to perform auto-tuning.
- During droop control for V/f control, the acceleration/deceleration time is enabled for the resultant frequency of droop control so that tripping does not occur even when there is a sudden change in load. As a result, the reflection of the frequency corrected during droop control on the motor speed under the influence of the acceleration/deceleration time is delayed, and the droop control may operate as disabled.

## 8-9-22 Magnetic Flux Level at Light Load

By setting Magnetic Flux Level at Light Load (H173), the magnetic flux of the motor during a light load can be reduced, and thus, the motor noise can be reduced. This function can be used only during vector control with speed sensor.
This is regardless of Load Mode Selection (F080).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H173 | Magnetic Flux Level at Light Load | 10 to 100 | 100 | % |

- The magnetic flux command when the Torque Current Command value is less than 50% can be changed. Set the magnetic flux command when the Torque Current Command value is 0% to Magnetic Flux Level at Light Load (H173). Refer to the figure below.




## 8-9-23 Pre-excitation

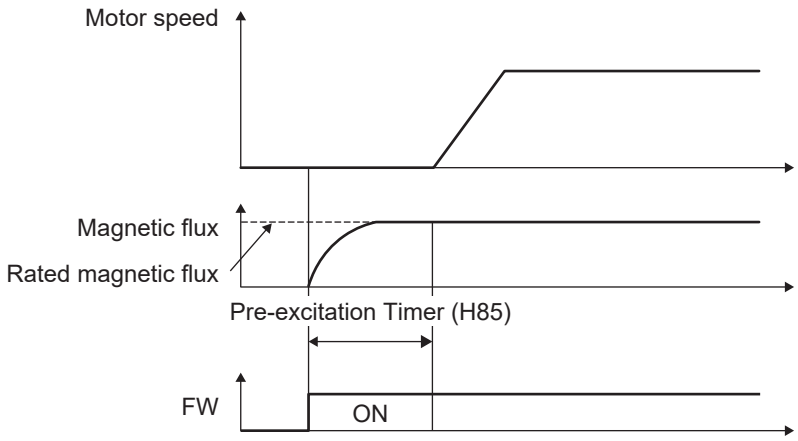
The motor generates torque through magnetic flux and torque current. Since the establishment of magnetic flux has a lag element, sufficient torque is not generated at the time of starting. Pre-excitation is a function for establishing the magnetic flux before startup to ensure sufficient torque even during the time of starting.
There are two methods for issuing pre-excitation commands: one is to execute for the period of Pre-excitation Timer (H085) after the RUN command is turned ON, and the other is to turn ON the EXITE terminal and apply pre-excitation until the RUN command is input.

### Controlling by Pre-excitation Timer

When the pre-excitation (Timer) elapses, it is judged that magnetic flux has been established, and acceleration is started. Secure sufficient time for establishment of magnetic flux with Pre-excitation Timer (H085).
The appropriate value of the pre-excitation (Timer) is different for each capacity. As a standard, consider it equivalent to the default value of the Power Interruption Restart Wait Time (H013).
This function is disabled when the pre-excitation timer is set to 0.00.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H085 | Pre-excitation Timer | 0.00: Disable<br>0.01 to 30.00 | 0.00 | s |
| H084 | Pre-excitation Level*1 | 100 to 400 | 100 | % |

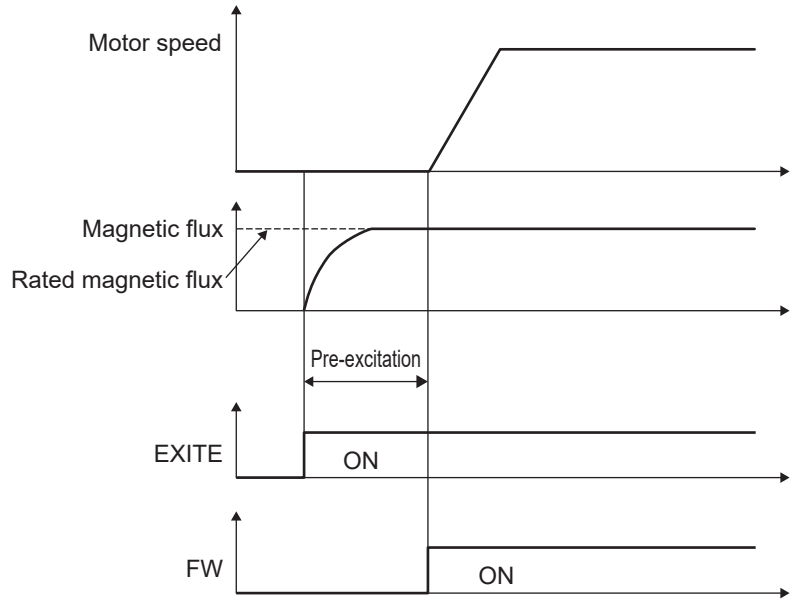
*1. Pre-excitation Level (H084) sets the ratio with the rated magnetic flux as 100%. This is used to raise the output current to more than specified to shorten the pre-excitation timer. Generally, there is no need to change the settings. If a set value is too large, instantaneous overcurrent (alarm code: 01) sometimes is generated.




## Controlling by Pre-excitation Command Terminal (32: EXITE)

Pre-excitation starts operating when the EXITE terminal is turned ON regardless of the setting of Pre-excitation Timer (H085). After this, when the RUN command is input, pre-excitation operation ends, and acceleration starts. When the time until the RUN command is input is short, establishment of magnetic flux sometimes does not arrive at a sufficient level. In this case, lengthen the time until the RUN command is input.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 32: EXITE (Pre-excite) | - | - |




- The pre-excitation function is disabled in V/f control (including automatic torque boost and torque vector). Substitute it with DC braking or starting frequency continuation.
- Even when the motor is stopped by the pre-excitation operation, the voltage is output to the output terminals [U], [V] and [W] of the inverter.

## 8-9-24 Forced Stop

The forced stop function is used to perform a deceleration stop by Deceleration Time for Forced Stop (H056) when the STOP terminal is turned OFF.
After the deceleration stop, the operation error (alarm code: 24) is displayed and the status changes to alarm status.
When a forced stop is detected, the STOP-OUT terminal turns ON.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H056 | Deceleration Time for Forced Stop | 0.00 to 6000 | 6.00 | s |
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 30: STOP (Force to stop)*1 | - | - |
| E020/E027 | Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection | 152: STOP-OUT (Forced stop detection) | - | - |

*1. As standard, Force to stop (30: STOP) is an NC contact. To use the function for an NO contact, set “1030.”

## 8-9-25 Overload Stop Function

This function is used to detect the load condition, and if the state exceeding the Overload Stop Detection Level (J064) continues for the Overload Stop Detection Timer (J067) or longer, stop operation is performed by the overload stop function.
Select the stop operation at Overload Stop Mode Selection (J065). If “0: Disable” is selected, the overload stop function is disabled.
The overload stop function is enabled only for the 1st control.
Select the operation to detect at Overload Stop Operation Mode (J066).
Select the item to detect at Overload Stop Item Selection (J063).

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| J065 | Overload Stop Mode Selection | 0: Disable<br>1: Deceleration stop 2: Free run stop<br>3: Torque limit operation (Deceleration) | 0 | - |
| J063 | Overload Stop Item Selection | 0: Torque<br>1: Current | 0 | - |
| J064 | Overload Stop Detection Level | 20 to 200 | 100 | % |
| J066 | Overload Stop Operation Mode | 0: During constant speed running and deceleration<br>1: During constant speed running<br>2: Anytime | 0 | - |
| J067 | Overload Stop Detection Timer | 0.00 to 600.00 | 0 | s |
| J090 | Overload Stop Function P gain | 0.000 to 2.000<br>999: 0.050 | 32767 | Times |
| J091 | Overload Stop Function Integral time | 0.001 to 9.999<br>999: 0.025 | 32767 | Times |
| J092 | Overload Stop Function Current level | 50.0 to 150.0 | 100 | % |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 46：OLS (Enable overload stop) | - | - |

## Overload stop enabled OLS

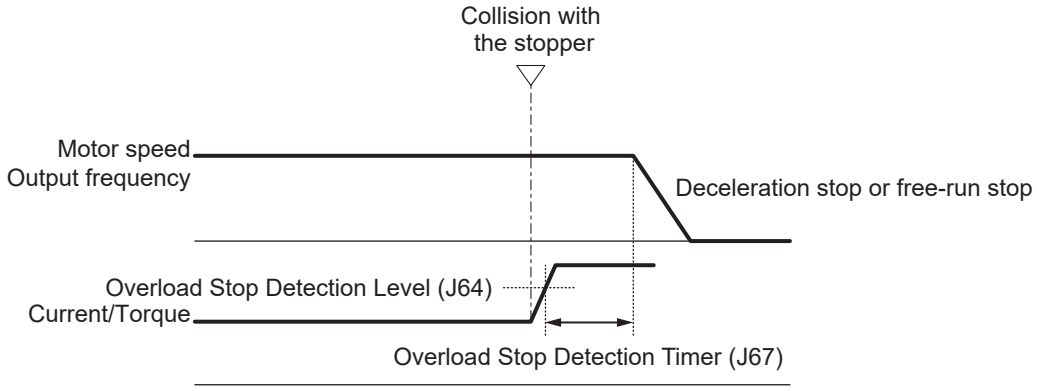
Turning the OLS terminal ON enables overload stop and turning the terminal OFF disables overload stop.
Note that if overload stop is disabled by turning OFF the OLS terminal in a state when the inverter has stopped due to overload stop, the inverter will restart.

## Overload Stop Mode Selection (J065)

- Select the stop operation at Overload Stop Mode Selection (J065). If “0: Disable” is selected, the overload stop function is disabled.

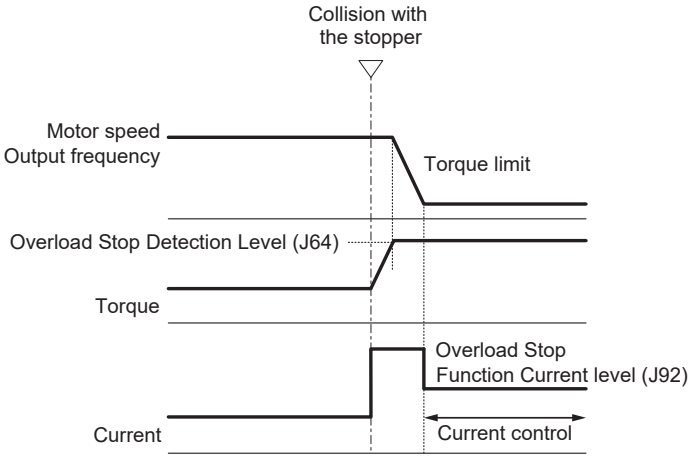
### For operation selection (J065 = 1, 2)

If deceleration stop (J065= 1) is set when output torque or output current has continued for the detection timer (J064) or longer set with the Overload Stop Detection Level (J067), a deceleration stop is performed at the selected deceleration time.
When free run stop (J065= 2) is set, inverter immediately shuts down and the motor enters the free-run state.




### For operation selection (J065 = 3)

- PI control is started by the set values of Overload Stop Function P gain (P) (J064) and Overload Stop Function Integral time (J090) when the Overload Stop Detection Level (J091) is reached. Torque is controlled by PI control so that the Overload Stop Detection Level (J064) is maintained. When the Frequency Lower Limit (F016/E118) is reached, control is switched to current control. Overload Stop Item Selection (J063) is not related to this setting.




## Proportional Gain (P), Integral Time (I) and Current Limitation Level

When “3: Torque limit operation (Deceleration)” function is selected for Overload Stop Mode Selection (J065), the parameters described below can be set.

- Overload Stop Function P gain (J090)
  If the response of the torque limitation operation is slow, increase the gain, and if hunting occurs, decrease the gain.

- Overload Stop Function Integral time (J091)
  If the response of the torque limitation operation is slow, decrease the integral time, and if hunting occurs, increase the integral time.

- Overload Stop Function Current level (J092)
  This function is used to correct the current command during current limitation. When the set value is increased, the retention torque increases, but an inverter overload alarm (0LU) or a motor overload alarm (0L1) may occur, and vibrations may occur in the mechanical system.

## 8-9-26 Battery Operation Enable Command (BATRY)

When the BATRY terminal is turned ON, undervoltage protection is disabled, and the motor can be operated even in an undervoltage state. In an event that an elevator fails to stop at a normal position due to power failure, this command is expected to operate the elevator to the normal position with a low-voltage and small-capacity emergency power supply.
When “BATRY” is allocated to the input terminal, the momentary power failure operation is not performed regardless of the setting of Power Interruption Restart Mode Selection (F014), and the inverter trips during a power failure.
When the BATRY terminal is ON, the input phase loss protection is disabled regardless of the setting of Input Phase Loss Protection Function Selection (H411).
While the BATRY terminal is ON, the IRDY terminal turns OFF.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 59: BATRY (Enable battery-driven operation) | - | - |
| E020/E027 | Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection | 10: IRDY (Operation ready signal) | - | - |

## 8-9-27 Universal Terminal

- The input terminal is not used as startup of the inverter functions, but it can be used as a signal monitor.
- The inverter status is not output; the value set to parameters can be output from output terminals [DO1] and [ROA, ROB].

### Universal DI

When “25:U-DI (Universal DI)” is allocated to the input terminal, ON/OFF can be checked by Operation command (S006) and the input signal can be checked by Input Terminal Monitor (W040) regardless of inverter operation.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| E001 to E005, E098, E099 | Input Terminal [DI1] to [DI7] Function Selection | 25: U-DI (Universal DI) | - | - |
| S006 | Operation command | Bit15: RST<br>Bit14: DI7<br>Bit13: DI6<br>Bit12: -<br>Bit11: -<br>Bit10: -<br>Bit9: -<br>Bit8: -<br>Bit7: -<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: REV<br>Bit0: FWD | 0 | - |

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| W040 | Input Terminal Monitor | Bit15: -<br>Bit14: -<br>Bit13:-<br>Bit12: EN2<br>Bit11: EN1<br>Bit10: -<br>Bit9: -<br>Bit8: -<br>Bit7: -<br>Bit6: DI5<br>Bit5: DI4<br>Bit4: DI3<br>Bit3: DI2<br>Bit2: DI1<br>Bit1: DI7<br>Bit0: DI6 | 0 | - |

## Universal DO

When “27: OPO (Option board output)” is allocated to the output terminal, output is performed from the corresponding output terminal when data is written to the Communication Data Terminal [DO] (S007) from communication regardless of inverter operation.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| S007 | Communication Data Terminal [DO] | Bit8: RO<br>Bit0: DO1 | 0 | - |

## 8-9-28 Protection/Maintenance Mode Selection Function

Main circuit capacitor life judgment selection, main circuit capacitor life judgment, inrush current prevention resistor overheat detection, and braking transistor broken detection operations can be selected and set as combined operations.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| H098 | Protection/Maintenance Function Mode Selection | 0 to 255 | 80 | - |

Set function settings as binary values to their respective bits, and set the resulting data as decimal data to Protection/Maintenance Function Mode Selection (H098).
The following shows the settings of each bit and each function.

| Bit | Function | Data = 0 | Data = 1 |
|---|---|---|---|
| Bit 0 | Lower the carrier frequency automatically | Disable | Enable |
| Bit 1 | Input phase loss protection | Disable | Enable |
| Bit 2 | Output phase loss protection | Disable | Enable |
| Bit 3 | Main circuit capacitor life judgment standards selection | Default value | User setting |
| Bit 4 | Judge main circuit capacitor life | Disable | Enable |
| Bit 5 | Detect inrush current prevention resistor overheat | Enable | Disable |
| Bit 6 | Braking transistor error detection | Continuous running | Alarm processing |

| Bit | Function | Data = 0 | Data = 1 |
|---|---|---|---|
| Bit 7 | Reserved | - | - |

Use the reserved bit fixed at 0.

Below are the details of each function.

## Judge Main Circuit Capacitor Life (Bit 4)

To judge the life of the main circuit capacitor, measure the discharge time when the power supply is shut off. The discharge time is determined by the capacity of the main circuit capacitor and the inverter's internal load. Accordingly, accurate measurement is not possible when the inverter's internal load conditions fluctuate considerably. Life is also sometimes judged erroneously in some conditions. To prevent erroneous judgment of the life of the main circuit capacitor, life judgment based on the discharge time of the main circuit capacitor can be disabled (life judgment based on incrementation of the time that voltage is applied to the main circuit capacitor continues to stay active). For details, refer to *8-8-10 Capacitor Life Warning Signal (WAC)* on page 8-89.

When using the control power supply auxiliary inputs, the load varies considerably. For this reason, during run operation, either disable life judgment and then enable life judgment after aligning conditions at periodic inspection, or measure by a method matched to actual usage conditions.

## Inrush Current Prevention Resistor Overheat Detection Protection (Alarm Code: 46) (Bit 5)

On 0.1 to 15 kW inverters, when overheating of the inrush current prevention resistor inside the inverter is detected when the main circuit power is turned ON and started, the overheat protection function (alarm code: 46) is activated. When startup is slow due to the main circuit power being a variable power supply device, the overheat protection function is sometimes activated. In this case, protection can be disabled.

## Braking Transistor Error Detection (Alarm Code: 16) (Bit 6)

Detects the built-in braking transistor error and stops the inverter by Braking transistor broken detection (alarm code: 16). To disable alarm generation without using the braking transistor, set this bit to “0.”

## Main Circuit Capacitor Life Judgment Selection (Bit 3)

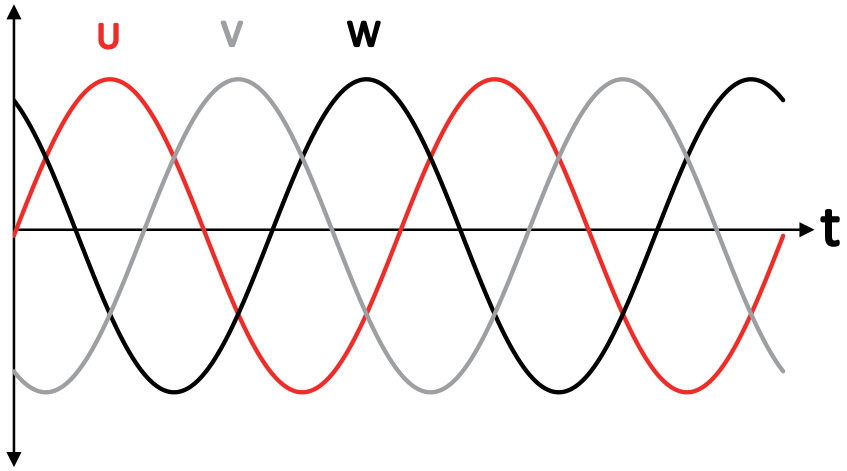
Either of the factory default standards or user setting standards can be selected as the criteria level for judging the life of the main circuit capacitor.
When user setting standards are selected, the reference level must be measured and set beforehand. For details, refer to *8-8-10 Capacitor Life Warning Signal (WAC)* on page 8-89.

## 8-9-29 Inversion of Motor Output Phase Rotation

This function allows switching the direction of forward rotation without the need to modify motor wiring. The parameter H190 specifies the output phase order of the motor.

### Standard motor phase order

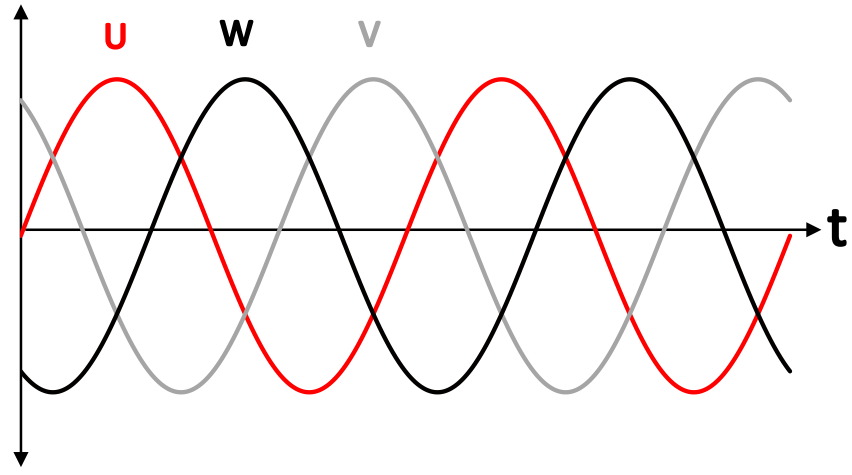
When H190 = 0, the normal phase order (U→V→W) is applied when Forward Run command is given with positive speed reference




U phase: 0° (reference), V phase: 120° delay, W phase: 240° delay

### Reverse motor phase order

When H190 = 1, the reverse phase order (U→W→V) is applied when Forward Run command is given with positive speed reference, resulting in the motor rotating in reverse direction. When this is used, it is needed to check also the proper direction of encoders or sensors linked to the motor.




U phase: 0° (reference), W phase: 120° delay, V phase: 240° delay,



**Additional Information**

- The encoder signal is not affected by the H190 setting. If changes to the encoder signal are required, the d014 setting must also be adjusted.
- For applications using PM motor vector control with PG, it is essential to re-execute magnetic pole position offset tuning after modifying the H190 parameter

**Motor and encoder rotation inversion related parameters**

| ParameterNo. | Function name | Data | Defaultdata |
|---|---|---|---|
| H190 | Output Phase Order Selection | 0: Normal (UVW)<br>1: Inverse (UWV) | 0 |
| d014 | Input Terminal [PIA]<br>[PIB] Pulse Input Format Selection | 0: Pulse train signing/pulse train input 1: Forward/reverse rotation pulse<br>2: Quadrature A/B signal (B phase lead)<br>3: Quadrature A/B signal (A phase lead) | 2 |

# 9

# Troubleshooting



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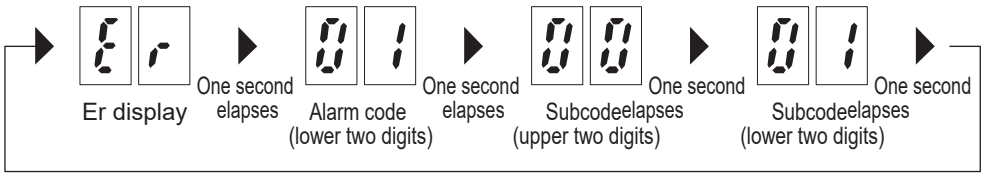
# 9-1 Alarm Display and Remedies

## 9-1-1 Alarm Display

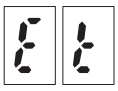
If an error occurs, the inverter shuts off its output (“trip”), turns ON or causes the ERROR LED to flash, and displays an alarm code and sub code. After checking the RUN command and other signals, you can reset the alarm.
Before resetting the alarm, be sure to investigate the cause of the trip and remove the trip factor(s) according to the displayed alarm code.
This section describes how to deal with troubles that may occur after you start using the inverter.

### Alarm Display

- Alarm, light alarm occurred
  When an alarm or a light alarm has occurred, the display is as follows. The alarm code displayed is the lower two digits of the error code (603FHex).




- EMP terminal block board error occurred
  When an EMP terminal block board error has occurred, the display is as follows.



- STO state
  The STO state is displayed as follows.



These displays flash at 0.5 second intervals while in an alarm state.
When multiple causes for an alarm occur simultaneously when an alarm is displayed, display priority is as follows: “EMP terminal block board error,” “Alarm, light alarm” and “STO state.”

### How to Reset a Trip State

For details on how to reset an inverter trip state, refer to *6-8 Reset* on page 6-42. The above reset methods may not be effective depending on the trip factor. In such cases, cycle the power supply.

## Data Clear Processing for Communications Error

Communications command parameter (Parameter S) data can be automatically cleared when a communications error alarm (alarm code: 23 Hex) is generated.
Clearing this will remove the frequency reference and RUN command, therefore the inverter will not start inadvertently when clearing the alarm.

| Parameter No. | Function name | Data | Default data | Unit |
|---|---|---|---|---|
| y095 | Data Clear Processing for EtherNet Communications Error | 0: Do not clear the data of function codes S when a communications error occurs. (compatible with the conventional inverters)<br>1: Clear the data of function codes S001, S005, and S019 when a communications error occurs<br>2: Clear the run command assigned bit of function code S06 when a communications error occurs<br>3: Clear both data 1 and 2 above | 0 | - |

## 9-1-2 Alarm Code List

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 3B Hex (dbA) | | Braking transistor error | Error in braking resistor connection terminal wiring | Check that the braking resistor is correctly wired in to the [P+] and [DB] terminals on the main circuit terminal block.<br>Check that the motor wiring is not erroneously connected to the terminal [DB].<br>→ If there is no miswiring, request repair of the inverter. |
| | | | The braking transistor is damaged. | Check that the braking resistor value is correct, and that it is not miswired.<br>→ If there is no problem, request repair of the inverter. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 16 Hex (dbH) | | Braking resistor overheating | (1) High braking load | Re-calculate the relationship between braking load calculations and braking capacity.<br>→ Reduce braking load.<br>→ Review braking resistor selection, and increase braking capacity.<br>(Resetting of objects F050, F051, F052 data is necessary) |
| | | | (2) Short deceleration time | Recalculate deceleration torque and deceleration time required from the moment of inertia of the load and deceleration time.<br>→ Lengthen deceleration time (parameters F008, E011, E013, E015, H056)<br>→ Review braking resistor selection, and increase braking capacity.<br>(Resetting of objects F050, F051, F052 data is necessary) |
| 39 Hex (ECF) | | EN circuit failure | (1) Enable circuit (safe stop circuit) logic failure | • Check that the output from the safety switch is input using the same logic (High or Low/Low) to both terminals [SF1]/[SF2].<br>→ Cycle the power to clear the alarm. |
| | | | (2) Enable circuit (safe stop circuit) damage (single failure) detected | If this is not resolved by the procedure above, the inverter is faulty.<br>→ Replace the inverter. |
| 82 Hex (EnF) | | STO (SF) Terminals OFF | (1) Alarm signaling the operation of the STO safety terminals. | → When both SF1 and SF2 terminals are in the OFF state, an alarm or warning will occur depending on the setting of E190. Set E190=0 to disable this alarms |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 1F Hex (Er1) | | Memory error | (1) Power disconnected during parameter data writing (in particular during initialization) and control power dropped | Initialize data with Data Initialization (H003), and when initialization is complete, use the reset to check that the alarm can be canceled.<br>→ Restore the initialized parameter data, and restart operation. |
| | | | (2) During parameter data writing (in particular during initialization), strong noise received from surrounds | Check methods for measures against noise (grounding conditions, control/main circuit wiring and installation).<br>Additionally, perform the same checks as in (1).<br>→ Perform measures against noise, restore the initialized parameter data, and restart operation. |
| | | | (3) Error occurred in control circuit | Initialize data with Data Initialization (H003), and when initialization is complete, use the reset to check if the alarm continues even when trying to cancel this.<br>→ Replace the inverter. |
| | | | (4) Power disconnected during saving of user settings with object H193, and control power dropped | Save user settings with object H193, and when saving is complete, use the reset to check if the alarm continues even when trying to cancel this.<br>→ Replace the inverter. |
| | | | (5) During saving of user settings with object H193, strong noise received from surrounds | Check methods for measures against noise (grounding conditions, control/main circuit wiring and installation).<br>Additionally, perform the same checks as in (4).<br>→ Replace the inverter. |
| 21 Hex (Er3) | | CPU error | (1) Strong noise received from surrounds | Check measures against noise (grounding conditions, signal wiring and communication cable/main circuit wiring and installation methods, etc.).<br>→ Improve measures against noise. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 23 Hex (Er5) | 2000 Hex | Ethernet communications error | (1) An EtherNet communications cable is disconnected, broken, short-circuited, or has a contact failure in a daisy chain configuration. | Connect the EtherNet communications cable securely. If the cable is broken, replace it. |
| | | | (2) The ring disconnection<br>• In a ring topology configuration,t h e ring disconnection status occurred.<br>• In a ring topology configuration,t h e ring disconnection status was fixed. | Refer to Method for Ring Disconnection Maintenance and Inspection and perform inspection. |
| | | | (3) Noise | Take noise countermeasures so that the noise does not affect the EtherNet communications cable. |
| | | | (4) Failure of the EtherNet physical layer of a Inverter. | If this event occurs again after you performed all corrections shown above, replace the Inverter. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 24 Hex (Er6) | 2 to 6 | Operation error | (1) With the start check function enabled (object H096 = 2), the start check function has operated | Check if the following operation has been performed while there is a RUN command input.<br>• Power supply ON<br>• Alarm cancel<br>• Switch to link RUN command<br>→ With the Run operation error occurring, review sequences, etc. so that a RUN command is not input.<br>If unintended operation, review object H096 settings.<br>(Before clearing the alarm, turn the RUN command OFF.) |
| | 1 | | (2) Forced stop "STOP" (digital input terminal) turned OFF | Check if forced stop "STOP" has been turned OFF.<br>→ If unintended operation, review terminals [DI1] to [DI7] object E001 to E005, E098, E099 settings. |
| | 8 | | (3) Brake check signal "BRKE" and brake control signal "BRKS" mismatch | Check that the signal input into the X terminal to which brake check signal "BRKE" is assigned and the brake control signal "BRKS" output from the Y terminal match.<br>• Signal disconnection<br>• Check that the logic matches<br>• If there is a delay, adjust the object H180 (brake control signal) time. |
| | 30 | | (4) A RUN command (FW/REV signals are ON) is input while the power recovery restart prevention (USP) signal is input | Check the power recovery restart prevention (USP) signal. |
| 25 Hex (Er7) | - | Tuning Precautions | (1) The connection between the inverter and the motor is missing phases | → Ensure a correct connection between the inverter and motor. |
| | - | | (2) V/f settings and motor rated current are not set correctly | Check that object (F004*, F005*, {H50}, {H51}, {H52}, {H53}, {H65}, {H66}, P002*, P003*) data matches motor specifications. |
| | - | | (3) Wiring between the inverter and motor is too long | Check that wiring between the inverter and motor does not exceed 50 m.<br>(Smaller inverter capacity will be more impacted by wiring length)<br>→ Review layout so that wiring between the inverter and motor can be made shorter.<br>Alternatively, shorten wiring lengths as much as possible.<br>→ Does not use automatic tuning, and does not use automatic torque boost<br>(Set object E112 / E113* = 0) |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 25 Hex (Er7) | - | Tuning Precautions | (4) Major discrepancy between the inverter rated capacity and the capacity of the connected motor | Check that the capacity of the connected motor is lower than three or more ranks of the inverter rated capacity, or higher than two or more ranks.<br>→ Review the inverter capacity.<br>→ Manually set the motor constant (object P006*, P007*, P008*).<br>→ Does not use automatic tuning, and does not use automatic torque boost (Set object F037* = 1) |
| | - | | (5) A special motor, such as a high-speed motor | → Does not use automatic tuning, and does not use automatic torque boost (Set object F037* = 1) |
| | - | | (6) Tuning operation during which the motor is rotated with the brake applied (P004* = 2) | → Tune the motor while stopped (object P004* = 1).<br>→ Release the brake then tune the motor (object P004* = 2). |
| 25 Hex (Er7) | 1 (01h)<br>2 (02h)<br>3 (03h)<br>4 (04h)<br>5059 to 5065 (13C3h to 13C9h) | Tuning Errors | Motor phases current or phase balance problem | → When unbalance between phases or a<br>→ phase loss is detected, or when an open<br>→ output or short-circuit causes the tuning result to be abnormally small or large<br>Check that there is no error occurring in the wiring between the inverter and motor.<br>When there is an electromagnetic contactor (MC) between the inverter and motor, check to see if the contact is open. |
| | 7 (07h)<br>8 (08h)<br>9 (09h) | | Autotuning cancelled by external command | → When RUN command OFF, forced stop<br>→ “STOP” and free-run stop “FRS,” etc. are input during tuning<br>Do not turn the RUN command OFF during tuning. |
| | 6 (06h)<br>10 (0Ah) | | Output current too high during autotuning | → When an abnormally large current flows<br>→ during tuning<br>Check the state of the mechanical brake. Also, check if the motor can be mechanically rotated. |
| | 13 (0Dh) | | Autotuning limit conditions | → When various limit operations occur during tuning, or when a limit is applied at the maximum output frequency or frequency limiter (upper limit)<br>Change so that the limit value becomes 50% or higher of the base frequency. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 25 Hex (Er7) | 15 (0Fh) | Tuning Errors | Autotuning voltage output too low. | → When an insufficient voltage state has<br>→ occurred or an alarm has occurred For details on countermeasures for individual alarms, refer to *9-1 Alarm Display and Remedies* on page 9-2. |
| | 18 (12h) | | Autotuning Acceleration rate error. | → When 3x the set value of acceleration<br>→ time in F007 is exceeded for the output frequency to reach 50% of the base frequency<br>Increase the value of F007. |
| | 21 (15h) | | Wrong tuning parameter settings. | → PM motor only<br>→ Although the motor is rotated for magnetic pole position tuning when P030 = 0 or 3, when P004* = 1: Tune the motor parameters while stopped is performed at this setting<br>When P004 = 5: Tune the motor parameters while stopped is performed when F042 = 15<br>Set to the correct combination. |
| | 27 (1Bh) | | Encoder rotation direction error | → Motor rotation direction and encoder<br>→ output do not match.<br>→ Check the encoder wiring, and the phase sequence of AB or UVW phase. Invert the encoder direction either by reversing the encoder wiring connections or by using parameter d014. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 25 Hex (Er7) | 5003 (138Bh) | Tuning Errors | Motor found impedance out of expected range | → When the rated impedance or rated inductance is outside the valid (reasonable) range expected for the motor capacity and specs.<br>Check setting of F004, F005 and P003. |
| | 5005 (138Dh) | | Error in determining Ld and Lq proper motor values. | → PM motor only<br>→ When P030 = 1 or 3 is set: When the salient pole ratio of the motor inductance is small<br>When P030 = 2 is set: When there is no magnetic saturation characteristic of the motor<br>When P030 = 1, change P087 to a small value. Note, however, that in the case of motors that are difficult to magnetically saturate, tuning is sometimes impossible.<br>When P030 = 2 or 3, set P030 = 0, and adjust while increasing F024 in stages in increments between about 0.5 to 5.0 s until rotation tuning no longer fails. |
| | 5056 (13C0h) | | Can not recognize pole position. Too low magnetic saturation current | → PM motor only : When the magnetic saturation characteristic of the motor is small and the magnetic pole position cannot be distinguished<br>Increase the value of P087 in stages taking about 120% as the upper limit. When there is no apparent effect, set P030 = 0 or 3, and set to about F024 = 0.5 to 5.0 s. |
| | 5057 (13C1h) | | Magnetic Saturation current Too High | → PM motor only : When the magnetic saturation characteristic of the motor is large, and a large current flows for distinguishing the magnetic pole position, which is dangerous<br>Set P087 to a small value. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 2A Hex (Erd) | | Stall detection/startup magnetic pole position detection failure | (1) Different motor characteristics | Check that object F004, F005, P001, P002, P003, P060, P061, P062, P063, P064 data matches motor constants.<br>→ Perform auto tuning. |
| | | | (2) Magnetic pole position detection method is not appropriate | Check that the magnetic pole position detection method matches the motor type.<br>→ Match the magnetic pole position detection method (object P030) selection to the motor type. |
| | | | (3) Insufficient starting frequency (holding time) (object F024) | Check that, when setting the magnetic pole position detection method selection (object P030*) to 0 or 3, the starting frequency (holding time) (object F024) is set optimally.<br>→ Set a time that enables the motor to rotate one revolution or more.<br>F024 ≥ P001 / 2 / F023 (P001: pole, F023: starting frequency) |
| | | | (4) Insufficient starting torque | Check acceleration time (object F007, E010, E012, E014) and reference current at starting (object P074) data.<br>→ Set an acceleration time that matches the load.<br>→ Raise the reference current at starting. |
| | | | (5) Low braking load | Check reference current at starting (object P074*) data.<br>→ Lower the reference current at starting.<br>When a motor is run on its own, such as during a test run, set to 80% or lower. |
| | | | (6) The connection between the inverter and the motor is missing phases | → Ensure a correct connection between the inverter and motor. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 32 Hex (ErC) | | Magnetic pole position detection error | (1) Inverter settings are not appropriate | Check presence and model of the used motor, and of the speed/magnetic pole position sensor, and that 1st Drive Control Selection (F042)/Input Terminal [PIA][PIB] Pulse Input Format Selection (d014) and Input Terminal [PIA][PIB] Encoder Pulse Resolution (d015) are coordinated.<br>→ Check the equipment configuration (model and specifications of motor, speed/magnetic pole position sensor), and set F042 / d014 / d015 correctly.<br>Set the 1st PM Motor Starting Method (P030) to 0 or 3, and check if the 1st PM Motor Magnetic Pole position Offset (P095*) is set to “999: Offset not adjusted.”<br>→ Set P095 correctly. (Auto-tuning also is possible. Refer to *Offline Auto-tuning of Synchronous Motor (PM Motor)* on page 7-72.) |
| | | | (2) Error with speed/magnetic pole position sensor connection | Check for errors with speed/magnetic pole position sensor output wiring connection, and the phase sequence of AB or UVW phase.<br>→ Correctly connect the feedback input terminal block board with the speed/magnetic pole position sensor.<br>Check for bad connections in the motor wiring, and the phase sequence.<br>→ Ensure a correct connection with the inverter and motor. |
| | | | (3) Motor rotation direction and sensor output do not match | |
| | | | (4) Error in terminal block board connection | Check if the terminal block board connector and inverter unit connector are correctly connected.<br>→ Mount the terminal block board correctly in the inverter unit. |
| | | | (5) Strong noise received from surrounds | Check measures against noise (grounding conditions, signal wiring and communication cable/main circuit wiring and installation methods, etc.).<br>→ Implement measures against noise. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 2F Hex (ErE) | | Speed mismatch/excessive speed deviation | (1) Error in parameter settings | Check 1st Motor Pole Number (P001*) settings.<br>→ Set P001* to match the motor used. |
| | | | (2) Excessive load | Measure the output current.<br>→ Reduce the load. |
| | | | | Check if mechanical braking is occurring.<br>→ Eliminate any mechanical braking. |
| | | | (3) Speed does not increase because of current limiter operation | Check 1st Overload Protect Level (F044) data.<br>→ Change F044 to appropriate values, or if current limiter operation is not necessary, change F043 data to 0 (Disable). |
| | | | | Check the object (F004*, F005*, P001*, P012*) data to ensure that V/f settings are correct.<br>→ Coordinate V/f settings with motor ratings.<br>→ Change settings to match the motor used. |
| | | | (4) Parameter settings and the motor have different characteristics | Check that P001*, P002*, P003*, P006*, P007*, P008*, P009*, P010*, and P012* match motor constants.<br>→ Perform auto tuning with P004*. |
| | | | (5) Erroneous wiring to motor | Check wiring to the motor.<br>→ Wire the inverter output wiring (U, V, W) to motor wiring (U, V, W) respectively. |
| | | | (6) Speed does not increase because of torque limit operation | Check Torque Limit 3 (E016) data.<br>→ Change Torque Limit 3 (E016) to appropriate value, or if torque limit operation is not necessary, set it to 300%. |
| 33 Hex (ErF) | | Data save er- ror in case of undervoltage | (1) During data save at power interruptions, the control power supply dropped suddenly as a result of rapid discharge of the Main Circuit DC Voltage, etc. | Check the power drop time at Main Circuit DC Voltage at power interruption.<br>→ Eliminate the cause of rapid discharge of the Main Circuit DC Voltage, etc. After performing a reset to cancel the alarm, return the frequency reference and PID command to their original settings, and restart operation. |
| | | | (2) Strong noise received from surrounds during data saving at power interruption. | Check methods for measures against noise (grounding conditions, control/main circuit wiring and installation).<br>→ Implement measures against noise. After performing a reset to cancel the alarm, return the frequency reference and PID command to their original settings, and restart operation. |
| | | | (3) Error occurred in control circuit | Check that error occurs every time at power on.<br>→ Replace the inverter. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 36 Hex (ErH) | | Hardware error | (1) Error in combination of control PCB and power PCB | Replace the inverter. |
| 38 Hex (Ero) | | Position control error | (1) Position control system insufficient gain (servo lock) | Readjust Servo Lock Gain (J097) and Speed Control 1 P Proportional Gain (d003). |
| FE Hex (Err) | | Mock alarm | (1) Object H045 (Mock alarm) set to 1. | → Perform a reset. |
| 44 Hex (ErU) | | Tool disconnection diagnosis | (1) A disconnection occurred on the tool during a test run. | Check if the USB cable or a connector is disconnected.<br>→ Perform a reset. |
| | | | (2) A disconnection occurred on the tool during forced status changing of multi-function output. | |
| 0B Hex (Lin) | | Input phase loss | (1) Main power supply input terminal wiring disconnected | Measure the input voltage.<br>→ Repair or replace the main power supply input wiring or input equipment (molded case circuit breaker, magnetic contactor, etc.) |
| | | | (2) Loose main power supply input terminal connection | Check if main power supply input terminal screws are loose.<br>→ Tighten to the recommended tightening torque. |
| | | | (3) High phase imbalance in three-phase power supply | Measure the input voltage.<br>→ Install an AC reactor (ACR) to reduce the phase imbalance.<br>→ Increase the inverter capacity. |
| | | | (4) Frequent excessive load | Measure the ripple waveform of the Main Circuit DC Voltage.<br>→ If a ripple in the Main Circuit DC Voltage is high, increase the inverter capacity. |
| | | | (5) Three-phase power supply connected to a product with three-phase power supply specifications | Recheck the inverter model.<br>→ Reselect an inverter matching the power supply specifications. |
| FD Hex (LoK) | | Password cancellation error | (1) User password 1 or 2 entered incorrectly more than a specified number of times | Cancel the alarm.<br>→ Turn OFF the inverter power supply, then turn ON the power supply again. Or 20 minutes elapse after the occurrence of the error.<br>If you have forgotten the password.<br>→ Set Data Initialization (H003) to 1 and execute parameter initialization. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 0A Hex (LU) | 1 | Undervoltage | (1) Momentary power failure occurred | → Cancel the alarm.<br>→ To restart without an alarm, set the Power Interruption Restart Mode Selection (F014) data to 3, 4, or 5 depending on the type of load. |
| | 3 | | | |
| | 2 | | (2) Short interval when cycling power (if F014 = 1) | → Increase the interval for turning the power supply OFF then back ON. |
| | 0 | | (3) The power supply voltage has not reached the inverter specification range (three-phase 200 V: 180 VDC/three-phase 400 V: 360 VDC/single-phase 200 V: 160 VDC) | Measure the input voltage.<br>→ Increase the power supply voltage to within the specified range. |
| | | | (4) Equipment damage or miswiring in power supply circuit | Measure the input voltage and identify the damaged equipment or miswiring.<br>→ Replace damaged equipment, or repair miswiring. |
| | | | (5) A large starting current flows to a different load connected to the same power supply, and the power supply voltage temporarily drops | Measure the input voltage, and check for voltage fluctuations.<br>→ Review the power supply system. |
| | | | (6) Insufficient capacity in the power supply transformer resulting in drop in power supply voltage due to inverter inrush current. | Check that an alarm occurs when the molded case circuit breaker, ground leakage circuit breaker (with overcurrent protection function), and magnetic contactor are on.<br>→ Review the power supply transformer capacity. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 1 Hex (during acceleration) (0C1)<br>2 Hex (during deceleration) (0C2)<br>3 Hex (during constant speed operation) (0C3)<br>(0Cn) | | Instantaneous overcurrent | (1) Short in inverter output | Remove wiring from the inverter output terminal (U, V, W), and measure the resistance between motor wiring phases. Check for phases with very low resistance.<br>→ Remove the shorted section (including replacement of wiring, relay terminals, and motors)<br>If an overcurrent is displayed when run with wiring removed from the inverter output terminal (U, V, W).<br>→ This indicates an inverter fault possibility. Replace the inverter. |
| | | | (2) Inverter output terminal has a ground fault | Remove wiring from the inverter output terminal (U, V, W), and perform a megger test.<br>→ Remove ground faults (including replacement of wiring, relay terminals, and motors).<br>If an overcurrent is displayed when run with wiring removed from the inverter output terminal (U, V, W).<br>→ This indicates an inverter fault possibility. Replace the inverter. |
| | | | (3) High load | Measure current going in to the motor, establish current trends, and determine if this is larger than the load calculation values designed in to the system.<br>→ If overload, either decrease the load or increase the inverter capacity. |
| | | | | Check current trends, and check if there are rapid changes in current.<br>→ If the current changes rapidly, either decrease the load or increase the inverter capacity.<br>→ Enable instantaneous overcurrent limiting (H012 = 1). |
| | | | (4) Large torque boost (If manual torque boost (F037* = 0, 1, 3, 4)) | Check if the current drops when 1st Manual Torque Boost Voltage (F009*) is lowered, or if there is a stall.<br>→ If it is determined that there is no stall, lower F009*. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 1 Hex (during acceleration) (0C1)<br>2 Hex (during deceleration) (0C2)<br>3 Hex (during constant speed operation) (0C3)<br>(0Cn) | | Instantaneous overcurrent | (5) Short acceleration/deceleration time | Recalculate torque required from the moment of inertia of the load and acceleration/deceleration time, and determine if appropriate.<br>→ Lengthen the acceleration/deceleration time (F007, F008, E010, E015, H056).<br>→ Enable 1st Overload Protect Function Selection (F043 and torque limit (F040, F041, E016, E017).<br>→ Increase the inverter capacity. |
| | | | (6) Internal braking transistor short detection has operated | Check that the braking resistor connection terminal (P+, DB) is not shorted.<br>Check if the connected braking resistor resistance value is very low.<br>→ Connect the appropriate braking resistor. |
| | | | (7) Malfunction because of noise | Check methods for measures against noise (grounding conditions, control/main circuit wiring and installation).<br>→ Implement measures against noise. For details, refer to *2-3-4 Wiring for Main Circuit Terminals* on page 2-15.<br>→ Enable the retry function (H004).<br>→ Connect a surge absorber to coils, solenoids, etc. in magnetic contactors that are the cause of noise. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 11 Hex (0H1) | | Cooling fin overheating | (1) The ambient temperature exceeds the inverter specification range | Measure the ambient temperature.<br>→ Reduce the ambient temperature such as by improving the air flow to the panel. |
| | | | (2) The airflow path is blocked | Check that there is sufficient installation space.<br>→ Re-install at a site where sufficient installation space can be ensured.<br>Check for fin clogging.<br>→ Clean. |
| | | | (3) Reduced fan airflow because of the cooling fan service life or of damage | Check Cumulative Run Time of Cooling Fan (H043).<br>→ Replace the cooling fan.<br>Visually check that the cooling fan is operating correctly.<br>→ Replace the cooling fan. |
| | | | (4) High load | Measure the output current.<br>→ Set 28: OHF (Cooling fan overheat warning) to Output Terminal [DO1] Function Selection (E020) and Output Terminal [ROA, ROB] Function Selection (E027) whose load is to be reduced. Alternatively, reduce the load before an overload occurs using the Overload early warning 2 Level (OL2) (E034).<br>→ Reduce Carrier Frequency (F026).<br>→ Enable Overload Prevention Control (H070) |
| 12 Hex (0H2) | | External trip | (1) External equipment alarm function is operating | Inspect the operation of the external equipment.<br>→ Remove the cause of the alarm caused in the external equipment. |
| | | | (2) Miswiring or bad connection in external trip wiring | Check that wiring is correctly connected to the terminal for which “9: External trip (EXT)” is selected from E001 to E005, E098, E099.<br>→ Connect the external alarm wiring correctly. |
| | | | (3) Error in parameter settings | Check if “9: External trip (EXT)” is selected for an unused terminal from E001 to E005, E098, E099.<br>→ Change assignment. |
| | | | | Check that the “EXT” logic set in E001 to E005, E098, E099 and the external signal logic (positive/negative) match.<br>→ Set the logic correctly. |
| 13 Hex (0H3) | 0000 Hex | Inverter internaloverheating | (1) The ambient temperature exceeds the inverter specification range | Measure the ambient temperature.<br>→ Reduce the inverter ambient temperature such as by improving the air flow to the panel. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 14 Hex (0H4) | | Motor protection (PTC thermistor) | (1) The motor ambient temperature exceeds the specification range | Measure the ambient temperature.<br>→ Reduce the ambient temperature. |
| | | | (2) Motor cooling system damaged | Check that the motor cooling system is operating correctly.<br>→ Replace or repair the motor cooling system. |
| | | | (3) High load | Measure the output current.<br>→ Reduce the load (use the Overload early warning 2 Level (OL2) (E034), and reduce the load before an overload occurs.) (During winter, the load may increase.)<br>→ Reduce the ambient temperature.<br>→ Increase Carrier Frequency (F026). |
| | | | (4) Incorrect PTC thermistor operating level (H027*) | Check the PTC thermistor specifications, and recalculate the detection voltage.<br>→ Change the parameter data. |
| | | | (5) 1st Manual Torque Boost Voltage (F009*) too high | Check the F009* data, and readjust so that this does not stall even if data is lowered.<br>→ Adjust F009*. |
| | | | (6) Error in V/f settings | Check that 1st Base Frequency (F004*) and 1st Rated Voltage at Base Frequency (F005*) match the rated nameplate value.<br>→ Match these to the rated nameplate value. |
| | | | (7) Error in parameter settings | While not using PTC thermistor, the Thermistor Function Selection (MOH) (H026*) is in an operation state.<br>→ Change Thermistor Function Selection (MOH) (H026*) to 0 (Disable). |
| 46 Hex (0H6) | | Inrush current prevention resistor overheat | (1) The inverter power supply has been turned OFF and then ON frequently. | Reduce the frequency at which the power supply is turned OFF and then ON.<br>→ Turn OFF and then ON less than once every 30 minutes. |
| | | | (2) The inverter power supply has not been turned OFF and then ON frequently. | An error is generated each time the power supply is turned OFF and then ON.<br>→ The inrush current protection circuit is damaged. Request repair. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 17 Hex (OL1)<br>18 Hex (OL2)<br>(0Ln) | | Motor overload 1<br>Motor overload 2 | (1) The thermal characteristics of the electronics and the motor overload characteristics do not match | Check motor characteristics.<br>→ Review object (F010*, F012*) data.<br>→ Use an external thermal relay. |
| | | | (2) Inappropriate electronics thermal operating level | Recheck motor allowable continuous current.<br>→ Reconsider and change object (F011*) data. |
| | | | (3) Short acceleration/deceleration time | Recalculate acceleration/deceleration torque and acceleration/deceleration time required from the moment of inertia of the load and acceleration/deceleration time.<br>→ Lengthen the acceleration/deceleration time (F007, F008, E010, E015, H056). |
| | | | (4) High load | Measure the output current.<br>→ Reduce the load (use the Overload early warning 2 Level (OL2) (E034), and reduce the load before an overload occurs.) (During winter, the load may increase.) |
| | | | (5) 1st Manual Torque Boost Voltage (F009*) too high | Check the F009* data, and readjust so that this does not stall even if data is lowered.<br>→ Adjust F009*. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 19 Hex (0LU) | | Inverter overload | (1) The ambient temperature exceeds the inverter specification range | Measure the ambient temperature.<br>→ Reduce the ambient temperature such as by improving the air flow to the panel. |
| | | | (2) 1st Manual Torque Boost Voltage (F009*) too high | Check 1st Manual Torque Boost Voltage (F009*) and readjust so that this does not stall even if data is lowered.<br>→ Adjust F009*. |
| | | | (3) Short acceleration/deceleration time | Recalculate acceleration/deceleration torque and acceleration/deceleration time required from the moment of inertia of the load and acceleration/deceleration time.<br>→ Lengthen the acceleration/deceleration time (F007, F008, E010, E015, H056). |
| | | | (4) High load | Measure the output current.<br>→ Reduce the load (use the Overload early warning 2 Level (OL2) (E034), and reduce the load before an overload occurs.) (During winter, the load may increase.)<br>→ Decrease Carrier Frequency (F026).<br>→ Enable Overload Prevention Control (H070). |
| | | | (5) The airflow path is blocked | Check that there is sufficient installation space.<br>→ Ensure sufficient installation space. |
| | | | | Check for fin clogging.<br>→ Clean. |
| | | | (6) Reduced fan airflow because of the cooling fan service life or of damage | Check the cumulative run time of the cooling fan. (Refer to *8-8-13 Cooling Fan Life Warning Signal (WAF)* on page 8-92.)<br>→ Replace the cooling fan. |
| | | | | Visually check that the cooling fan is operating correctly.<br>→ Replace the cooling fan. |
| | | | (7) Long output wiring, with high leakage current | Measure the leakage current<br>→ Insert an output circuit filter (OFL). |
| E2 Hex (0PL) | | Output phase loss detection | (1) Disconnected invert output wiring | Measure the output current.<br>→ Replace the output wiring. |
| | | | (2) Motor windings broken | Measure the output current.<br>→ Replace the motor. |
| | | | (3) Loose inverter output terminal connection | Check if inverter output terminal screws are loose.<br>→ Tighten to the recommended tightening torque. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 1B Hex (0S) | | Excessive speed protection | (1) Error in parameter settings | Check 1st Motor Pole Number (P001*) settings.<br>→ Set P001* to match the motor used. |
| | | | | Check 1st Maximum Output Frequency (F003*) settings.<br>→ Set F003* to match the output frequency. |
| | | | | Check Speed Limit 1 in Forward (d032) and Speed Limit 2 in Reverse (d033) settings.<br>→ Disable Speed Limit 1 in Forward (d032) and Speed Limit 2 in Reverse (d033). |
| | | | | Check Over Speed Detection Level (d035) settings.<br>→ Set Over Speed Detection Level (d035) to 120%. |
| | | | (2) Insufficient speed regulator gain | Check that the speed does not overshoot during high-speed running.<br>→ Increase Speed Control 1 P Proportional Gain (d003*).<br>(In some cases, a review of filters and integral time will be necessary.) |
| | | | (3) Noise superimposed on the PG signal | Check the PG signal input monitor, and check measures against noise (grounding conditions, signal wiring/main circuit wiring and installation methods, etc.).<br>→ Implement measures against noise. |
| | | | (4) Output frequency and motor rotation speed exceeded 599 Hz | If using at near 590 Hz, check that the acceleration time is not short, there is no load variation, and that the speed regulator Speed Control 1 P Proportional Gain (d003*) and Speed Control 1 I Integral Time (d004*) are appropriate.<br>→ Decrease the run frequency. |
| 6 Hex (during acceleration) (0U1)<br>7 Hex (during deceleration) (0U2)<br>8 Hex (during constant speed operation) (0U3)<br>(0Un) | | Overvoltage | (1) The power supply voltage exceeds the inverter specification range (three-phase 200 V and single-phase 200 V: 420 VDC/three-phase 400 V: 840 VDC) | Measure the input voltage.<br>→ Decrease the power supply voltage to within the specified range.<br>→ If the power supply voltage is within the specification range, this indicates an inverter fault. Replace the inverter. |
| | | | (2) Surge in the input power supply | When a phase advance capacitor is turned ON/OFF or a thyristor converter operates on the same power supply system, a transient abnormal surge may occur in input voltage.<br>→ Set a DC reactor. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 6 Hex (during acceleration) (0U1)<br>7 Hex (during deceleration) (0U2)<br>8 Hex (during constant speed operation) (0U3)<br>(0Un) | | Overvoltage | (3) Short deceleration time for the moment of inertial of the load. | Recalculate the deceleration torque from the moment of inertia of the load and the deceleration time.<br>→ Lengthen the deceleration time (F008, E011, E013, E015, H056).<br>→ Enable Anti-regenerative Control Function Selection (H069) or Over-Excitation Control Selection during Deceleration Function Selection (H071).<br>→ Enable torque limit (F040, F041, E016, E017).<br>→ Set 1st Rated Voltage at Base Frequency (F005*) to 0, and increase braking performance.<br>→ Consider use of braking resistor. |
| | | | (4) Short acceleration time | Check if an overvoltage alarm occurs at the end of sudden acceleration.<br>→ Lengthen the acceleration time (F007, E010, E012, E014).<br>→ Use Acceleration/Deceleration Pattern Selection (H007).<br>→ Consider use of braking resistor. |
| | | | (5) High braking load | Compare load braking torque and inverter braking torque.<br>→ Set 1st Rated Voltage at Base Frequency (F005*) to 0, and increase braking performance.<br>→ Consider use of braking resistor. |
| | | | (6) Output has a Ground fault | If it operates correctly when run with wiring removed from the inverter output terminal (U, V, W).<br>→ Check that the output wiring or the motor do not have a ground fault.<br>If an overvoltage is displayed when run with wiring removed from the inverter output terminal (U, V, W).<br>→ This indicates an inverter fault possibility. Replace the inverter. |
| | | | (7) Malfunction because of noise | Check that the Main Circuit DC Voltage at the time of overvoltage is at or below the overvoltage level.<br>→ Implement measures against noise.<br>→ Enable Retry Count at Trip (H004).<br>→ Connect a surge absorber to coils, solenoids, etc. in magnetic contactors that are the cause of noise. |
| 10 Hex (PbF) | | Charging circuit malfunction (1.5 kW min.) | (1) The charging circuit is damaged | Repair of the inverter is required.<br>→ Replace the inverter. |

| Alarm code | Alarm subcode | Name | Description | Check point and remedy reference |
|---|---|---|---|---|
| 1C Hex (PG) | | PG disconnection | (1) Break in wiring between pulse generator and option | Check that the pulse generator is correctly connected, and that there is no break in wiring.<br>→ Check that the pulse generator is correctly connected, or tighten screws.<br>→ Check that the connecting sections are not caught.<br>→ Replace with wiring that is not broken. |
| | | | (2) Strong noise received from surrounds | Check measures against noise (grounding conditions, signal wiring and communication cable/main circuit wiring and installation methods, etc.).<br>→ Implement measures against noise.<br>→ Separate main circuit wiring and control circuit wiring as much as possible. |
| 34 Hex (d0) | | Excessive positioningdeviation | (1) Encoder disconnection | Check that there are no breaks in encoder wiring. |
| | | | (2) Mismatch between the encoder rotation direction (wiring phase sequence) and motor rotation direction (inverter output phase sequence) | Connect so that all directions match, and review settings.<br>Review d014 to d017 settings values. |
| | | | (3) Deviation over settings values are too low | Review d223, d224 settings values.<br>If settings values are low, increase these. |
| | | | (4) Position control gain is too low | Review d203, d204 settings values.<br>If settings values are low, increase these. |
| | | | (5) Speed control gain is too low. | Review d003 (A045, b045, r045) settings values.<br>If settings values are low, increase these. |
| | | | (6) Torque is limited | If a torque limit is operating, then position control and speed control will not operate correctly.<br>Take the following measures so that the torque limit is not applied.<br>• Reduce load<br>• Review acceleration/deceleration time<br>• To reduce load, review the speed reduction ratio, motor capacity, and other equipment configuration. |
| 6FHex to 73Hex, 79Hex to 7DHex (---) | | DriveAppp Custom Warnings/ Alarms | --- | DriveApp custom warnings/alarms. They are specified and described in the particular DriveApp application documentation |

Parameters marked with * are for 1st control only. When using 2nd control, refer to *2nd Control Switch Function (SET)* on page 6-45 and replace these values.

## 9-1-3 Minor Fault Code List

**Minor Fault Code List**

| Alarm code | Alarm subcode | Name | Description | | Check point and remedy reference |
|---|---|---|---|---|---|
| 6D Hex (CnT) | 0000 Hex | Equipment servicel i f e (number of startups) | (1) Equipment service life (number of start-ups) | - | Displayed when the motor number of startups reaches the number set in 1st Preset Startup Count for Motor Maintenance (H079). Additionally, the current number of start-ups can be confirmed in 1st Startup Count for Motor (H044), therefore before reset, set H044 data to 0000. |
| 82 Hex (EnF) | | STO (SF) Terminals OFF | (1) Minor Fault signaling the operation of the STO safety terminals. | - | When both SF1 and SF2 terminals are in the OFF state, an alarm or warning will occur depending on the setting of E190. Set E190=0 to disable this alarms |
| 67 Hex (LiF) | 0000 Hex | Life prediction | (1) Life prediction | - | Any one of the main circuit capacitor used in the inverter, the electrolytic capacitor inside the inverter, and the cooling fan has reached the end of its life. Referring to *8-8-10 Capacitor Life Warning Signal (WAC)* on page 8-89, *8-8-13 Cooling Fan Life Warning Signal (WAF)* on page 8-92 and *8-8-14 Life Alarm (LIFE)* on page 8-93, check the status of consumable parts. |
| 66 Hex (0H) | 0000 Hex | Cooling fin overheat prediction | (1) Cooling fin overheat prediction | - | This message is displayed as an early warning before the cooling fin overheats (alarm code: 11). For corrective actions and additional details, see ( page 9-18) |
| 65 Hex (0L) | 0000 Hex | Motor overload prediction | (1) Motor overload prediction | - | Displayed as a prediction prior to a motor overload alarm (alarm code: 17, 18) occurring, and sets the current value at which the Overload early warning 2 Level (OL2) (3005Hex-23Hex) operates. Check that the actual current flowing in the motor is not higher than the value set in 3005Hex-23Hex. |
| 69 Hex (Pid) | 0000 Hex | PID warning output | (1) PID warning output | - | Displayed when a warning (warning from absolute value, warning from PID error) is output during PID operation. For details, refer to *Excessive PID deviation (OD)* on page 8-122. |
| 68 Hex (rEF) | 0000 Hex | Command loss | (1) Command loss | - | When the analog frequency settings (terminal AI1) command suddenly decreases to 10% or less, it is judged to be a wire break and a reference loss alarm (alarm code: 68) is displayed. Check the wiring. |

| Alarm code | Alarm subcode | Name | Description | | Check point and remedy reference |
|---|---|---|---|---|---|
| 6B Hex (rTE) | 0000 Hex | Equipment service life (cumulative operation time of motor) | (1) Equipment service life (cumulative operation time of motor) | - | Displayed when the cumulative operation time of motor reaches the time set in object 3008Hex-4FHex (Maintenance interval). Cumulative motor run time can be checked in 3008Hex-5FHex* (Cumulative operation time of motor). This can also be reset by setting the 3008Hex-5FHex* value to 0. |
| FD Hex (LoK) | 0000 Hex | Password cancellation error | (1) User password 1 or 2 entered incorrectly 5 times. | - | Cancel the alarm.<br>→ Turn OFF the inverter power supply, then turn ON the power supply again. Or 20 minutes elapse. |

## 9-1-4 Errors on a Communications Line

There are seven EtherNet LED lit states as follows.

| Abbreviation | Name/State |
|---|---|
| On | ON |
| Off | OFF |
| F | Flashes by flickering ON and OFF at 50 ms intervals. |
| B | Flashes by blinking ON and OFF at 200 ms intervals. |
| SF | Flashes as a single flash ON for 200 ms and OFF for 1,000 ms. |
| D | Flashes as a double flash ON for 200 ms, OFF for 200 ms, ON for 200 ms and OFF for 1,000 ms. |
| - | Unknown |

| EtherNet RUN | EtherNet ERR | L/A IN L/A OUT | Description | | Remarks |
|---|---|---|---|---|---|
| On | Off | F | EtherNet communications in progress | EtherNetcommunications is currently being executed. | A normal state if either or both of process data communications or message communications is currently being executed. |
| - | - | On | Physical layer link established | Operation wait state after the physical layer link is established. | There was a state transition instruction from the host system during operation, and the state transitioned to a state other than Operational. Check that the Master Unit is correctly operating.<br>Refer to the manual for the Master Unit. |

| EtherNet RUN | EtherNet ERR | L/A IN L/A OUT | Description | | Remarks |
|---|---|---|---|---|---|
| - | - | Off | Physical layer link not established | The physical layer link is not established (the Master Unit is not participating in the network). | • Check that communication cables are correctly connected to connectors.<br>• Check that the wiring of commu- nication cables is correct.<br>• Check that the Master Unit is correctly operating. If using an OMRON Master Unit, check the Master Unit mode and the node address-setting ID switches of the inverter.<br>• If the Master Unit is made by another manufacturer, refer to the instruction manual for that product.<br>• When there are devices in the surrounding area that generate noise, adopt measures against noise for the Master Unit, inverter and communication cables. |
| Off | Off | Off | Power supply abnormality | Power is not being supplied normally to the inverter. | • Check that the inverter power supply is being supplied normally (for example, the main power supply of the inverter is wired correctly, the power supply voltage has not dropped, and inverter operation is normal).<br>• Remove the cause of the abnormality and turn the inverter power supply OFF then back ON again. |
| Off | On | - | Inverter abnormality | A hardware alarm has occurred. | • A slave initialization error occurred in the master.<br>• Replace the inverter. |
| | F | | Communication Unit hardware error | A hardware alarm has occurred. | Replace the inverter. |
| | B | | | | |
| - | B | - | Sync Manager setting error | The Sync Manager settings are in error. | Correct the set values. |
| - | D | - | Process data communications timeout | An error occurred in PDO communication. | After checking the following items, turn OFF the inverter power supply and then restart the inverter.<br>• Is cable length appropriate (max. 100 m)?<br>• Is the cable disconnected or loose?<br>• Is there a lot of noise? |

| EtherNet RUN | EtherNet ERR | L/A IN L/A OUT | Description | | Remarks |
|---|---|---|---|---|---|
| SF | - | - | Safe operational state | There was a transition instruction to the safe operational state from the master. | When this occurs during system operation, check the status of the host master. |
| B | - | - | Pre-operational state | There was a transition instruction to the pre-operational state from the master. | |
| Off | - | - | Initialization state | There was a transition instruction to the initialization state from the master. | |

# 9-2 Troubleshooting

If you feel that the inverter operation is strange or that the inverter does not operate as intended, use the following information as a reference, even if the inverter displays no alarm indication.
If the inverter trips with an alarm indication, refer to *9-1 Alarm Display and Remedies* on page 9-2.

| Symptom | Possible cause | Remedy | Reference page |
|---|---|---|---|
| The power supply is not turned on. (The POWER LED on the inverter is not lit.) | The short-circuit bar between the terminal +1 and P/+2 is removed, or no DC reactor is connected. | Install the short-circuit bar, or connect a DC reactor. | page 2-10 page 2-53 |
| | Input wiring is disconnected. | Check the input wiring. | |

| Symptom | Possible cause | Remedy | Reference page |
|---|---|---|---|
| The RUN command is input, but the motor does not rotate. | 1st RUN Command Selection (F002) is incorrect. | Set 1st RUN Command Selection (F002) correctly. | page 6-22 |
| | 1st Frequency Reference Selection (F001) is incorrect. | Set 1st Frequency Reference Selection (F001) correctly according to the frequency reference input method, and specify the frequency. | |
| | There frequency is set to 0 Hz. | When the 1st Frequency Reference Selection (F001) is set to “1: Analog voltage input,” input the analog voltage corresponding to the frequency to the terminal AI1. | page 6-24 |
| | | Input the frequency according to the 1st Frequency Reference Selection (F001). (The input frequency will be displayed in the frequency reference monitor (monitor mode: 3_02).) | |
| | | For the multi-step speed operation, set the frequency to the multi-step speed reference 0 to 15 (C005 to C019). | page 6-50 |
| | No multifunction input terminal is allocated for the RUN command. | To input the RUN command via a multi-function input terminal, set the used terminal to “98: FW (forward rotation)” or “99: RV (reverse rotation).” To input the RUN command via the 3-wire input function, set them to “98: FW,” “6: STP” and “97: F/R.” | page 6-48 page 6-49 |
| | Multi-step speed settings “0: CF1” to “03: CF4” are set to the multifunction input terminal, and these are ON. | Disable the multi-step speed setting. (When this setting is enabled, multi-step speed operation is performed, so the motor does not rotate if the frequency values in the Multi-step Frequency Reference 1 to 15 (C015 to C019) are 0 (default)). | page 6-50 |
| | Both the forward and reverse input terminals are ON. | To input the RUN command via the forward/reverse input terminal, turn ON either of them. | page 6-48 |
| | The Reverse Rotation Prevention Function (H008) is set to limit the forward or reverse rotation. | Set Reverse Rotation Prevention Function (H008) correctly. | page 8-108 |
| | The input terminal wiring or short-circuit bar connection for the RUN command is incorrect. | Wire correctly. (The multi-function input terminal status can be checked in the Input Terminal Monitor (W040)/Output Signal Monitor (W041).) | page 2-10 page 2-12 page 2-59 |
| | The analog input or variable resistor wiring for the frequency reference is incorrect. | Wire correctly.<br>• For the analog voltage or variable resistor input, measure the voltage between the terminals AI1 to AIC with a tester, etc. to check that the voltage is correct. | page 2-10 page 8-33 |

| Symptom | Possible cause | Remedy | Reference page |
|---|---|---|---|
| The RUN command is input, but the motor does not rotate. | Although the inverter is operated via the digital operator, the multifunction input terminal is set to “162: F-TM (Forced terminal block)” and that terminal is ON. | Turn OFF the terminal to which the function is allocated. | page 8-62 |
| | An inverter trip occurred. (The ERR LED lights and the alarm code is displayed) | Perform a reset to cancel the trip, after determining the cause and taking countermeasures based on the alarm code, restart the inverter. | page 6-42 page 9-2 |
| | When the safety function selector switch (SW9) is OFF, either the multifunction input terminal SF1 or SF2 is OFF. | To use the safety function, turn ON both of the safety input terminals SF1 and SF2. To disable this function, set the safety function selector switch to ON. | page 8-61 |
| | The multifunction input terminal is set to “8: RS (Reset),” “15: CS (Commercial switching),” “16: SW60 (Commercial switching)” or “7: FRS (Free-run stop),” and that terminal is ON. | Turn OFF the terminal to which the function is allocated. | page 8-52 page 6-42 page 8-129 |
| | The multifunction input terminal is set to “38: ROK: (Permission of run command)” and that terminal is ON. | Turn ON the terminal to which the function is allocated. | page 8-108 |
| | The wiring from the inverter to the motor, or the internal wiring of the motor, is disconnected. | Check the input wiring. | page 2-10 page 2-56 |
| | The load is too heavy. | Reduce the load. | - |
| | The motor brake is applied. | Release the brake. | - |
| | There is a contact failure for the analog input or variable resistor. | Check the input wiring.<br>• For the analog voltage or variable resistor input, measure the voltage between the terminals AI1 to AIC with a tester, etc. to check that the voltage is correct. | page 2-10 page 8-33 |
| | The overload limit or overcurrent suppression function is active. | Disable the function, or increase the level at which the function is activated. | page 8-76 page 8-80 |
| | The 1st Maximum Output Frequency (F003) and 1st Frequency Upper Limit (F015)/2nd Frequency Upper Limit (E117) are set too low. | Change the set value. | page 6-17 page 6-27 |
| | The acceleration time is too long. | Decrease the acceleration time (F007/E010/E012/E014). | page 6-33 |
| The RUN command is input, but the motor does not rotate. | The multifunction input terminal is set to “10: J0G: (Jogging)” and that terminal is ON. | Turn OFF the terminal to which the function is allocated. | page 6-52 |

| Symptom | Possible cause | Remedy | Reference page |
|---|---|---|---|
| The motor rotation speed does not increase. | Multi-step speed settings “0: CF1” to “3: CF4” are set to the multifunction input terminal, and these are ON. | Disable the multi-step speed setting. (When this setting is enabled, multi-step speed operation is performed, so the motor runs according to the frequency set in the Multi-step Frequency Reference 1 to 15 (C005 to C019).) | page 6-50 |
| | The load is too heavy. | Reduce the load. | - |
| | The motor brake is applied. | Release the brake. | - |
| The parameter settings cannot be changed. | The inverter is in operation. | Stop the inverter. Then, set the parameters again after the motor stops with deceleration. Some parameters can be switched even when the inverter is operating. | - |
| The motor rotates in reverse. | The phase sequence of wiring to the motor is incorrect. (The motor is not designed to rotate forward in the phase sequence: U/T1, V/T2, W/T3.) | Reverse the order of two wires connected to U/T1, V/T2, W/T3, or change the phase sequence to match that of the motor. | page 2-11 |
| | The 3-wire input function is enabled, but the forward/reverse logic is incorrect. | Check the logic of the “97: F/R (3-wire forward/reverse)” allocated to a multifunction input terminal. | page 6-49 |
| The inverter trips with an overcurrent protection during operation. | The acceleration time is set too short. | Increase the acceleration time (F007/E010/E012/E014). | page 6-33 page 6-37 |
| | | Use the acceleration/deceleration stop function to change the operation pattern to stop accelerating temporarily. | page 6-35 |
| | The load is too heavy. | Reduce the load. | - |
| | | Use the torque boost function to adjust the torque. | page 6-63 |
| | | With 1st Drive Control Selection (F042)/2nd Drive Control Selection (A014) set to “0: IM V/f control,” set “Free V/f voltage (E167/E169/E171/E173/E175/E177/E179)” or “5: IM Vector control without speed sensor” and “15: PM Vector control without speed and pole position sensor” and perform tuning. | page 6-8 page 7-15 |
| | 1st Overload Protect Function Selection (F043)/2nd Overload Protect Function Selection (E146) is set to “0: Disable.” | Enable 1st Overload Protect Function Selection (F043)/2nd Overload Protect Function Selection (E146). | page 8-76 |
| | If an overcurrent trip occurs during operation although the overload limit function is enabled: | | |
| | 1st Overload Protect Level (F044)/2nd Overload Protect Level (E147) is too high. | Decrease 1st Overload Protect Level (F044)/2nd Overload Protect Level (E147). | page 8-79 |

| Symptom | Possible cause | Remedy | Reference page |
|---|---|---|---|
| The motor or machine causes a loud noise. | The carrier frequency is too low. | Increase Carrier Frequency (F026). However, this may increase noise or leakage current from the inverter. In addition, the output current must be derated depending on the model. For details, refer to *A-7 Derating Table* on page A-276. | page 8-103 page A-276 |
| | The frequency of the motor in rotation resonates with the machine's natural frequency. | Change the frequency setting. If resonance occurs during acceleration/deceleration, use the Jump Frequency (C001 to C004) to avoid the resonance frequency. | page 8-107 |
| | The motor is overexcited. | Set 1st Base Frequency (F004)/2nd Base Frequency (A002), 1st Rated Voltage at Maximum Output Frequency (F006)/2nd Rated Voltage at Maximum Output Frequency (A004) according to the motor ratings. If this does not improve the condition, slightly lower the 1st Rated Voltage at Base Frequency (F005)/2nd Rated Voltage at Base Frequency (A003) value. Or set 1st Drive Control Selection (F042)/2nd Drive Control Selection (A014) to “0: V/f control (No slip compensation),” or, if using “V/f control with speed sensor,” use Non-linear V/f Frequency 1 (E166)/Non-linear V/f Voltage 7 (E179) and perform tuning. | page 6-8 page 6-17 |
| The inverter trips with an overcurrent protection (alarm code: 19). | The thermistor trip is not set appropriately. | Disable Thermistor Function Selection (MOH) (H026). Alternatively, adjust 1st Thermistor Error Detection Level (MOH) (H027). | page 8-81 |
| The inverter trips with an overvoltage protection (alarm code: 06, 07, 08) during deceleration. | The set deceleration time is too short. | Increase the deceleration time (F008/E011/E013/E015). | page 6-33 page 6-37 |
| | Anti-regenerative Control Function Selection (H069) is set to “0: Disable.” | Enable Anti-regenerative Control Function Selection (H069). However, when this function is enabled, the actual deceleration time may be longer than the set value. For details, refer to *8-8-2 Anti-regenerative Control Function* on page 8-79. | page 8-79 |
| | If an overvoltage trip occurs during deceleration although Anti-regenerative Control Function Selection (H069) is enabled: | | |
| | The Frequency Rising Limit for Torque Limit (H076) value is inappropriate. | Change the set values. For details, refer to *8-8-2 Anti-regenerative Control Function* on page 8-79. | page 8-79 |
| The inverter trips with a thermistor error (alarm code: 14). | 24-VDC voltage is input to the PTC terminal. | Remove 24-VDC voltage from the PTC terminal. | page 8-81 |

| Symptom | Possible cause | Remedy | Reference page |
|---|---|---|---|
| The output frequency is unstable. | The parameter settings are inappropriate. | Change the output frequency value slightly away from the power supply frequency. | page 6-24 |
| | | Change 1st Output Current Fluctuation Damping Gain (H080) and 2nd Output Current Fluctuation Damping Gain (A041). | page 8-133 |
| | The load changes significantly. | Increase the motor/inverter capacity. | - |
| | The power supply voltage fluctuates. | Take measure to reduce the fluctuation. | - |
| The torque is insufficient. | The parameter settings are inappropriate. (During acceleration/constant speed) | Increase 1st Manual Torque Boost Voltage (F009)/2nd Manual Torque Boost Voltage (A005). | page 6-63 |
| | | Set 1st Torque Boost Function Selection (E112) and 2nd Torque Boost Function Selection (E113) to “1: Automatic torque boost.” | page 6-63 |
| | | Decrease the Carrier Frequency (F026) value. | page 8-103 |
| | | Set 1st Drive Control Selection (F042)/2nd Drive Control Selection (A014) to “5: IM Vector control without speed sensor.” | page 7-15 |
| | The parameter settings are inappropriate. (During deceleration) | Increase the deceleration time (F008/E011/E013/E015). | page 6-33 |
| | | Set 1st AVR Function Selection (E122)/2nd AVR Function Selection (E123) to OFF. | page 8-111 |
| | | Use braking resistors or regenerative braking units. | - |
| Operating the inverter activates the earth leakage breaker. | The leakage current from the inverter is too large. | Decrease the Carrier Frequency (F026) value. | page 8-103 |
| | | Increase the sensitivity current of the earth leakage breaker. Or, replace the earth leakage breaker with one with a higher sensitivity current. | page 2-50 |
| The DC injection braking function does not work. | The DC injection braking power is not set. | Set 1st DC Injection Braking Level (F021)/2nd DC Injection Braking Level (A010). | page 8-55 |
| | The DC injection braking time is not set. | Set 1st DC Injection Braking Time (F022)/2nd DC Injection Braking Time (A011). | page 8-55 |
| The inverter trips with an undervoltage (alarm code: 0A). | The voltage dropped because the power supply capacity is insufficient. | Increase the power supply capacity. | - |
| Noise enters in the TV or radio located near the inverter. | The TV or radio is affected by the radiated noise from inverter. | Move the TV or radio as far away as possible from the inverter. | - |

| Symptom | Possible cause | Remedy | Reference page |
|---|---|---|---|
| An option error (alarm code: 23) occurred. | The inverter received an error detected in the option unit. | Refer to the manual for the option unit. | - |
| | Inverter fault: The option connector does not work normally. | The connector may be faulty if the problem persists even after taking a remedy on the option unit side. If the problem persists even after checking the option connector for loose fitting and dirt on the contacts, replace the inverter. | - |
| An option communications error (alarm code: 23) occurred. | The inverter stops communicating with the option unit after recognizing it. The option unit is not mounted securely. | Check the option connector for loose fitting and dirt on terminal contacts. Check that the terminal block cover of the inverter is fit securely on the inverter. | - |
| Sysmac Studio cannot make an online connection. | The USB cable is not connected correctly. | Fully insert the USB cable into both the PC and controller. | - |
| | Sysmac Studio “Communications Settings” > “Communications Method” is not set to “USB-Direct Connection.” | Set Sysmac Studio “Communications Settings” > “Communications Method” to “USB-Direct Connection.” | - |
| | The USB driver is not correctly installed. | Install the USB driver. For details of USB driver installation methods, refer to the appendix of *Sysmac Studio Version 1 Operation Manual (SBCA-470)*. | - |
| The brake control function causes an overload protection (alarm code: 19). | The inverter is in operation with the brake force. | Turn OFF the RUN command to the inverter in the brake force state. Even under DC injection braking, an overload protection alarm may occur. | page 7-77 |
| | With at or lower than the Brake Control Brake-release Frequency (J069) set frequency, the brake does not release. | Set the frequency to a value exceeding the Brake Control Brake-release Frequency (J069) value. | page 7-77 |
| Brake transistor error (alarm code: 3B) occurred. | The brake transistor is damaged. | Replace the inverter. | - |
| Brake error (alarm code: 24) occurred. | The output current does not reach the set brake release current value. | Increase Brake Control Brake-release Timer (J070) or decrease Brake Control Brake-release Current (J068). | page 7-77 |
| | The brake confirmation signal is not input. | • Correct the wiring for the brake confirmation signal (57: BRK). If not used, deallocate the brake confirmation function from the multi-function input setting.<br>• Review the operation sequence so that the brake confirmation signal (57: BRK) is input after the brake is released.<br>• Replace the brake if it is faulty. | page 7-77 |
| | Brake confirmation signal is not input within the time set in Brake Error Detection Time (H180). | Adjust Brake Error Detection Time (H180). | page 7-77 |

| Symptom | Possible cause | Remedy | Reference page |
|---|---|---|---|
| The brake control function causes the load to fall. | The set brake release current is insufficient. | Increase the Brake Control Brake-release Current (J068) value. | page 7-77 |
| | The frequency setting for releasing/forcing the brake is too low. | Increase the Brake Control Brake-release Frequency (J069), Brake Force Frequency (J071), or Brake Control Brake-applied Frequency (J071) values. | page 7-77 |
| The PM motor rotates during startup. | The magnetic pole position of the motor during startup is incorrect. | Set 1st PM Motor Starting Method (P030) to “1: IPM (Embedded magnet motor method 1),” and reduce initial rotation at startup. If 0 or 3 is used in P030, reduce 1st PM Motor Reference Current at Starting (P074) to make reverse rotation more difficult. | page 7-22 |
| | The PM motor stalls. | Increase the 1st PM Motor Reference Current at Starting (P074) value. Or perform adjustments according to *7-4-4 Adjustment of PM Motor Mode Settings* on page 7-22. | page 7-22 |
| | The load is too heavy. | Reduce the load. Or, increase the acceleration/deceleration time. | - |
| The parameter settings cannot be changed (changed from link function) | (1) Attempted to change a parameter that cannot be changed during operation | • Stop operation and then change the parameter. | - |
| | (2) Object F002 data cannot be changed | • Turn both terminal signals “FW” and “RV” OFF. | page 6-48 |
| St display | (1) SF1 and SF2 terminals are OFF | • Turn SF1 and SF2 ON. | page 8-61 |
| | | • When FW/RV signals are ON, turn the FW/RV signals OFF. | page 6-48 |
| The EtherNet RUN LED and ERR LED both are out | • Power is not being supplied normally to the inverter. | • Check that the inverter power supply is wired correctly. Remove the cause of the power supply disconnection and turn the inverter power supply OFF then back ON again. | page 2-10 page 2-49 |
| EtherNet ERR LED is lit red | Fatal error such as a watchdog timeout | The communications unit is faulty. Replace the inverter. | - |
| EtherNet ERR LED is lit red | • The Sync Manager settings are in error.<br>• An error occurred in commu- nication. | • Correct the set values.<br>• Check the connection and the length of the communication cable. In addition, take noise control measures such as mounting the ferrite core on the communication cable.<br>• If the ERR LED continues to flash in spite of performing the above corrective action, replace the inverter. | - |
| The EtherNet RUN LED continues to flash green and there is no change in the state of the LED. | There was a state transition instruction from the host system during operation, and the state transitioned to a state other than Operational. | • Referring to the manual for the Master Unit, check that the Host Master Unit is correctly operating. | - |

| Symptom | Possible cause | Remedy | Reference page |
|---|---|---|---|
| The EtherNet L/A IN LED and L/A OUT LED stay out and there is no change in the state of the LEDs | • The slave is not connected to the network.<br>• When the L/A IN LED and L/A OUT LED of a specific slave stay continually out and there is no change in the state of the LEDs, replace that slave.<br>• When there are devices in the surrounding area that generate noise, adopt measures against noise. Mounting ferrite cores on the communication cable, near the connectors will be effective. | • Check that the Master Unit is correctly operating. If using an OMRON Master Unit, check the Master Unit mode and the slave node address.<br>• If the Master Unit is made by another manufacturer, refer to the instruction manual for that product.<br>• Check that the wiring of communication cables is correct.<br>• Check that there are no breaks in the wiring sections of the communication cable to the connector.<br>• When the L/A IN LED and L/A OUT LED of a specific slave stay continually out and there is no change in the state of the LEDs, replace that slave.<br>• When there are devices in the surrounding area that generate noise, adopt measures against noise. Mounting ferrite cores on the communication cable, near the connectors will be effective. | - |
| The EtherNet L/A IN LED and L/A OUT LED stay flashing green and there is no change in the state of the LEDs | • The slave state has not transitioned to the operational state. | • Referring to the manual for the Master Unit, check that the Master Unit is correctly operating.<br>• When the L/A IN LED and L/A OUT LED of a specific slave stay continually flashing and there is no change in the state of the LEDs, replace that slave. | - |
| Et display<br>(PDO setting error) | • The EtherNet master RxPDO and TxPDO settings are in error.<br>• The inverter is faulty. | Correct the RxPDO and TxPDO settings according to the definitions in the ESI of the inverter, and download the settings again to the EtherNet master.<br>If this problem persists even after downloading the corrected settings to the EtherCAT master, the inverter is faulty. Replace the inverter. | - |

# 10

# Maintenance and Inspection



**10-1 Maintenance and Inspection ..... 10-2**
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10-1-7 I/O Voltage/Current/Electric Power Measurement Method ..... 10-7

# 10-1 Maintenance and Inspection

## 10-1-1 Daily Inspection

Check the following during operation.

- The motor operates according to the settings.
- There are no faults in the installation environment.
- There are no faults in the cooling system.
- There is no abnormal vibration or sound.
- There is no abnormal overheat or discoloration.
- There is no abnormal odor.
- There is no alarm display.

Check the input voltage of the inverter during operation by using a tester or other measuring equipment.

- There is no frequent power supply voltage fluctuation.
- The line voltage is balanced.

## 10-1-2 Cleaning

Always keep the inverter clean.
Lightly wipe the exterior surfaces of the inverter with a soft cloth moistened with a neutral detergent to remove dirt.

Do not use solutions such as acetone, benzene, toluene, or alcohol for cleaning. Doing so may cause the inverter surfaces to dissolve or its coating to come off.
In particular, do not use any detergent or alcohol to clean the data display.

## 10-1-3 Periodic Inspection

Check the parts that must be checked with the operation stopped, as well as those that require periodic inspection.
Even if the power supply is turned OFF, it takes time for the smoothing capacitor of the main circuit DC section to discharge. Since this can be dangerous, use a tester or something similar to confirm that the Main Circuit DC Voltage has dropped down to a safe value (+25 VDC or below), and then perform inspection.

- There are no faults in the cooling system. →Clean the air filter etc.
- Check for loose screws, and retighten.
  →The screws, bolts and other tightened parts may become loose due to vibration, temperature change, or other influences. Check these parts carefully and retighten them if necessary.
- Check for corrosion or damage to conductors and insulators.
- Measure the insulation resistance.
- Check the cooling fan, smoothing capacitor and relay.

Using STO safety function, periodical inspection must be performed at least once in three months, to maintain reliability of the safety function.

• See *Periodic Inspection (STO)* on page 8-64 for detail of inspection

## 10-1-4 Daily/Periodic Inspection Items

| Inspection category | Inspection item | Inspection point | Inspection frequency | | | Inspection method | Criteria | Meter |
|---|---|---|---|---|---|---|---|---|
| | | | Daily | Periodic | | | | |
| | | | | 1 year | 2 years | | | |
| General | Ambient environment | Check ambient temperature, humidity and surrounding atmosphere (presence of dust, gas, oil mist, water droplets, etc.). | Required | | | Refer to *2-1 Installation* on page 2-2. | Ambient temperature: -10 to 50°C, no freezing Operating humidity: 95% max., no condensation | Thermometer Hygrometer Recorder |
| | Entire system | There is no abnormal vibration or sound. | Required | | | Perform visual and acoustic inspection. | No faults | |
| | Power supply voltage | Is the backup power supply voltage normal? | Required | | | Measure the voltage of the backup power supply +24 VDC (across the [P24][0] terminals). | The voltage must be within the allowable voltage. | Tester, digital multimeter |
| | | Check main circuit voltage. | Required | | | Measure line voltage between inverter main circuit terminals L1/R, L2/S and L3/T. | Within allowable AC voltage fluctuation range | |
| | Structural components such as the casing or cover | Check for deformation or damage. | Required | | | Perform visual inspection. | No faults | |
| | | No deposition of dirt or dust | Required | | | Perform visual inspection. | No faults | |

| Inspection category | Inspection item | Inspection point | Inspection frequency | | | Inspection method | Criteria | Meter |
|---|---|---|---|---|---|---|---|---|
| | | | Daily | Periodic | | | | |
| | | | | 1 year | 2 years | | | |
| Main circuit | General | Perform megger check (Between main circuit terminals and ground terminal). | | Required | | Disconnect I/O wires from the inverter main circuit terminal block and remove the control terminal block PCB. Then, after removing the short-circuit bar for switching the inverter built-in filter function, measure using a megger the resistance between the ground terminal and the short-circuited terminals L1/R, L2/S, L3/T, U, V, W, P(+), P1, N(-) and DB. | 5 MΩ min. | 500-VDC class megger |
| | | Check for loose bolts and screws. | | Required | | Retighten loose bolts and screws. | No faults | |
| | | Check each part for traces of overheating. | | Required | | Perform visual inspection. | No faults | |
| | Conductors/wires | Check for distorted conductors. | | Required | | Perform visual inspection. | No faults | |
| | | Check for broken cable sheaths. | | Required | | | | |
| | Terminal Blocks | Check for damage. | | Required | | Perform visual inspection. | No faults | |
| | Smoothing capacitor*1 | Check that there is no liquid leakage. | Required | | | Perform visual inspection. | No faults | Capacity meter |
| | | Check that the safety valve does not come out and that there is no bulge. | Required | | | | | |

| Inspection category | Inspection item | Inspection point | Inspection frequency | | | Inspection method | Criteria | Meter |
|---|---|---|---|---|---|---|---|---|
| | | | Daily | Periodic | | | | |
| | | | | 1 year | 2 years | | | |
| Main circuit | Relay | Check for chattering sound during operation. | | Required | | Perform acoustic inspection. | No faults | |
| | | Check for rough contact surface. | | Required | | Perform visual inspection. | No faults | |
| Control circuit, protection circuit | Operation check | Check output voltage balance between phases during stand-alone inverter operation. | | Required | | Measure the line voltage between the inverter main circuit terminals U, V and W. | Phase-to-phase voltage balance<br>200-V class: 4 V max.<br>400-V Class: 8V max. | Digital multimeter<br>Rectifier Voltmeter |
| | | Check that there is no error in protection and display circuits through sequence protection function test. | | Required | | Short-circuit or open the inverter protection circuit output under simulated conditions. | Error is found in the sequence. | |
| Cooling system | Cooling fan | There is no abnormal vibration or sound. | Required | | | Rotate the fan manually with the power off. | Smooth rotation, no faults*2 | |
| | | Check for loose connections. | | Required | | Perform visual inspection. | | |
| | Cooling fin | Check for clogging. | | Required | | Perform visual inspection. | No clogging. | |
| Display | Display | Check that the LED indicators are lit properly. | Required | | | Perform visual inspection. | The LED indicators are lit. | |
| | | Perform cleaning. | | Required | | Clean with rags. | | |

| Inspection category | Inspection item | Inspection point | Inspection frequency | | | Inspection method | Criteria | Meter |
|---|---|---|---|---|---|---|---|---|
| | | | Daily | Periodic 1 year | Periodic 2 years | | | |
| Motor | General | There is no abnormal vibration or sound. | Required | | | Perform acoustic, sensory and visual inspection. | No faults | |
| | | There is no abnormal odor. | Required | | | Check for abnormal odor due to overheating, damage, etc. | No faults | |
| | Isolation resistance | Perform megger check (between motor terminals and ground terminal). | | | Required | Disconnect wires from the inverter main circuit terminals U, V, W and short-circuit the three-phase motor wires. Then, use a megger to measure the resistance between each motor wire and the ground terminal. | 5 MΩ min. | 500-VDC class megger |

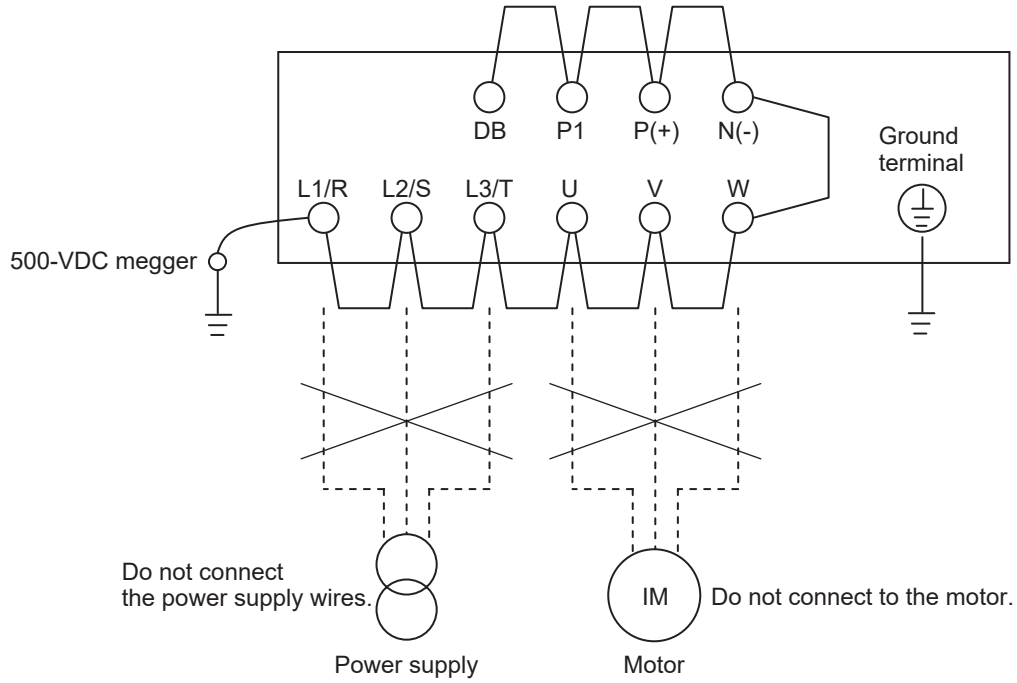
*1. The capacitor service life is influenced by the ambient temperature.
For inverter replacement guidelines, refer to *A-8 Smoothing Capacitor Life Curve* on page A-282.

*2. The life of the cooling fan depends on environmental conditions, such as the ambient temperature and/or dust. Check the operating conditions in daily inspection.

## 10-1-5 Megger Test

Before performing a megger test on external circuits, be sure to disconnect all the terminals of the inverter and not to apply the test voltage to the inverter. Use a 500 VDC megger for a megger test. For a megger test on the inverter main circuit, short-circuit the terminals L1/R, L2/S, L3/T, U, V, W, DB, P1, P(+) and N(-) with wires, as shown below.
Because the insulation resistance rating of the single inverter unit is 5 MΩ or higher, it is normal if the resistance is 5 MΩ or higher.

- For the inverter, do not perform a megger test on the control circuit. Perform it only on the main circuit.
- Use a tester (in a high resistance range) for a power-on test on the control circuit. Do not use a megger or buzzer.

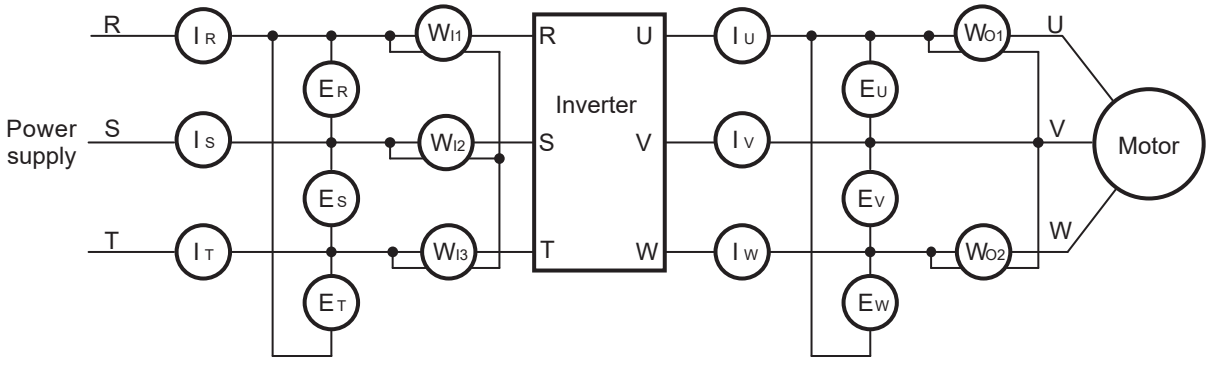



## 10-1-6 Withstand Voltage Test

Do not conduct a withstand voltage test on any part of the inverter.
Doing this test is dangerous because it may cause damage to or deterioration of the parts inside the inverter.

## 10-1-7 I/O Voltage/Current/Electric Power Measurement Method

Measuring instruments commonly used for input/output voltage, current, or electric power measurement are shown below.

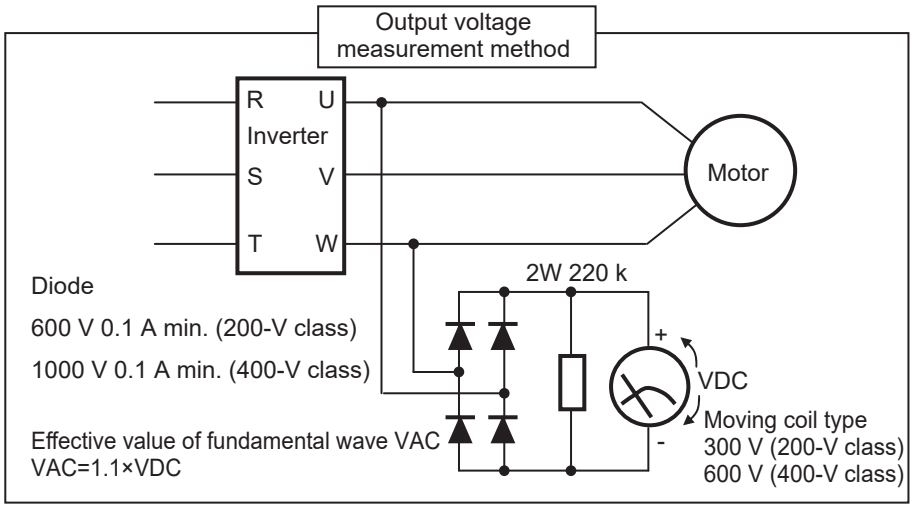



| Measurement item | Measurement point | Measuring instrument | Remarks | Measurement value reference |
|---|---|---|---|---|
| Power supply voltage $E_{IN}$ | Between L1/R and L2/S ($E_R$)<br>Between L2/S and L3/T ($E_S$)<br>Between L3/T and L1/R ($E_T$) | Moving-iron voltmeter or rectifier type voltmeter | All effective values | 200-V class: 200 to 240 V, 50/60 Hz<br>400-V class: 380 to 480 V, 50/60 Hz |

| Measurement item | Measurement point | Measuring instrument | Remarks | Measurement value reference |
|---|---|---|---|---|
| Power supply current $I_{IN}$ | Current in L1/R, L2/S, L3/T ($I_R$), ($I_S$), ($I_T$) | Moving iron ammeter | All effective values | When input current is not balanced: $I_{IN}= (I_R+I_S+I_T)/3$ |
| Input electric power $W_{IN}$ | Between L1/R and L2/S ($W_{I1}$)<br>Between L2/S and L3/T ($W_{I2}$)<br>Between L3/T and L1/R ($W_{I3}$) | Electrodynamic wattmeter | All effective values | Three-wattmeter method<br>($W_{I1}$) + ($W_{I2}$) + ($W_{I3}$) |
| Input power factor $Pf_{IN}$ | Calculate this from the measured values of power supply voltage $E_{IN}$, power supply current $I_{IN}$, and input electric power $W_{IN}$.<br>$Pf_{IN} = \frac{W_{IN}}{\sqrt{3} \cdot E_{IN} \cdot I_{IN}} \times 100\,[\%]$ | | | - |
| Output voltage $E_{OUT}$ | Between U and V ($E_U$)<br>Between V and W ($E_V$)<br>Between W and U ($E_W$) | Refer to the figure on the next page, or rectifier type voltmeter. | Effective value of fundamental wave | - |
| Output current $I_{OUT}$ | Current of U, V and W ($I_U$), ($I_V$), ($I_W$) | Moving iron ammeter | All effective values | - |
| Output power $W_{OUT}$ | Between U and V ($W_{O1}$)<br>Between V and W ($W_{O2}$) | Electrodynamic wattmeter | All effective values | Two-wattmeter method (or three-wattmeter method) ($W_{O1}$) + ($W_{O2}$) |
| Output power factor $Pf_{OUT}$ | Calculate this from the measured values of output voltage $E_{OUT}$, output current $I_{OUT}$, and output electric power $W_{OUT}$.<br>$Pf_{OUT} = \frac{W_{OUT}}{\sqrt{3} \cdot E_{OUT} \cdot I_{OUT}} \times 100\,[\%]$ | | | - |

**Note 1.** For the output voltage, use a measuring instrument that shows effective values of fundamental wave. For the current and the electric power, use a measuring instrument that shows all effective values.

**Note 2.** The output waveform of the inverter has a margin of error, especially at low frequencies, because it was generated under PWM control. Note that many general-purpose testers may not be usable due to noise.


Output voltage measurement method
R
U
Inverter
S
V
T
W
Motor
2W 220 k
Diode
600 V 0.1 A min. (200-V class)
1000 V 0.1 A min. (400-V class)
+
VDC
-
Moving coil type
300 V (200-V class)
600 V (400-V class)
Effective value of fundamental wave VAC
VAC=1.1×VDC

# A

# Appendices

This section provides explanation of the profiles used in each protocol to control the inverter, lists of available ID objects, Sysmac error status codes, derating tables, capacitor life curves, and inverter selection criteria. Parameter lists with address information are in Section 5.



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**A-2 EtherNet/IP Functional Assemblies ..... A-16**
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A-2-4 Omron Specific EtherNet/IP Drive Assembly Instances ..... A-23
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A-3-1 GSDML Device Description ..... A-34
A-3-2 PROFIdrive Identification parameters (Acyclic) ..... A-34
A-3-3 Vendor Specific Parameters (Acyclic) ..... A-35
**A-4 PROFIdrive Control and Status (Cyclic) ..... A-36**
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# A-1 EtherNet/IP Communication Objects



This appendix describes EtherNet/IP objects used for device identification, network configuration, connection management, diagnostics, and parameter access. These objects are typically accessed via explicit messaging (Class 3) and engineering tools. These objects are not directly responsible for motion or drive control, but are essential for:

- device identification
- network setup
- diagnostics
- parameter access
- engineering tools

## A-1-1 Core CIP Identity & Infrastructure

| Class Code | Object Name | Functions |
|---|---|---|
| 0x01 | Identity Object | Device identification (Vendor ID, Product Code, Revision) |
| 0x06 | Connection Manager Object | Manages CIP connections (Forward Open/Close) |
| 0xF5 | TCP/IP Interface Object | IP address, subnet, gateway, ACD |
| 0xF6 | Ethernet Link Object | Physical port status, speed, counters |
| 0x109 | LLDP Management Object | Network discovery and topology |
| 0x10A | LLDP Data Table Object | Neighbor and device information |

### Identity Object (Class Code 0x01)

Class Attribute (Instance ID: 0x00)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 1 | Get | Revision | UINT | Revision information for this object | 1 |
| 2 | Get | Max Instance | UINT | Maximum number of instances of the object currently being created | 1 |
| 3 | Get | Number of Instance | UINT | Number of object instances that are currently being created | 1 |

Class Service

| Service Code | Name | Description |
|---|---|---|
| 0x01 | Get_Attribute_All | Reads the content of all attributes. |
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |

Instance Attribute (Instance ID: 0x01)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 1 | Get | Vender ID | UINT | Identification number of each vendor | 319 (Fuji Electric) |
| 2 | Get | Device Type | UINT | General type of product | 2 (AC drive) |
| 3 | Get | Product Code | UINT | Identification of each vendor's individual product | Refer to Chapter 4.1 ○b |
| 4 | Get | Revision | STRUCT of | Revision of the field represented by identity | Includes the following |
| | | Major Revision | USINT | Major revision | 1 |
| | | Minor Revision | USINT | Minor Revision | 60 |
| 5 | Get | Status | WORD | Device Overview Status | According to CIP specifications. |
| 6 | Get | Serial Number | UDINT | Serial number of the device | Lower 4 bytes of MAC address |
| 7 | Get | Product Name | SHORT_ STRING | Distinguished name that the user can recognize | Refer to Chapter 4.1 ○b |

Instance Services

| Service Code | Name | Description |
|---|---|---|
| 0x01 | Get_Attribute_All | Reads the content of all attributes. |
| 0x05 | Reset | Starts RESET service. |
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |

## Connection Manager Object (Class Code 0x06)

Class Attribute (Instance ID: 0x00)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 1 | Get | Revision | UINT | Revision information for this object | 1 |
| 2 | Get | Max Instance | UINT | Maximum number of instances of the object currently being created | 1 |
| 3 | Get | Number of Instance | UINT | Number of object instances that are currently being created | 1 |

Class Service

| Service Code | Name | Description |
|---|---|---|
| 0x01 | Get_Attribute_All | Reads the content of all attributes. |
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |

Instance Attribute (Instance ID: 0x01)

| Attr. ID | Access Rules | Name | Data type |
|---|---|---|---|
| 1 | Get | Open Request | UINT |
| 2 | Get | Open Format Rejects | UINT |
| 3 | Get | Open Resource Rejects | UINT |
| 4 | Get | Open Other Rejects | UINT |
| 5 | Get | Close Request | UINT |
| 6 | Get | Close Format Requests | UINT |
| 7 | Get | Close Other Requests | UINT |
| 8 | Get | Connection Timeouts | UINT |

Instance Services

| Service Code | Name | Description |
|---|---|---|
| 0x01 | Get_Attribute_All | Reads the content of all attributes. |
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |
| 0x4E | Forward_Close | - |
| 0x52 | Unconnected_Send | - |
| 0x54 | Forward_Open | - |
| 0x5B | Large_Forward_Open | - |

## TCP/IP Interface Object (Class Code 0xF5)

Class Attribute (Instance ID: 0x00)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 1 | Get | Revision | UINT | Revision information for this object | 4 |
| 2 | Get | Max Instance | UINT | Maximum number of instances of the object currently being created | 1 |
| 3 | Get | Number of Instance | UINT | Number of object instances that are currently being created | 1 |

Class Service

| Service Code | Name | Description |
|---|---|---|
| 0x01 | Get_Attribute_All | Reads the content of all attributes. |
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |

Instance Attribute (Instance ID: 0x01)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 1 | Get | Status | DWORD | Interface status | 2 |
| 2 | Get | Configuration Capability | DWORD | Interface capability flags | 224 |
| 3 | Get | Configuration Control | DWORD | Interface control flags | - |
| 4 | Get | Physical Link | STRUCT of | Path to physical link object | - |
| | | Path size | UINT | Size of Path | 2 |
| | | Path | Padded EPATH | Logical segments identifying the physical link object | 20 F6 24 03 |
| 5 | Get | Interface Configuration | STRUCT of | | - |
| | | IP Address | UDINT | The device's IP address | - |
| | | Network Mask | UDINT | The device's network mask | - |
| | | Gateway Address | UDINT | Default gateway address | - |
| | | Name Server | UDINT | Primary name server | - |
| | | Name Server 2 | UDINT | Secondary name server | - |
| | | Domain Name | STRING | Default domain name | - |
| 6 | Get | Host Name | STRING | The Host Name attribute contains the device's host name | - |
| 8 | Get | TTL Value | USINT | TTL value for EtherNet/IP multicast packets | 1 |
| 9 | Get | Mcast Config | STRUCT of IP | IP multicast address configuration | - |
| | | Alloc Control | USINT | Multicast address allocation control word. Determines how addresses are allocated. | 0 |
| | | Reserved | USINT | - | 0 |
| | | Num Mcast | UINT | Number of IP Multicast addresses to allocate for EtherNet/IP | 32 |
| | | Mcast Start Addr | UDINT | Starting multicast address from which to begin allocation. | - |
| 10 | Get/Set | SelectACD | BOOL | Activates the use of ACD<br>0: ACD disabled<br>1: ACD enabled | 1 |
| 11 | Get/Set | LastConflict Detected | STRUNT of: | - | - |
| | | AcdActivity | USINT | State of ACD activity when last conflict detected | - |
| | | RemoteMAC | Array of 6 USINT | Remote MAC | - |
| | | ArpPdu | Array of 28 USINT | ARP PDU | - |
| 13 | Get/Set | Encapsulation Inactivity Timeout | USINT | Number of seconds of inactivity before TCP connection is closed | 120 |

Instance Services

| Service Code | Name | Description |
|---|---|---|
| 0x01 | Get_Attribute_All | Reads the content of all attributes. |
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |
| 0x10 | Set_Attribute_Single | Writes the content of the specified attribute. |

## Ethernet Link Object (Class Code 0xF6)

Class Attribute (Instance ID: 0x00)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 1 | Get | Revision | UINT | Revision information for this object | 4 |
| 2 | Get | Max Instance | UINT | Maximum number of instances of the object currently being created | 3 |
| 3 | Get | Number of Instance | UINT | Number of object instances that are currently being created | 3 |

Class Service

| Service Code | Name | Description |
|---|---|---|
| 0x01 | Get_Attribute_All | Reads the content of all attributes. |
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |

Instance Attribute (Instance ID: 0x01)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 1 | Get | Interface Speed | UDINT | Interface speed currently in use | 100: “100Mbps”<br>10: “10 Mbps” |
| 2 | Get | Interface Flags | DWORD | Interface status flags | - |
| 3 | Get | Physical Address | ARRAY of 6 USINTs | MAC layer address | MAC address |
| 4 | Get | Interface Counters | STRUCT of | - | - |
| | | In Octets | UDINT | Octets received on the interface | - |
| | | In Ucast Packets | UDINT | Unicast packets received on the interface | - |
| | | In NUcast Packets | UDINT | Non-unicast packets received on the interface | - |
| | | In Discards | UDINT | Inbound packets received on the interface but discarded | - |
| | | In Errors | UDINT | Inbound packets that contain errors (does not include In Discards) | - |
| | | In Unknown Protos | UDINT | Inbound packets with unknown protocol | - |
| | | Out Octets | UDINT | Octets sent on the interface | - |
| | | Out Ucast Packets | UDINT | Unicast packets sent on the interface | - |
| | | Out NUcast Packets | UDINT | Non-unicast packets sent on the interface | - |
| | | Out Discards | UDINT | Outbound packets discarded | - |
| | | Out Errors | UDINT | Outbound packets that contain errors | - |
| 5 | Get | Media Counters | STRUCT of | Media-specific counter | - |
| | | Alignment Errors | UDINT | Frames received that are not an integral number of octets in length | - |
| | | FCS Errors | UDINT | Frames received that do not pass the FCS check | - |
| | | Single Collisions | UDINT | Successfully transmitted frames which experienced exactly one collision | - |
| | | Multiple Collisions | UDINT | Successfully transmitted frames which experienced more than one collision | - |
| | | SQE Test Errors | UDINT | Number of times SQE test error message is generated | - |
| | | Deferred Transmissions | UDINT | Frames for which first transmission attempt is delayed because the medium is busy | - |
| | | Late Collisions | UDINT | Number of times a collision is detected later than 512 bit-times into the transmission of a packet | - |
| | | Excessive Collisions | UDINT | Frames for which transmission fails due to excessive collisions | - |
| | | MAC Transmit Errors | UDINT | Frames for which transmission fails due to an internal MAC sub layer transmit error | - |

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 5 | Get | Carrier Sense Errors | UDINT | Times that the carrier sense condition was lost or never asserted when attempting to transmit a frame | - |
| | | Frame Too Long | UDINT | Frames received that exceed the maximum permitted frame size | - |
| | | MAC Receive Errors | UDINT | Frames for which reception on an interface fails due to an internal MAC sub layer receive error | - |
| 6 | Get/Set | Interface Control | STRUCT of | Configuration for physical interface | - |
| | | Control Bit | WORD | Interface Control Bits | - |
| | | Forced Interface Seed | UINT | Speed at which the interface shall be forced to operate | - |
| 7 | Get | Interface Type | USINT | Type of interface : twisted pair, fiber, internal, etc. | - |
| 8 | Get | Interface State | USINT | Current state of the interface : operational,disabled, etc. | - |
| 9 | Get/Set | Admin State | USINT | Administrative state: enable, disable | - |
| 10 | Get | Interface Label | SHORT_ STRING | Human readable identification | - |
| 11 | Get | Interface Capability | STRUCT of | Indication of capabilities of the interface | - |
| | | Capability Bits | DWORD | Interface capabilities, other than speed/duplex | - |
| | | Speed/Duplex Options | STRUCT of | Indicates speed/duplex pairs supported in the interface Control Attribute | - |
| | | Speed/Duplex Array Count | USINT | - | - |
| | | Speed/Duplex Array | ARRAY of | - | - |
| | | Speed/Duplex Pair | STRUCT of | - | - |
| | | Interface Speed | UINT | - | - |
| | | Interface Duplex Mode | USINT | - | - |
| | | Interface Speed | UINT | - | - |
| | | Interface Duplex Mode | USINT | - | - |
| | | Interface Speed | UINT | - | - |
| | | Interface Duplex Mode | USINT | - | - |
| | | Interface Speed | UINT | - | - |
| | | Interface Duplex Mode | USINT | - | - |

Instance Services

| Service Code | Name | Description |
|---|---|---|
| 0x01 | Get_Attribute_All | Reads the content of all attributes. |
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |
| 0x10 | Set_Attribute_Single | Writes the content of the specified attribute. |

## LLDP Management Object (Class Code 0x109)

Class Attribute (Instance ID: 0x00)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 1 | Get | Revision | UINT | Revision information for this object | 1 |
| 2 | Get | Max Instance | UINT | Maximum number of instances of the object currently being created | 1 |
| 3 | Get | Number of Instance | UINT | Number of object instances that are currently being created | 1 |

Class Service

| Service Code | Name | Description |
|---|---|---|
| 0x01 | Get_Attribute_All | Reads the content of all attributes. |
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |

Instance Attribute (Instance ID: 0x01)

| Attr. ID | Access Rules | Name | Data type |
|---|---|---|---|
| 1 | Get/Set | LLDP Enable | STRUCT of |
| | | LLDP Enable Array Length | UINT |
| | | LLDP Enable Array | ARRAY of: BYTE |
| 2 | Get/Set | msgTxInterval | UINT |
| 3 | Get/Set | msgTxHold | USINT |
| 4 | Get | LLDP Datastore | WORD |
| 5 | Get | Last Change | UDINT |

Instance Services

| Service Code | Name | Description |
|---|---|---|
| 0x01 | Get_Attribute_All | Reads the content of all attributes. |
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |
| 0x10 | Set_Attribute_Single | Writes the content of the specified attribute. |

# LLDP Data Table Object (Class Code 0x10A)

Class Attribute (Instance ID: 0x00)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 1 | Get | Revision | UINT | Revision information for this object | 1 |
| 2 | Get | Max Instance | UINT | Maximum number of instances of the object currently being created | - |
| 3 | Get | Number of Instance | UINT | Number of object instances that are currently being created | - |

Class Service

| Service Code | Name | Description |
|---|---|---|
| 0x01 | Get_Attribute_All | Reads the content of all attributes. |
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |
| 0x11 | Find_Next_Object_Instance | - |

Instance Attribute (Instance ID: 0x01)

| Attr. ID | Access Rules | Name | Data type |
|---|---|---|---|
| 1 | Get | Ethernet Link Instance Number | UINT |
| 2 | Get | MAC Address | ETH_MAC_ADDR |
| 3 | Get | Interface Label | SHORT_STRING |
| 4 | Get | Time to Live | UINT |
| 5 | Get | System Capabilities TLV | STRUCT of |
| | | System Capabilities | WORD |
| | | Enabled Capabilities | WORD |
| 6 | Get | Ipv4 Management Addresses | STRUCT of |
| | | Management Address Count | USINT |
| | | Management Address | ARRAY of UDINT |
| 7 | Get | CIP Identification | STRUCT of |
| | | Vendor ID | UINT |
| | | Device Type | UINT |
| | | Product Code | UINT |
| | | Major Revision | BYTE |
| | | Minor Revision | USINT |
| | | CIP Serial Number | UDINT |
| 8 | Get | Additional Ethernet Capabilities | STRUCT of |
| | | Preemption Support | BOOL |
| | | Preemption Status | BOOL |
| | | Preemption Active | BOOL |
| | | Additional Fragment Size | USINT |
| 9 | Get | Last Change | UDINT |

Instance Services

| Service Code | Name | Description |
|---|---|---|
| 0x01 | Get_Attribute_All | Reads the content of all attributes. |
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |

## A-1-2 Generic CIP Data Handling

| Class Code | Object Name | Functions |
|---|---|---|
| 0x04 | Assembly Object (generic definition) | Base CIP container definition (non-functional by itself) |

### Assembly Object (Class Code 0x04)

Although the Assembly Object (Class 0x04) is a generic CIP object, this description includes specific drive-related assembly instances.

Class Attribute (Instance ID: 0x00)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 1 | Get | Revision | UINT | Revision information for this object | 1 |
| 2 | Get | Max Instance | UINT | Maximum number of instances of the object currently being created | 199 |
| 3 | Get | Number of Instance | UINT | Number of object instances that are currently being created | 26 |

Class Service

| Service Code | Name | Description |
|---|---|---|
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |

Instance Attribute (Instance ID: 0x01)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 3 | Get/Set | Data | ARRAY of octet | I/O Assembly object data | According to the selection of I/O Assembly instances. |

Instance Services

| Service Code | vName | Description |
|---|---|---|
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |
| 0x10 | Set_Attribute_Single | Writes the content of the specified attribute. |

Supported Instance

| Instance ID | Access Rules | Name | Size Byte | Remarks |
|---|---|---|---|---|
| 20 | Get/Set | Basic Speed Control Output | 4 | Output (Set and command from master to inverter) |
| 21 | | Extended Speed Control Output | 4 | |
| 22 | | Speed and Torque Control Output | 6 | |
| 23 | | Extended Speed and Torque Control Output | 6 | |
| 101 | | Vender Speed/Torque Control Output | 8 | |
| 115 | | Vender Extended Speed/Torque Control Output | 40 | |
| 116 | | Vender High Speed/Torque Control Output | 44 | |
| 117 | | Vender 8-Byte Dynamic Output | 8 | |
| 118 | | Vender 12-Byte Dynamic Output | 12 | |
| 119 | | Vender 18-Byte Dynamic Output | 18 | |
| 120 | | Vender 24-Byte Dynamic Output | 24 | |
| 121 | | Vender 32-Byte Dynamic Output | 32 | |
| 70 | Get | Basic Speed Control Input | 4 | Input (Monitor status from inverter to master) |
| 71 | | Extended Speed Control Input | 4 | |
| 72 | | Speed and Torque Control Input | 6 | |
| 73 | | Extended Speed and Torque Control Input | 6 | |
| 151 | | Vender Speed/Torque Status Input | 8 | |
| 155 | | Vender Extended Speed/Torque Status Input | 40 | |
| 166 | | Vender High Speed/Torque Status Input | 44 | |
| 167 | | Vender 8-Byte Dynamic Input | 8 | |
| 168 | | Vender 12-Byte Dynamic Input | 12 | |
| 169 | | Vender 18-Byte Dynamic Input | 18 | |
| 170 | | Vender 24-Byte Dynamic Input | 24 | |
| 171 | | Vender 32-Byte Dynamic Input | 32 | |

# A-1-3 Parameter & Diagnostic Access

## Vendor Specific Object (Class Code 0xA2)

Class Attribute (Instance ID: 0x00)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 1 | Get | Revision | UINT | Revision information for this object | 1 |
| 2 | Get | Max Instance | UINT | Maximum number of instances of the object currently being created | 2 |
| 3 | Get | Number of Instance | UINT | Number of object instances that are currently being created | 2 |

Class Service

| Service Code | Name | Description |
|---|---|---|
| 0x01 | Get_Attribute_All | Reads the content of all attributes. |
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |

Supported Instances

| Instance ID | Name |
|---|---|
| 0x01 | 2byte parameter access |
| 0x02 | 4byte parameter access |

Class Attribute (Instance ID: 0x01)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 0x0011 | Get/Set | Address 0x0011 | WORD | Accesses to 0x0011 (M016) | - |
| 0x0012 | Get/Set | Address 0x0012 | WORD | Accesses to 0x0012 (X025) | - |
| 0x0015 | Get/Set | Address 0x0015 | WORD | Accesses to 0x0015 (X021) | - |
| … | … | … | … | … | … |

* Attribute IDs (parameter addresses) and internal formats are shown in parameter lists

Class Attribute (Instance ID: 0x02)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 0x0013 | Get/Set | Address 0x0013 | DWORD | Accesses to 0x0013 (X020) | - |
| 0x0017 | Get/Set | Address 0x0017 | DWORD | Accesses to 0x0017 (X108) | - |
| 0x0019 | Get/Set | Address 0x0019 | DWORD | Accesses to 0x0019 (X026) | - |
| … | … | … | … | … | … |

* Attribute IDs (parameter addresses) and internal formats are shown in parameter lists

Instance Services

| Service Code | Name | Description |
|---|---|---|
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |
| 0x10 | Set_Attribute_Single | Writes the content of the specified attribute. |

# A-2 EtherNet/IP Functional Assemblies

This appendix describes EtherNet/IP objects and assemblies used for real-time drive control, speed and torque command, operational status monitoring, and AC Drive Profile compliance.

I/O Assemblies, Control & Status Data for effective drive operation.

These objects directly affect drive behavior, real-time control, and operational feedback.

They are typically accessed via Class 1 I/O or drive-profile services.

## A-2-1 ODVA AC Drive Profile Control and Status Objects

| Class Code | Object Name | Functions |
|---|---|---|
| 0x28 | Motor Data Object | Set Motor nameplate and motor-related parameters<br>Note: Motor Type can not be set from EtherNet/IP |
| 0x29 | Control Supervisor Object | Set Run/Stop, direction, control authority<br>Get Drive state machine, alarms, warnings |
| 0x2A | AC/DC Drive Object | Set Speed, torque, limits, scaling<br>Get Actual speed, torque, current, limits |

### Motor data Object (Class Code 0x28)

Class Attribute (Instance ID: 0x00)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 1 | Get | Revision | UINT | Revision information for this object | 1 |
| 2 | Get | Max Instance | UINT | Maximum number of instances of the object currently being created | 1 |
| 3 | Get | Number of Instance | UINT | Number of object instances that are currently being created | 1 |

Class Service

| Service Code | Name | Description |
|---|---|---|
| 0x01 | Get_Attribute_All | Reads the content of all attributes. |
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |

Instance Attribute (Instance ID: 0x01)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 1 | Get | NumAttr | USINT | Number of Attributes | 4 |
| 3 | Get | MotorType | USINT | Specify motor type | 3 = PM synchronous motor<br>7 = Squirrel-cage induction motor |
| 6 | Get/Set | RatedCurrent | UINT | Motor rated current (Unit: 100mA) | According to the setting of the inverter<br>Example) 6=0.6 A |
| 7 | Get/Set | RatedVoltage | UINT | Motor rated voltage (Unit: 1V) | According to the setting of the inverter.<br>Example) 200=200 V |
| 12 | Get/Set | PoleCount | UINT | Number of motor poles | According to the setting of the inverter. |

Instance Services

| Service Code | Name | Description |
|---|---|---|
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |
| 0x10 | Set_Attribute_Single | Writes the content of the specified attribute. |

## Control Supervisor Object (Class Code 0x29)

Class Attribute (Instance ID: 0x00)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 1 | Get | Revision | UINT | Revision information for this object | 1 |
| 2 | Get | Max Instance | UINT | Maximum number of instances of the object currently being created | 1 |
| 3 | Get | Number of Instance | UINT | Number of object instances that are currently being created | 1 |

Class Service

| Service Code | Name | Description |
|---|---|---|
| 0x01 | Get_Attribute_All | Reads the content of all attributes. |
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |

Instance Attribute (Instance ID: 0x01)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 3 | Get/Set | Run1 | BOOL | Forward operation command | 0: Stop command<br>1: Operation command |
| 4 | Get/Set | Run2 | BOOL | Reverse operation command | 0: Stop command<br>1: Operation command |
| 5 | Get/Set | NetCtrl | BOOL | Right of operation command.<br>The actual status can be monitored by attribute 15 (CtlFromNet). | 0: Other than network (default)<br>1: Network control |
| 6 | Get | State | UINT | Inverter status | 1=Startup<br>2=Not_ready<br>3=Ready<br>4=Enabled<br>5=Stopping<br>6=Fault_Stop<br>7=Faulted |
| 7 | Get | Running1 | BOOL | Operation status (forward) | 0: Stopped or reverse operation<br>1: During forward operation |
| 8 | Get | Running2 | BOOL | Operation status (reverse) | 0: Stopped or forward operation<br>1: During reverse operation |
| 9 | Get | Ready | BOOL | Status of inverter operation preparation | 0: Otherwise<br>1: Operation ready |
| 10 | Get | Faulted | BOOL | Alarm occurrence status | 0: Normal<br>1: Alarm occurring |
| 11 | Get | Warning | BOOL | Warning occurrence status | 0 : Normal<br>1 : During warning |
| 12 | Get/Set | FaultRst | BOOL | Request to cancel the alarm status | 0->1: Alarm release request |
| 15 | Get | CtlFromNet | BOOL | Status of the operation command control side | 0: Controlled outside the network<br>1: Control from the network |

Instance Services

| Service Code | Name | Description |
|---|---|---|
| 0x05 | Reset | Starts RESET service. |
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |
| 0x10 | Set_Attribute_Single | Writes the content of the specified attribute. |

## AC/DC Drive Object (Class Code 0x2A)

Class Attribute (Instance ID: 0x00)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 1 | Get | Revision | UINT | Revision information for this object | 1 |
| 2 | Get | Max Instance | UINT | Maximum number of instances of the object currently being created | 1 |
| 3 | Get | Number of Instance | UINT | Number of object instances that are currently being created | 1 |

Class Service

| Service Code | Name | Description |
|---|---|---|
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |

Instance Attribute (Instance ID: 0x01)

| Attr. ID | Access Rules | Name | Data type | Description | Value |
|---|---|---|---|---|---|
| 3 | Get | AtReference | BOOL | Frequency attainment [FAR] | 1: Frequency being reached |
| 4 | Get/Set | NetRef | BOOL | Operation right of the frequency command | 0: Other than network (default)<br>1: Network control |
| 6 | Get | DriveMode | USINT | Operation mode | 0: Vendor specific mode |
| 7 | Get | SpeedActual | INT | Speed detection value | Range: -32768 to 32767 |
| 8 | Get/Set | SpeedRef | INT | Speed setting value | Range: -32768 to 32767 |
| 9 | Get | CurrentActual | INT | Output current<br>Unit : 100mA / 2CurrentScale | Range: -32768 to 32767 |
| 11 | Get | TorqueActual | INT | Output torque Unit : 0.1%<br>* Polarity depends on E49. | Range: -32768 to 32767 |
| 12 | Get/Set | TorqueRef /TorqueLimit | INT | Torque setting value or torque limit value<br>Unit : 0.1%<br>*If you set a value once, it will keep writing values. To disable writing, set H493=0. | Range: -32768 to 32767 |
| 17 | Get | OutputVoltage | INT | Output voltage Unit : V / 2VoltageScale | Range: -32768 to 32767 |
| 18 | Get/Set | AccelTime | UINT | Acceleration time Unit : ms / 2TimeScale | Range: 0 to 65535<br>(Initial value: 6000) |
| 19 | Get/Set | DecelTime | UINT | Deceleration time Unit : ms / 2TimeScale | Range: 0 to 65535<br>(Initial value: 6000) |
| 20 | Get/Set | LowSpeedLimit | UINT | Lower limit frequency<br>Unit : r/min / 2SpeedScale | Range: 0 to 65535<br>(Initial value: 0) |
| 21 | Get/Set | HighSpeedLimit | UINT | Maximum Frequency<br>Unit : r/min / 2SpeedScale | Range: 0 to 65535<br>(Initial value: 1800) |
| 22 | Get/Set | SpeedScale | SINT | Speed scaling factor | Range: -128 to127<br>(Initial value: 0) |
| 23 | Get/Set | CurrentScale | SINT | Current scaling factor | Range: -128 to127<br>(Initial value: 0) |
| 27 | Get/Set | VolatageScale | SINT | Voltage scaling factor | Range: -128 to127<br>(Initial value: 0) |
| 28 | Get/Set | TimeScale | SINT | Time scaling factor | Range: -128 to127<br>(Initial value: 0) |
| 29 | Get | RefFromNet | BOOL | Status of the frequency setting command control side | 0:Controlled outside the network<br>1:Control from the network |

Instance Services

| Service Code | Name | Description |
|---|---|---|
| 0x0E | Get_Attribute_Single | Reads the content of the specified attribute. |
| 0x10 | Set_Attribute_Single | Writes the content of the specified attribute. |

## A-2-2 EtherNet/IP Drive Assembly Instances

Assemblies 20, 70 , 21, 71, 22, 72, 23 and 73 are ODVA standard I/O Assembly instance numbers for AC drives supported in M1-EMP.

Omron Assemblies (101, 151, 115, 155, 116, 166, 117, 167, 118, 168, 119, 169, 120, 170, 121 and 171) are defined to provide extended and flexible control of up to 16 arbitrary parameters.
These instances are common in Omron drives, but full compatibility is impossible due to error codes and alarms and register addresses for dynamic input and output are different in M1 compared to legacy drives.

### Signal Descriptions in assemblies

| Symbol | Description | Remark |
|---|---|---|
| Run Fwd | Forward RUN Command<br>0: Stop<br>1: Forward RUN | |
| Run Rev | Reverse RUN Command<br>0: Stop<br>1: Reverse RUN | |
| Fault Reset | 0: -<br>1: Fault Reset | |
| NetCtrl | Run command is from network<br>0: Run command is depending on F002/E102.<br>1: Run command is from network | |
| NetRef | Speed/Torque reference is from network<br>0: Speed reference depends on F001/C030, Torque reference depends on H332.<br>1: Speed/Torque reference is from network | |
| Speed Reference/ Speed Limit | Speed Command<br>Sets drive speed reference when using Speed Control.<br>Sets the Speed Limit when using Torque Control.<br>Unit is affected by Speed Scale SS.<br>Unit depends on H491. | Refer to H491 for units |
| Faulted | 0: No Fault<br>1: Fault | Inverter alarm |
| Alarm | 0: No Alarm<br>1: Alarm | Inverter warning |
| Running 1 | Forward Running<br>0 : Stop or Reverse Running<br>1 : Forward Running | |
| Running 2 | Reverse Running<br>0 : Stop or Forward Running<br>1 : Reverse Running | |
| Ready | 0: Not Ready<br>1: Ready | |
| Speed Agree | 0: -<br>1: Speed actual at speed reference | Same as “FAR” signal |
| State | Contains the value from the Control Supervisor (Class 0x29)<br>Instance 1 Attribute 6. | |
| Speed Actual | Actual Drive Speed<br>Monitors drive output frequency.<br>Unit is affected by Speed Scale SS.<br>Unit depends on H491. | Refer to H491 for units |
| Torque Reference / Torque Limit | Sets the Torque Reference/Torque Limit. Sets in units of 0.1%. Sets the Torque Reference when using Torque Control [H18 =2, 3].<br>Sets the Torque Limit when using Speed Control [H18 = 0].<br>The Torque Reference/Torque Limit are disabled when H493 = 0. | Once a value is set, it will continue to write values. To disable writing, set H493=0. |
| Torque Actual | Output Torque<br>Value displays in 0.1% units. | Same as M007 |

# A-2-3 Standard ODVA EtherNet/IP Drive Assembly Instances

## Basic Speed Control Output – 20(0x14)

Provides basic Run/Stop control and speed reference with minimal status feedback. Suitable for simple speed control applications.

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 20 (0x14) | 0 | - | - | - | - | - | Fault Reset | - | Run Fwd |
| | 1 | - | | | | | | | |
| | 2 | Speed Reference/Speed Limit (Low byte) | | | | | | | |
| | 3 | Speed Reference/Speed Limit (High byte) | | | | | | | |

## Basic Speed Control Input – 70(0x46)

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 70 (0x46) | 0 | - | - | - | - | - | Running 1 | - | Faulted |
| | 1 | - | | | | | | | |
| | 2 | Speed Actual (Low byte) | | | | | | | |
| | 3 | Speed Actual (High byte) | | | | | | | |

## Extended Speed Control Output – 21(0x15)

Adds network command and reference source control, better drive status reporting for more robust speed control.

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 21 (0x15) | 0 | - | NetRef | NetCtrl | - | - | Fault Reset | Run Rev | Run Fwd |
| | 1 | - | | | | | | | |
| | 2 | Speed Reference/Speed Limit (Low byte) | | | | | | | |
| | 3 | Speed Reference/Speed Limit (High byte) | | | | | | | |

## Extended Speed Control Input – 71(0x47)

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 71 (0x47) | 0 | Speed Agree | NetRef | NetCtrl | Ready | Running 2 | Running 1 | Alarm | Faulted |
| | 1 | State | | | | | | | |
| | 2 | Speed Actual (Low byte) | | | | | | | |
| | 3 | Speed Actual (High byte) | | | | | | | |

## Speed and Torque Control Output – 22(0x16)

Supports both speed reference and torque reference/limit, enabling torque-limited or torque-controlled operation with the simplest status feedback.

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 22 (0x16) | 0 | - | - | - | - | - | Fault Reset | - | Run Fwd |
| | 1 | - | | | | | | | |
| | 2 | Speed Reference/Speed Limit (Low byte) | | | | | | | |
| | 3 | Speed Reference/Speed Limit (High byte) | | | | | | | |
| | 4 | Torque Reference/Torque Limit (Low byte) | | | | | | | |
| | 5 | Torque Reference/Torque Limit (High byte) | | | | | | | |

## Speed and Torque Control Input – 72(0x48)

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 72 (0x48) | 0 | - | - | - | - | - | Running 1 | - | Faulted |
| | 1 | - | | | | | | | |
| | 2 | Speed Actual (Low byte) | | | | | | | |
| | 3 | Speed Actual (High byte) | | | | | | | |
| | 4 | Torque Actual (Low byte) | | | | | | | |
| | 5 | Torque Actual (High byte) | | | | | | | |

## Extended Speed and Torque Control Output – 23(0x17)

Combines speed and torque control with extended status feedback information and network control indication.

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 23 (0x17) | 0 | - | NetRef | NetCtrl | - | - | Fault Reset | Run Rev | Run Fwd |
| | 1 | - | | | | | | | |
| | 2 | Speed Reference/Speed Limit (Low byte) | | | | | | | |
| | 3 | Speed Reference/Speed Limit (High byte) | | | | | | | |
| | 4 | Torque Reference/Torque Limit (Low byte) | | | | | | | |
| | 5 | Torque Reference/Torque Limit (High byte) | | | | | | | |

## Extended Speed and Torque Control Input – 73(0x49)

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 73 (0x49) | 0 | Speed Agree | NetRef | NetCtrl | Ready | Running 2 | Running 1 | Alarm | Faulted |
| | 1 | State | | | | | | | |
| | 2 | Speed Actual (Low byte) | | | | | | | |
| | 3 | Speed Actual (High byte) | | | | | | | |
| | 4 | Torque Actual (Low byte) | | | | | | | |
| | 5 | Torque Actual (High byte) | | | | | | | |

# A-2-4 Omron Specific EtherNet/IP Drive Assembly Instances

## Omron Speed/Torque Control Output – 101(0x65)

Adds terminal I/O control, fault handling, and extended speed/torque monitoring.

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 101 (0x65) | 0 | DI6 | DI5 | DI4 | DI3 | DI2 | DI1 | Run Rev | Run Fwd |
| | 1 | - | - | DO1 | - | - | - | Fault Reset | External Fault |
| | 2 | Speed Reference/Speed Limit (Low byte) | | | | | | | |
| | 3 | Speed Reference/Speed Limit (High byte) | | | | | | | |
| | 4 | Torque Reference/Torque Limit (Low byte) | | | | | | | |
| | 5 | Torque Reference/Torque Limit (High byte) | | | | | | | |
| | 6 | Torque Compensation (Low byte) | | | | | | | |
| | 7 | Torque Compensation (High byte) | | | | | | | |

## Omron Speed/Torque Status Input – 151(0x97)

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 151 (0x97) | 0 | Faulted | Alarm | Ready | Speed Agree | Fault Reset | Running 2 | ZSP | Running |
| | 1 | ZSV | - | - | - | DO1 | LOCAL/ REMOTE | Uv | - |
| | 2 | Output Frequency (Low byte) | | | | | | | |
| | 3 | Output Frequency (High byte) | | | | | | | |
| | 4 | Torque Actual (Low byte) | | | | | | | |
| | 5 | Torque Actual (High byte) | | | | | | | |
| | 6 | Current Actual (Low byte) | | | | | | | |
| | 7 | Current Actual (High byte) | | | | | | | |

## Omron Extended Speed/Torque Control Output – 115(0x73)

Provides extended monitoring data such as current, DC voltage, frequency commands, and alarms.

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 115 (0x73) | 0 | DI6 | DI5 | DI4 | DI3 | DI2 | DI1 | Run Rev | Run Fwd |
| | 1 | - | - | DO1 | - | - | - | Fault Reset | External Fault |
| | 2 | Speed Reference/Speed Limit (Low byte) | | | | | | | |
| | 3 | Speed Reference/Speed Limit (High byte) | | | | | | | |
| | 4 | Torque Reference/Torque Limit (Low byte) | | | | | | | |
| | 5 | Torque Reference/Torque Limit (High byte) | | | | | | | |
| | 6 | Torque Compensation (Low byte) | | | | | | | |
| | 7 | Torque Compensation (High byte) | | | | | | | |
| | 8 - 39 | - | | | | | | | |

## Omron Extended Speed/Torque Status Input – 155(0x9B)

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 155 (0x9B) | 0 | Faulted | Alarm | Ready | Speed Agree | Fault Reset | Running 2 | ZSP | Running |
| | 1 | ZSV | - | - | - | DO1 | LOCAL/ REMOTE | Uv | - |
| | 2 - 3 | Motor Speed (Low, High byte) | | | | | | | |
| | 4 - 5 | Torque Actual (Low, High byte) | | | | | | | |
| | 6 - 7 | - | | | | | | | |
| | 8 - 9 | Frequency Command (Low, High byte) | | | | | | | |
| | 10 - 11 | Output Frequency (Low, High byte) | | | | | | | |
| | 12 - 13 | Output Current (Low, High byte) | | | | | | | |
| | 14 - 15 | - | | | | | | | |
| | 16 - 17 | Main Circuit DC Voltage (Low, High byte) | | | | | | | |
| | 18 - 19 | Error Alarm Signal 1 (Low, High byte) | | | | | | | |
| | 20 - 21 | Error Alarm Signal 2 (Low, High byte) | | | | | | | |
| | 22 - 23 | Error Alarm Signal 3 (Low, High byte) | | | | | | | |
| | 24 - 25 | - | | | | | | | |
| | 26 - 27 | - | | | | | | | |
| | 28 - 29 | Terminal AI1 Input (Low, High byte) | | | | | | | |
| | 30 - 39 | - | | | | | | | |

## Omron High Speed/Torque Control Output – 116(0x74)

High-bandwidth I/O with extensive status, diagnostics, and dynamic input/output mapping for advanced applications.

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 116 (0x74) | 0 | DI6 | DI5 | DI4 | DI3 | DI2 | DI1 | Run Rev | Run Fwd |
| | 1 | - | - | DO1 | - | - | - | Fault Reset | External Fault |
| | 2 - 3 | Speed Reference/Speed Limit (Low, High byte) | | | | | | | |
| | 4 - 5 | Torque Reference/Torque Limit (Low, High byte) | | | | | | | |
| | 6 - 7 | Torque Compensation (Low, High byte) | | | | | | | |
| | 8 | - | | | | | | | |
| | 9 | - | - | - | - | - | - | - | DI7 |
| | 10 | - | - | - | - | - | - | NetCtrl | NetRef |
| | 11 | - | - | - | - | - | - | - | - |
| | 12 - 19 | - | | | | | | | |
| | 20 - 21 | Dynamic Output 1 specified by parameter o221 (Low, High byte) | | | | | | | |
| | 22 - 23 | Dynamic Output 2 specified by parameter o222 (Low, High byte) | | | | | | | |
| | 24 - 25 | Dynamic Output 3 specified by parameter o223 (Low, High byte) | | | | | | | |
| | 26 - 27 | Dynamic Output 4 specified by parameter o224 (Low, High byte) | | | | | | | |
| | 28 - 29 | Dynamic Output 5 specified by parameter o225 (Low, High byte) | | | | | | | |
| | 30 - 31 | Dynamic Output 6 specified by parameter o226 (Low, High byte) | | | | | | | |
| | 32 - 33 | Dynamic Output 7 specified by parameter o227 (Low, High byte) | | | | | | | |
| | 34 - 35 | Dynamic Output 8 specified by parameter o228 (Low, High byte) | | | | | | | |
| | 36 - 37 | Dynamic Output 9 specified by parameter o229 (Low, High byte) | | | | | | | |
| | 38 - 39 | Dynamic Output 10 specified by parameter o230 (Low, High byte) | | | | | | | |
| | 40 - 43 | - | | | | | | | |

## Omron High Speed/Torque Status Input – 166(0xA6)

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 166 (0xA6) | 0 | Faulted | Alarm | Ready | Speed Agree | Fault Reset | Running 2 | ZSP | Running |
| | 1 | ZSV | - | - | - | DO1 | LOCAL/ REMOTE | Uv | - |
| | 2 - 3 | Motor Speed (Low, High byte) | | | | | | | |
| | 4 - 5 | Torque Actual (Low, High byte) | | | | | | | |
| | 6 - 7 | - | | | | | | | |
| | 8 - 9 | Frequency Command (Low, High byte) | | | | | | | |
| | 10 - 11 | Output Frequency (Low, High byte) | | | | | | | |
| | 12 - 13 | Output Current (Low, High byte) | | | | | | | |
| | 14 - 15 | Terminal AI1 Input (Low, High byte) | | | | | | | |
| | 16 - 17 | Main Circuit DC Voltage (Low, High byte) | | | | | | | |
| | 18 - 19 | Error Code (Low, High byte) | | | | | | | |
| | 20 - 21 | Dynamic input 1 specified by parameter o253 (Low, High byte) | | | | | | | |
| | 22 - 23 | Dynamic input 2 specified by parameter o254 (Low, High byte) | | | | | | | |
| | 24 - 25 | Dynamic input 3 specified by parameter o255 (Low, High byte) | | | | | | | |
| | 26 - 27 | Dynamic input 4 specified by parameter o256 (Low, High byte) | | | | | | | |
| | 28 - 29 | Dynamic input 5 specified by parameter o257 (Low, High byte) | | | | | | | |
| | 30 - 31 | Dynamic input 6 specified by parameter o258 (Low, High byte) | | | | | | | |
| | 32 - 33 | Dynamic input 7 specified by parameter o259 (Low, High byte) | | | | | | | |
| | 34 - 35 | Dynamic input 8 specified by parameter o260 (Low, High byte) | | | | | | | |
| | 36 - 37 | Dynamic input 9 specified by parameter o261 (Low, High byte) | | | | | | | |
| | 38 - 39 | Dynamic input 10 specified by parameter o262 (Low, High byte) | | | | | | | |
| | 40 - 43 | - | | | | | | | |

## Omron 8-Byte Dynamic Output – 117(0x75)

Compact dynamic I/O with free parameter mapping; suitable when limited I/O size is required.

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 117 (0x75) | 0 | DI6 | DI5 | DI4 | DI3 | DI2 | DI1 | Run Rev | Run Fwd |
| | 1 | - | - | DO1 | - | - | - | Fault Reset | External Fault |
| | 2 | Speed Reference/Speed Limit (Low byte) | | | | | | | |
| | 3 | Speed Reference/Speed Limit (High byte) | | | | | | | |
| | 4 - 5 | Dynamic Output 1 specified by parameter o221 (Low, High byte) | | | | | | | |
| | 6 - 7 | Dynamic Output 2 specified by parameter o222 (Low, High byte) | | | | | | | |

## Omron 8-Byte Dynamic Input – 167(0xA7)

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 167 (0xA7) | 0 | Faulted | Alarm | Ready | Speed Agree | Fault Reset | Running 2 | ZSP | Running |
| | 1 | ZSV | - | - | - | DO1 | LOCAL/ REMOTE | Uv | - |
| | 2 | Output Frequency (Low byte) | | | | | | | |
| | 3 | Output Frequency (High byte) | | | | | | | |
| | 4 - 5 | Dynamic Input 1 specified by parameter o253 (Low, High byte) | | | | | | | |
| | 6 - 7 | Dynamic Input 2 specified by parameter o254 (Low, High byte) | | | | | | | |

## Omron 12-Byte Dynamic Output – 118(0x76)

Medium-size dynamic I/O with multiple freely assignable parameters.

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 118 (0x76) | 0 | DI6 | DI5 | DI4 | DI3 | DI2 | DI1 | Run Rev | Run Fwd |
| | 1 | - | - | DO1 | - | - | - | Fault Reset | External Fault |
| | 2 | Speed Reference/Speed Limit (Low byte) | | | | | | | |
| | 3 | Speed Reference/Speed Limit (High byte) | | | | | | | |
| | 4 - 5 | Dynamic Output 1 specified by parameter o221 (Low, High byte) | | | | | | | |
| | 6 - 7 | Dynamic Output 2 specified by parameter o222 (Low, High byte) | | | | | | | |
| | 8 - 9 | Dynamic Output 3 specified by parameter o223 (Low, High byte) | | | | | | | |
| | 10 - 11 | Dynamic Output 4 specified by parameter o224 (Low, High byte) | | | | | | | |

## Omron 12-Byte Dynamic Input – 168(0xA8)

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 168 (0xA8) | 0 | Faulted | Alarm | Ready | Speed Agree | Fault Reset | Running 2 | ZSP | Running |
| | 1 | ZSV | - | - | - | DO1 | LOCAL/ REMOTE | Uv | - |
| | 2 | Output Frequency (Low byte) | | | | | | | |
| | 3 | Output Frequency (High byte) | | | | | | | |
| | 4 - 5 | Dynamic Input 1 specified by parameter o253 | | | | | | | |
| | 6 - 7 | Dynamic Input 2 specified by parameter o254 | | | | | | | |
| | 8 - 9 | Dynamic Input 3 specified by parameter o255 | | | | | | | |
| | 10 - 11 | Dynamic Input 4 specified by parameter o256 | | | | | | | |

## Omron 18-Byte Dynamic Output – 119(0x77)

Expanded dynamic I/O for additional mapped parameters and monitoring signals.

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 119 (0x77) | 0 | DI6 | DI5 | DI4 | DI3 | DI2 | DI1 | Run Rev | Run Fwd |
| | 1 | - | - | DO1 | - | - | - | Fault Reset | External Fault |
| | 2 | Speed Reference/Speed Limit (Low byte) | | | | | | | |
| | 3 | Speed Reference/Speed Limit (High byte) | | | | | | | |
| | 4 - 5 | Dynamic Output 1 specified by parameter o221 | | | | | | | |
| | 6 - 7 | Dynamic Output 2 specified by parameter o222 | | | | | | | |
| | 8 - 9 | Dynamic Output 3 specified by parameter o223 | | | | | | | |
| | 10 - 11 | Dynamic Output 4 specified by parameter o224 | | | | | | | |
| | 12 - 13 | Dynamic Output 5 specified by parameter o225 | | | | | | | |
| | 14 - 15 | Dynamic Output 6 specified by parameter o226 | | | | | | | |
| | 16 - 17 | Dynamic Output 7 specified by parameter o227 | | | | | | | |

## Omron 18-Byte Dynamic Input – 169(0xA9)

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 169 (0xA9) | 0 | Faulted | Alarm | Ready | Speed Agree | Fault Reset | Running 2 | ZSP | Running |
| | 1 | ZSV | - | - | - | DO1 | LOCAL/ REMOTE | Uv | - |
| | 2 | Output Frequency (Low byte) | | | | | | | |
| | 3 | Output Frequency (High byte) | | | | | | | |
| | 4 - 5 | Dynamic Input 1 specified by parameter o253 | | | | | | | |
| | 6 - 7 | Dynamic Input 2 specified by parameter o254 | | | | | | | |
| | 8 - 9 | Dynamic Input 3 specified by parameter o255 | | | | | | | |
| | 10 - 11 | Dynamic Input 4 specified by parameter o256 | | | | | | | |
| | 12 - 13 | Dynamic Input 5 specified by parameter o257 | | | | | | | |
| | 14 - 15 | Dynamic Input 6 specified by parameter o258 | | | | | | | |
| | 16 - 17 | Dynamic Input 7 specified by parameter o259 | | | | | | | |

## Ormon 24-Byte Dynamic Output – 120(0x78)

Large dynamic I/O allowing extensive parameter mapping and feedback.

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 120 (0x78) | 0 | DI6 | DI5 | DI4 | DI3 | DI2 | DI1 | Run Rev | Run Fwd |
| | 1 | - | - | DO1 | - | - | - | Fault Reset | External Fault |
| | 2 | Speed Reference/Speed Limit (Low byte) | | | | | | | |
| | 3 | Speed Reference/Speed Limit (High byte) | | | | | | | |
| | 4 - 5 | Dynamic Output 1 specified by parameter o221 | | | | | | | |
| | 6 - 7 | Dynamic Output 2 specified by parameter o222 | | | | | | | |
| | 8 - 9 | Dynamic Output 3 specified by parameter o223 | | | | | | | |
| | 10 - 11 | Dynamic Output 4 specified by parameter o224 | | | | | | | |
| | 12 - 13 | Dynamic Output 5 specified by parameter o225 | | | | | | | |
| | 14 - 15 | Dynamic Output 6 specified by parameter o226 | | | | | | | |
| | 16 - 17 | Dynamic Output 7 specified by parameter o227 | | | | | | | |
| | 18 - 19 | Dynamic Output 8 specified by parameter o228 | | | | | | | |
| | 20 - 21 | Dynamic Output 9 specified by parameter o229 | | | | | | | |
| | 22 - 23 | Dynamic Output 10 specified by parameter o230 | | | | | | | |

## Omron 24-Byte Dynamic Input – 170(0xAA)

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 170 (0xAA) | 0 | Faulted | Alarm | Ready | Speed Agree | Fault Reset | Running 2 | ZSP | Running |
| | 1 | ZSV | - | - | - | DO1 | LOCAL/ REMOTE | Uv | - |
| | 2 | Output Frequency (Low byte) | | | | | | | |
| | 3 | Output Frequency (High byte) | | | | | | | |
| | 4 - 5 | Dynamic Input 1 specified by parameter o253 | | | | | | | |
| | 6 - 7 | Dynamic Input 2 specified by parameter o254 | | | | | | | |
| | 8 - 9 | Dynamic Input 3 specified by parameter o255 | | | | | | | |
| | 10 - 11 | Dynamic Input 4 specified by parameter o256 | | | | | | | |
| | 12 - 13 | Dynamic Input 5 specified by parameter o257 | | | | | | | |
| | 14 - 15 | Dynamic Input 6 specified by parameter o258 | | | | | | | |
| | 16 - 17 | Dynamic Input 7 specified by parameter o259 | | | | | | | |
| | 18 - 19 | Dynamic Input 8 specified by parameter o260 | | | | | | | |
| | 20 - 21 | Dynamic Input 9 specified by parameter o261 | | | | | | | |
| | 22 - 23 | Dynamic Input 10 specified by parameter o262 | | | | | | | |

## Omron 32-Byte Dynamic Output – 121(0x79)

Maximum-size dynamic I/O, supporting the highest number of user-assignable parameters and signals.

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 121 (0x79) | 0 | DI6 | DI5 | DI4 | DI3 | DI2 | DI1 | Run Rev | Run Fwd |
| | 1 | - | - | DO1 | - | - | - | Fault Reset | External Fault |
| | 2 | Speed Reference/Speed Limit (Low byte) | | | | | | | |
| | 3 | Speed Reference/Speed Limit (High byte) | | | | | | | |
| | 4 - 5 | Dynamic Output 1 specified by parameter o221 | | | | | | | |
| | 6 - 7 | Dynamic Output 2 specified by parameter o222 | | | | | | | |
| | 8 - 9 | Dynamic Output 3 specified by parameter o223 | | | | | | | |
| | 10 - 11 | Dynamic Output 4 specified by parameter o224 | | | | | | | |
| | 12 - 13 | Dynamic Output 5 specified by parameter o225 | | | | | | | |
| | 14 - 15 | Dynamic Output 6 specified by parameter o226 | | | | | | | |
| | 16 - 17 | Dynamic Output 7 specified by parameter o227 | | | | | | | |
| | 18 - 19 | Dynamic Output 8 specified by parameter o228 | | | | | | | |
| | 20 - 21 | Dynamic Output 9 specified by parameter o229 | | | | | | | |
| | 22 - 23 | Dynamic Output 10 specified by parameter o230 | | | | | | | |
| | 24 - 25 | Dynamic Output 11 specified by parameter o231 | | | | | | | |
| | 26 - 27 | Dynamic Output 12 specified by parameter o232 | | | | | | | |
| | 28 - 29 | Dynamic Output 13 specified by parameter o233 | | | | | | | |
| | 30 - 31 | Dynamic Output 14 specified by parameter o234 | | | | | | | |

## Omron 32-Byte Dynamic Input – 171(0xAB)

| Instance | Byte | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|---|---|
| 171 (0xAB) | 0 | Faulted | Alarm | Ready | Speed Agree | Fault Reset | Running 2 | ZSP | Running |
| | 1 | ZSV | - | - | - | DO1 | LOCAL/ REMOTE | Uv | - |
| | 2 | Output Frequency (Low byte) | | | | | | | |
| | 3 | Output Frequency (High byte) | | | | | | | |
| | 4 - 5 | Dynamic Input 1 specified by parameter o253 | | | | | | | |
| | 6 - 7 | Dynamic Input 2 specified by parameter o254 | | | | | | | |
| | 8 - 9 | Dynamic Input 3 specified by parameter o255 | | | | | | | |
| | 10 - 11 | Dynamic Input 4 specified by parameter o256 | | | | | | | |
| | 12 - 13 | Dynamic Input 5 specified by parameter o257 | | | | | | | |
| | 14 - 15 | Dynamic Input 6 specified by parameter o258 | | | | | | | |
| | 16 - 17 | Dynamic Input 7 specified by parameter o259 | | | | | | | |
| | 18 - 19 | Dynamic Input 8 specified by parameter o260 | | | | | | | |
| | 20 - 21 | Dynamic Input 9 specified by parameter o261 | | | | | | | |
| | 22 - 23 | Dynamic Input 10 specified by parameter o262 | | | | | | | |
| | 24 - 25 | Dynamic Input 11 specified by parameter o263 | | | | | | | |
| | 26 - 27 | Dynamic Input 12 specified by parameter o264 | | | | | | | |
| | 28 - 29 | Dynamic Input 13 specified by parameter o264 | | | | | | | |
| | 30 - 31 | Dynamic Input 14 specified by parameter o266 | | | | | | | |

# A-3 PROFINET IO Communication Model

The 3G3M1-EMP functions as a PROFINET IO Device supporting RT communication, Class-B conformance, and PROFIDrive V4.2. Cyclic data exchange is performed via PROFIdrive telegrams, while configuration and diagnostics are handled using standard PROFINET mechanisms.

For PROFIdrive practical use concepts such as state machines, operational sequences, and application examples refer to chapter 4 of this user manual.

## A-3-1 GSDML Device Description

GSDML file is a descriptor file that defines how the 3G3M1-EMP is identified and instantiated by a PROFINET IO Controller. It needs to be installed in the controller application in order to support M1-EMP.

- Vendor ID and Device ID
- PROFINET and PROFIDrive certification versions
- Supported RT class and minimum cycle time
- Identification & Maintenance data (I&M0–I&M3)
- Device Access Points (DAP)
- Slot model used by the drive
- Association of PROFIdrive telegrams to slots
- Subslot concept for I/O data and diagnostics

## A-3-2 PROFIdrive Identification parameters (Acyclic)

The Standard PROFIdrive PNU table contains parameters defined by the PROFIDrive profile specification and applicable to drives that conform to Application Class 1 (Standard Drives).

Standard PROFIdrive PNUs are generally read-only or configuration-oriented and should be interpreted according to the PROFIdrive specification, regardless of the device brand.

This table lists all PROFIdrive standard PNUs supported by the 3G3M1-EMP inverter:

| PNU | Subindex Data Type | Name | Attribute | Description |
|---|---|---|---|---|
| 922 | Unsigned16 | Telegram selection | R | Telegram1=1<br>Telegram100=100<br>Telegram101=101<br>(reflects the I/O setting received from the master) |
| 928 | Unsigned16 | Control priority DO IO Data | R | Fixed at 1 |
| 930 | Unsigned16 | Operation mode | R | Fixed at 1 (for speed control) |
| 944 | Unsigned16 | Fault message counter : Number of abnormal occurrences | R | Counts change edges of the inverter alarm status and responds with the value. |
| 947 | Array[63]: Unsigned16 | Fault Number : Error code | R | The history of M16 when an alarm occurs at the inverter is saved in the communication card.<br>In an 8-WORD x 8-block area, the blocks are switched by resetting STW1 bit7. |
| 964 | Array[6]: Unsigned16 | Drive Unit identification | R | [0]: Manufacturer<br>[1]: Manufacturer Fuji Electric Co., Ltd. (0015h)<br>[3]: SW-Version<br>[4]: Firmware Date(year)<br>[5]: Firmware Date(day/month)<br>[6]: PROFINET Number of Drive Object |
| 965 | OctetString2 | Profile ID | R | Byte1 : Profile=3,<br>Byte2 : PROFIDrive Version = 42(4.2) |
| 974 | Array[3]: Unsigned16 | Parameter Access ID | R | Accessible Communication Size |
| 975 | Array[9]: Unsigned16 | DO Identification | R | Drive Object identity<br>[0]: Manufacturer Fuji Electric Co., Ltd. (0015h)<br>[1]: DO type(0)<br>[2]: Firmware version<br>[3]: Firmware date(year)<br>[4]: Firmware date(day/month)<br>[5]: DO type class Axis(1)<br>[6]: DO type sub class1 AC1(1)<br>[7]: Drive Object ID(1)<br>[8] to [9] : Reserved |
| 980 to 989 | Array[n] Unsigned16 | A numbered list of predefined parameters | R | A list of parameter numbers defined in the device |
| 60000 | Float32 | Velocity reference value | R | The speed reference value sets the 100% speed value for the N2/N4 normalized speed signal (NIST, NSOLL). |

## A-3-3 Vendor Specific Parameters (Acyclic)

The Vendor-specific PNU table contains parameters that extend the standard PROFIdrive functionality with drive-specific features. In M1-EMP, these PNUs are used to:

- access internal inverter parameters via PROFINET
- map Modbus parameter addresses to PROFINET acyclic access

This table lists all vendor specific PNUs supported by the 3G3M1-EMP inverter:

| PNU | Subindex Data Type | Name | Attribute | Description |
|---|---|---|---|---|
| 1024 | [0] to [65535] Unsigned16 | 2byte parameter data | R/W | Sets Modbus address of 2byte parameter to Subindex |
| 1025 | [0] to [65535] Unsigned32 | 4byte parameter data | R/W | Sets Modbus address(upper address) of 4byte parameter to Subindex |

# A-4 PROFIdrive Control and Status (Cyclic)

This section describes the cyclic drive control interface defined by the PROFIdrive profile implemented in 3G3M1-EMP. Control and status words, setpoints, and feedback values exchanged cyclically between the PROFINET IO Controller and the inverter. For application examples, check chapter 4.

- Standard Telegram 1
- Vendor-specific Telegram 100
- Vendor-specific Telegram 101

Minimum supported cycle time (4 ms)

## A-4-1 Standard Telegram 1 (cyclic PROFIdrive control)

This is the basic PROFIdrive control and status monitoring.

| I/O word offset | Output data (Master → Inverter) | Input data (Inverter → Master) |
|---|---|---|
| 1 | Control word 1 (STW1) | Status word 1 (ZSW1) |
| 2 | Reference speed setpoint (NSOLL_A) | Speed actual (NIST_A) |

## A-4-2 Telegram 100 (Vendor Specific PROFIdrive + Short Flexible map)

This telegram combines PROFIdrive inverter control and speed reference with the possibility to freely map other control registers, setting parameters or monitoring parameters convenient for the application.

| I/O word offset | Output data(Master → Inverter) | Input data(Inverter → Master) |
|---|---|---|
| 1 | Control word (STW1) | Status word (ZSW1) |
| 2 | Speed command (NSOLL_A) | Speed Detection Value (NIST_A) |
| 3 | Write to the parameter specified by parameter o221 | Read from the parameter specified by parameter o253 |
| 4 | Write to the parameter specified by parameter o222 | Read from the parameter specified by parameter o254 |
| 5 | Write to the parameter specified by parameter o223 | Read from the parameter specified by parameter o255 |
| 6 | Write to the parameter specified by parameter o224 | Read from the parameter specified by parameter o256 |

The o200 series is a new parameter group added for Ethernet communication.

It consists of a look-up table to the addresses defined in the parameter table in section 5. This allows mapping any parameter that can be mapped (also defined in the parameter table)

When assigning 4-byte data, specify consecutive addresses and follow the rules described in section 3 of this user manual.

Example 1: Writing a Position Reference (S020 – Positioning Data via Communication, 32-bit)

Modbus addresses (example), following the upper/lower word rule:

- Low word: 5015h
- High word: 5016h

| o2xx Parameter | Function | Assigned Value |
|---|---|---|
| o221 | Dynamic Output 1 (Low word) | 5015h |
| o222 | Dynamic Output 1 (High word) | 5016h |

Example 2: Reading the actual position (W142/W143 – Feedback Current Position Monitor, 32-bit)

Following the upper/lower word rule:

- Low word: 532Bh
- High word: 532Ch

| o2xx Parameter | Function | Assigned Value |
|---|---|---|
| o253 | Dynamic Input 1 (Low word) | 532Bh |
| o254 | Dynamic Input 1 (High word) | 532Ch |

## A-4-3 Telegram 101 (Vender Specific Telegram, Long Flexible map)

This is a expanded complete free mapping parameter. PROFIdrive controls are not included by default and many control and status feedback parameters to be used for the application. Unused slots (undefined address in o2xx table), does not consume communications bandwidth.

| I/O word offset | Output data (Master → Inverter) | Input data (Inverter → Master) |
|---|---|---|
| 1 | Write to the parameter specified by parameter o221 | Read from the parameter specified by parameter o253 |
| 2 | Write to the parameter specified by parameter o222 | Read from the parameter specified by parameter o254 |
| 3 | Write to the parameter specified by parameter o223 | Read from the parameter specified by parameter o255 |
| 4 | Write to the parameter specified by parameter o224 | Read from the parameter specified by parameter o256 |
| : | : | : |
| 31 | Write to the parameter specified by parameter o251 | Read from the parameter specified by parameter o283 |
| 32 | Write to the parameter specified by parameter o252 | Read from the parameter specified by parameter o284 |

Same examples as for Telegram 100 apply.

## Control Word (STW1)

Defines how the controller commands the drive as per PROFIdrive standards.

| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
|---|---|---|---|---|---|---|---|
| Reset | Enable Setpoint | Freeze Ramp | Enable Ramp | Enable Operation | ON3/OFF3 | ON2/OFF2 | ON/OFF1 |
| bit15 | bit14 | bit13 | bit12 | bit11 | bit10 | bit9 | bit8 |
| DI4 | DI3 | DI2 | DI1 | Direction | Control By PLC | - | - |

The meaning of the control bits:

| Bit | Name (PROFIDrive) | Meaning | Practical Effect |
|---|---|---|---|
| 0 | ON/OFF1 | Switch ON command | Enables power stage (when conditions are met) |
| 1 | ON/OFF2 | Enable operation | Allows drive to enter “Operation Enabled” |
| 2 | ON/OFF3 | Enable voltage | Enables DC link / output stage |
| 3 | Enable operation | Final enable | Drive may run if no fault is present |
| 4 | Enable ramp | Ramp enable | Allows acceleration/deceleration ramps |
| 5 | Enable setpoint | Setpoint enable | Speed/torque reference is accepted |
| 6 | Setpoint freeze | Freeze setpoint | Holds current setpoint value |
| 7 | Fault reset | Fault acknowledge | Rising edge resets drive faults |
| 8 | Direction control | Direction selection | 0 = Forward, 1 = Reverse |
| 9 | — | Reserved | Must be set to 0 |
| 10 | — | Reserved | Must be set to 0 |
| 11 | — | Reserved | Must be set to 0 |
| 12 | Direction via PLC | Direction source | Direction controlled via bus |
| 13 | — | Reserved | Must be set to 0 |
| 14 | — | Reserved | Must be set to 0 |
| 15 | — | Reserved | Must be set to 0 |

Typical STW1 Control Word use example

- Enable drive  Bits 0–3 = 1
- Run with ramp  Bits 4–5 = 1
- Reset fault  Bit 7 = 1 (pulse)
- Reverse direction  Bit 8 = 1

## Status Word (ZSW1)

Defines how the drive reports its operational state as per PROFIdrive standards.

| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
|---|---|---|---|---|---|---|---|
| Warning | Switch On | Quick Stop | Coast Stop | Fault | Operation Enabled | Ready to Operation | Ready to Switch On |
| bit15 | bit14 | bit13 | bit12 | bit11 | bit10 | bit9 | bit8 |
| Direction | - | - | - | - | AT Setpoint | Remote | Speed Error |

The meaning of the status bits:

| Bit | Name (PROFIDrive) | Meaning | Interpretation |
|---|---|---|---|
| 0 | Ready to switch ON | Drive ready | Power stage available |
| 1 | Ready for operation | Preconditions met | Drive can be enabled |
| 2 | Operation enabled | Drive enabled | Output stage active |
| 3 | Fault | Fault present | Drive stopped by fault |
| 4 | Coast stop active | Coast stop | Output disabled |
| 5 | Quick stop active | Quick stop | Fast deceleration |
| 6 | Switch-on inhibit | Inhibit active | Enable not allowed |
| 7 | Warning | Warning present | Non-critical issue |
| 8 | Direction | Actual direction | 0 = Forward, 1 = Reverse |
| 9 | Remote | Control source | 1 = Bus control |
| 10 | At setpoint | Speed reached | Actual ≈ reference |
| 11 | Internal limit | Limit active | Torque/speed limiting |
| 12 | — | Reserved | Always 0 |
| 13 | — | Reserved | Always 0 |
| 14 | — | Reserved | Always 0 |
| 15 | — | Reserved | Always 0 |

Typical ZSW1 Status Word interpretation

- Drive ready but stopped  Bits 0–1 = 1
- Running normally  Bits 2 = 1
- Fault condition  Bit 3 = 1
- Warning only  Bit 7 = 1
- Bus-controlled  Bit 9 = 1
- Speed reached  Bit 10 = 1

## Speed Command — NSOLL_A

**Format:**

- Data type: INT16 (signed)
- Range: –32768 … +32767
- Interpretation: Normalized speed value

| Value | Meaning | If rated speed = 1500 rpm |
|---|---|---|
| 0 | Zero speed | 0 rpm |
| +16384 | ≈ +50% of rated speed | 750 rpm |
| +32767 | +100% rated speed | 1500 rpm |
| –32768 | –100% rated speed (reverse) | -750 rpm |

## Speed Detection Value — NIST_A

**Format:**

Data type: INT16 (signed)

Range: –32768 … +32767

Scaling: Normalized speed value same as Speed Command

# A-5 Modbus TCP Function Codes

Read/Write Functions and Frame Structures

## A-5-1 Read Coil Function Code: 0x01

Coils are an alternative way to access the control and status bits of the M1 in a bit level, instead of Word level. This function 0x01 is used to read multiple consecutive coils.

The start address of the coil and the number of coils to be read are specified in the request frame.

### Request

| Address (Byte) | Name | Data length (Byte) | Description | Remark |
|---|---|---|---|---|
| 0 | Function code | 1 | Function code | 0x01 |
| 1<br>2 | Start address | 2 | Start address :High Start address :Low | 0x0000 to 0x004F |
| 3<br>4 | Number of coils | 2 | Number of register :High Number of register :Low | 0x0001 to 0x0050 |

### Response (normal)

| Address (Byte) | Name | Data length (Byte) | Description | Remark |
|---|---|---|---|---|
| 0 | Function code | 1 | Function code | 0x01 |
| 1 | Byte count | 1 | Number of bytes | Quotient of (K*+7) ÷ 8 = N |
| …<br>N+1 | Value of coil | N | Values of the start coil to N coil | 1 to 80 |

K : number of coils , N : Number of Registers

### Response (error)

| Address (Byte) | Name | Data length (Byte) | Remark |
|---|---|---|---|
| 0 | Error Code | 1 | 0x81 (ERROR) |
| 1 | Extension Code | 1 | 0x02: Start address is out of range.<br>0x03: Number of coils is incorrect (0 or too many).<br>The size of the request message is smaller than the required size |

## A-5-2 Modbus TCP Coil adresses (R/W and Read Only)

For the individual index, ad the coil base number and the column offset to obtain the final coil value.

| Coil | +7 | +6 | +5 | +4 | +3 | +2 | +1 | +0 | Remark |
|---|---|---|---|---|---|---|---|---|---|
| **1** | - | DI5 | DI4 | DI3 | DI2 | DI1 | REV | FWD | **S006 (R/W) Operation Command** |
| **9** | RST | DI7 | DI6 | - | - | - | - | - | |
| **17** | VL | TL | NUV | BRK | INT | EXT | REV | FWD | **M014 (RO) Operation Status 1** |
| **25** | BUSY | - | - | RL | ALM | DEC | ACC | IL | |
| **33** | FAN | - | THM | IPF | SETM | IRDY | FA2 | FA1 | **M070 (RO) Operation Status 2** |
| **41** | - | OL | LOC | OL2 | OLP | LIFE | OHF | TRY | |
| **49** | - | DI5 | DI4 | DI3 | DI2 | DI1 | REV | FWD | **M013 (RO) Final Operattion Command** |
| **57** | RST | DI7 | DI6 | - | EN | - | - | - | |
| **65** | - | - | - | - | - | - | - | DO1 | **M015 (RO) Output Terminal Status** |
| **73** | - | - | - | - | - | - | - | RO | |

The detailed meaning of each coil.

| Coil | Register | Symbol | Access | Meaning / Function |
|---|---|---|---|---|
| 1 | S006 | FWD | R/W | Forward run command (start/stop). Equivalent to FWD terminal. |
| 2 | | REV | R/W | Reverse run command (start/stop). Equivalent to REV terminal. |
| 3 | | DI1 | R/W | Digital input 1 simulation. Same function as DI1 terminal. |
| 4 | | DI2 | R/W | Digital input 2 simulation. Same function as DI2 terminal. |
| 5 | | DI3 | R/W | Digital input 3 simulation. Same function as DI3 terminal. |
| 6 | | DI4 | R/W | Digital input 4 simulation. Same function as DI4 terminal. |
| 7 | | DI5 | R/W | Digital input 5 simulation. Same function as DI5 terminal. |
| 14 | | DI6 | R/W | Digital input 6 simulation. Same function as DI6 terminal. |
| 15 | | DI7 | R/W | Digital input 7 simulation. Same function as DI7 terminal. |
| 16 | | RST | R/W | Fault reset command. Clears active fault when permitted. |
| 17 | M014 | FWD | RO | Forward command status (operation direction monitor). |
| 18 | | REV | RO | Reverse command status (operation direction monitor). |
| 19 | | EXT | RO | External operation selected status (terminal control). |
| 20 | | INT | RO | Internal operation selected status (keypad or network). |
| 21 | | BRK | RO | Brake function active status. |
| 22 | | NUV | RO | DC bus undervoltage status. |
| 23 | | TL | RO | Torque limit active status. |
| 24 | | VL | RO | Voltage limit active status. |

The detailed meaning of each coil (continued)

| Coil | Register | Symbol | Access | Meaning / Function |
|---|---|---|---|---|
| 25 | M014 | IL | RO | Current limit active status. |
| 26 | | ACC | RO | Acceleration in progress status. |
| 27 | | DEC | RO | Deceleration in progress status. |
| 28 | | ALM | RO | Alarm/warning present status. |
| 29 | | RL | RO | Internal ramp/limit function active status. |
| 32 | | BUSY | RO | Drive busy/transition status. |
| 33 | M070 | FA1 | RO | Status bit FA1 (drive internal status flag). |
| 34 | | FA2 | RO | Status bit FA2 (drive internal status flag). |
| 35 | | IRDY | RO | Inverter ready status. |
| 36 | | SETM | RO | Set/mode status (internal mode active). |
| 37 | | IPF | RO | Input power failure status. |
| 38 | | THM | RO | Thermal status (temperature warning/limit). |
| 40 | | FAN | RO | Cooling fan operation status. |
| 41 | | TRY | RO | Retry/auto-restart sequence active status. |
| 42 | | OHF | RO | Overheat warning status. |
| 43 | | LIFE | RO | Lifetime warning status. |
| 44 | | OLP | RO | Overload pre-warning status. |
| 45 | | OL2 | RO | Overload level 2 status. |
| 46 | | LOC | RO | Local mode status (keypad/local control). |
| 47 | | OL | RO | Overload active status. |
| 49 | M013 | FWD | RO | Final forward run command status (effective command). |
| 50 | | REV | RO | Final reverse run command status (effective command). |
| 51 | | DI1 | RO | Final DI1 effective state status. |
| 52 | | DI2 | RO | Final DI2 effective state status. |
| 53 | | DI3 | RO | Final DI3 effective state status. |
| 54 | | DI4 | RO | Final DI4 effective state status. |
| 55 | | DI5 | RO | Final DI5 effective state status. |
| 60 | | EN | RO | Final enable condition status. |
| 62 | | DI6 | RO | Final DI6 effective state status. |
| 63 | | DI7 | RO | Final DI7 effective state status. |
| 64 | | RST | RO | Final reset effective state status. |
| 65 | | DO1 | RO | Digital output DO1 status. |
| 73 | | RO | RO | Relay output status. |

## A-5-3 Read Holding Registers Function Code: 0x03

This function reads multiple consecutive holding registers.

It is not possible to read from address 0x7FFF to the free-mapped register address 0x8000. In that case, the read value will be 0 from address 0x8000 onwards.

### Request

| Address (Byte) | Name | Data length (Byte) | Description | Remark |
|---|---|---|---|---|
| 0 | Function code | 1 | Function code | 0x03 |
| 1<br>2 | Start address | 2 | Start address :High Start address :Low | 0x0000 to 0xFFFF |
| 3<br>4 | Number of Registers (N) | 2 | Number of registers :High Number of registers :Low | 0x0001 to 0x007D |

N : Number of Registers

### Response (normal)

| Address (Byte) | Name | Data length (Byte) | Description | Remark |
|---|---|---|---|---|
| 0 | Function code | 1 | Function code | 0x03 |
| 1 | Byte count | 1 | Number of bytes | N x 2 |
| …<br>(N x 2)+1 | Value of registers | N | Values of register address | |

N : Number of Registers

### Response (error)

| Address (Byte) | Name | Data length (Byte) | Remark |
|---|---|---|---|
| 0 | Error Code | 1 | 0x83 |
| 1 | Extension Code | 1 | 0x03: Number of registers is incorrect (0 or over).<br>The size of the request message is smaller than the required size |

## Modbus TCP Holding Register areas

| Address | Description | Remark |
|---|---|---|
| 0x0000 to 0x57FF | Parameter | Refer to parameter list |
| 0x8000 to 0x803F | Free mapped data(o221 to o284) | |

For details of Parameters and corresponding Holding Register addresses, check *Section 5 - "Parameter Table Structure"*

# A-5-4 Write Single Coil : 0x05

This function writes an ON/OFF output value to a single coil.

### Request

| Address (byte) | Name | Data length (byte) | Description | Remark |
|---|---|---|---|---|
| 0 | Function code | 1 | Function code | 0x05 |
| 1<br>2 | Output address | 2 | Output address :High<br>Output address :Low | 0x0000 to 0x000F |
| 3<br>4 | Output value | 2 | Output : High<br>Output : Low | ON=0xFF00<br>OFF=0x0000 |

### Response (normal)

| Address (Byte) | Name | Data length (Byte) | Description | Remark |
|---|---|---|---|---|
| 0 | Function code | 1 | Function code | 0x05 |
| 1<br>2 | Output address | 1 | Output address :High<br>Output address :Low | 0x0000 to 0x000F |
| 3<br>4 | Output value | 2 | Output : High<br>Output : Low | ON=0xFF00<br>OFF=0x0000 |

### Response (error)

| Address (Byte) | Name | Data length (Byte) | Remark |
|---|---|---|---|
| 0 | Error Code | 1 | 0x85 |
| 1 | Extension Code | 1 | 0x02: Output address is out of range.<br>0x03: Output value is incorrect.<br>The size of the request message is smaller than the required size |

## Modbus TCP Coil adresses (Write capable)

| Coil | +7 | +6 | +5 | +4 | +3 | +2 | +1 | +0 | Remark |
|---|---|---|---|---|---|---|---|---|---|
| **1** | - | DI5 | DI4 | DI3 | DI2 | DI1 | REV | FWD | **S006 (R/W)<br>Operation Command** |
| **9** | RST | DI7 | DI6 | - | - | - | - | - | |

## A-5-5 Write Single Register : 0x06

This function writes a register value to a single holding register (only 16bits possible)

To write to a 4-byte register, use "Write Multiple registers : 0x10".

If ”Write Single Register : 0x06” is used to write 4-byte register, a normal response will be returned but no writing will occur

### Request

| Address (Byte) | Name | Data length (Byte) | Description | Remark |
|---|---|---|---|---|
| 0 | Function code | 1 | Function code | 0x06 |
| 1<br>2 | Register address | 2 | Register address :High<br>Register address :Low | 0x0000 to 0xFFFF |
| 3<br>4 | Value of register | 2 | Value of register :High<br>Value of register :Low | 0x0000 to 0xFFFF |

### Response (normal)

| Address (Byte) | Name | Data length (Byte) | Description | Remark |
|---|---|---|---|---|
| 0 | Function code | 1 | Function code | 0x06 |
| 1<br>2 | Register address | 2 | Register address :High<br>Register address :Low | 0x0000 to 0xFFFF |
| 3<br>4 | Value of register | 2 | Value of register :High<br>Value of register :Low | 0x0000 to 0xFFFF |

### Response (error)

| Address (Byte) | Name | Data length (Byte) | Remark |
|---|---|---|---|
| 0 | Error Code | 1 | 0x86 |
| 1 | Extension Code | 1 | 0x03: The size of the request message is smaller than |
| | | | the required size |

## A-5-6 Write Multiple Coils : 0x0F

This function writes ON/OFF output values to multiple consecutive coils.

### Request

| Address (Byte) | Name | Data length (Byte) | Description | Remark |
|---|---|---|---|---|
| 0 | Function code | 1 | Function code | 0x0F |
| 1<br>2 | Start address | 2 | Start address :High<br>Start address :Low | 0x0000 to 0x000F |
| 3<br>4 | Number of outputs | 2 | Number of outputs :High<br>Number of outputs :Low | 0x0001 to 0x0010 |
| 5 | Byte count | 1 | Number of bytes | Quotient of (K*+7) ÷ 8 = N |
| …<br>N+5 | Value of output | N | Coil value for the number of outputs from the start address | "1"=ON, "0"=OFF bit arrangement, LSB indicates starting coil number |

K : number of coils , N : Number of Registers

### Response (normal)

| Address (byte) | Name | Data length (byte) | Description | Remark |
|---|---|---|---|---|
| 0 | Function code | 1 | Function code | 0x0F |
| 1<br>2 | Start address | 2 | Start address :High<br>Start address :Low | 0x0000 to 0x000F |
| 3<br>4 | Number of Outputs | 2 | Number of Outputs :High<br>Number of Outputs :Low | 0x0001 to 0x0010 |

### Response (error)

| Address (Byte) | Name | Data length (Byte) | Remark |
|---|---|---|---|
| 0 | Error Code | 1 | 0x8F |
| 1 | Extension Code | 1 | 0x02: Start address is out of range.<br>0x03: Number of coils is incorrect (0 or over).<br>Byte count is incorrect.<br>The size of the request message is smaller than the required size. |

## A-5-7 Write Multiple Registers : 0x10

This function writes successive holding registers.
It is not possible to write from address 0x7FFF to the free-mapped register address 0x8000.
In that case, do not write to addresses beyond 0x8000.

### Request

| Address (Byte) | Name | Data length (Byte) | Description | Remark |
|---|---|---|---|---|
| 0 | Function code | 1 | Function code | 0x10 |
| 1<br>2 | Start address | 2 | Start address :High<br>Start address :Low | 0x0000 to 0xFFFF |
| 3<br>4 | Number of registers | 2 | Number of registers :High<br>Number of registers :Low | 0x0001 to 0x007B |
| 5 | byte count | 1 | Number of bytes | N x 2 |
| 6<br>7<br>… | Value of register | N x 2 | Value of registers :High<br>Value of registers :Low<br>… | |

N : Number of Registers

### Response (normal)

| Address (Byte) | Name | Data length (Byte) | Description | Remark |
|---|---|---|---|---|
| 0 | Function code | 1 | Function code | 0x10 |
| 1<br>2 | Start address | 2 | Start address :High<br>Start address :Low | 0x0000 to 0xFFFF |
| 3 | Number of register | 2 | Number of register :High<br>Number of register :Low | 0x0001 to 0x007B |

### Response (error)

| Address (Byte) | Name | Data length (Byte) | Remark |
|---|---|---|---|
| 0 | Error Code | 1 | 0x90 |
| 1 | Extension Code | 1 | 0x03: Number of registers is incorrect (0 or over).<br>Byte count is incorrect.<br>The size of the request message is smaller than the required size. |

## A-5-8 Read/Write Multiple Registers : 0x17

This function code performs a combination of one read and one write operation in a single MODBUS transaction. The write operation is performed before the read.

### Request

| Address (Byte) | Name | Data length (Byte) | Description | Remark |
|---|---|---|---|---|
| 0 | Function code | 1 | Function code | 0x17 |
| 1<br>2 | Start address for read | 2 | Start address :High<br>Start address :Low | 0x0000 to 0xFFFF |
| 3<br>4 | Number of registers for read (M) | 2 | Number of registers :High<br>Number of registers :Low | 0x0001 to 0x007D |
| 5<br>6 | Start address for write | 2 | Start address :High<br>Start address :Low | 0x0000 to 0xFFFF |
| 7<br>8 | Number of registers for write (N) | 2 | Number of registers :High<br>Number of registers :Low | 0x0001 to 0x0079 |
| 9 | byte count for write | 1 | N x 2 | |
| 10<br>11<br>…<br>9+(N x 2) | Value of register for write | N x 2 | Value of registers :High<br>Value of registers :Low<br>… | |

M : Number of registers for read,  N : Number of registers for write

### Response (normal)

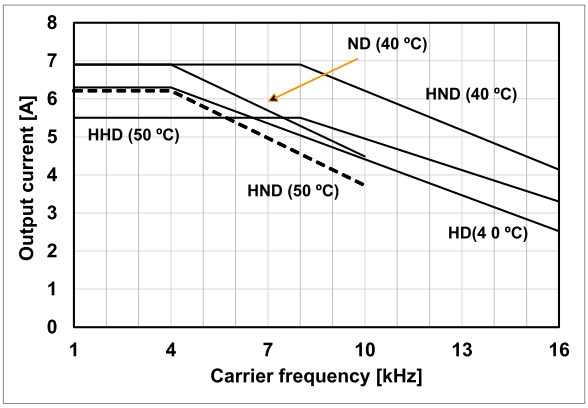
| Address (Byte) | Name | Data length (Byte) | Description | Remark |
|---|---|---|---|---|
| 0 | Function code | 1 | Function code | 0x17 |
| 1 | Byte count for read | 1 | M x 2 | |
| 2<br>3<br>…<br>1+(M x 2) | Value of register for read | 2 | Value of register :High<br>Value of register :Low<br>… | |

### Response (error)

| Address (Byte) | Name | Data length (Byte) | Remark |
|---|---|---|---|
| 0 | Error Code | 1 | 0x97 |
| 1 | Extension Code | 1 | 0x03:<br>Number of registers is incorrect (0 or over).<br>Byte count is incorrect.<br>The size of the request message is smaller than the required size. |

# A-6 Derating Table

If you intend to use the inverter models with HND/HD/ND modes at the temperature of 40°C or higher, derating is required. Refer to the following output current derating depending on ambient temperature.



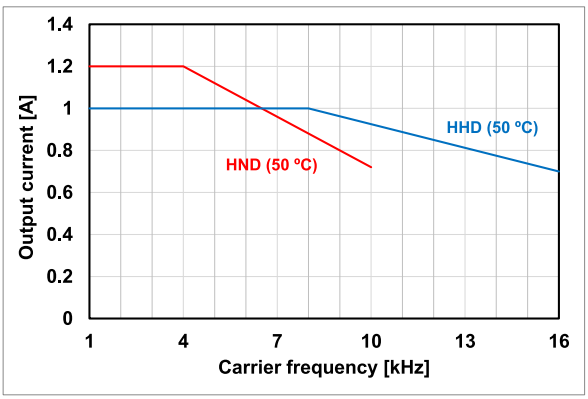

*1. If using any of 3G3M1-A2022/A2037/A4022/A4040/A4022/AB004/AB007/AB015/AB022-EMP at 50°C, refer to the following *charts*..

## When Changing the Carrier Frequency for Use

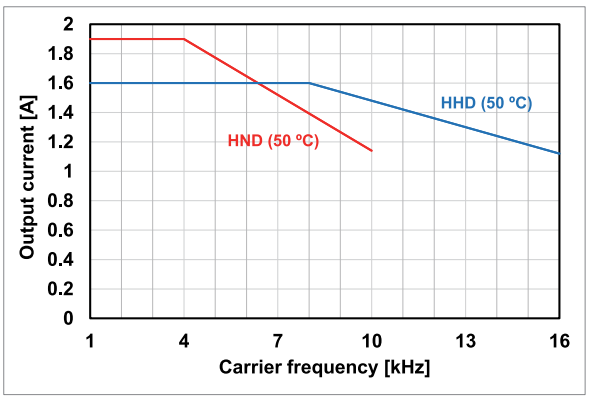
Refer to the following for derating output current when the carrier frequency is changed from the factory default. However, when using it side-by-side, the following derating is used in an ambient temperature of 40°C for HHD/HND and in an ambient temperature of 30°C for HD/ND.

### 3G3M1-AB001 / 3G3M1-AB002

3G3M1-AB001

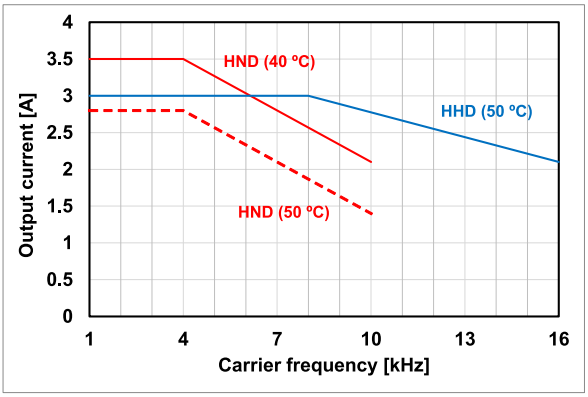



3G3M1-AB002

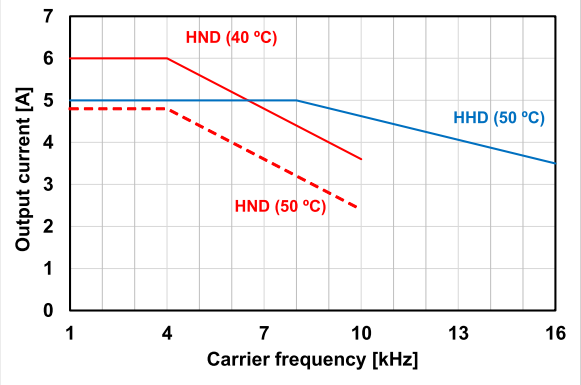


## 3G3M1-AB004 / 3G3M1-AB007

3G3M1-AB004

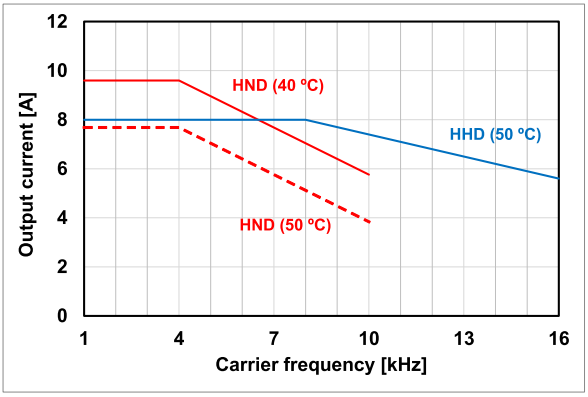



3G3M1-AB007

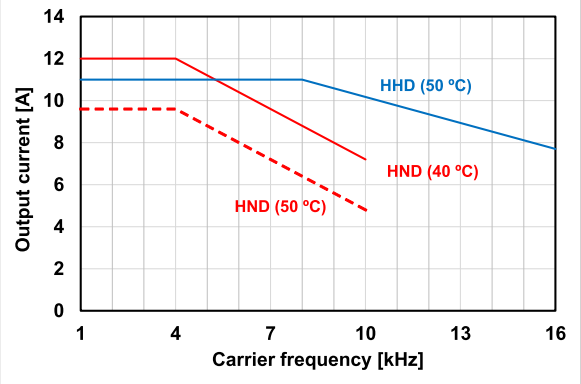



## 3G3M1-AB015 / 3G3M1-AB022

3G3M1-AB015

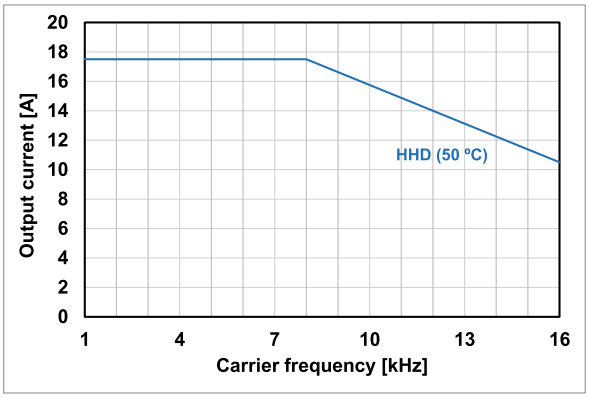



3G3M1-AB022



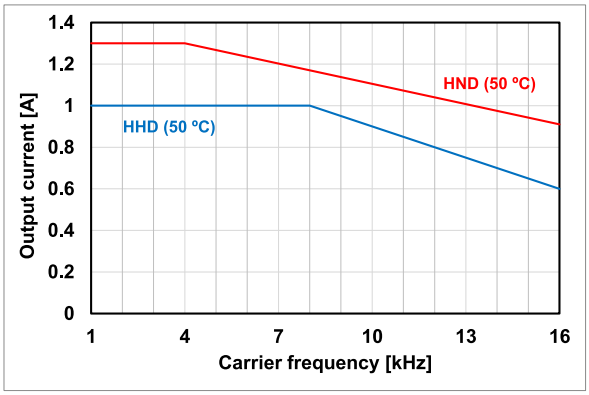

## 3G3M1-AB037

3G3M1-AB037

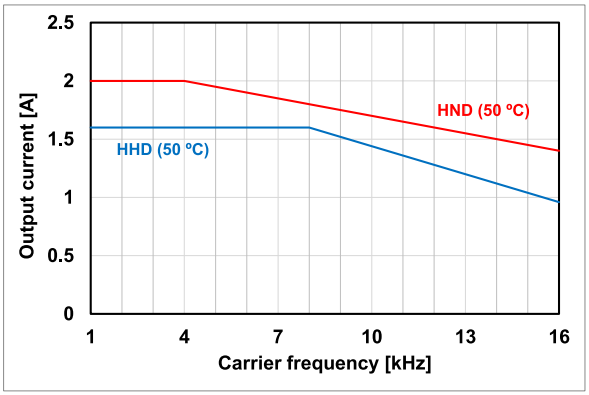


## 3G3M1-A2001 / 3G3M1-A2002

3G3M1-A2001

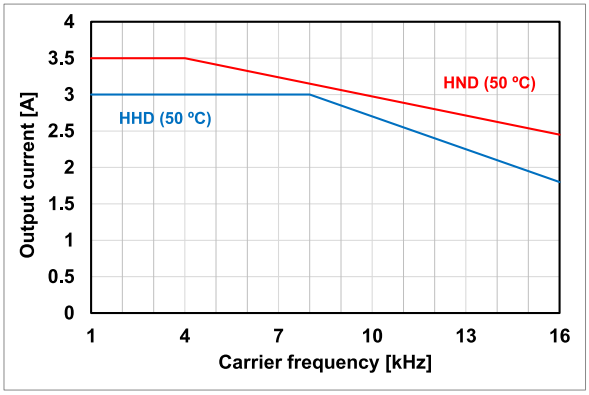



3G3M1-A2002

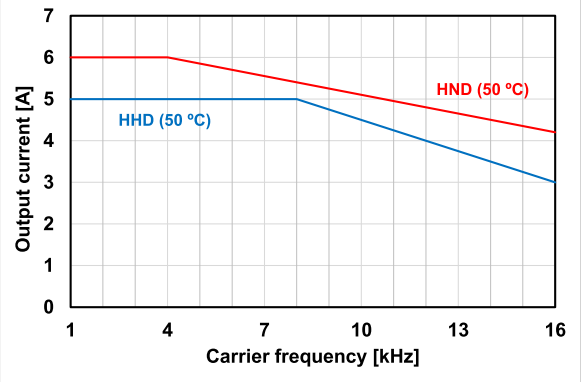



## 3G3M1-A2004 / 3G3M1-A2007

3G3M1-A2004

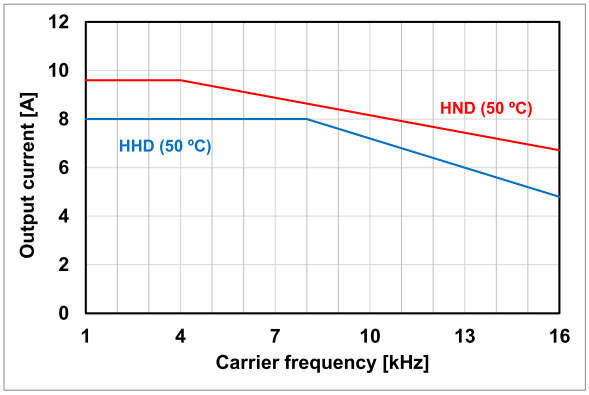



3G3M1-A2007

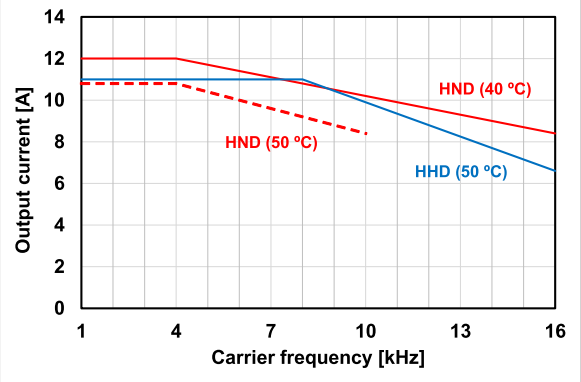



## 3G3M1-A2015 / 3G3M1-A2022

3G3M1-A2015

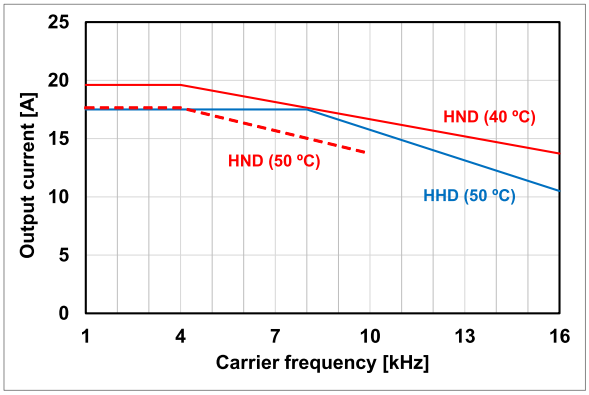



3G3M1-A2022

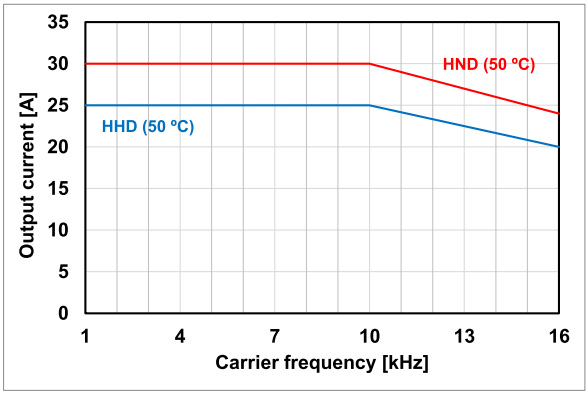


## 3G3M1-A2037 / 3G3M1-A2055

3G3M1-A2037

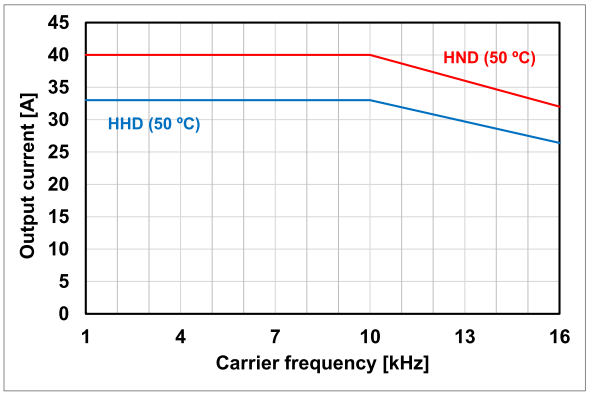



3G3M1-A2055

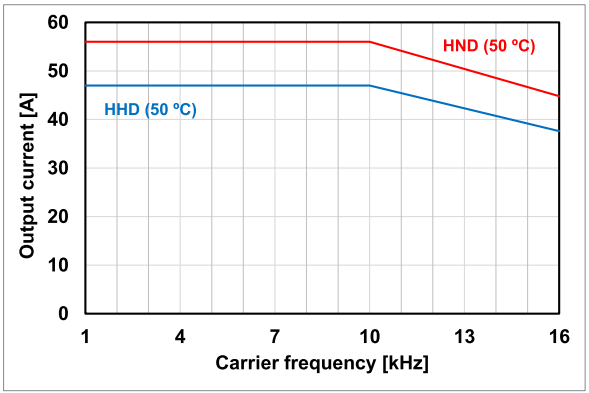



## 3G3M1-A2075 / 3G3M1-A2110

3G3M1-A2075

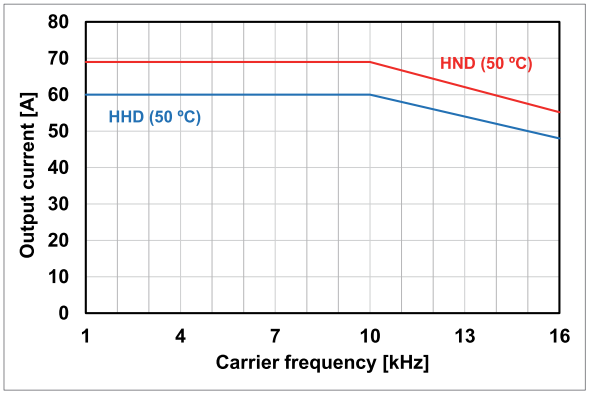



3G3M1-A2110

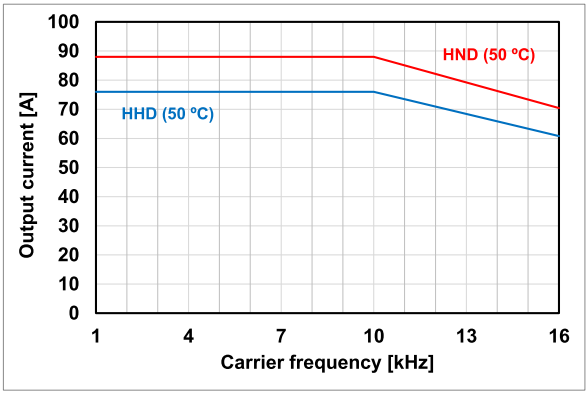



## 3G3M1-A2150 / 3G3M1-A2185

3G3M1-A2150

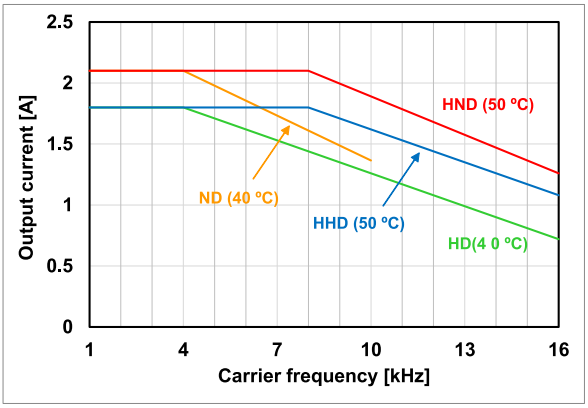



3G3M1-A2185

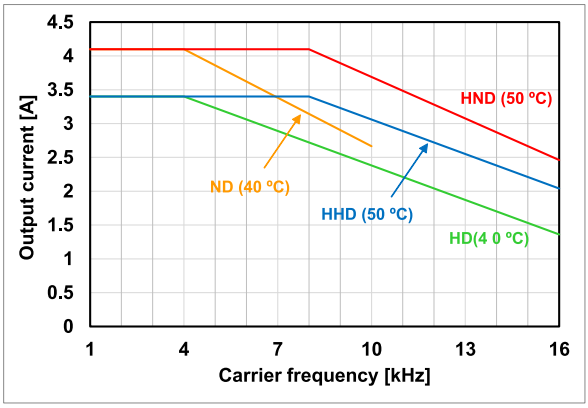


## 3G3M1-A4004 / 3G3M1-A4007

3G3M1-A4004

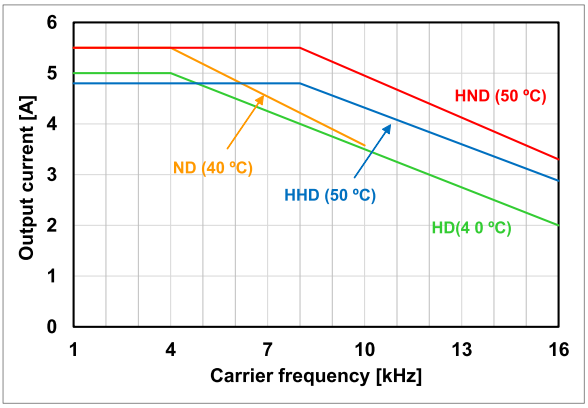



3G3M1-A4007

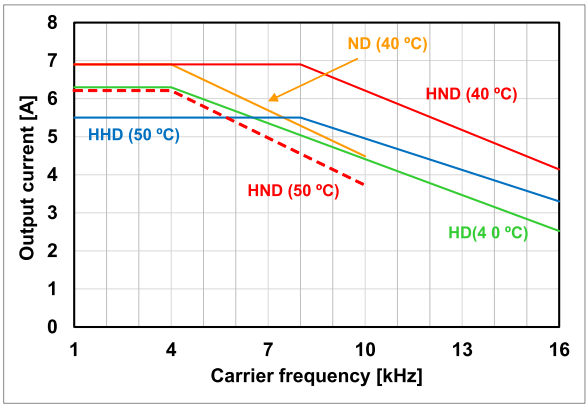



## 3G3M1-A4015 / 3G3M1-A4022

3G3M1-A4015

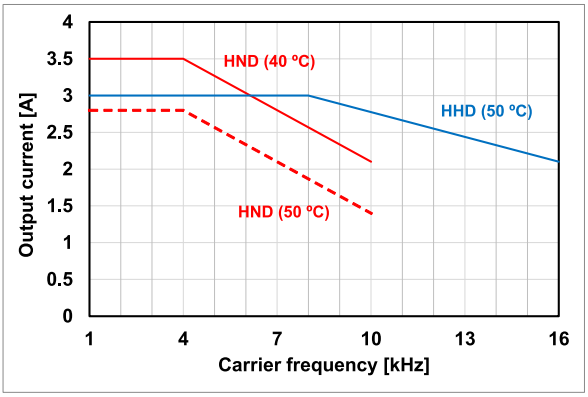



3G3M1-A4022

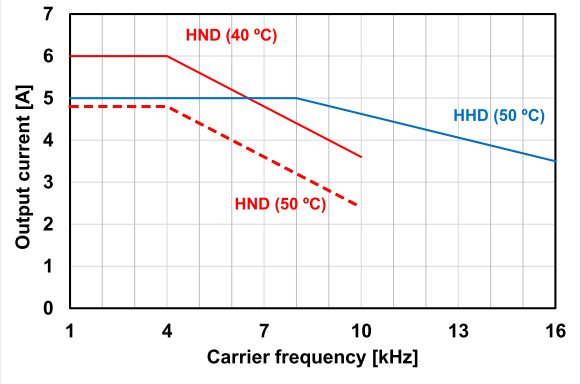



## 3G3M1-A4030 / 3G3M1-A4040

3G3M1-A4030

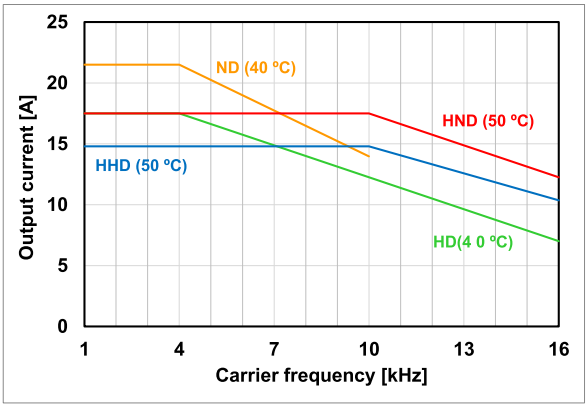



3G3M1-A4040

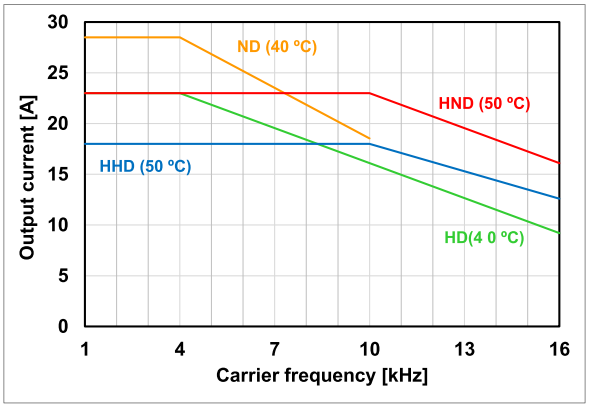


## 3G3M1-A4055 / 3G3M1-A4075

3G3M1-A4055

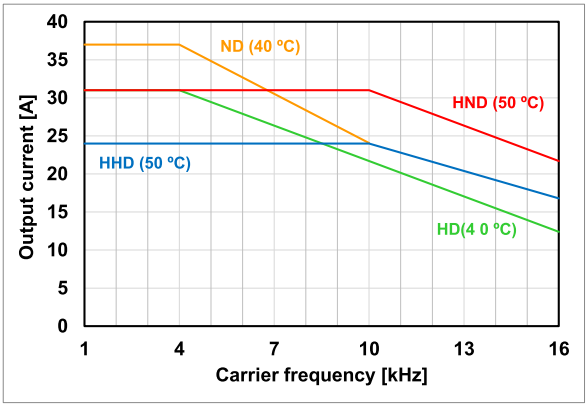



3G3M1-A4075

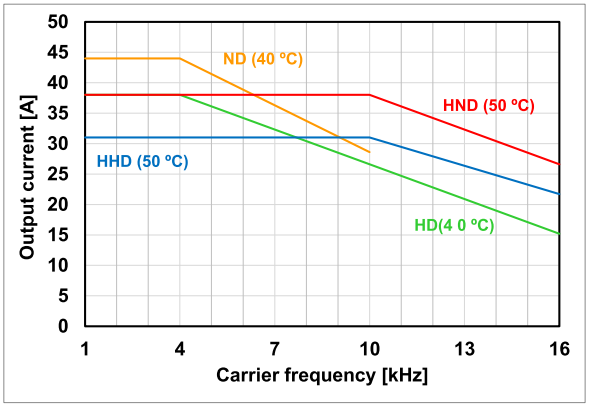



## 3G3M1-A4110 / 3G3M1-A4150

3G3M1-A4110

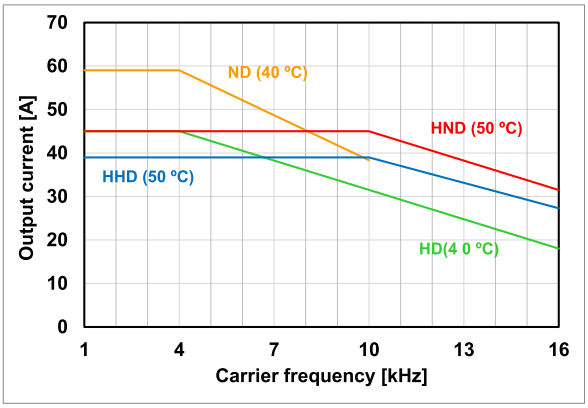



3G3M1-A4150

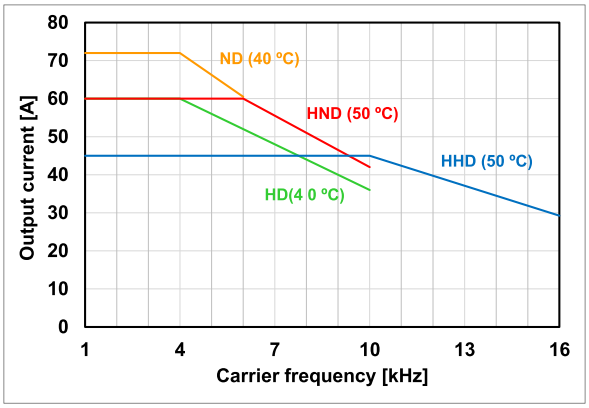



## 3G3M1-A4185 / 3G3M1-A4220

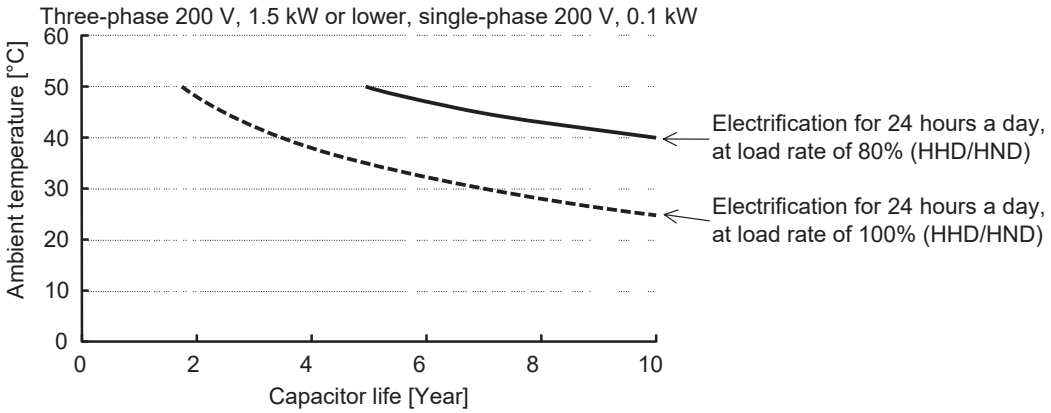
3G3M1-A4185

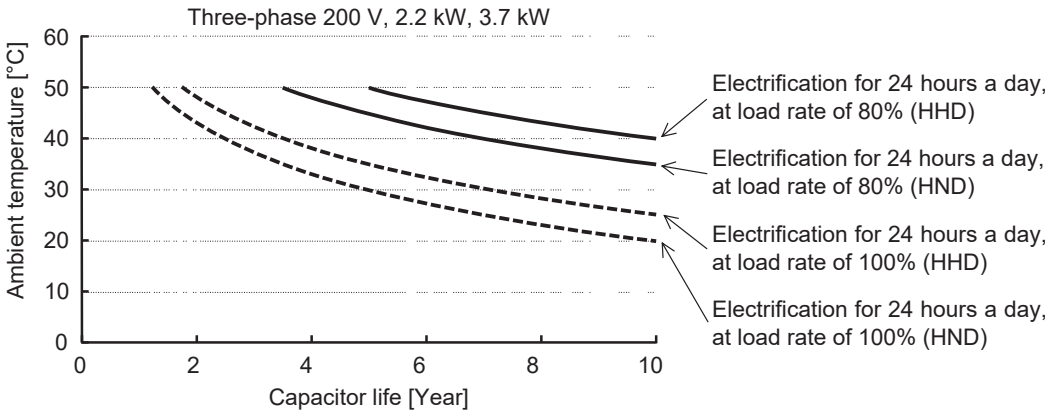


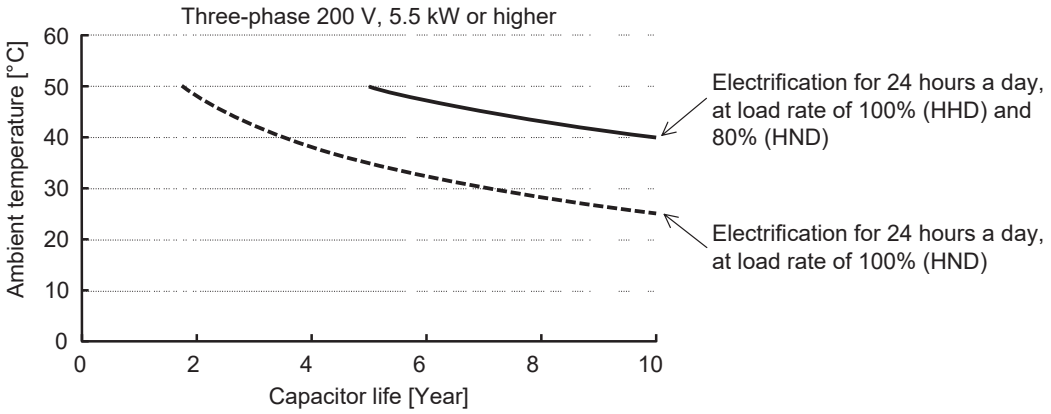

3G3M1-A4220

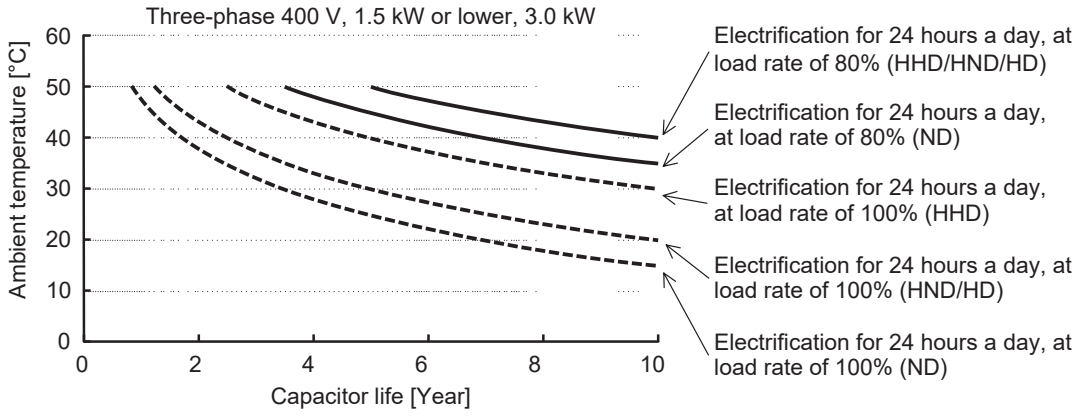


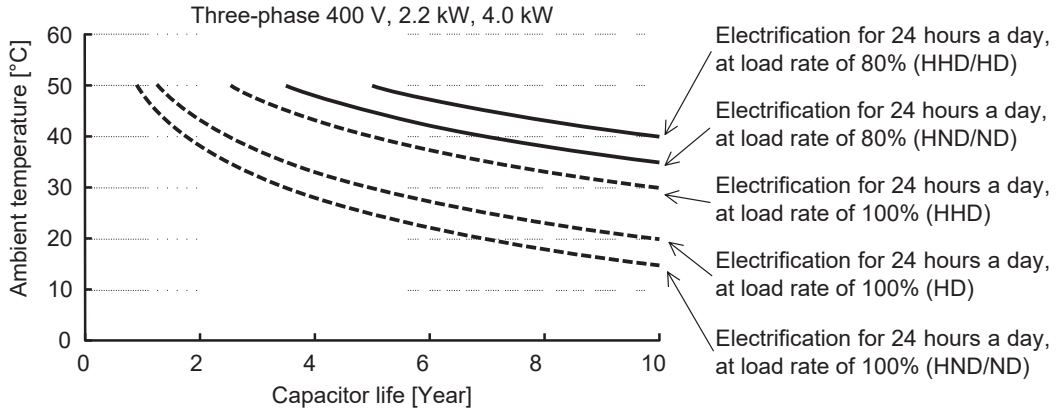
# A-7 Smooth Capacitor Life Curve

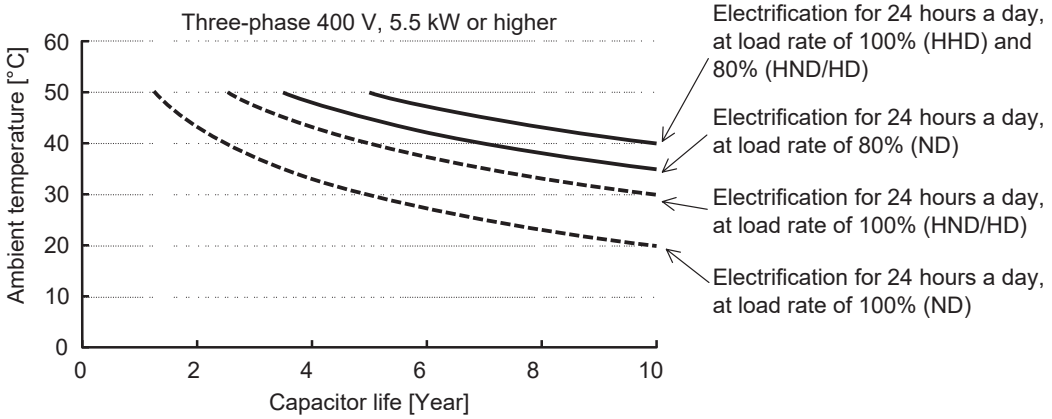


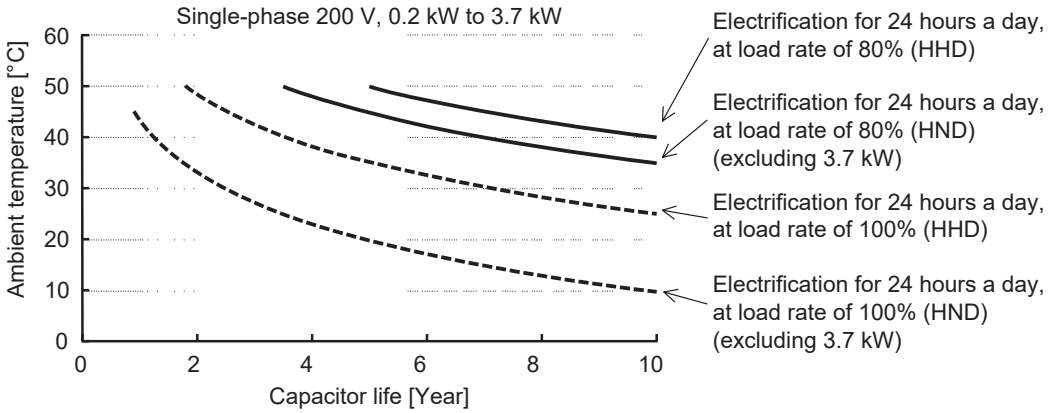




Three-phase 400 V, 1.5 kW or lower, 3.0 kW
Ambient temperature [°C]
60
50
40
30
20
10
0
0
2
4
6
8
10
Capacitor life [Year]
Electrification for 24 hours a day, at load rate of 80% (HHD/HND/HD)
Electrification for 24 hours a day, at load rate of 80% (ND)
Electrification for 24 hours a day, at load rate of 100% (HHD)
Electrification for 24 hours a day, at load rate of 100% (HND/HD)
Electrification for 24 hours a day, at load rate of 100% (ND)


Three-phase 400 V, 2.2 kW, 4.0 kW
Ambient temperature [°C]
60
50
40
30
20
10
0
0
2
4
6
8
10
Capacitor life [Year]
Electrification for 24 hours a day, at load rate of 80% (HHD/HD)
Electrification for 24 hours a day, at load rate of 80% (HND/ND)
Electrification for 24 hours a day, at load rate of 100% (HHD)
Electrification for 24 hours a day, at load rate of 100% (HD)
Electrification for 24 hours a day, at load rate of 100% (HND/ND)


Three-phase 400 V, 5.5 kW or higher
Ambient temperature [°C]
60
50
40
30
20
10
0
0
2
4
6
8
10
Capacitor life [Year]
Electrification for 24 hours a day, at load rate of 100% (HHD) and 80% (HND/HD)
Electrification for 24 hours a day, at load rate of 80% (ND)
Electrification for 24 hours a day, at load rate of 100% (HND/HD)
Electrification for 24 hours a day, at load rate of 100% (ND)




**Note 1.** "Ambient temperature" refers to the temperature measured at a distance of approximately 1 cm from the bottom center of the inverter (atmospheric temperature).
It refers to an interior temperature if the inverter is stored in a cabinet.

**Note 2.** The smoothing capacitor has a limited life because it is subjected to chemical reaction inside the part and, as a guide, the inverter needs to be replaced once a decade approximately. (This period is an expected design life, and not the guaranteed value.)
However, if the inverter is used at a high ambient temperature or in a heavy loaded environment, such as at the over-rated current, its life will be significantly shortened.

# A-8 Life Alarm Output

The inverter can output an alarm by the self-diagnostic function when the service life of each consumable part incorporated in the inverter (main circuit capacitor, cooling fan, PC board electrolytic capaci- tor) comes close to the end. Use this as a guide to know the time for the parts replacement. Note that this alarm is output by the self-diagnosis based on the expected design life (not guaranteed value). It has a margin of error depending on your environment or operation conditions.
For details, refer to *8-8-10 Capacitor Life Warning Signal (WAC)* on page 8-89, *8-8-13 Cooling Fan Life Warning Signal (WAF)* on page 8-92, and *8-8-14 Life Alarm (LIFE)* on page 8-93.

# A-9 Overview of Inverter Selection

## A-9-1 Motor Capacity Selection

Before selecting an inverter, first the motor should be chosen. In selecting the motor, calculate the load inertia appropriate to the application, and then calculate the required capacity and torque.

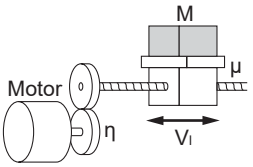
### Simplified Selection Method (Required Output Calculation)

This method of calculation helps you select a motor by calculating the output (kW) required by the motor to maintain its steady rotations. To use this method for motor selection, make allowance for the calculated result because it does not include acceleration/deceleration and other transient state calculations. The simplified selection method is suitable for fan, conveyor, mixer and other applications where a constant state continues for a while.

**Note** The simplified selection method cannot be used for the following applications. For these applications, use the detailed selection method.

- Those requiring rapid startup (acceleration).
- Those that frequently repeat run and stop.
- Those that have a large inertia at the power transfer part.
- Those that have an inefficient power transfer part.

### For linear motion: Steady power $P_0$ [kW]

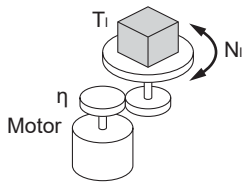



$$P0\ [kW] = \frac{\mu \cdot M \cdot g \cdot V_I}{60 \cdot \eta} \times 10^{-3}$$

μ : Friction coefficient
M : Mass of linear motion part [kg]
g : Acceleration of gravity (g ≈ 9.8 [m/s$^2$])
$V_I$ : Speed of linear motion part [m/min]
η : Efficiency of transfer part (η ≤ 1)

**Note** The same calculating formula is applicable to belt conveyors.

### For rotation motion: Steady power $P_0$ [kW]




$$P0\ [kW] = \frac{2\pi \cdot T_I \cdot N_I}{60 \cdot \eta} \times 10^{-3}$$

$T_I$ : Load torque (Load shaft) [N·m]
$N_I$ : Rotation speed of load shaft [r/min]
η : Efficiency of transfer part (η ≤ 1)

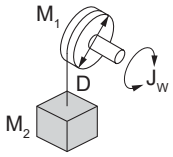
## Detailed Selection Method (RMS Calculation)

This method helps you select a motor by calculating the effective torque and maximum torque values required to achieve a certain pattern of operation for the application. It selects a motor that is optimal for a particular operation pattern.

### Calculation of load inertia and motor-shaft conversion inertia

Depending on the type of the motor transfer system, calculate the inertia for all parts and convert it into the motor-shaft inertia.

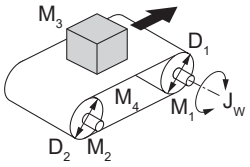
- Example in hoist application




$$J_W\ [kg \cdot m^2] = J_1 + J_2 = \left( \frac{M_1 \cdot D^2}{8} + \frac{M_2 \cdot D^2}{4} \right) \times 10^{-6}$$

$J_W$ : Shaft conversion inertia [kg·m$^2$]
$J_1$ : Inertia of cylinder (Shaft conversion) [kg·m$^2$]
$J_2$ : Inertia of workpiece (Shaft conversion) [kg·m$^2$]
$M_1$ : Mass of cylinder [kg]
$M_2$ : Mass of workpiece [kg]
D : Diameter of cylinder [mm]

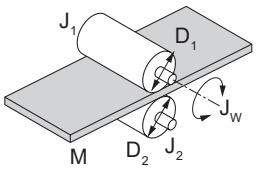
- Example in conveyor application




$$J_W\ [kg \cdot m^2] = J_1 + J_2 + J_3 + J_4 = \left( \frac{M_1 \cdot D_1^2}{8} + \frac{M_2 \cdot D_2^2}{8} \cdot \frac{D_1^2}{D_2^2} + \frac{M3 \cdot D_1^2}{4} + \frac{M_4 \cdot D_1^2}{4} \right) \times 10^{-6}$$

$J_W$: Shaft conversion inertia (Cylinder-1-shaft conversion) [kg·m $^2$]
$J_1$ : Inertia of cylinder 1 (Cylinder-1-shaft conversion) [kg·m$^2$]
$J_2$ : Inertia of cylinder 2 (Cylinder-1-shaft conversion) [kg·m$^2$]
$J_3$ : Inertia of workpiece (Cylinder-1-shaft conversion) [kg·m$^2$]
$J_4$ : Inertia of belt (Cylinder-1-shaft conversion) [kg·m$^2$]
$M_1$: Mass of cylinder 1 [kg]
$M_2$: Mass of cylinder 2 [kg]
$M_3$: Mass of workpiece [kg]
$M_4$: Mass of belt [kg]
$D_1$ : Diameter of cylinder 1 [mm]
$D_2$ : Diameter of cylinder 2 [mm]

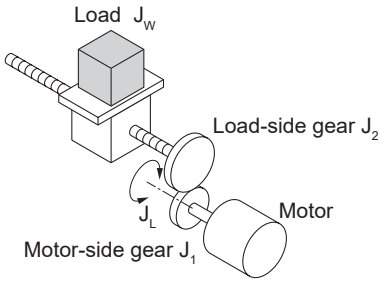
- Example in roller application




$$J_W\ [kg{\cdot}m^2] = J_1 + \left(\frac{D_1^2}{D_2^2}\right)J_2 + \frac{M{\cdot}D_1^2}{4} \times 10^{-6}$$

$J_W$ : Shaft conversion inertia (Roller-1-shaft conversion) [kg·m²]
$J_1$ : Inertia of roller 1 (Roller-1-shaft conversion) [kg·m²]
$J_2$ : Inertia of roller 2 (Roller-2-shaft conversion) [kg·m²]
M : Mass of workpiece [kg]
$D_1$ : Diameter of roller 1 [mm]
$D_2$ : Diameter of roller 2 [mm]

- Example of conversion into motor-shaft inertia



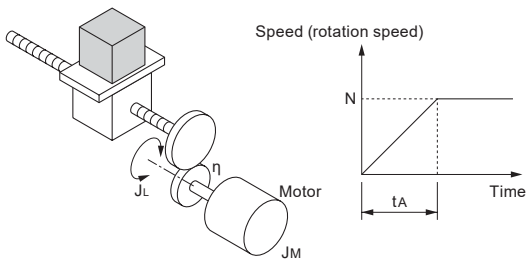

$$J_L\ [kg{\cdot}m^2] = J1 + G^2(J2 + Jw)$$

JL : Motor-shaft conversion inertia [kg·m²]
$J_W$ : Load inertia (Load-side gear-shaft conversion) [kg·m²]
$J_1$ : Inertia of motor-side gear [kg·m²]
$J_2$ : Inertia of load-side gear [kg·m²]
$Z_1$ : Number of motor-side gear teeth
$Z_2$ : Number of load-side gear teeth
G : Gear ratio (Speed reduction ratio) = $Z_1 / Z_2$

## Calculation of motor-shaft conversion torque and effective torque

Calculate the acceleration torque from the motor-shaft conversion load inertia, the motor-rotor inertia and the acceleration. Then, calculate the load torque from the external force (gravity and tension) and friction force applied to the load. Finally, combine these calculation results to calculate the torque required for the motor.

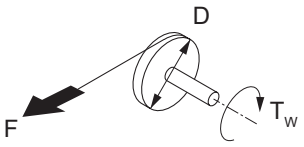
- Calculation of acceleration torque (TA)




$$T_A[N{\cdot}m] = \frac{2\pi \cdot N}{60 \cdot t_A}\left(J_M + \frac{J_L}{\eta}\right)$$

$T_A$ : Acceleration torque [N·m]
$J_L$ : Motor-shaft conversion load inertia [kg·m²]
$J_M$ : Motor-rotor inertia [kg·m²]
η : Efficiency of transfer part (η≦1)
$t_A$ : Acceleration time [s]
N : Motor rotation speed [r/min]

- Calculation of motor-shaft conversion load torque ($T_L$)



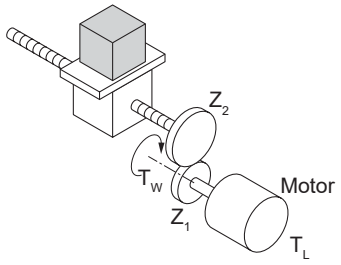

$$T_W\ [N{\cdot}m] = F \cdot \frac{D}{2} \times 10^{-3}$$

$T_W$: Load torque (Load-shaft conversion) [N·m]
F: External force [N]
D: Diameter of cylinder [mm]

(Generally, the friction force can be calculated as below:)

$F = \mu Mg\ [N]$

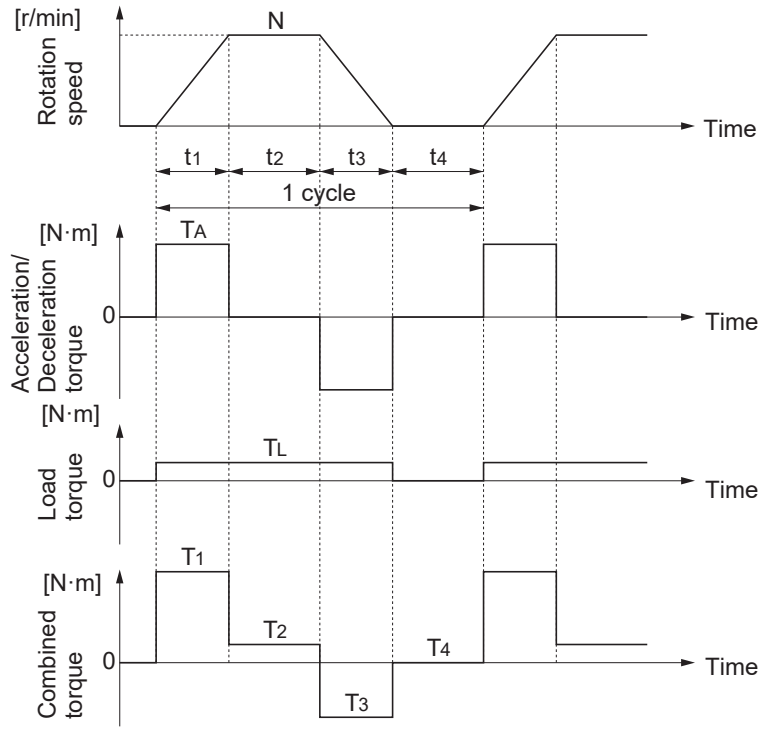
μ: Coefficient of friction
M: Mass of motion part [kg]
g: Acceleration of gravity (g≈9.8 [m/s²])




$$T_L\,[N\cdot m] = T_W \cdot \frac{G}{\eta}$$

$T_L$ : Motor-shaft conversion load torque [N·m]
$T_W$: Load torque (Load-shaft conversion) [N·m]
$Z_1$ : Number of motor-side gear teeth
$Z_2$ : Number of load-side gear teeth
G : Gear ratio (Speed reduction ratio) = $Z_1 / Z_2$

- Calculation of combined torque and effective torque




- Effective torque $T_{RMS}$ [N·m]

$$= \sqrt{\frac{\Sigma(T_i^2 \cdot t_i)}{\Sigma t_i}}$$

$$= \sqrt{\frac{T_1^2 \cdot t_1 + T_2^2 \cdot t^2 + T_3^2 \cdot t_3 + T_4^2 \cdot t_4}{t_1 + t_2 + t_3 + t_4}}$$

- Maximum torque $T_{MAX}$ [N·m] = $T_1 = T_A + T_L$

### Motor selection

Based on the above calculation results, select the motor capacity by using the following formulae. Select the larger of the two calculated values as the motor capacity. Also, when selecting a motor, take into consideration the errors in calculation and modeling. Select a motor whose capacity is at least approximately 20% larger.

- Motor capacity conversion to effective torque

$$\text{Motor capacity [kW]} = \frac{2\pi \cdot T_{RMS} \cdot N}{60} \times 10^{-3}$$ N : Maximum rotation speed [r/min]

- Motor capacity required for maximum torque output

$$\text{Motor capacity [kW]} = \frac{2\pi \cdot T_{MAX} \cdot N}{60 \cdot 1.5} \times 10^{-3}$$ N : Maximum rotation speed [r/min]

**Note** The above calculation formulae assume that the maximum motor toque is 150% of the rated torque.

## A-9-2 Inverter Capacity Selection

Select an inverter that can be used with the motor you selected based on the result of motor capacity selection.

Basically, select an inverter which fits the maximum applicable motor capacity of the selected motor. After selecting an inverter, check if it meets both of the following conditions. If not, select an inverter with one size larger in capacity and check again.

**Rated motor current ≤ Rated output current of inverter**

**Max. continuous torque output time for application ≤ 1 min**

**Note 1**

In the light load mode, the overload capacity of the inverter is 150% of the rated torque for 5 seconds. Use the 5-seconds rating when determining the maximum continuous torque.

**Note 2**

If you want to use 0 Hz sensorless vector control, need a holding torque at a rotation speed of 0 (r/min), or frequently require 150% of the rated torque or more, use an inverter with one size larger in capacity than the one selected by the above method.

## A-9-3 Overview of Braking Resistor Selection

### Requirement of Braking Resistor

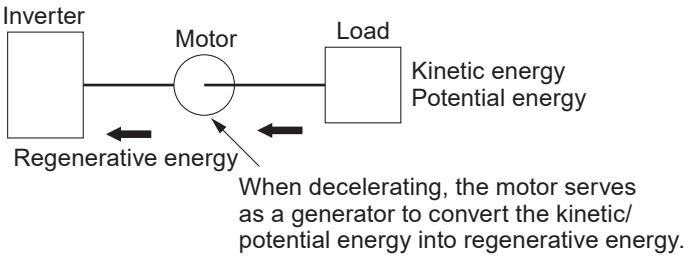
If the regenerative energy generated in deceleration or descent in an application is too large, the main circuit voltage in the inverter may increase, which results in damage to the inverter.

Normally, the inverter has a built-in overvoltage protection function, which detects an overvoltage (0 V) in the main circuit to prevent inverter damage. However, because it detects a fault to stop the motor, stable and continuous operation will be prevented.

Therefore, you need to use one or more braking resistors/regenerative braking units to absorb this regenerative energy outside the inverter.

### What is regenerative energy?

The load connected to a motor has kinetic energy when rotating, and potential energy when it is subject to the gravity. When the motor decelerates, or when the load descends, the energy is fed back to an inverter. This phenomenon is known as regeneration, and the energy is called regenerative energy.




### Preventing an overvoltage (0 V) in the main circuit without use of braking resistors

The following are methods to prevent the occurrence of an overvoltage (0 V) in the main circuit without connection of braking resistors.

Since these methods prolong the deceleration time, check that the selected method will not cause application problems.

Enable the overvoltage suppression function during deceleration

The overvoltage suppression function during deceleration is enabled by default.

It automatically increases the deceleration time to prevent the occurrence of an overvoltage in the main circuit.

- Set a longer deceleration time

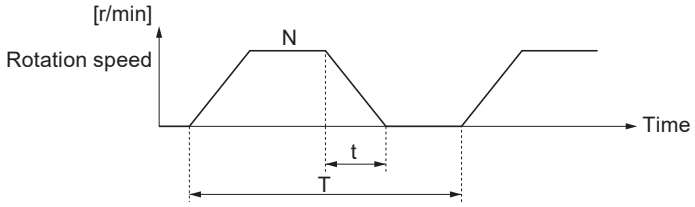
Increase the deceleration time to prevent the occurrence of an overvoltage in the main circuit. This decreases the amount of regenerative energy per unit time.

- Select free-run stop

This prevents the regenerative energy from being fed back to the inverter.

## Simplified Braking Resistor Selection

This is a simple method to select an appropriate braking resistor based on the percentage of the time in which regenerative energy is produced in a normal operation pattern.




Usage rate [%ED] = 100 × t / T  t : Deceleration time (regenerative time) [s]
T : 1 cycle operation time [s]

All models of the 3G3M1 Series Inverter have built-in regenerative braking circuit.

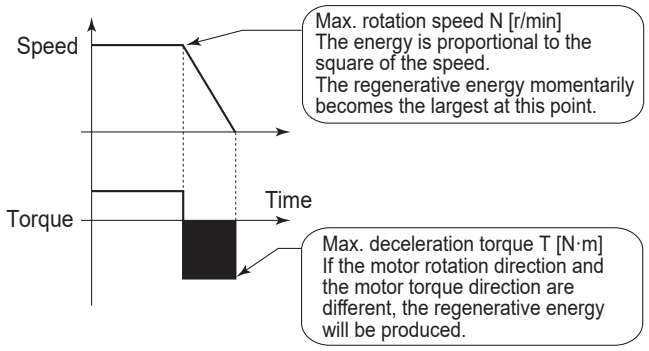
Select a braking resistor based on the usage rate calculated from the operation pattern.

Connect a braking resistor suitable for your inverter according to the braking resistor list provided in the inverter manual/catalog.

## Detailed Braking Resistor Selection

When the usage rate of the braking resistor selected on the previous section exceeds 10% ED, or when an extremely large braking torque is required, use the method below to calculate a regenerative energy and make your selection.

### Calculation of Required Braking Resistance



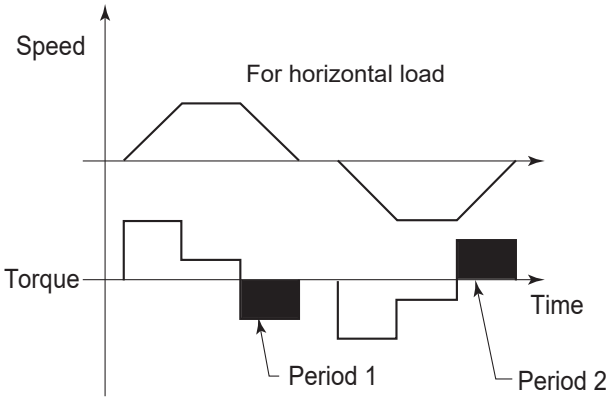

$$\text{Resistance of braking resistor : } R \leq \frac{60 \times V^2}{2\pi \cdot (T - 0.2 \times T_m) \cdot N}$$

V : 200-V class inverter 362.5 [V]
400-V class inverter 725 [V]
T : Maximum braking torque [N·m]
$T_m$ : Motor rating torque [N·m]
N : Maximum rotation speed [r/min]

**Note** Calculate a braking torque according to Inverter Capacity Selection in the Motor Capacity Selection section

### Calculation of average regenerative energy

Regenerative energy is produced when the motor rotation and the torque are opposite in direction. Use the following formula to calculate the regenerative energy for each period in a cycle.



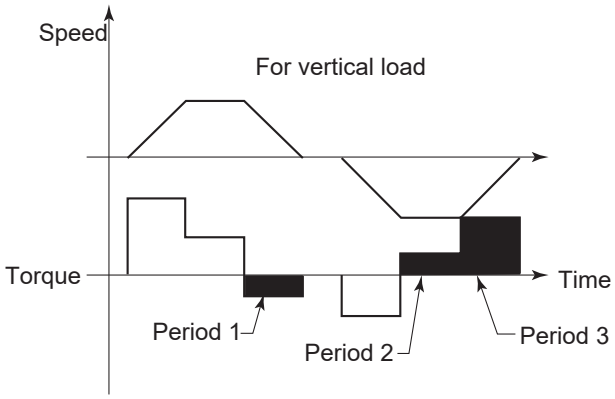

$$P_i = N \times T \times t \times 1.047 \times 10^{-1}$$

$P_i$ : Regenerative energy in Period $i$ [J]
N : Motor rotation speed [r/min]
When the number of rotations changes, take an average value.

*ex*. For linear deceleration
$(N_{MAX}+N_{MIN})/2$

T : Deceleration torque [N·m]
t : Deceleration time [s]

For the average regenerative energy, calculate the time average by adding the regenerative energy for all periods in a cycle and dividing it by the cycle time, as shown below.




$$\text{Average regenerative energy [W]} = \frac{(P1+P2 \ldots +Pi)[J]}{1 \text{ cycle time [s]}}$$

**Note 1**

For Speed, the forward rotation direction is indicated as positive. For Torque, the torque in the forward rotation direction is indicated as positive.

**Note 2**

Calculate a braking torque according to Inverter Capacity Selection in the Motor Capacity Selection section.

## Braking Resistor Selection

Select a braking resistor from the required braking resistance and the average regenerative energy obtained in this calculation.

- Required braking resistance ≥ Resistance of braking resistor ≥ Min. connection resistance of inverter
- Average regenerative energy ≤ Resistance capacity of braking resistor

**Note 1**

Connecting a braking resistor whose resistance is less than the minimum connection resistance value of the inverter results in damage to the internal braking transistor. If the required braking resistance is less than the minimum connection resistance, change the inverter to one having a larger capacity and ensure that the required braking resistance is not less than the minimum connection resistance.

**Note 2**

Make allowance for the resistance capacity of the braking resistor. Otherwise, it may be overheated. Select a braking resistor whose capacity is at least 20% larger than the calculated value.

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