SYSMAC CS-Series
CS1W-PNT21

PROFINET IO
Controller Unit

OPERATION MANUAL

OMRON

CS1W-PNT21

PROFINET IO
Controller Unit

Operation Manual

Produced August 2010

CS1W-PNT21 vs. CJ1W-PNT21

The PROFINET IO functionality of CS1W-PNT21 is identical to that of CJ1W-PNT21.

To operate the Unit, refer to attached Operation Manual W12E, and where applicable, substitute "CJ" by "CS".

Mechanical differences between CS and CJ Units should be taken into account in the following sections of Operation Manual W12E:

⚠ **ATTENTION!** CS1W-PNT21 units can be used in the configuration with CS1D (duplex system) but **do NOT support HOT SWAPPING function**.
If you insert PROFINET IO Controller CS1W-PNT21 on the PLC backplane while the CS1D (duplex) PLC system is in operation (i.e. as part of an online replacement procedure), „I/O Bus error" will occur in the CS1D CPU unit, and program execution will stop. Whether or not a programming device is used at the time has no effect on this.
If the problem occurs, the system will resume normal operation after switching OFF/ON the power supply of the PLC system.
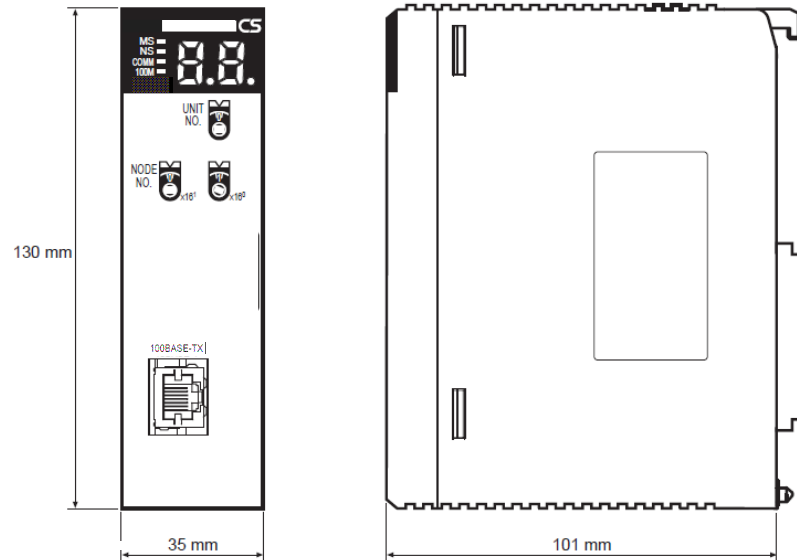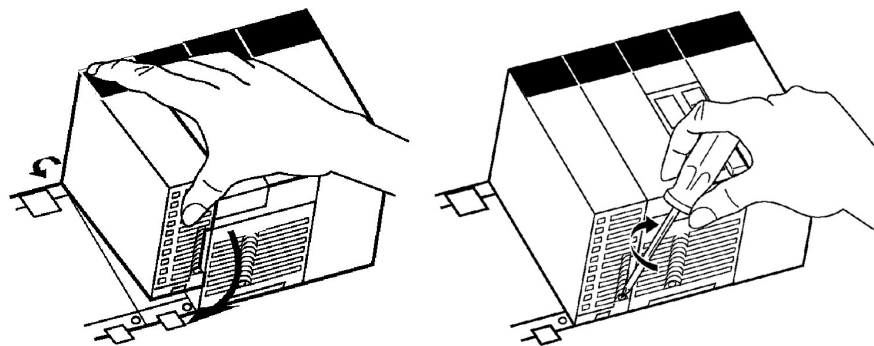
3-1-1 Nomenclature and Functions
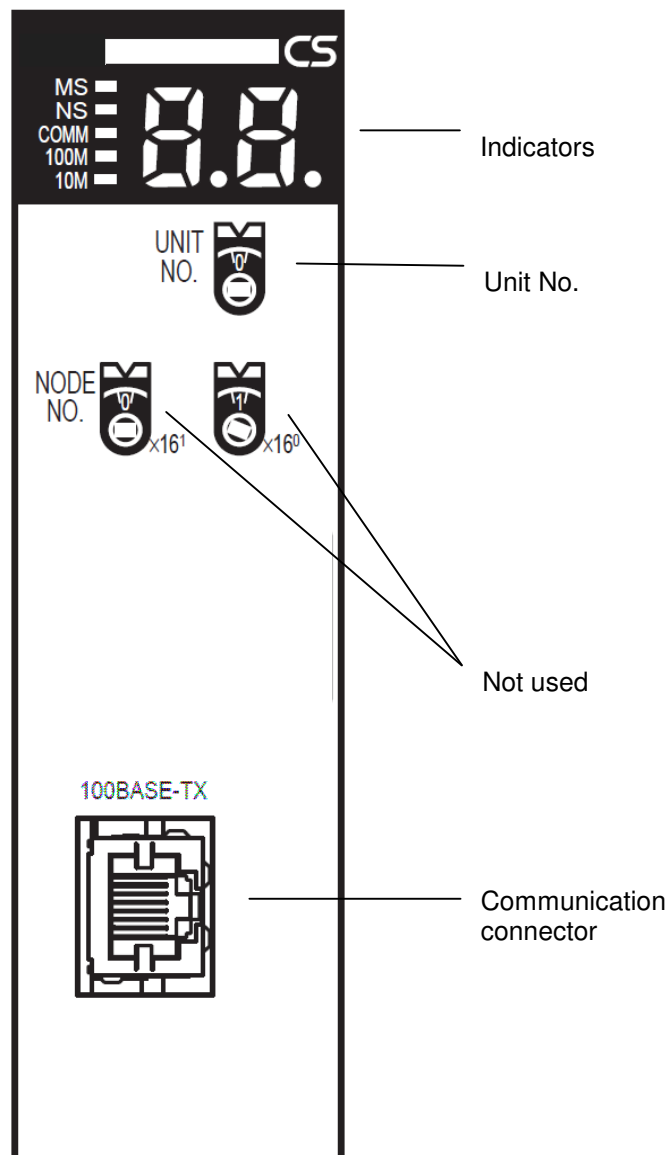
3-1-4 Switch Settings

Rotary switch to set the Unit Number

2-2-2 External Dimensions

130 mm

35 mm

101 mm

Dimensions are in millimeters.

2-2-3 Mounting

1. Mount the Unit to the Backplane by hooking the top of the Unit into the slot on the Backplane and rotating the I/O Unit downwards. Make sure that the connector on the back of the Unit is properly inserted into the connector in the Backplane.

2. Use a Phillips-head screwdriver to tighten* the screw on the bottom of Unit. The screwdriver must be held at a slight angle, so be sure to leave enough space below each Rack.

To remove a Unit, use a Phillips-head screwdriver to loosen the screw at the bottom of the Unit, rotate the Unit upward, and remove it.

* The screw at the bottom of the Unit must be tightened with a torque of 0.4 Nm

CJ1W-PNT21
PROFINET IO
Controller Unit

OPERATION MANUAL

OMRON

Notice

OMRON products are manufactured for use by a trained operator and only for the purposes described in this manual.

The following conventions are used to classify and explain the precautions in this manual. Always heed the information provided with them.

⚠ **WARNING**   Indicates information that, if not heeded, could possibly result in serious injury or loss of life.

⚠ **Caution**   Indicates information that, if not heeded, could possibly result in minor or relatively serious injury, damage to the product or faulty operation.

OMRON product references

All OMRON products are capitalized in this manual.
The first letter of the word *Unit* is also capitalized when it refers to an OMRON product, regardless of whether it appears in the proper name of the product.

Visual aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note   Indicates information of particular interest for efficient and convenient operation of the product.

Trademarks and copyrights

All other product names, company names, logos or other designations mentioned herein are trademarks of their respective owners.

Copyright

Appendix A
PROFINET IO technology   93

Appendix B
PROFINET IO alarm messages   103

Appendix C
Explicit messages   105

Appendix D
Memory Card Backup Functions   111

Revision history   115

SECTION 1
Precautions

The information contained in this section is important for the safe and reliable operation of the CJ1W-PNT21 PROFINET IO Controller Unit. You must read this section and understand the information contained before attempting to set up or operate a CJ1W-PNT21 PROFINET IO Controller Unit and related systems.

1-1 Intended audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).
- Personnel in charge of installing FA systems.
- Personnel in charge of designing FA systems.
- Personnel in charge of managing FA systems and facilities.

1-2 General precautions

The user must operate the product according to the performance specifications described in the operation manuals.

Before using the product under conditions which are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

This manual provides information for installing and operating using the OMRON CJ1W-PNT21 PROFINET IO Controller Unit. Be sure to read this manual before attempting to use the Unit and keep this manual close at hand for reference during operation.

1-3 Safety precautions

⚠ **WARNING** It is extremely important that the Unit is used for the specified purpose and under the specified conditions, especially in applications that can directly or indirectly affect human life. You must consult with your OMRON representative before using the Unit in a system in the above mentioned applications.

⚠ **WARNING** Provide safety measures in external circuits (i.e., not in the Programmable Controller), including the following items, to ensure safety in the system if an abnormality occurs due to malfunction of the PLC or another (external) factor affecting the operation of the PLC. Not doing so may result in serious accidents.

- Emergency stop circuits, interlock circuits, limit circuits and similar safety measures must be provided in external control circuits.
- The PLC will stop operation when its self-diagnosis function detects any error or when a severe failure alarm (FALS) instruction is executed. As a countermeasure for such errors, external safety measures must be provided to ensure safety in the system.
- The PLC outputs may remain ON or OFF due to deposits on or burning of the output relays, or destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
- When the 24 VDC output (service power supply to the PLC) is overloaded or short-circuited, the voltage may drop and result in the outputs being turned OFF. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
- SmartSlice I/O Terminals will continue operating even if one or more I/O Units is removed from or falls out of the SmartSlice I/O Terminal, i.e., the other I/O Units will continue control operations, including outputs. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.

⚠ **WARNING** The CPU Unit refreshes I/O even when the program is stopped (i.e., even in PROGRAM mode). Confirm safety thoroughly in advance before changing the status of any part of memory allocated to Output Units, Special I/O Units, or CPU Bus Units. Any changes to the data allocated to any Unit may result in unexpected operation of the loads connected to the Unit. Any of the following operations may result in changes to memory status.

- Transferring I/O memory data to the CPU Unit from a Programming Device.
- Changing present values in memory from a Programming Device.
- Force-setting/force-resetting bits from a Programming Device.
- Transferring I/O memory files from a Memory Card or EM file memory to the CPU Unit.
- Transferring I/O memory from a host computer or from another PLC on a network.

⚠ **WARNING** Never attempt to disassemble any Units or touch the terminal block while power is being supplied. Doing so may result in serious electrical shock or electrocution.

1-3 Operating environment precautions

⚠ **Caution** Do not operate the control system in the following locations:

- Locations subject to direct sunlight.
- Locations subject to temperatures or humidities outside the range specified in the specifications.
- Locations subject to condensation as the result of severe changes in temperature.
- Locations subject to corrosive or flammable gases.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.

Provide proper shielding when installing the Unit in the following locations:
- Locations subject to static electricity or other forms of electric noise.
- Locations subject to strong electromagnetic fields.
- Locations subject to possible exposure to radioactivity.
- Locations close to power supplies.

⚠ **Caution** The operating environment of the Unit can have a large effect on the longevity and reliability of the system. Unsuitable operating environments can lead to malfunction, failure and other unforeseeable problems with the system. Ensure that the operating environment is within the specified conditions at installation and remains within the specified conditions during the life of the system. Follow all installation instructions and precautions provided in the operation manuals.

1-4 Application precautions

Observe the following precautions when using the CJ1W-PNT21 PROFINET IO Controller Unit.

⚠ **Caution** Failure to abide by the following precautions could lead to faulty operation of the Unit or the system. Always heed these precautions:

- Install double safety mechanisms to ensure safety against incorrect signals that may be produced by broken signal lines or momentary power interruptions.
- When adding a new device to the network, make sure that the baud rate is the same as other stations.
- When adding a new SmartSlice I/O Unit to the Communication Unit, make sure that the CJ1W-PNT21 PROFINET IO Controller Unit is powered down, to prevent unexpected results when starting up the new station.
- Use specified communication cables.
- Do not extend connection distances beyond the ranges given in the specifications.
- Always turn OFF the power supply to the personal computer, Slaves, and Communication Units before attempting any of the following:
  - Mounting or dismounting the CJ1W-PNT21 PROFINET IO Controller Unit, Power Supply Units, I/O Units, CPU Units, or any other Units.
  - Assembling a Unit.
  - Setting DIP-switches or rotary switches.
  - Connecting or wiring the cables.
  - Connecting or disconnecting connectors.
- Be sure that all the mounting screws, terminal screws, Unit mounting screws, and cable connector screws are tightened to the torque specified in the relevant manuals. Incorrect tightening torque may result in malfunction.
- Always use the power supply voltage specified in this manual.
- Double-check all the wiring and connection of terminal blocks and connectors before mounting the Units.
- Take appropriate measures to prevent foreign objects from entering the unit when mounting or wiring it. Failure to do so, may result in unit damage, electric shock or fire.
- Use crimp terminals for wiring. Do not connect bare stranded wires directly to terminals.
- Observe the following precautions when wiring the communication cable.
  - Separate the communication cables from the power lines or high-tension lines.
  - Do not bend the communication cables.
  - Do not pull on the communication cables.
  - Do not place heavy objects on top of the communication cables.
  - Be sure to wire communication cable inside ducts.
  - Use appropriate communication cables.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied in places where the power supply is unstable. An incorrect supply power may result in malfunction.
- Install external breakers and take other safety measures against short-circuits in external wiring. Insufficient safety measures against short-circuits may result in burning.
- Double-check all the wiring and switch settings before turning ON the power supply.
- When transporting or storing the product, cover the PCB's with electrically conductive materials to prevent LSI's and IC's from being damaged by static electricity, and also keep the product within the specified storage temperature range.
- When transporting the Unit, use special packing boxes and protect it from being exposed to excessive vibration or impacts during transportation.
- Do not attempt to disassemble, repair, or modify any Units.
- Do not remove the network cable during operation. Removing the network cable result in communication failures.

⚠ **Caution** Failure to abide by the following precautions could lead to serious or possibly fatal injury. Always heed these precautions:

- Always connect to a class-3 ground (100 Ω or less) when installing the Units.
- Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes.Not doing so may result in serious accidents.

1-5 Conformance to EC Directives

1-5-1 Applicable directives

- EMC (ElectroMagnetic Compatibility) Directives
- Low-voltage directive

1-5-2 Concepts

OMRON units complying with EC Directives also conform to related product standards making them easier to incorporate in other units or machines. The actual products have been checked for conformity to product standards. Whether the products conform to the standards in the system used by the customer, however, must be checked by the customer.

Product related performance of OMRON units complying with EC Directives will vary depending on the configuration, wiring, and other conditions of the equipment or control panel in which OMRON devices are installed. The customer must, therefore, perform final checks to confirm that units and the overall system conforms to product standards.

A Declaration of Conformity for the CJ1W-PNT21 PROFINET IO Controller Unit can be requested at your nearest OMRON representative.

1-5-3 Conformance to EC Directives

PROFINET IO units should be installed as follows, for the complete configuration to meet the EC directives:

1 The units are designed for installation inside control panels. All units must be installed within control panels.

2 Use reinforced insulation or double insulation for the DC power supplies used for the communication power supply, internal circuit power supply, and the I/O power supplies. Ensure that stable outputs can be provided even if a 10 ms interruption occurs at the input.

3 The CJ1W-PNT21 PROFINET IO Controller Unit meets the generic emission standard. However as EMC performance can vary in the final installation, additional measures may be required to meet the standards. It should therefore be verified that the overall machine or device also meets the relevant standards. You must therefore confirm that EC directives are met for the overall machine or device, particularly for the radiated emission requirement (10 m).

Dispose of in accordance with WEEE Directive

SECTION 2
Features and specifications

This section provides an introductory overview of the CJ1W-PNT21 PROFINET IO Controller for the CJ-Series, its functions and how to set up and configure it for a PROFINET IO network.

SECTION 2
Features and specifications   1

2-1 Overview of CJ1W-PNT PROFINET IO Controller

The CJ1W-PNT21 PROFINET IO Controller is a Unit that can be installed on a CJ1 PLC system. The Unit provides a communication means through a PROFINET IO network to OMRON and non-OMRON PROFINET IO Devices. The figure below shows a typical I/O configuration.
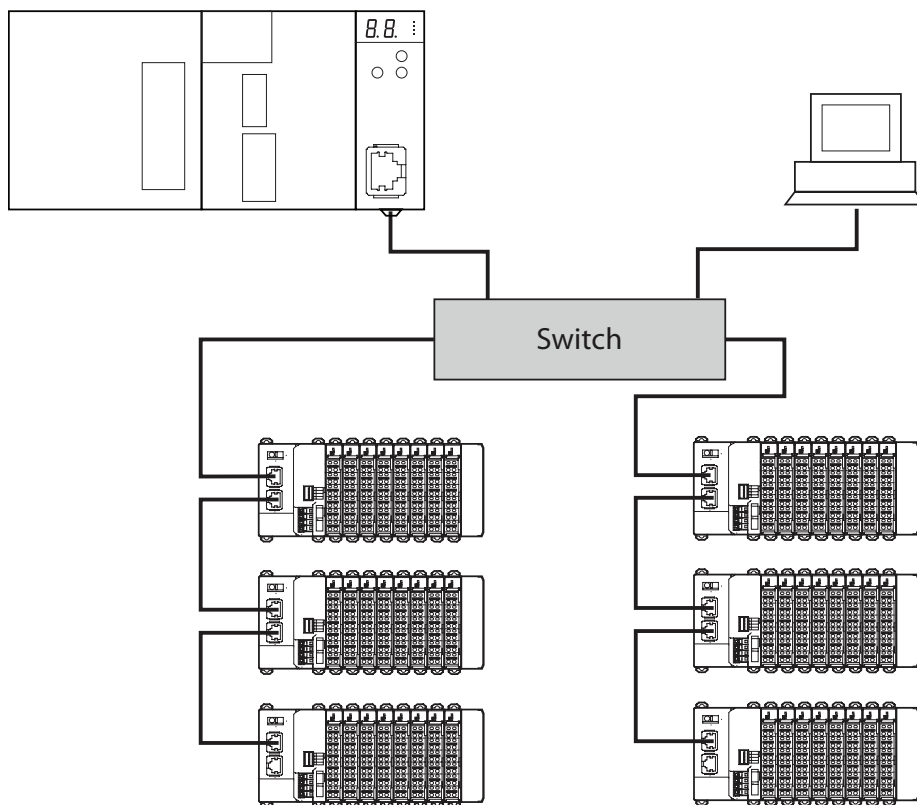
Figure 2.1: CJ1W-PNT21 connected to IO Devices through PROFINET

2-2   CJ1W-PNT21 PROFINET IO Controller Unit

2-2-1   Features

PROFINET IO Controller Unit
The CJ1W-PNT21 PROFINET IO Controller Unit is a CPU Bus Unit, which can be installed on a CJ1 PLC System. The CJ1W-PNT21 controls the data exchange between PROFINET IO Devices and a CJ1 PLC system over a PROFINET IO network. For an overview of the PROFINET IO technology refer to Appendix A PROFINET IO technology.

CPU Bus Unit
A total of up to 16 CPU Bus Units can be mounted on a CPU or Expansion Rack. The total of 16 includes one or more PROFINET IO Controller Units in addition to all other CPU Bus Units on the rack.

Unit Control and Status
In total 25 control and status words are exchanged between the PROFINET IO Controller Unit and a dedicated CIO memory area, of which the location is related to the Unit Number of the PROFINET IO Controller Unit. The CIO words provide status and diagnostics information on the Unit itself, the PROFINET IO network and PROFINET IO Devices.

I/O Data
The maximum size of the I/O data exhanged between the CJ1W-PNT21 and the PLC is 7168 words. The I/O data can be distributed over two input areas and two output areas. Each of the input and output areas can be mapped to any location in the DM Area, CIO Area, WR Area, HR Area, or the EM banks.

I/O Data Exchange
The PROFINET IO Controller initiates and maintains cyclic I/O data exchange with its assigned IO Devices. In addition to the I/O data exchange, parameter data and status information in a PROFINET IO Device can be accessed via the PROFINET IO Controller Unit by acyclic messaging.

FINS/UDP Interface
The PROFINET IO Controller Unit is provided with a FINS/UDP Interface enabling the PROFINET IO Controller to access SmartSlice I/O Units using FINS messaging. Additionally, any device supporting a UDP interface (such as a Personal Computer using CX-Server Lite) can access the CJ1 PLC System allowing remote stations to configure and monitor the PROFINET IO Controller and the CJ1 PLC System. The maximum length of the FINS message is 1500 bytes.

Facilitating IO Controller Redundancy
To ensure a highly reliable implementation of the application, the PROFINET IO Controller Unit and all PROFINET IO Devices offer the possibility of PLC controller redundancy. To facilitate redundancy, two IO Controllers (one active and one standby) in a networked connectionCX-ConfiguratorFDT of I/O Devices, ensures a fast change from active to standby PLC / IO Controller in case of a single device or network malfunction.

Configuration

Before the PROFINET IO Controller Unit is able to control the PROFINET IO Devices, it must first be configured using the configuration program CX-ConfiguratorFDT. Without this configuration, the Unit will not be able to start any data exchange, neither send any acyclic messages.

Troubleshooting Functions
The PROFINET IO Controller Unit provides a variety of troubleshooting functions for prompt recovery in case of errors:
• Extensive self-diagnostic functions at startup.
• Data exchange flags indicating whether I/O data is being exchanged with the IO Devices.
• Alarm flags indicating if new IO Device Alarm data is available.
• Various status and error flags indicating the status of the Unit and the PROFINET IO network.
• An error log for recording error history data.

2-2-2   Specifications

Functional specifications

Item		Specification
Installation	Model	CJ1W-PNT21
	Applicable PLC series	CJ-series
	Unit classification	CJ-series CPU Bus Unit
	Mounting position	CPU Rack or Expansion Rack
	Number of Units that can be mounted	16 (restrictions may apply for certain PLC types)
	Applicable unit numbers	0 to F (hex)
	Current consumption	420mA at 5V DC from the PLC power supply.
	Dimensions (WxHxD)	31 x 90 x 65 mm
	Weight	100 gram (typical)
Environment	Ambient operating temperature	0 °C to +55 °C (no icing or condensation)
	Ambient operating humidity	20 % to 90 % Relative Humidity with no condenstion
	Storage temperature	−20 °C to +75 °C (no icing or condensation)
	Vibration resistance	Conforms to IEC60068-2-6, tes Fc 10 to 58.4Hz, 0.25mm-amplitude, 54.8 to 300Hz, acceleration: 29.4m/s2 in X, Y and Z directions for 120 minutes each. (Total time: 12 linear/sweeps * 10 minutes / sweep = 120 minutes)
	Shock resistance	Conforms to IEC60068-2-27, test Ea.196m/s2 three times each in X, Y, and Z directions.
	Dielectric strength	600 VAC (between isolated circuits)
	Conformance to EMC and Electrical safety standards	EN6100-6-1: 2001 EN61000-6-4: 2001/CISPR11 EN 61131-2: 1994+a12:2000
Front case	Settings	Unit Number rotary switch, range:0~F (hex) Two rotary switches (reserved)
	Indicators	LEDs indicating Unit status and PROFINET status; • Two-digit, 7-segment display • Module Status, MS (Green/Red LED), • Network Status, NS (Green/Red LED),). • Data Exchange Status, 100M (Yellow LED), • Network Activity, COMM (Yellow LED).
	PROFINET IO Connector	1 x RJ45 8-pin Modular Connector (conforming to ISO 8877)

Item		Specification
Memory Area Allocation	CIO Area words allocated for the CPU Bus Unit	Fixed allocation of 25 words per Unit. Start address: CIO 1500 + (25 * Unit number)
	DM Area words allocated for the CPU Bus Unit	Not used
	I/O data allocations	Maximum total size: 7168 words. I/O Data can be allocated to up to 2 input and 2 output areas. Input and output areas can be mapped to CIO, DM, WR, and HR areas, as well to EM banks. Mapping must be defined through the configuration software.
FINS Messaging	Reading IO Device Alarm	The MEMORY AREA READ FINS command can be used to obtain the last received IO Device Alarm message.
	Reading and controlling the error-log	Catalogues the history of error events. The Unit supports the following Error Log related FINS commands: • ERROR LOG READ • ERROR LOG CLEAR
FINS Services	FINS/UDP	Supported Maximum packet size is 1500 bytes
Other functions	Error history size and storage	The PROFINET IO Controller Unit supports storage of up to 80 error events, including time stamps, in volatile memory. 16 error events can be logged in non-volatile memory.
	Memory Card backup function	Allows PROFINET IO Controller Unit's Configuration to be backed up as a file to a Memory Card in the CPU Unit. The backed up configuration data can later be restored from the Memory Card into the PROFINET IO Controller Unit.

Protocol specifications

Item		Specification
PROFINET interface	Protocol	PROFINET IO
	PROFINET unit type	PROFINET IO Controller
	Isochronous mode	No
	Alarms	Yes, Alarm events from PROFINET IO Devices are stored at and can be forwarded from the CJ1W-PNT21
Transfer specifications	Bitrate	100 Mbps (100Base-TX)
	Automatic detection of transmission speed	No, fixed.
PROFINET IO cable	Type	LAN cable according to PROFINET specification.
	Max transmission distance	100 m (distance between nodes)
PROFINET redundancy	Protocol	PROFINET IO Controller Redundancy.
Configuration	DTM	Included in CX-ConfiguratorFDT
FINS service	FINS/UDP	Supported

External dimensions

CJ1W-PNT21
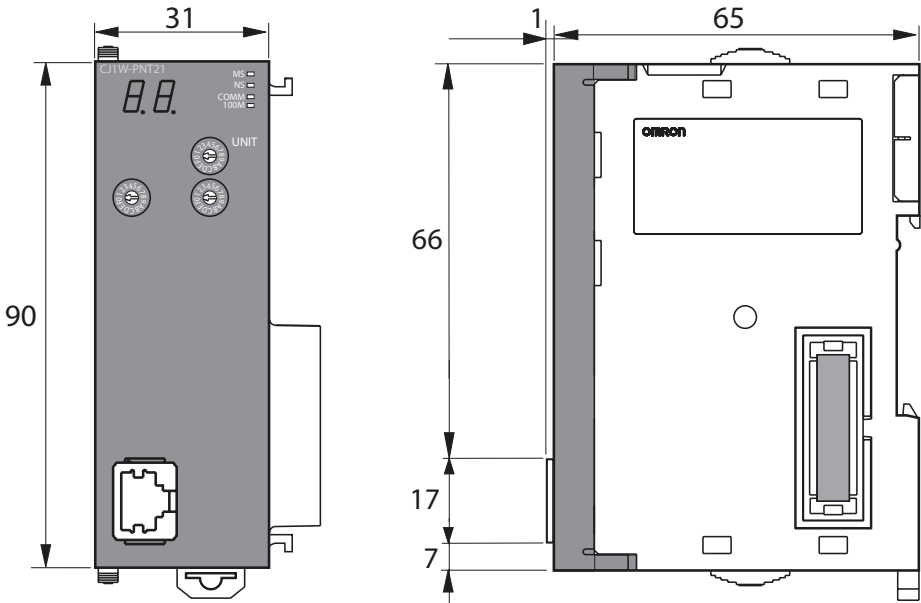
Figure 2.2: CJ1W-PNT21 PROFINET IO Controller Unit external dimensions

2-3   CJ1W-PNT21 configuration

PROFINET IO Configuration Means

The PROFINET IO Controller Unit must be configured before it can exchange I/O data with any of its IO Devices. To configure the unit, information about the IO Devices must be available. OMRON provides two means to provide an IO Controller Unit with IO Device information:
- by DTM
- by GSDML file

Configuration by DTM

The DTM is an executable component provided by the device vendor to be used in an FDT Container program like OMRON's CX-ConfiguratorFDT (see also Appendix A PROFINET IO technology, FDT/DTM Technology). The DTM runs inside this FDT Container and has its own User Interface. It can access online parameters of the IO Device and present that information to the user. It can also load and save the settings, using the features of the FDT Container program. A DTM generally provides the user with the following features:
- PROFINET I/O Configuration
- Configuration of the individual parameters of an IO Device
- Monitoring of an I/O Device

Configuration by GSDML File

The GSDML file concept is another way of configuration. The GSDML file is an XML-based file, which contains all options required to configure a PROFINET IO Controller Unit. The file can be loaded by the configuration software of the IO Controller Units, which will then present the information to the user to allow the appropriate selections to be made.

The drawback of the GSDML file is that - unlike the DTM - it only provides setting options for configuring the PROFINET IO Controller. The GSDML file does not provide the means to access data of the IO Device Units directly.

CJ1W-PNT21 I/O Data Exchange Configuration

To configure the I/O Data exchange between the IO Controller an the IO Devices, the user must use the Configuration User Interface to define the configuration of PROFINET IO Devices connected to the PROFINET IO Controller Unit. It also allows the user to make parameter settings for individual PROFINET IO Devices.

The I/O Data Exchange Configuration consists of the following parts:

- It is used by the PROFINET IO Controller Unit when mapping the I/O data of individual PROFINET IO Devices onto the PLC memory areas.
- The I/O Data Exchange Configuration holds information that is sent by the PROFINET IO Controller Unit to the PROFINET IO Devices for verification when establishing communication. The I/O Configuration sent by the PROFINET IO Controller Unit must match the physical configuration of PROFINET IO Devices to be able to proceed with I/O data exchange
- Further parameters are sent from the IO Controller to the IO Device to setup the IO Device properly. Parameters are used to setup for instance ranges, alarm limits and other runtime behaviour.

Monitoring the PROFINET IO Network

The Monitoring User Interface allows the user to read information from the PROFINET IO Controller. The Interface also provides a means to read the Error Log of the PROFINET IO Controller and provide the status of all connected PROFINET IO Devices.

Downloading the configuration

After setting up the configuration, it must be downloaded to the PROFINET IO Controller Unit.

2-4 Basic operating procedure

2-4-1 Overview

The following diagram provides an overview of the installation procedures. For experienced installation engineers, this may provide sufficient information. For others, cross-references are made to various sections in this manual where more explicit information is given.

```
┌─────────────────────────────────────────────────────┐
│   Mount the CJ1W-PNT21 PROFINET IO Controler Unit.   │
└─────────────────────────────────────────────────────┘
                           ▼
┌─────────────────────────────────────────────────────┐
│             Setup the PROFINET IO network.           │
└─────────────────────────────────────────────────────┘
                           ▼
┌─────────────────────────────────────────────────────┐
│    Power up the CJ1W-PNT21 and perform initial setup.│
└─────────────────────────────────────────────────────┘
                           ▼
┌─────────────────────────────────────────────────────┐
│        Configure the PROFINET IO Controller Unit.    │
└─────────────────────────────────────────────────────┘
                           ▼
┌─────────────────────────────────────────────────────┐
│  PROFINET IO starts communicating, confirmed by the  │
│  LEDs turning on. Check status of other LED Indicators.│
└─────────────────────────────────────────────────────┘
```
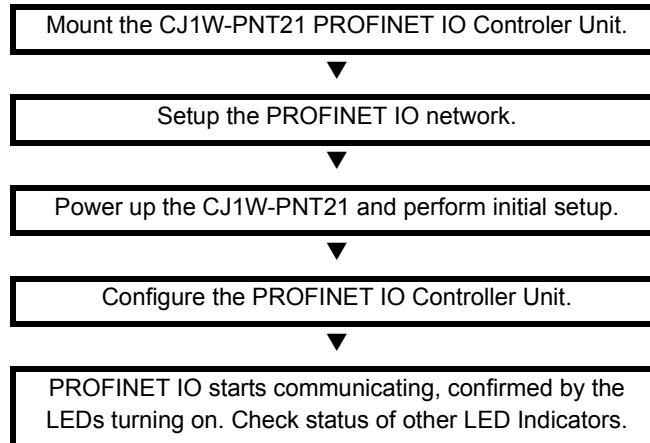
2-4-2   Preparations for use

The following procedure shows the basic steps required before using the PROFINET IO Controller and IO Device Units.

Initial setup procedure
1 Mount the CJ1W-PNT21 Unit in the PLC I/O system on the DIN rail.
2 Set the Unit Number of the CJ1W-PNT21 to a unique value.
3 Wire the PROFINET IO network by connecting IO Devices to the PROFINET IO Controller Unit.
4 Turn ON the power to the PLC and the I/O Devices.
5 Make sure the CJ1W-PNT21 is recognized in the I/O-table of the CJ1-PLC.

Configuration procedure
Use the following procedure to configure the PROFINET IO Controller and PROFINET IO Devices using CX-ConfiguratorFDT, using the IO Controller and IO Device DTMs:
1 Turn ON the PLC power supply and the power supplies of the IO Devices on the network.
2 Use the PROFINET IO Controller DTM's Network Scan function to assign Device Names to the actual IO Devices in the network.
3 In CX-ConfiguratorFDT, create a network and define the parameters and I/O configurations for the PROFINET IO Controller Unit and the allocated IO Devices. Choose the update rate for each IO Device.
4 Download the network configuration to the PROFINET IO Controller Unit. After downloading the configuration, CX-ConfiguratorFDT will restart the PROFINET IO Controller Unit.
5 After restart of the PROFINET IO Controller Unit, communication with the PROFINET IO Devices will start automatically.

SECTION 3
Installation and wiring

This section shows the CJ1-series PROFINET IO Controller Unit and identifies the controls and indicators of the Unit. This section also contains the procedures for installing and wiring the CJ1W-PNT21 Unit, in addition to the procedures for setting up the PROFINET IO network.

SECTION 3
Installation and wiring 11

3-1 CJ1W-PNT21 Unit components

3-1-1 Overview

The illustration below shows the Status LED indicators with 7-segment display (A), the Unit number selector switch (B) and the PROFINET IO Ethernet connector (C) on the front side of the CJ1W-PNT21 Unit. Each of these components is explained in the following sections.
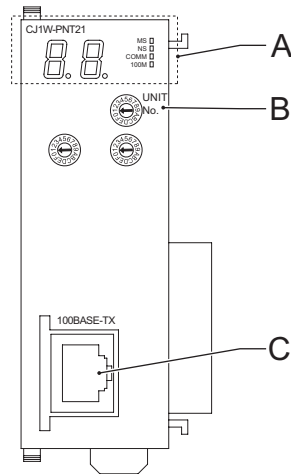
Figure 3.1: CJ1W-PNT21 overview

3-1-2 Ethernet connector

The CJ1W-PNT21 has one Ethernet port.
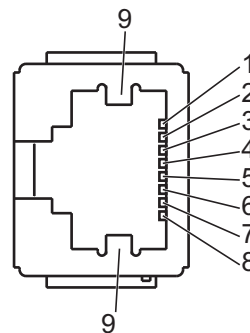
Figure 3.2: CJ1W-PNT21 Ethernet connector

Pin	Signal	Abbreviation	Signal direction
1	Transmission data +	TD+	Output
2	Transmission data -	TD-	Output
3	Reception data +	RD+	Input
4	Not used	---	---
5	Not used	---	---
6	Reception data -	RD-	Input

Pin	Signal	Abbreviation	Signal direction
7	Not used	---	---
8	Not used	---	---
9	Field Ground	FG	---

The following standards and specifications apply to the Ethernet connector and the twisted-pair cable.
- Electrical specifications: Conforming to IEEE 802.3 standards
- Connector structure: RJ45 8-pin Modular Connector (conforming to ISO 877). For more information about connectors see the PROFINET Cabling and Interconnection Technology Guideline Order No.: 2.252 available through PI (Profi International).

For the Ethernet infrastucture please follow the following guidelines:
- Shielded twisted-pair (STP) cable: minimum category CAT5 in accordance with ISO/IEC 24702 but only suitable for Conformance Class A. PROFINET-specific cable in accordance with IEC 61784-5-3 is preferable for Conformance Class A. And is mandatory for Conformance Class B/C. For more information see the PROFINET Conformance Class A Cabling Guideline. Order No.: 7.072 available through PI.
- Make sure to follow the PROFINET Installation Guideline for Cabling and Assembly Order No.: 8.072 available through PI.

3-1-3   LED indicators

The CJ1W-PNT21 PROFINET IO Controller Unit uses the following LED indicators.
- Four LEDs to indicate status of the Unit and the PROFINET IO network
- Two 7-segment displays to show extra information.
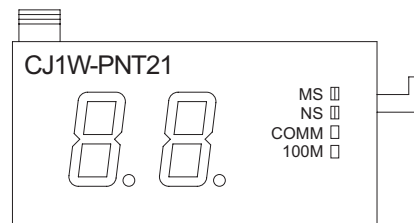
Figure 3.3: CJ1W-PNT21 LED indicators

Status indicators specifications

Indicator	Colour	Status	Meaning
MS Module status	Green	ON	Initialization successful, unit is in normal operation.
		Flashing	No connection to the Ethernet Network, but initialization was successful.
	Red	ON	A non-recoverable, fatal error has occured. (Watchdog timer error, memory error or system error.) Replace the unit if recurring.
		Flashing	A recoverable, non-fatal error has occured. (Structure error, switch setting error, PLC initialization error, PLC interface error or routing table error.) Correct the error and reset the Unit
	--	OFF	Power isn't being supplied or the unit is initialising

13

Indicator	Colour	Status	Meaning
NS Network Status	Green	ON	PROFINET IO data exchange with all active devices.
		Flashing	PROFINET attempting to establish data exchange with all configured devices.
	Red	ON	--
		Flashing	The Unit 's PROFINET IO Configuration is not available or incorrect.
	--	OFF	The Unit is in OFFLINE mode. PROFINET Communication is not possible.
COMM	Yellow	ON	Ethernet communication is active.
	--	OFF	Ethernet communication is not active.
100M	Yellow	ON	PROFINET IO data exchange with at least one active IO Device
		OFF	No PROFINET data exchange with any of the active IO Devices..

Note Unless otherwise specified the frequency of a flashing LED is 1 Hz (50% duty cycle).

7-Segment Display The following table explains the status information of the 7-segment display.

Status	Display	
IOController in normal operation	Displays character "r"	Lit
Initialising Unit at startup	Displays character "--"	Lit
Downloading new PROFINET Configuration to the Unit	Displays character "d"	Flashing
Finished downloading new PROFINET Configuration to the Unit	Displays character "d"	Lit
The Unit encountered and error	Error code value	Lit
PROFINET output data valid status ON: Output data is valid. Flashing: Output data is invalid.	Left dot	
Reserved	Right dot	

Error Code There is no priority in the error codes; all errors will be displayed in the order they occur. All error codes consist of a combination of a letter and a number, so they can be distinguished from the other state indications immediately. Please refer to [Ref 7-2 Troubleshooting using LED indicators] for details.

3-1-4 Switch settings

Setting the Unit Number The unit number is used to identify individual CPU Bus Units mounted on a PLC. The unit number must be unique for each CPU Bus Unit. Selecting a non-unique number for a CPU Bus Unit will prevent the PLC System from starting correctly.

CJ1W-PNT21

UNIT NO.

Setting range:
0 ~ F (Hexadecimal)
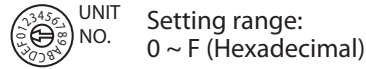
Figure 3.4: CJ1W-PNT21 Rotary switch

1 Turn OFF the power supply before setting the Unit number.
2 Set the rotary switch to the (new) Unit number. Use a small flathead screwdriver to make the setting, taking care not to damage the rotary switch. The unit number is factory-set to 0.
3 Turn ON the power again.

Note   Always turn OFF the power to the PLC CPU before changing the Unit number setting. The Unit only reads the Unit number setting during initialization after power-up, not after a software reset.

Note   If the unit number is set for the first time or is changed, an I/O table must be created for the PLC. For more information regarding creating the PLC I/O table please consult the manual W393 SYSMAC CJ Series Programmable Controllers Operation Manual.

The lower two rotary switches are reserved for future use.

Unit Number and CPU Bus Unit Word Allocations

With CJ-series PLCs, data areas for CPU Bus Units are automatically allocated in the CIO and DM Areas. The PROFINET I/O Controller Unit uses these areas for receiving control data from the CPU Unit and for notifying the CPU Unit about its status. The addresses in the allocated areas for the CPU Bus Unit are important when creating the user program for using the PROFINET I/O Controller Unit. This must be considered when setting the unit number.

The contents of the allocated CIO and DM Words are discussed in detail in 4-2 Allocated CIO Area Words. The tables below show the relation between the unit number and the allocated CIO Area and DM Area words.

Unit No. (decimal)	Allocated words	Unit No. (decimal)	Allocated words
0 (0)	CIO1500 to CIO1524	8 (8)	CIO1700 to CIO1724
1 (1)	CIO1525 to CIO1549	9 (9)	CIO1725 to CIO1749
2 (2)	CIO1550 to CIO1574	A (10)	CIO1750 to CIO1774
3 (3)	CIO1575 to CIO1599	B (11)	CIO1775 to CIO1799
4 (4)	CIO1600 to CIO1624	C (12)	CIO1800 to CIO1824
5 (5)	CIO1625 to CIO1649	D (13)	CIO1825 to CIO1849
6 (6)	CIO1650 to CIO1674	E (14)	CIO1850 to CIO1874
7 (7)	CIO1675 to CIO1699	F (15)	CIO1875 to CIO1899

Unit No. (decimal)	Allocated words	Unit No. (decimal)	Allocated words
0 (0)	D30000 to D30099	8 (8)	D30800 to D30899
1 (1)	D30100 to D30199	9 (9)	D30900 to D30999
2 (2)	D30200 to D30299	A (10)	D31000 to D31099
3 (3)	D30300 to D30399	B (11)	D31100 to D31199
4 (4)	D30400 to D30499	C (12)	D31200 to D31299
5 (5)	D30500 to D30599	D (13)	D31300 to D31399
6 (6)	D30600 to D30699	E (14)	D31400 to D31499
7 (7)	D30700 to D30799	F (15)	D31500 to D31599

The CJ1W-PNT21 does not use the DM Area.

3-2 Installing the CJ1W-PNT21 Unit

3-2-1 Handling precautions

When installing the PROFINET IO Controller Unit on the PLC system, observe the following handling precautions.

- Always turn OFF the power supply to the PLC before mounting or dismounting a Unit or connecting or disconnecting cables.
- Provide separate conduits or ducts for the I/O lines and network cables to prevent noise from high-tension lines or power lines.
- When wiring leave the label on top of the Unit attached. Removing the label prior to wiring may result in malfunction if foreign matter enters the Unit.
- Remove the label after completing the wiring to ensure proper air circulation. Leaving the label attached may result in malfunction.

3-2-2 Mounting the CJ1W-PNT21

The PROFINET IO Controller Unit can be mounted to any slot in either a CJ-series CPU Rack, or Expansion Rack. The CJ-series PLC supports up to 3 Expansion Racks, in addition to the CPU Rack.

The figure below shows the number and the positions of the slots to which PROFINET IO Controller Units can be mounted. The CJ1W-PNT21 can be mounted using the sliders on the top and bottom of the Unit. In a single CJ1 PLC system, up to 16 PROFINET IO Controller Units can be mounted. If the CJ1W-PNT21 is mounted in combination with other CPU Bus Units (e.g., Ethernet Units), the maximum number of CPU Bus Units that can be mounted is 16.

PS: Power Supply Unit
CPU: CPU Unit
IC: I/O Control Unit
II: I/O Interface Unit
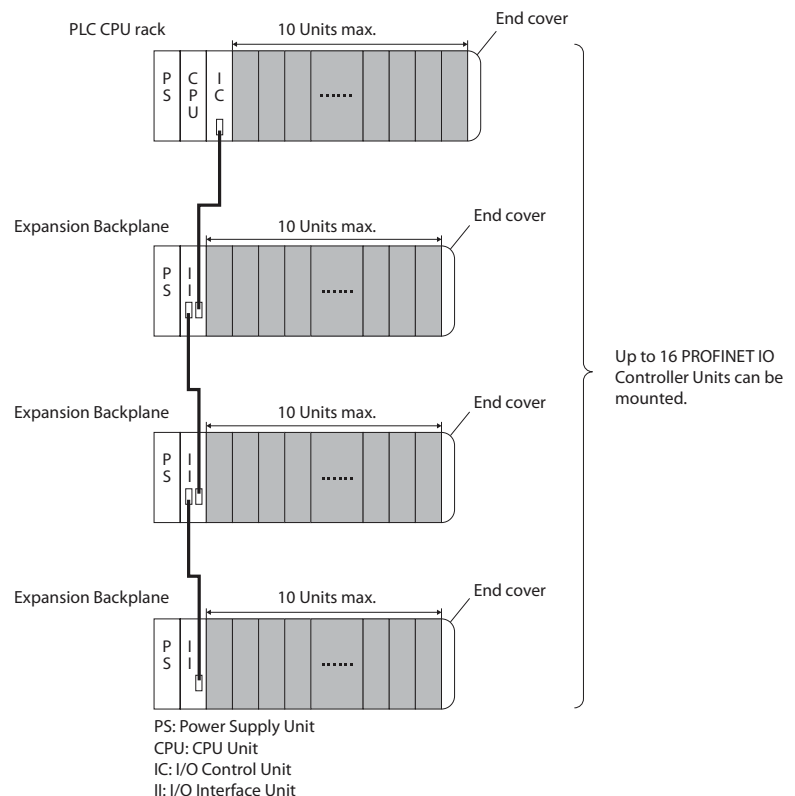
Figure 3.5: CJ-series CPU Rack and Expansion Racks

Note   The maximum current consumption of the CJ1W-PNT21 PROFINET IO Controller Unit is 420 mA. Make sure that the total current consumption of all the Units connected to the same CPU Backplane or Expansion Backplane does not exceed the output capacity of the Power Supply Unit.

Mounting Procedure

Mount the CJ1W-PNT21 PROFINET IO Controller Unit to the PLC using the following procedure.

1 Carefully align the connectors to mount the PROFINET IO Controller Unit.
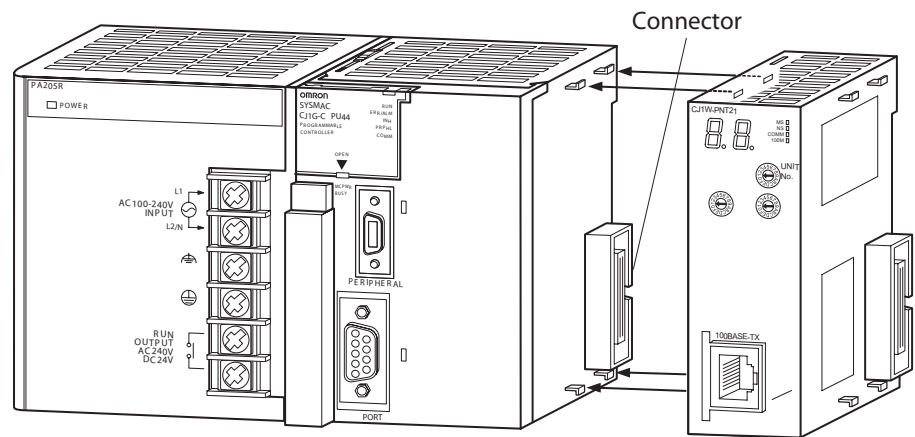
Figure 3.6: Aligning the PROFINET IO Controller

2 Lock the Unit into position by moving the yellow sliders on the top and bottom of the Unit until they click into position.
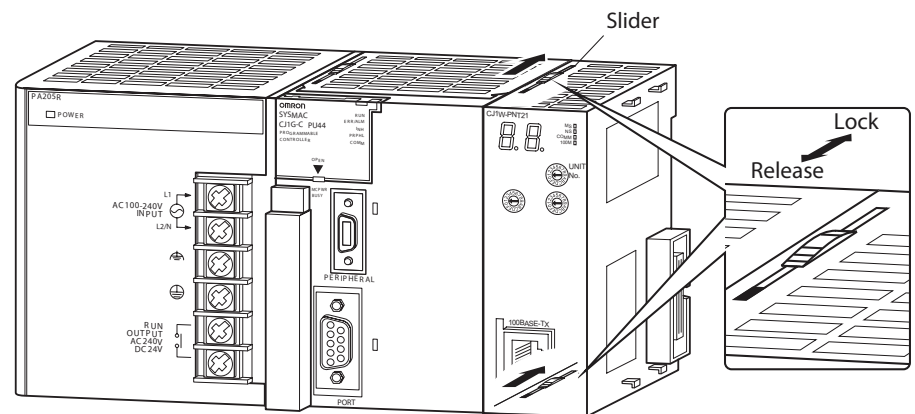
Figure 3.7: Locking the PROFINET IO Controller

Note If the sliders are not securely locked, the PROFINET IO Controller Unit may not function correctly.

To dismount the Unit, move the sliders in the opposite direction ("Release").

3-3 Initial Setup Procedure

After mounting the PROFINET IO Controller Unit to the PLC System the Initial Setup Procedure must be applied. The Initial Setup Procedure allows the Unit to start up properly and to be configured for operation.

• Before the PLC's power supply is turned on a unique Unit number must be set.

• An I/O table must be created in the PLC, to register the Unit on the PLC CPU.

• If forwarding of FINS messages is used, the CJ1W-PNT21 needs a FINS Routing table. This must be created.

3-3-1 Creating a I/O table

An I/O table identifies any Units connected to the PLC and to allocate PLC memory areas to each of these Units. The I/O table is stored in the PLC CPU and loaded at start up. If any change is made to the Unit configuration of a CJ-series PLC, the I/O table must be created again to identify the Units to the CPU Unit.

To create the I/O table, connect a PC with CX-Programmer or CX-Integrator installed to the PLC.
For details regarding creation of the I/O Table using CX-Programmer or CX-Integrator, refer to the CX-Programmer User's Manual or CX-Integrator User's Manual.
After creating the I/O table, the Unit is ready to be configured for first use on the PROFINET IO network.

3-3-2 Creating a FINS Routing table

A FINS Routing table is used to forward FINS messages from one network to another. The CJ1W-PNT21 supports FINS/UDP communication and can be used to forward FINS-messages.
A FINS Routing table must be created if message transfer via other communication units is required, like the CJ1W-ETN21 (Ethernet Communication Unit), CJ1W-SCU (Serial Communication Unit) or CJ1W-DRM21 (DeviceNet Communication Unit). It is very important to assign a valid network number to the CJ1W-PNT21.
If a FINS Routing table exists but there is no entry for the CJ1W-PNT21, the CJ1W-PNT21 will operate normally. However, forwarding FINS messages through the CJ1W-PNT21 will not be possible.

3-4   Setting up the PROFINET IO network

3-4-1   Network structure

A PROFINET IO network can be setup as a line, star, tree or ring network. When using the CJ1W-PNT21 unit in any of these networks, the following precautions apply:

- Always be aware that any additional Ethernet communication through the PROFINET network may influence the PROFINET IO Communication.
- It is recommended to physically separate the PROFINET IO network from other Ethernet-based communication networks (e.g. IT infrastructure) to assure reliable I/O data exchange.
- Severely overloading the CJ1W-PNT21 with data traffic may cause the Unit to temporarily block the Ethernet port, interrupting all traffic including PROFINET IO communication.

3-4-1-1   Line

A line topology comprises multiple IO Devices connected in series. Many IO Devices, such as the Omron GRT1-PNT IO Device Unit have an Ethernet switch integrated in the Unit offering an easy way to interconnect all Devices.
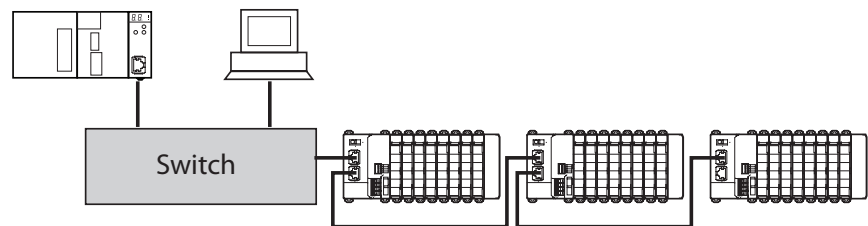
Figure 3.8: Ethernet line topology

Advantages of the line topology:

- In most control systems, the line topology requires the lowest cabling effort.
- A line topology resembles a traditional field bus structure (comparable e.g. to PROFIBUS-DP).
- A basic system can be built without additional Ethernet switches.

Disadvantages of the line topology:

- Communication paths through many switches affect transmission times.
- A malfunction or power disruption of a single Device will result in disconnection of part of the network.

Part	Recommendation
Switch (optional)	Industrial Ethernet Switch (either managed or unmanaged).

3-4-1-2   Star

The star topology is the most common topology for Ethernet networks. A central switch allows for communication between all connected devices.
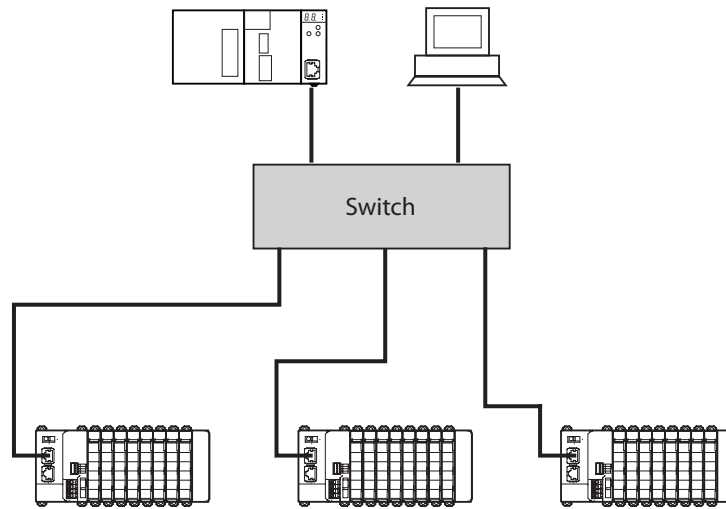
Figure 3.9: Ethernet star topology

Advantages of the star topology:
*   Flexible adding and removing of devices without changes in existing connections.
*   Easy diagnostics of the network by fault isolation.

*   Reduced data traffic per connection.

Disadvantages of the star topology:
*   Aditional cabling effort and cost.
*   Failure or power disruption of the switch will fail the complete network.

Part	Recommendation
Switch	Industrial Ethernet Switch (either managed or unmanaged).

3-4-1-3   Tree

The tree topology is a hierarchial combination of multiple star topologies interconnected with each other.
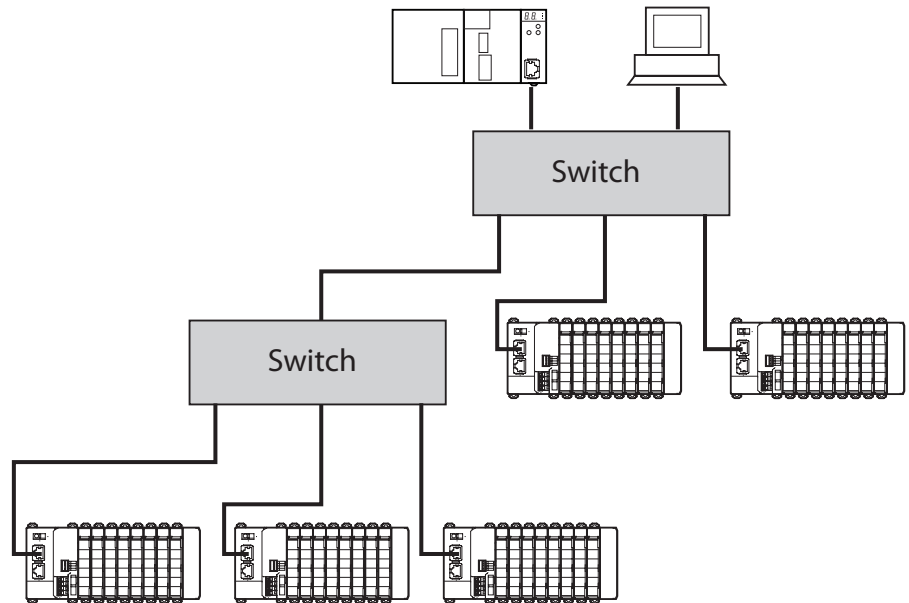
Figure 3.10: Ethernet tree topology

Advantages of the tree topology:
- Flexible adding and removing of devices without changes in existing connections.
- Easy diagnostics of the network by default isolation.

- Further reduced data traffic per connection than when in star topology.

Disadvantages of the tree topology:
- Additional cabling effort and cost.
- Failure or power disruption of one switch will fail a part of the network.

Part	Recommendation
Switch	Industrial Ethernet Switch (either managed or unmanaged).

3-4-1-4 Ring

The ring topology is achieved by extending a line topology back to its starting point. A network redundancy ring protocol such as PROFINET MRP (see Appendix A MRP Ring Redundancy) must be supported by all devices that form the ring. This allows monitoring the state of the network and reconfiguring the communication paths in case of a disturbance..
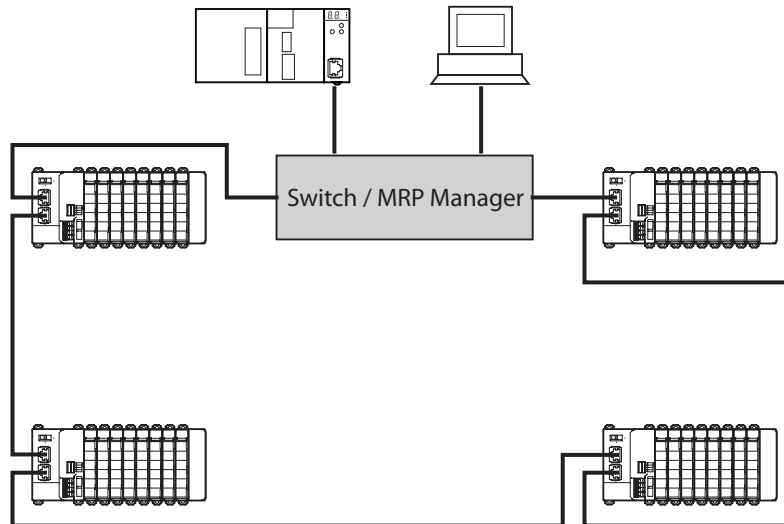
Advantage of a ring topology:
• Malfunction of a single IO Device will not result in disconnection of part of the network as the network redundancy mechanism will automatically maintain the connection with the other devices.

Disadvantage of a ring topology:
• Malfunction or power disruption to the MRP manager will result in disconnection of the entire network.

• High data traffic per connection.

Part	Recommendation
Switch	Industrial Ethernet Switch supporting MRP manager function. Suggestion: Hirschmann Automation and Control GmbH, Series RS20/30/40, Software Version 4 or higher.

3-4-2 MRP Ring Redundancy

This protocol, which is part of the PROFINET IO Specification, enables the Unit to be part of a ring-shaped network structure and adds redundancy to the network. The internal Ethernet Switch of for instance the Omron GRT1-PNT IO Device Unit supports the Media Redundancy Protocol (MRP).

In case one of the line connections fails, the MRP ensures communication to all IO Devices through the redundant path. The ring structure can contain up to 50 Units and typically switches to the redundant path within 150ms (max 500ms).

The network requires an MRP manager to facilitate the redundancy. As an MRP client, there are no specific settings required for the Omron GRT1-PNT IO Device Unit. Please refer to the manual of the used MRP manager unit for details on how to set up and operate the MRP network.
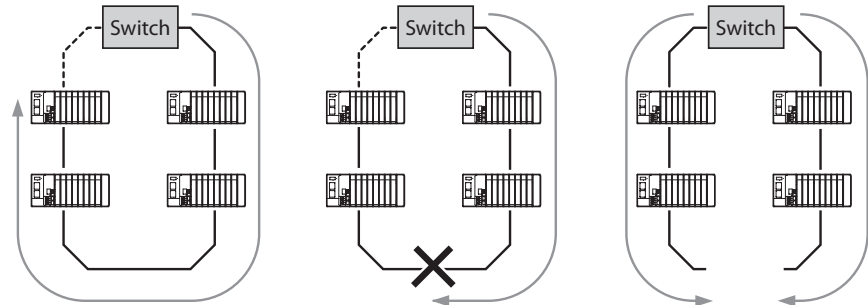
Figure 3.11: MRP ring redundancy

In case a connection fails, MRP Ring Redundancy ensures communication to all devices through the alternative path.

3-4-3   PROFINET IO Controller redundancy

The PROFINET IO Controller redundancy feature ensures a seamless change-over of the active PLC / IO Controller to the standby PLC / IO Controller in case of malfunction. To support redundancy for the PROFINET IO Controller a redundancy Function Block can be downloaded from the OMRON website.

Both the active and the standby IO Controller exchange data with all IO Devices in the network. However, only the active IO Controller is in control of the outputs of the IO Devices.

The I/O data sent from the IO Controller to the I/O Device and vice versa includes data state information. This data-state information is used to signal to the receiving side that the I/O Data is valid or invalid. In case of invalid the receiving side will discard the data.

For IO Controller redundancy, the PROFINET IO Device must be capable of handling relations to multiple IO Controllers. It is up to the IO Device to handle the situation where both IO Controllers signal that the output data is valid. Normally the first IO Controller that signalled that the output data is valid will be in control of the outputs of the IO Device. OMRON can therefore only guarantuee proper IO Controlle redundancy operation if implemented with GRT1-PNT IO Devices.

In case of malfunction of the active IO Controller the Function Block will transfer control to the standby PLC system. To avoid momentary changes in output data during this control change the Data Hold parameter of each IO Device should be set sufficiently high for the standby IO Controller to take over seamlessly. The appropriate Data Hold value should be determined experimentally.
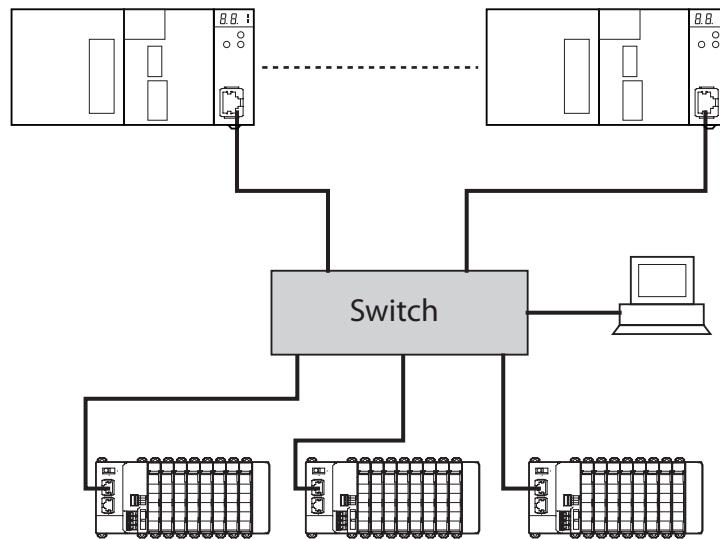
Figure 3.12: PROFINET IO Controller redundancy

3-4-4   Network and Controller redundancy

When combining the PROFINET MRP ring redundancy and the IO Controller redundancy a control system with a high availabilty can be achieved. Single points of failure should have no influence on the operation of the application. A system with both PROFINET MRP ring redundancy and IO Controller redundancy could be set up like the picture below.
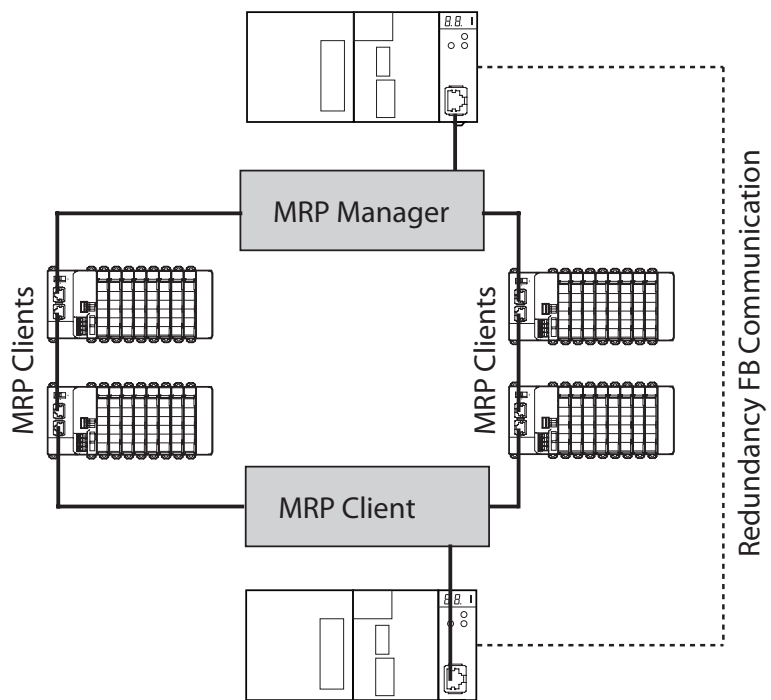
Figure 3.13: Network and Controller redundancy

3-4-5   Establishing the PROFINET IO network

This section describes how to create, connect and configure the PROFINET IO network using the CX-ConfiguratorFDT software and the Device DTMs.

1 Select the Network Components (see previous section) and build the network.

2 Connect the Personal Computer to the Ethernet network. Note that the PROFINET Scan Tool (for assigning the IO Device names) can only operate when connected to the Ethernet network.

3 Start the CX-ConfiguratorFDT software and install the appropriate GSDML files and DTMs for the connected IO Devices.

4 Scan the PROFINET network with the PROFINET Scan View included in the CJ1W-PROFINET IO Controller DTM. Give the detected IO Devices an appropriate name according to their position and /or function. It is possible to give a IO device a temporary IP-address but it will be set/changed later by the IO Controller.

5 Add the PROFINET IO Controller as parent in the Network View. Configure the communication parameters to connect to the IO Controller:
   • Set an IP address in the PROFINET IO Controller by using the Network Scan View.
   • Enter the same IP address in the DTM.
   • Confirm the on-line connection by putting the DTM on-line.
   • Set the PROFINET Names of the PROFINET IO Devices by using the Network Scan View.

6 Build up the network within CX-ConfiguratorFDT. Add the IO Devices to the Tree of the network by dragging and dropping from the Device Catalogue. Assign the I/O modules for each individual IO Device. Use the exact names given to the IO devices with the network scan tool. Make sure that the IP address for each item on the network is unique.

7 Allocate the modules of the IO Devices to the intended PLC memory areas.

8 Download the configuration to the IO Controller.

9 Confirm proper operation by checking the Monitoring GUI of DTM and LED status of the Unit.

Note A common mistake when implementing IO Controller redundancy, is to download the same configuration to both IO Controllers, thereby creating an IP address conflict as well as duplicating the symbolic name. This should be avoided.

3-5   Installation of Configuration Software

In order to operate the PROFINET IO system the PROFINET IO Controller needs to be configured for communication with the PROFINET IO Devices. For this purpose OMRON provides the CJ1W-PNT21 DTM via the OMRON web site http://technicalsupport.europe.omron.com/

After installation the DTM will run in the FDT Container, allowing the user to set up the I/O configuration and to set the parameters of the CJ1W-PNT 21.

3-5-1   Installation requirements

The following are the minimum requirements for a PC to install the CJ1W-PNT21 DTM configuration software:
- PC Pentium III or higher, 500 MHz minimum
- Operating System: Windows 2000 SP2, Windows XP or Windows Vista
- RAM: 256 MB minimum
- Hard disk space: 256 MB minimum
- Graphics resolution: 1024 x 768 pixels minimum
- Installed FDT Container software, i.e. OMRON's CX-ConfiguratorFDT.

3-5-2   Installation procedure

DTM Installation

This section explains how to install the PROFINET IO Controller DTM software.

1,2,3...   1 Exit all other Windows-based programs.
2 Double-click the file **CJ1W-PNT21_PROFINET_IO_Controller_Setup.exe**. The setup program for the CJ1W-PNT21 DTM will start.

Select the preferred Language for the Setup and click **OK**.

3 The user is then guided through the installation process.
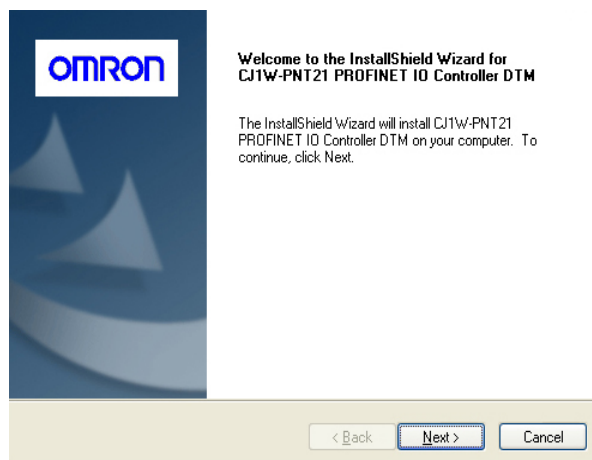
Pressing the **Next** button will start the installation.

4   When done, the installation program will notify the user of its completion. The update of the Device Catalogue of the FDT Container is required.

Updating the Device Catalogue

After installation of the CJ1W-PNT21 DTM the Device Catalogue in the FDT Container needs to be updated, to show the new CJ1W-PNT21 DTM in the list of available devices. For CX-ConfiguratorFDT the following procedure applies.

1,2,3...   1   Open the Device Catalogue window in CX-ConfiguratorFDT.
2   Press the **Update** button to initiate the update sequence.

After updating, the CJ1W-PNT21 DTM will be shown in the list of available devices. It can now be used to setup a PROFINET IO network and configure the PROFINET IO Controller Unit.

Note   In case the required PROFINET IO Controller DTM has not been installed, this needs to be done first to allow the full features of PROFINET IO Device DTM's to be used.

3-5-3   GSDML Files support

Apart from the configuration of OMRON PROFINET IO Devices by a DTM, OMRON provides the possibility to use GSDML files to allow configuration of third-party PROFINET IO Device Units, if a DTM is not provided.

To accomodate GSDML files in a FDT-container OMRON supplies a PROFINET IO Generic Device DTM. The GSDML files of the PROFNET IO Devices must be imported in CX-ConfiguratorFDT. The Generic device DTM will recognize the GSDML files and make them available for configuration with the PROFINET IO Controller.
The section Set-up using the GSDML file discusses the configuration of the PROFINET IO CX-ConfiguratorFDT using this GSDML file.

Using the GSDML file for configuration allows the user to configure the PROFINET IO Controller Unit for I/O data exchange with PROFINET IO Devices. It does not, however, provide the acyclic messaging capabilities to access parameters and status information in PROFINET IO Devices, such as accessing the parameters in individual SmartSlice I/O Units. The GRT1-PNT DTM does provide this capability.

For example: A GSDML file for the GRT1-PNT PROFINET IO Device is available for download (**GSDML-V2.1-OMRON-GRT1-PNT-20081205.xml)** through the OMRON Web site: http://technicalsupport.europe.omron.com/. However, configuring with the DTM is the preferred method.

3-5-3-1   Installation procedure

This section explains how to install the PROFINET IO Generic Device DTM software.

1,2,3...   1   Exit all other Windows-based programs.
        2   Double-click the file **OMRON PNIOGenericDeviceDTM setup.exe**.
             The setup program for the PROFINET IO Generic Device DTM will start.

Select the preferred Language for the Setup and click **OK**.

        3   The user is then guided through the installation process.
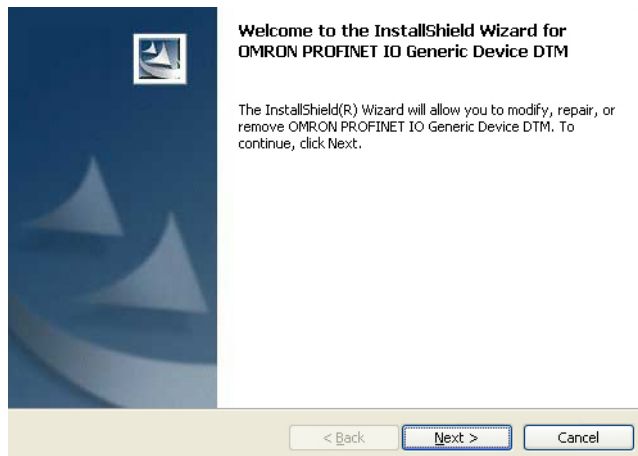
Pressing the **Next** button will start the installation.

4   When done, the installation program will notify the user of its completion. The update of the Device Catalogue of the FDT Container is required

Updating the Device Catalogue

After installation of the PROFINET IO Generic Device DTM the Device Catalogue in the FDT Container needs to be updated. This makes PROFINET IO devices that supply a GSDML file for configuration visible in the device catalogue. For CX-ConfiguratorFDT the following procedure applies.

1,2,3...   1   Open the Device Catalogue window in CX-ConfiguratorFDT.
2   Press the **Update** button to initiate the update sequence.

After updating, the GSDML file based PROFINET IO Devices will be shown in the list of available devices. It can now be used to setup a PROFINET IO network and configure the PROFINET IO Controller Unit.

SECTION 4
Configuration Software

This section presents an overview of the Configuration software and gives insight in the main aspects of defining a PROFINET IO configuration.

4-1   CX-ConfiguratorFDT

Omron CX-ConfiguratorFDT is the versatile network configuration tool for networks such as PROFIBUS and PROFINET. It is based on FDT/DTM technology. CX-ConfiguratorFDT is Omron's standalone FDT-container. For the various networks Omron provides device specific DTM's.

To configure PROFINET Omron delivers three different DTM's:
*   CJ1W-PNT21 PROFINET IO Controller DTM.
    This DTM is used to configure the IO-Controller to perform data-exchange and to set up the memory locations for the I/O data-exchange. Furthermore, the DTM provides online diagnostics functions.
*   GRT1-PNT SmartSlice PROFINET IO Device DTM.
    This DTM is used to configure the GRT1-PNT SmartSlice system. The type and number of units inserted in the SmartSlice system can be configured. This defines the amount of I/O data that is exchanged with the PROFINET IO Controller. All parameters of the SmartSlice buscoupler and the separate SmartSlice units are directly accessible.
*   Generic IO Device DTM.
    This DTM interprets standard PROFINET IO GSDML files. The DTM can only be used to configure the I/O Data exchange between the PROFINET IO Controller and PROFINET IO Devices. The DTM only contains very limited online diagnostics functions and online parameter setup is not possible.

This section provides information about the use of the CJ1W-PNT21 PROFINET IO Controller DTM and the Generic IO Device DTM. For the use of the GRT1-PNT SmartSlice PROFINET IO Device DTM please refer to the manual of the GRT1-PNT PROFINET IO Communication Unit (W13E-EN).

4-2 CX-ConfiguratorFDT Main Window

At first start up, the main application window of CX-ConfiguratorFDT opens with a New Project and the Device Catalogue is opened automatically. The Device Catalogue can also be opened from the menu.

The figure below shows the opened CX-ConfiguratorFDT main window for a project already containing a defined network, and with the Device Catalogue window opened.
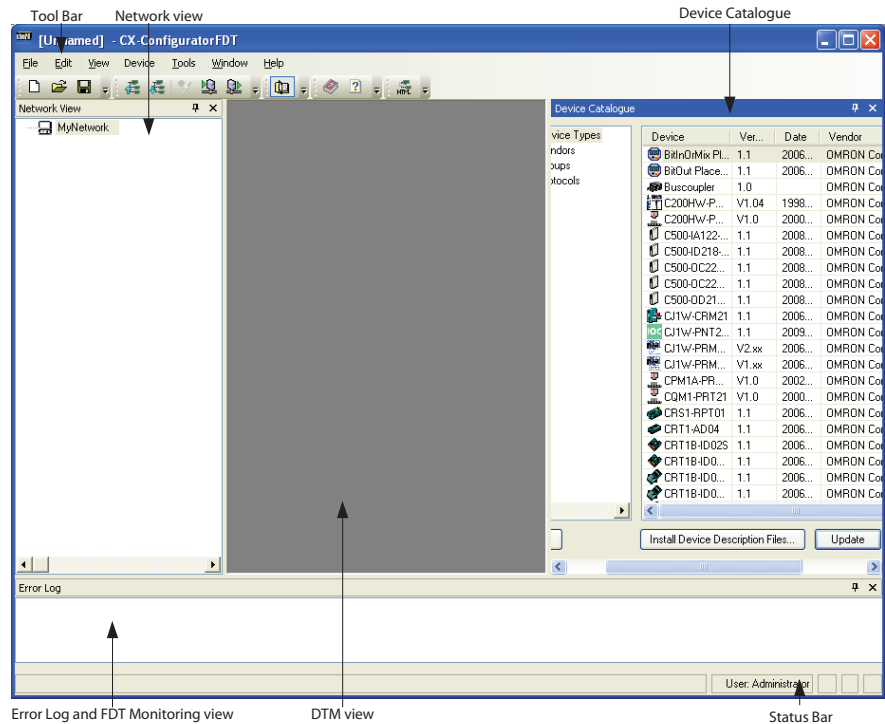
Figure 4.1: CX-ConfiguratorFDT main window

The main components in this window are:
• The Network view.
• The DTM / Catalogue view.
• The Error Log view.
• The FDT Monitoring view (not shown in the figure above).
• The Main menu.
• The Tool Bar and the Status Bar.

Network View

The Network view displays the structure of the PROFINET network in a tree format. The tree has at least three levels:
• The Network Level
• The Master Level
• The Slave Level

The highest level of the tree is the project. The next level is the network controller level. On this level one or more Controller or Master devices can be allocated. For example PROFINET IO Controllers. The third level contains the device DTMs. These can only be the devices that can connect to that particular network master. In this case IO Device DTMs.

The PROFINET IO network must be assembled in the Network view, that is the various DTMs are added to the network in the Network view. From the Network view the individual DTM User Interfaces can be opened and accessed.

35

CX-ConfiguratorFDT supports context menus in the Network view, which pop up when right clicking a device DTM. The contents of the context menu depends on the functionality supported by the DTM.

DTM / Device Catalogue Window

The DTM / Device Catalogue window holds the Device Catalogue and every opened DTM User Interface. The window is a Multiple Document Interface (MDI) window allowing one or more user interface windows to be opened, re-sized and moved.

Error Log view

The Error Log view at the bottom of the CX-ConfiguratorFDT application window displays the error messages reported by the DTMs. To each error message, a Time stamp, a Date stamp and the DTM name are added.
The contents of the Error Log view can be cleared, or copied to the clipboard for pasting to other applications.
When starting CX-ConfiguratorFDT the Error Log view is opened by default.

FDT Monitoring view

The FDT Monitoring view at the bottom of the CX-ConfigurationFDT application window displays the FDT-DTM communication function calls between CX-ConfiguratorFDT and the DTMs. A Time stamp, a Date stamp, the type of information, and the DTM name are added to the message.
The sequential order of the messages can be used to troubleshoot problems that may occur.
When starting CX-ConfiguratorFDT the FDT Monitoring view is not opened by default, but can be opened through the View - FDT Monitoring menu option.

Main Menu

The main menu of CX-ConfiguratorFDT provides all the necessary functionality to handle a complete project. The table below lists all main menu and sub menu items.

Menu	Command	Short Key	Description
File	New	CTRL-N	Creates a new Project
	Open	CTRL-O	Opens an existing Project
	Save	CTRL-S	Saves the current Project to a file
	Save as...	---	The save as command is the same as the Save, but the Filename Specification Window is always displayed.
	Import / Export	---	Imports or Exports Project data to binary or exports to HTML format and launches the browser.
	Info...	---	Opens an edit window to add or edit Project information
	Recent Files	---	Lists the recently used Project files.
	Exit	---	Exits CX-ConfiguratorFDT
Edit	Cut	CTRL-X	Cuts devices and copies them to the clipboard
	Copy	CTRL-C	Copies devices to the clipboard
	Paste	CTRL-V	Copies devices from the clipboard to the cursor position.
View	Full screen	CTRL-ALT-F	Switches the window to full screen view on the main display
	Network view	---	Hides or un-hides the Network view
	Device Catalogue	---	Hides or un-hides the Device Catalogue
	Statusbar	---	Hides or un-hides the Statusbar
	Error Log	---	Hides or un-hides the Error logging window

Menu	Command	Short Key	Description
	FDT Monitor	---	Hides un-hides the FDT monitoring view
Device	Add...	---	Opens the Device Catalogue Add windows, from which devices can be added to the selected network tree.
	Upload Parameters from Device	---	Uploads the parameters from a device to its associated DTM
	Download Parameters to Device	---	Downloads the parameters from a DTM to its associated device.
	Import/Export	---	Imports or Exports Project data to binary or exports to HTML format and launches the browser.
	Info...	---	Opens an edit window to add or edit Project information or opens the properties window of the selected DTM.
Tools	Customize	---	Opens the Customize window to set the Toolbars and Commands.
	Options...	---	Opens the Option window to set General options, User accounts / passwords and Frame Properties.
Window	Tabbed mode	---	When checked the windows are displayed using tab groups. When unchecked the windows are displayed using MDI style.
	Dockable	---	Switches between dockable and not-dockable style for the window which has the focus.
	Hide	---	Hides the window which has the focus.
	Floating	---	Switches between floating and not-floating style for the window which has the focus.
	Auto Hide	---	Auto hides the tool window which has the focus.
	Auto Hide All	---	Auto hides all tool windows currently displayed.
Help	Contents	---	Opens the Online Help System displaying the contents tab.
	Index	---	Opens the Online Help System displaying the index tab.
	About CX-Configurator-FDT	---	Opens the About box and gives access to edit licence key.

Tool Bar   The tool bar provides quick access buttons to the user for frequently used menu commands.

Status Bar   The status bar displays the current user role, that is the login level.
In case the Error Log view has been closed, the status bar will additionally display a symbol to indicate that new errors are available in the Error Log view. Double-clicking the symbol will open the Error Log view.

4-2-1   Device Catalogue

Device Catalogue Main Components   The Device Catalogue is one of the main components in CX-ConfiguratorFDT. Its main functions are:
- Maintain a list of installed DTM and GSDML files.
- Provide convenient sorting and categorizing of the list.
- Allow updating the list, after installation of new DTMs or GSDML files.
- Provide detailed information on selected DTMs.

The main layout of the Device Catalogue is shown below:
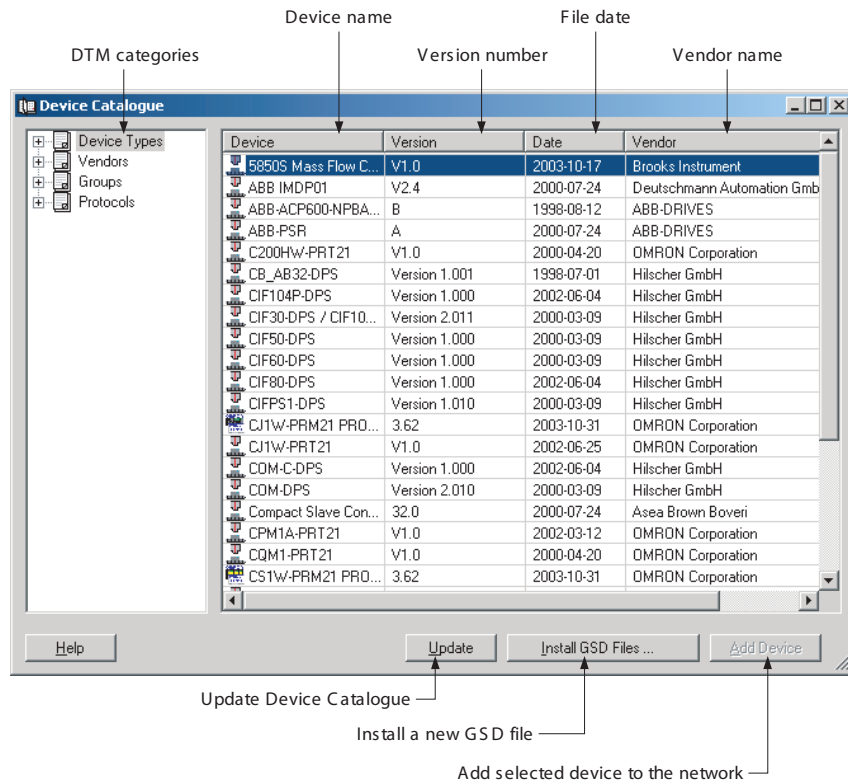
Figure 4.2: Device catalogue

Invoking the Device Catalogue

The Device Catalogue window is opened by either selecting the corresponding icon in the CX-ConfiguratorFDT toolbar or by selecting View - Device Catalogue from the menu. Both options have a toggle function; selecting the option again will close the Device Catalogue.

DTM view Layout

The left view allows selection of specific groups of DTMs to be displayed. The right view lists the DTMs, which are installed on the PC and which are available for setting up a network. A selection of DTMs is made by selecting a specific group in the left view.

Note

The list makes no distinction between normal DTMs and GSDML files which have been loaded through the Generic IO Device DTM. When both DTM and GSDML are available for one device, it is recommended to use the DTM.

DTM List Window

The list items in the right view are described in the following table.

Column	Description
Device	The Device column contains the names of the DTMs, as provided by the DTM or the GSDML file. If the device is defined by a GSDML file, the Generic IO Device DTM reads out the GSDML file entry "Model Name". The string provided by this variable is the name displayed in the list.
Version	The version number defines the revision number of the device. If the device is defined by a GSDML file, the Generic IO Device DTM reads out the GSDML file entry "Revision". The string provided by this variable is the version number displayed in the list.

Column	Description
Date	For DTMs, Date is the date associated with the revision. For GSDML file based slaves, the date listed in this column is the date the GSDML file was last modified.
Vendor	The Vendor name is provided by the DTM or the GSDML files.

DTM Group Selection Window

The left view allows selection of specific groups of device DTMs with common attributes, e.g. Vendor name, Protocol type etc. If a group is selected, all device DTMs which belong to that group will be listed in the right view. The table below lists the possible groups that can be selected.

List Item	Description
Device types	Sub groups, which can be selected are: • Communication DTMs, for example PROFINET IO Controller devices • Gateways, for example to another network type • Modular devices • Other devices, for example slave devices
Vendors	Sub groups, which can be selected are all available vendors. This information is provided by each DTM. It allows the user to select a group of devices from one vendor.
Groups	Sub groups are the device types, for example digital I/O, analog I/O and so on.
Protocols	Sub groups which can be selected are all the communication protocols found in the Device Catalogue.

Note   1   The sub groups are displayed by cicking on the + sign next to each main group.
2   Selecting the main group displays all devices in the group.

Additional DTM Information

In order to obtain more information of a specific DTM, right-click the DTM in the list, and select DTM Information from the pop-up menu. This opens a window with additional DTM information. The figure below provides an example for the CJ1W-PNT PROFINET IO Controller DTM.
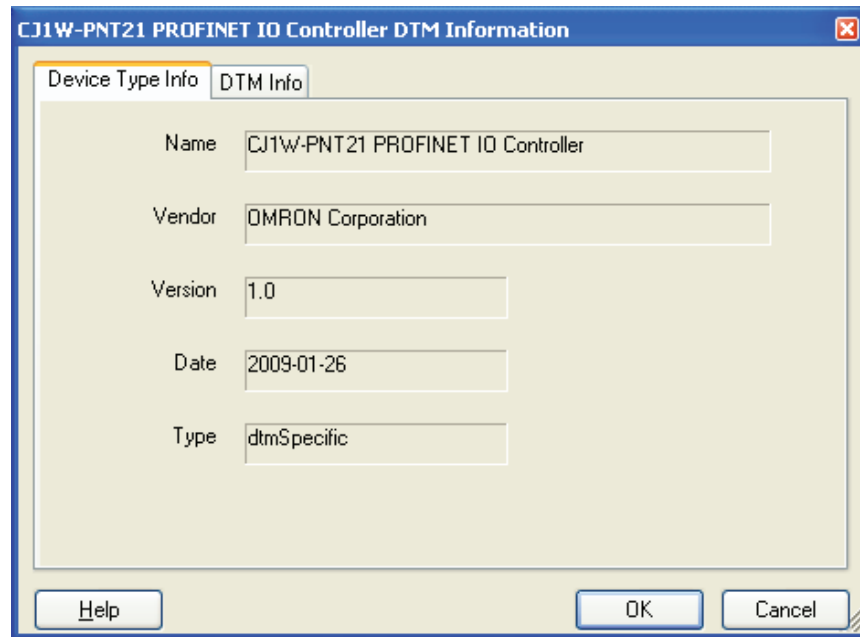
Figure 4.3: Additional DTM information

4-2-1-1 Installing GSDML Files

The Device Catalogue allows the installation of new GSDML files into the GSDML directory for the Generic IO Device DTM. Selecting the **Install Device Description Files...** button displays the standard Windows File selection window. After selecting the GSDML file, and clicking the **Open** button in the File selection window, the GSDML file will be copied to the GSDML file directory under CX-ConfiguratorFDT.

After copying the GSDML file, a warning window will be displayed, indicating that the Device Catalogue needs to be updated. To update the Device Catalogue select the **Yes** button in the warning window.

Note   1   Updating the Device Catalogue after copying the GSDML file can only be done if there is a new project opened, with no DTMs allocated to the network in order to prevent corruption of an existing network in case a GSDML file is removed or replaced.

2   The **Install Device Description Files..** option allows installation of more than one file at the same time.

4-2-1-2 Updating the Device Catalogue

If a new DTM has been installed, it will not automatically be included in the Device Catalogue. To add newly installed DTMs to the list, the Device Catalogue must be updated by clicking the **Update** button at the bottom of the Device Catalogue window.

Updating the Device Catalogue

Updating the Device Catalogue may take some time, depending on the number of DTMs installed. A dialogue window with a progress bar will be shown during the update process. After updating the Device Catalogue, the list is stored on hard disk. The next time CX-ConfiguratorFDT is started the updated list will be used.

4-2-1-3 Adding Devices to the Network

Setting up a network in CX-ConfiguratorFDT involves adding and configuring single device DTMs. The device DTMs as listed in the Device Catalogue can be added to the network in three ways:

1 Using the context menu

A context menu will pop up when selecting the CJ1W-PNT21 PROFINET IO Controller DTM and then right clicking the mouse. By selecting the menu option Add Device, a simplified Device Catalogue is displayed showing only the DTMs which are allowed to be added to the PROFINET IO Controller DTM.

2 Using the Drag & Drop function

A Device DTM listed in the standard Device Catalogue window can be dragged and dropped from the Device Catalogue to a desired position in the Network view.

3 Using the Add Device button

A device DTM selected in the Device Catalogue can be added to a selected Master DTM in the Network view by clicking the Add Device button in the Device Catalogue window.

4-2-2 Saving and Opening Projects

A project file, containing various DTMs, can both be saved to and opened from hard disk. To save a project file select the **File - Save** or **File - Save As...** menu option. This will display the standard Windows File selection window, allowing the user to enter a file name.

The Project File is saved with the extension *.CPR.

Saving the data is initiated from CX-ConfiguratorFDT, but every DTM must support the save function as well. The settings of each DTM is saved in the Project file.

A Project file can be opened by choosing the **File - Open** menu option. This will open the standard Windows File selection window, after which the Project file can be selected and opened.

Note When opening a Project file, the network tree view is automatically constructed. However, for performance reasons, the DTMs are not directly instantiated to speed up the construction of the tree.

A Project File can also be opened from Windows Explorer. Double-clicking a file with extension *.CPR will invoke CX-ConfiguratorFDT and open the selected file.

4-2-3 Exporting to HTML

CX-ConfiguratorFDT provides automatic generation of project documentation upon command of the user. The documentation is generated in HTML format, and can cover either single DTMs or the whole project. After generation of the HTML document, it will automatically launch the default Internet browser, to display the result.

Exporting Project to HTML To export the project information to HTML either:

• Select the **File - Export Project as HTML** option from the main menu, or
• Select the **Export to HTML** option from the context menu

First select the project level in the Network view, and then right click the mouse to display the context menu.

In both cases a window will pop up displaying the progress of the export process.

After exporting the information, the default browser is launched, showing the result of the export process. The HTML file contains links to open the information pages for the individual DTMs. The amount of the information displayed depends on the individual DTMs. The displayed information can range from only the device type and version information to up to all possible settings and selections made for the device.

Exporting DTM Information to HTML

To export single DTM information to HTML execute the following steps:

1,2,3... 1 Select the DTM in the Network view.
2 Right click the DTM to bring up the context menu.
3 Select the Export to HTML option from the context menu.

A window will pop up displaying the progress of the export process. When finished, CX-ConfiguratorFDT will launch the default browser to display the result. In this case, however, no links will be available to other DTMs in the network.

4-2-4 Error Logging and FDT Monitoring

CX-ConfiguratorFDT provides two logging windows at the bottom of the application window. Both windows are used for displaying events.

Error Log view

The Error Log view displays error messages reported by the DTMs and by the CX-ConfiguratorFDT FDT container application. All messages include the Time and Date of occurrence as well as the DTM Name, as shown in the Network view.

Purpose of the Error log

The purpose of the Error Log view is error reporting and troubleshooting. The contents of the window can be copied to the clipboard, for pasting to another application or into an E-mail. The errors and the sequence in which they occur may hold additional clues in case of problems.

Error Log Format
The format used in the Error Log view is:

Time: *<Time>* Date: *<Date>* - *<DTM name>* *<message>*

The message displayed, originates from the DTM in which the error occurred.

The figure below shows an example of an error message sequence. This example sequence is generated after attempting to change a slave address to that of another slave already assigned to the same Master Unit
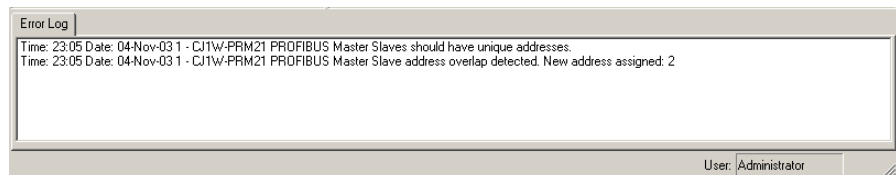
Figure 4.4: Error log

Right-clicking in the Error Log view displays a context menu providing the options listed below.

Error Log view Context Menu

Menu Item	Description	Equivalent menu command
Clear all entries	Clears the entire Error Log view	---
Copy to clipboard	Copies the entire contents of the Error Log view to the clipboard.	---
Hide	Hides the Error Log view	View - Error Logging

FDT Monitoring view

The FDT Monitoring view displays the communication between the FDT Container application (i.e. CX-ConfiguratorFDT) and any of the DTMs. The communication is listed as a sequence of function calls from the CX-Profibus to a DTM and vice versa.

Note

The FDT Monitoring view is hidden by default. After starting CX-ConfiguratorFDT, the window will be displayed, by selecting the **View - FDT Monitoring** option from the main menu.

The purpose of the FDT Monitoring view is troubleshooting in case problems occur with third party DTMs. The contents of the window can be copied to the clipboard, to allow it to be pasted into another document or into an E-mail. The messages themselves as well as the sequence of messages may hold additional clues in case of problems.

The format used in the FDT Monitoring view is:

Time: *<Time>* Date: *<Date> - <Information Type> <message>*

The message may include the name of the DTM involved in the communication. The figure below shows an example of an FDT Monitoring message sequence. This example sequence is generated when opening a CJ1W-PNT21 PROFINET IO Controller Unit DTM.
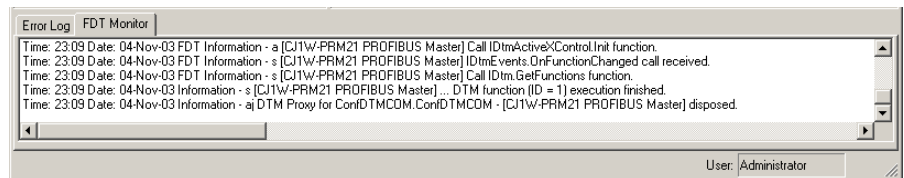
Figure 4.5: FDT monitor

Right-clicking in the Error Log view displays a context menu providing the options listed below.

Error Log view Context Menu

Menu Item	Description	Equivalent menu command
Clear all entries	Clears the entire FDT Monitoring view	---
Copy to clipboard	Copies the entire contents of the FDT Monitoring view to the clipboard.	---
Hide	Hides the FDT Monitoring view	View - FDT Monitoring

4-3   CJ1W-PNT21 PROFINET IO Controller DTM

CJ1W-PNT21 PROFINET IO Controller DTM

To allow configuration and data monitoring from within CX-ConfiguratorFDT a CJ1W-PNT21 PROFINET IO Controller DTM is installed. The DTM shows up in the Device Catalogue under the following name:

DTM Name	Functions
CJ1W-PNT21 PROFINET IO Controller	• I/O Configuration of PROFINET IO Controller Unit. • Monitoring of PROFINET IO Controller Unit. • Provide an Acyclic communication channel with PROFINET IO Devices.

The PROFINET IO Controller DTM has three main user interface components.
• DTM Configuration User Interface
  This user interface facilitates configuration of the IO Controller Unit.
• DTM PROFINET Identification.
  This user interface facilitates detection of IO Devices and configuration of IO device Names.
• DTM Diagnostics User Interface
  The DTM Diagnostics User Interface facilitates Unit status determination, IO Device status determination, and changing the Unit's PROFINET operational mode.

This section provides an overview of the PROFINET IO Controller DTM, and discusses the user interfaces.

4-3-1   DTM User Interface

Opening the DTM

To open the CJ1W-PNT21 IO Controller DTM:
• Select and double-click the IO Controller DTM in the Network view.
• Select and right-click the IO Controller DTM in the Network view. Next, select Configuration from the context menu.

The IO Controller DTM Configuration User Interface, which is displayed in the CX-ConfiguratorFDT DTM view is shown below.
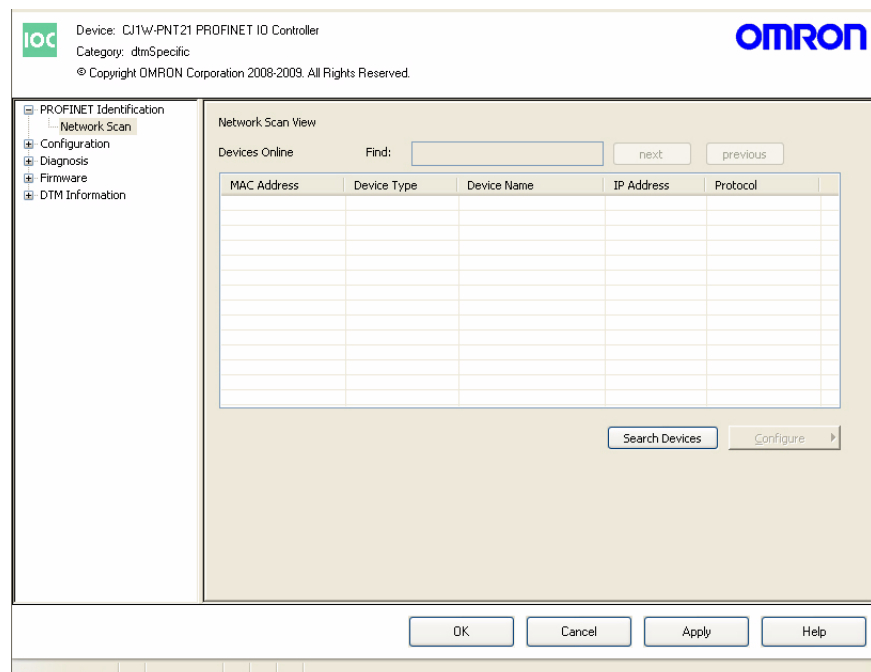
Figure 3.6: DTM user interface

Master DTM Configuration User Interface

The IO Controller DTM Configuration User Interface contains five main items.

- PROFINET Identification
- Configuration
- Diagnosis
- Firmware
- DTM Information

The five items are discussed below.

Configuration Interface Buttons

The IO Controller DTM Configuration User Interface contains four general buttons. The table below shows the name and the action for each button.

Button	Action
OK	Evaluate, and save the changes made (if any) and close the user interface. **Note:** If any invalid settings have been made, a warning message will be displayed, allowing cancellation of the command.
Cancel	Closes the user interface without saving. **Note:** If any changes were made, a warning message is displayed, allowing cancellation of the command.
Apply	Evaluate changes and save them.
Help	Launch context sensitive Help for the Active tab.

⚠ **Caution** Changes made by the user are saved in the DTM only, and not in the Project. This is indicated by the asterisk next to the DTM in the Network view. The next time in the same session the GUI is opened, the changes will still be there. To save the changes permanently, for example to hard disk, click the **File - Save** option from the main menu of CX-ConfiguratorFDT.

4-3-2 PROFINET Identification

The PROFINET Identification item is used to detect and setup the names of the PROFINET IO Devices on the network. The PROFINET Identification item has only one sub-item:

- Network Scan

The sub-item is described in the section below.

4-3-2-1 Network Scan

In the Network Scan sub-item the following settings and operations must be done prior to starting PROFINET IO Communication.

1 Acquire an overview of all IO Devices connected to the network.
2 Make the IO Devices or IO Controller LED's flash to be able to identify the Unit.
3 Set the Device Name for each of the IO Devices and IO Controllers connected to the network.

It is required for the PC to have an Ethernet connection to the Network to perform these operations. The Network Scan screen is shown below.
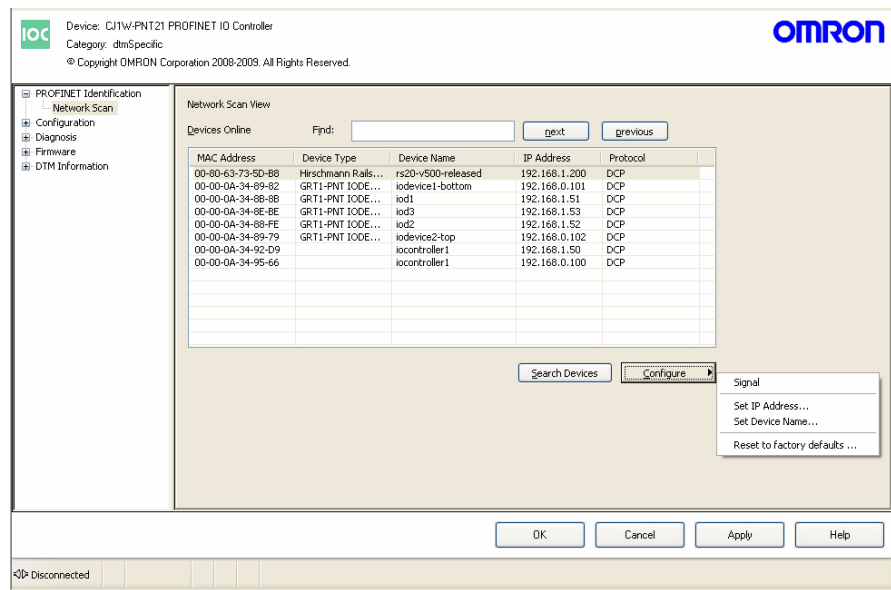
Figure 4.7: Network scan

Search Devices Button

To populate the Network Scan View follow the next sequence:

1 Press the **Search Devices** button to scan the network and get an overview of all the PROFINET devices connected to the Ethernet network.
2 Locate the IO devices at their physical location by making the IO Controllers and IO Devices flash their LED's.
3 Give each IO Device its PROFINET IO Device name.

The Controls have the following function:

Control	Description
Search Devices	The **Search Devices** button initiates a scan of the network and shows all found PROFINET IO Devices in the Network Scan View. For each device the MAC Address, Device Type, the currently assigned name and IP Address are displayed. The PROFINET Name and the IP Address can be adjusted from within this view.
Signal	When selecting "Signal" the selected IO Device or IO Controllers will flash its LEDs for 3 seconds. This can be used to locate the IO Controller or IO Device.
Set IP Address	An IP Address can be temporarily set to access the IO Device over TCP/IP with a device-specific tool. When the IO Controller opens a connection to the IO Device the IP Address is overwritten by the IP Address set in the IO Controller's configuration file. The IP Address can also be set temporarily for the IO Controller, however this can only be done when there is no configuration file in the IO Controller.

Control	Description
Set Device Name	The Device Name is used by the IO Controller to recognize the IO Device on the network, to download parameters to the IO Device and initiate I/O Data communication. Setting the Device Name is mandatory. According to the PROFINET specification the name may only contain lower case characters, dashes and numbers. During entry of the Device Name the characters entered are checked and corrected for possible illegal characters.
Reset to factory defaults.	The selected IO Device is reset to factory default settings. This normally means no Name and no IP Address (0.0.0.0)

Note   1 It is required for the PC to have an Ethernet connection to the Network to perform these operations.
2 Be sure to set the Device Name of the IO Device to exactly the same value as set in the IO Controller's IO Device setup sub-item.

Find field
In the Find field a selection of the found IO devices can be made. The search string can be used with wildcard characters (like *). The search is done on all fields of the Device Online list.

4-3-3   Configuration

The Main item "Configuration" (see figure below) provides the following four sub-items:
• PLC Setup
• IO Controller Setup
• IO Device Setup
• IO Device Area
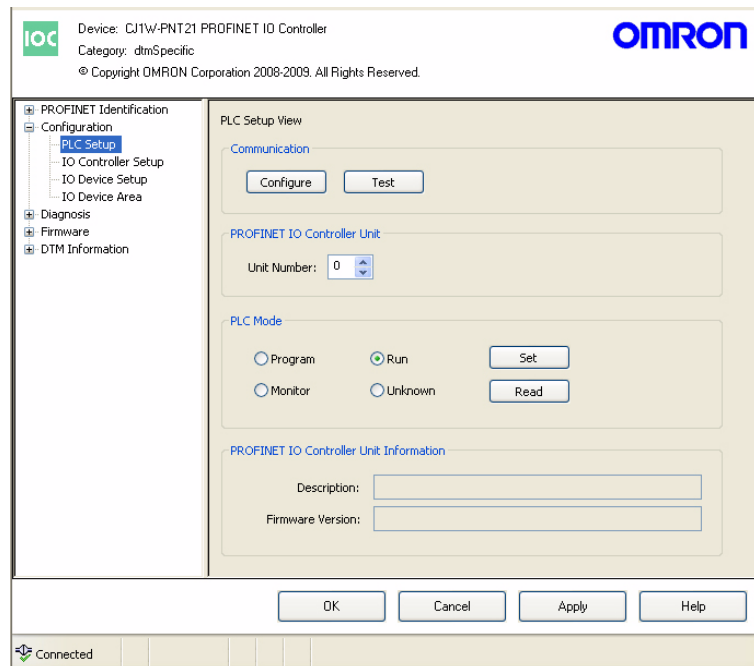
Figure 4.8: PROFINET IO Controller Configuration

Each sub-item is described in the sections below.

4-3-3-1 PLC Setup

The PLC Setup sub-item provides the controls to establish communication between the PC and the PROFINET IO Controller Unit. The PLC Setup allows setting of the unit number to identify the PROFINET IO Controller Unit on the PLC system. The PLC Setup also invokes the CX-Server interface to setup and test the communication between the PC and the PLC to which the Unit is attached.

The PLC Setup has the following Components:

PROFINET IO Controller Unit

The PROFINET IO Controller Unit box contains the settings the user must make before setting up the communication and before testing the communication.

Control	Description
Unit number	Set this to the value of the Unit Number Selector switch on the front of the Unit . This number is used in the communication between the PC and the PLC to transmit the messages to the targeted PROFINET IO Controller Unit

Communication

The Communication box contains a Configure and a Test button.

Configure Button

The **Configure** button invokes the CX-Server communications settings dialogue. CX-Server is the driver software providing the communications functionality between a PC and the PLC CPU, and forms the basis for Omron's CX-One programs.

CX-Server is provided with CX-ConfiguratorFDT, but it may already be installed on the PC, if other programs, for example CX-Programmer have been installed.

Note

The CX-Server is designed to manage the communication between the PC and the PLC and also to configure the connected PLC.

Test Button

The purpose of the **Test** button is to verify the communication setup, after CX-Server has been configured. If the PC and the PLC are connected, selecting the Test button will invoke a FINS request message to the PROFINET IO Controller Unit via the PLC, to read its name and firmware version. If the request succeeds, both items will be displayed in the PROFINET IO Controller Unit Information Box.

If the FINS request fails (no response), an error message will be displayed in the Error Log view. In this case the Firmware version field will revert back to its default contents, i.e. "--- ".

PROFINET IO Controller Information Box

The PROFINET IO Controller Information Box contains information obtained from the PROFINET IO Controller Unit, after pressing the test button.

Item	Description
Description	Displays the name of the Unit, that is CJ1W-PNT21.
Firmware Version	Displays the firmware version of the PROFINET IO Controller Unit.

PLC Mode Box

The PLC Mode Box contains information and gives the user the opportunity to change the PLC-mode. The status and buttons are greyed out when the PROFINET IO Controller DTM is in the offline mode. When in the online mode

clicking the **Read** button will read the current PLC mode. Selecting the required PLC mode and pressing the **Set** button will set the PLC to the required mode.

4-3-3-2   IO Controller Setup

The IO Controller Setup item contains settings regarding the behaviour of the PROFINET IO Controller Unit. The IO Controller Setup item is shown below.
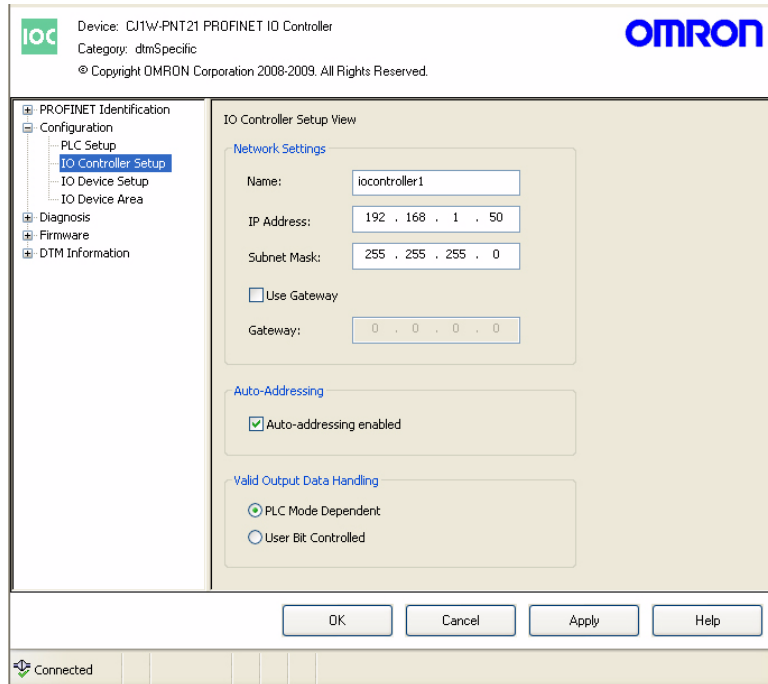
Figure 4.9: IO Controller setup

Network Settings Box

The Network Settings Box contains the fields to enter the PROFINET IO-Controller's Name, IP Address and Subnet Mask. This information is required to let the PROFINET IO Controller connect to the PROFINET IO network.

Item	Description
Name	This string is the PROFINET IO name of the Unit.
IP Address	This is the IP Address the PROFINET IO Controller Unit will use to setup communication to PROFINET IO Devices and on which the PROFINET IO Controller will be accessible from the Ethernet network. The last number of the IP Address for the PROFINET IO Controller Unit can not be higher that 126.
Subnet Mask	This is the Subnet Mask that will be used with the above IP-Address.
Use Gateway	This is currently not supported.

Auto-Addressing Box

The Auto-Addressing function incluences the I/O Mapping process when adding and removing I/O modules or when editing an existing I/O Mapping.

Control	Description
Auto Addressing enabled	The IO Controller DTM performs the I/O data mapping by allocating the I/O data in ascending order of IO Device address and selected I/O modules. Memory allocation gaps will be optimised for efficiency.
Auto Addressing disabled	New I/O modules are appended to the existing mapping. Changed I/O modules will be re-allocated to the end of the list. This may create gaps in the memory allocation.

Valid Output Data Handling Box

The Valid Output Data Handling Box defines the behaviour of the PROFINET IO Controller Unit on the PROFINET network in case a PLC mode change occurs. Check boxes define how the Unit should behave in case the PLC mode is changed from RUN / MONITOR mode to PROGRAM mode, or vice versa.

Control	Description
PLC Mode Dependent	The PROFINET IO Controller will mark its output data as invalid when the PLC is in Program mode. When the PLC is in Run/Monitor mode the PROFINET IO Controller will mark the output data as valid.
User Bit Controlled	The PROFINET IO Controller will mark its output data as invalid when bit 12 in the Software Switches 1 word is OFF. When bit 12 in the Software Switches 1 word is ON the PROFINET IO Controller will mark the output data as valid. The Software Switches 1 word is located at address CIO 1500 + (25 x Unit number).

The PROFINET IO Controller uses for this the Provider Status field in the PROFINET Output Data message. This Provider Status field is set valid or invalid by the Producer. The Consumer will interpret the Provider Status field. If the Provider Status field is set to invalid the Consumer will discard the received Output data. For more information about Provider Status field and the Output Data status see Appendix A.

4-3-3-3   IO Device Setup

At startup the PROFINET IO Controller configures the relations with the PROFINET IO devices. The PROFINET IO Controller will query the IO devices by name. After finding the PROFNET IO Device on the network the PROFINET IO Controller will issue an IP address to the IO device. This IP address will be used to configure the relation between the PROFINET IO Controller and the IO Device.

The following settings must be entered:
* The Device Name the IO Controller searches for
* The IP Address needed for configuration
* The Update Rate of the Connection
* Watchdog and DataHold Factors

The Device Name entered must be equal to the name that was given to the IO Device in the network Scan in the PROFINET Identification screen. If there is a mismatch the IO Controller can not establish a connection. The name entered in the Network Scan is not automatically copied to the IO Device Setup list.

The IO Device Setup item is shown below.
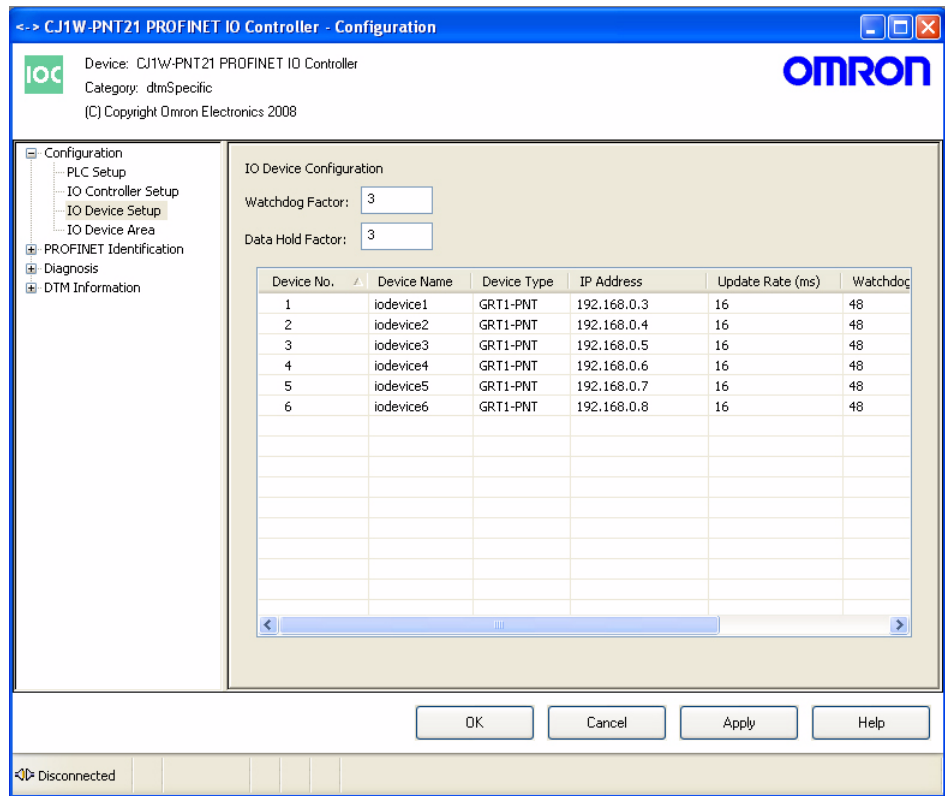
Figure 4.10: IO Device setup

Item	Description
Device No.	The Device No. is the number used by the PROFINET IO Controller DTM to reference the IO Device within the configuration. For instance in the Diagnostic screen IO Devices are represented by number.
Device Name	The Device Name is the name the PROFINET IO Controller will search for at startup. This name must be exactly the same as the name entered in the IO Device. Note that according to the PROFINET specification only lower case characters, dashes and numbers are allowed.
Device Type	The Device Type is supplied by the Device DTM and can not be altered.
IP Address	The IP Address is issued by the PROFINET IO Controller to the IO Device with the corresponding IP address. The IO Device is then reachable on the network by this IP Address.
Update Rate (ms)	The Update Rate is the time interval in milliseconds between subsequent Input Data and Output Data exchanges between the PROFINET IO Controller and the IO Device. The Update Rate can be set per IO Device.
Watchdog Factor	The Watchdog Factor is a multiplication factor on the Update Rate to define the watchdog timeout. If an update of I/O Data takes longer than the Watchdog Time the connection is considered to be terminated. A new connection attempt will be made by the PROFINET IO Controller.

Item	Description
Data Hold Factor	The Data Hold Factor is a multiplication factor on the Update Rate to define the datahold timeout. The Data Hold Time is the time that an IO Device will keep its Outputs set to the last known state after a successful data exchange. If the Data Hold Time elapses, the Outputs of the IO Device will turn to a safe state as defined by the configuration of each device. The Data Hold Factor must be equal to or larger than the Watchdog Factor
Watchdog Time (ms)	The Watchdog Time is the multiplication of the Update Rate and the Watchdog Factor.
Data Hold Time (ms)	The Data Hold Time is the multiplication of the Update Rate and the Data Hold Factor.

4-3-3-4   IO Device Area

The IO Device Area displays the mapping of the I/O data of the allocated IO Devices onto the PLC memory areas. The mapping can be made automatically or be changed by the user prior to downloading.

The figure below shows the IO Device Area, more in particular the Output Allocation tab.
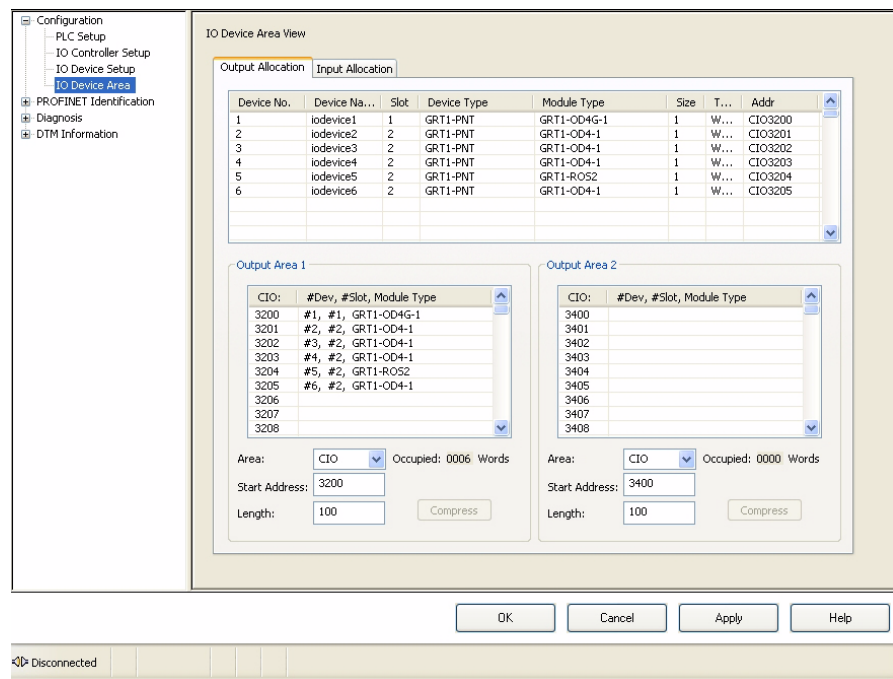
Figure 4.11: IO Device area

Allocation Areas   The IO Device Area allocation tabs define how the I/O data of each of the slave devices is mapped onto the PLC memory. The Slave area tab contains two tabs, one for Output Allocation and one for Input Allocation. Each tab contains an overall module list showing all the output or input data per slave, along with the Module names, sizes, data types and start addresses. This data is transferred to the Master DTM by each of the allocated slave DTMs. If no IO Devices have been allocated or configured the list will be empty.

Module List Box   The Module List Box list contains the following information (the table applies to the lists in the Input and Output Allocation tabs, see also the above figure).

Column	Description
Device No.	The Device No. is the number used by the PROFINET IO Controller DTM to reference the IO Device within the configuration.
Device Name	The Device Name is the name assigned to the IO device to which this I/O data belongs to.
Slot	The Slot number is the position in which this particular module is inserted. The information is supplied by the IO device DTM.
Device Type	The Device Type is supplied by the IO Device DTM.
Module Type	The Module Type is supplied by the IO Device DTM.
Size	The Size of the module.
Type	The Datatype of the module.
Address	The Address is the PLC Address with which the I/O Data of the module is exchanged.

I/O Mapping Box

Each Output/Input Allocation tab also contains two areas onto which the I/O data can be mapped. The areas are subsequently mapped onto the PLC memory. By default all data is mapped to Area 1, in ascending order of the IO Device Number.

Note

1 When mapping, the modules are copied from the module list to the mapping Area. The module list acts as a resource for the two Mapping Areas. To change the mapping of a module drag and drop it from the module list to the Mapping Area.

2 When adding or removing slaves and modules, while Auto Addressing has been enabled, the modules in the Areas will be remapped, usually also resulting in I/O data being re-mapped. Therefore it is recommended to define all slaves and modules, before setting up the PLC memory mapping configuration.

⚠ **Caution** The default mapping of areas onto the PLC memory is the same default mapping as used in the CJ1W-DRM21 Devicenet Master/Slave Unit and in the CJ1W-PRM21 PROFIBUS Master unit. Care should be taken to avoid data overlap, if such a Unit is part of the same PLC CPU system as the CJ1W-PNT21 PROFINET IO Controller Unit

Mapping Area Control

Each mapping Area in the Allocation tab is equipped with four controls and an information field located below the Area. The controls and information field are listed and explained in the table below

Control	Description
Area	Selects the PLC memory area to which the associated I/O Area will be mapped. Possible options are: • Not Used (List must be empty). • CIO • DM • WR • HR • EM Bank 0 to 12 (Decimal) (See Note 1)
Start Address	In this field the user can enter the start address in the PLC memory of the mapped data block.

Control	Description
Length	The length box allows the user to select the number of visible rows. The minimum and the default value is 100 words. The Length value can be set to up to 7168 words.
Occupied	This field displays the actual length of the data block (not necessarily the same as the amount of data contained by it). This length includes both data as well as any gaps between modules. Gaps may only be there if the Auto-Addressing option in the Master Setup tab is disabled (See also Note 2).
Compress Button	Pressing the Compress button will compress the Area list associated with it, that is gaps from the mapping list are removed by moving all mapped I/O modules as close as possible to the beginning of the memory area. (See Notes 3 and 4).

Note

1 If the selected PLC memory area, onto which the data must be mapped, is not supported by the PLC CPU a warning message will be displayed upon downloading the configuration.

2 If an invalid setting is made the Occupied length value changes its colour to red. Upon saving the changes, in addition, a warning message will be displayed. Examples of invalid settings are:
   - The start address and length definitions of the data block cause it to exceed the memory area in the PLC.
   - The data mapping of two or more I/O Areas (Output and/or Input) overlap each other partly or totally in the PLC memory.

3 The **Compress** button will be disabled, that is greyed out, when Auto-Addressing has been enabled.

4 Before compressing, the IO Controller DTM will display a warning message prompting the user for confirmation of the action.

Changing Mapped Data Allocations

By default, the data is mapped to Area 1 in both the Output and Input Allocation tabs. It is however possible to map a part of the data to the second area in the same tab. For example, an application may require to store all byte data in one location and all word data in another.

Moving data mapped in one Area to another Area is done from the module list. The procedure is as follows:

1,2,3...

1 Find and select the module to be mapped from module list.

2 Left-click the module and drag it, while holding the Left mouse button, to the desired Area. This can be the end of the list or any empty space in the list in which it will fit (See Note).

3 Release the mouse button. The module data is copied to the desired Area and appended to the already existing list. The corresponding entry in the originating list is now deleted.

4 Finally the PLC memory address, to which the module is mapped, is now updated in the module list.

Note

1 If Auto-Addressing is enabled (see IO Controller Setup tab in this section) any remaining empty spaces will be removed by compression of the list. Modules allocated to a higher address will be moved to a lower address to fill up the gaps.

2 If Auto-Addressing is disabled, compressing the list can be accomplished by pressing the **Compress** button (only after all modifications to the mapping have been made).

4-3-4   Diagnosis

The Diagnosis item shows the status of the IO Controller and the registered IO Devices. The Diagnosis item has the following three sub-items.

- IO Controller Status
- IO Device Status
- Error History

To display the Diagnosis information the PROFINET IO Controller DTM must be Online with the PROFINET IO Controller Unit. All information can be acquired once by pressing the **Manual** button in the Refresh box.
The information can also be refreshed continuously by setting the refresh option to **Automatic** by checking its check box.

4-3-4-1   IO Controller Status

The IO Controller Status has four separate boxes showing information concerning the status of the IO Controller and the status of the Ethernet connection. Further, information is shown of the status of the Unit's status and the status of the registered IO Devices.

The picture below shows the IO Controller Status.
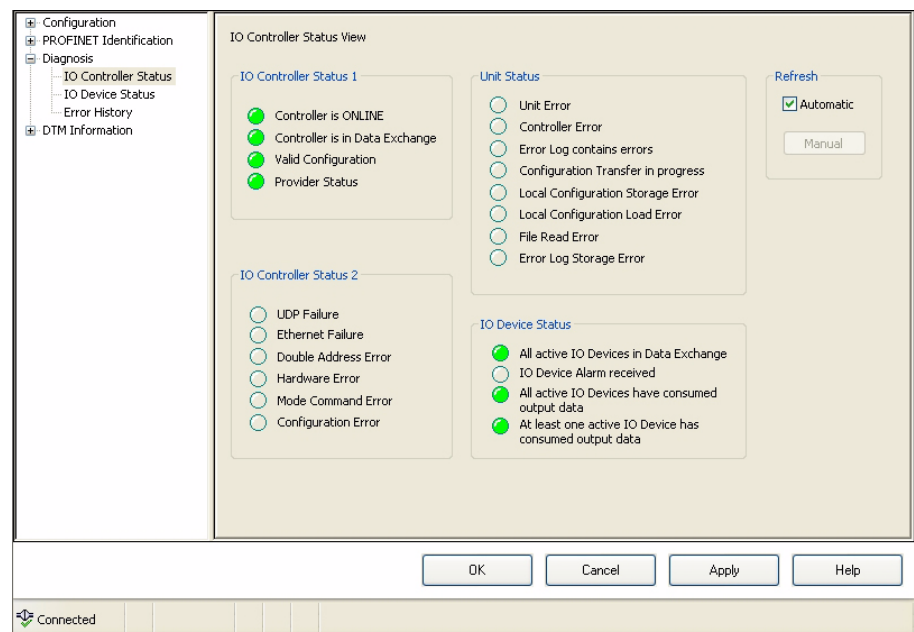
Figure 4.12: IO Controller status

The status information is read from the IO Controller Status words 1 and 2, in the Unit Status word and in the IO Device Status word. These words are located in the CIO Control and Status area at CIO 1500 + 25 * Unit Number.

4-3-4-2   IO Device Status

The IO Device Status presents an overview of the IO Devices that are in active Data Exchange or have the New Alarm flag raised. To view more information about the alarm a selection can be made in the Selected IO Device box.
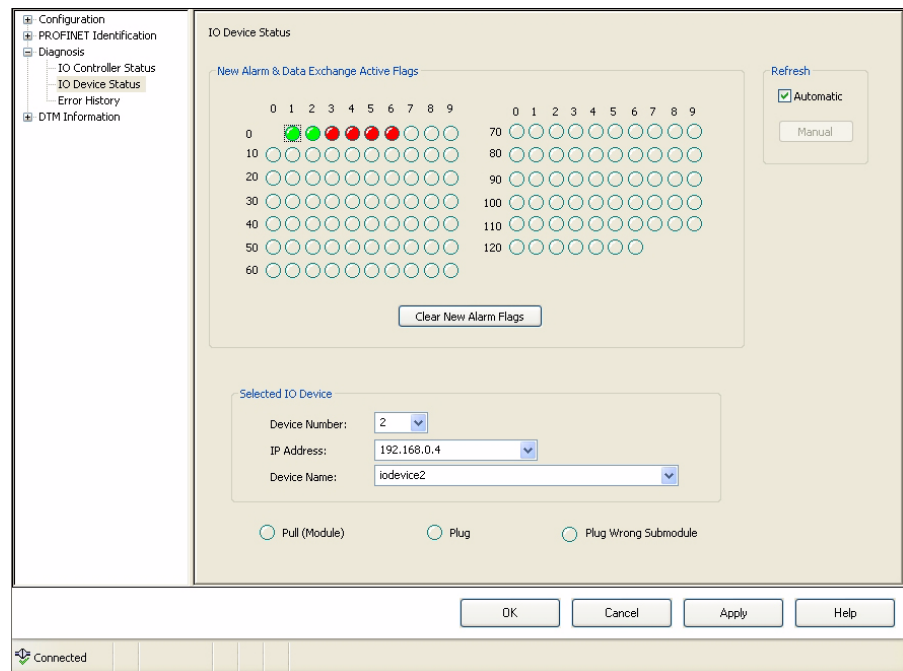
Figure 4.13: IO Device status

The New Alarm & Data Exchange Active Flags are a combination of the IO Device New Alarm and Data Exchange Active flags area's, which are located in the CIO Control and Status area at CIO 1500 + 25 * Unit Number.

In the Selected IO Device box a selection can be made by Device Number, IP Address or Device Name. If the selected Device has a Plug, Pull or Plug Wrong Submodule Alarm, this will be indicated.

4-3-4-3   Error History

The Error History shows the Error Log of the PROFINET IO Controller Unit. For troubleshooting refer to this Error Log.
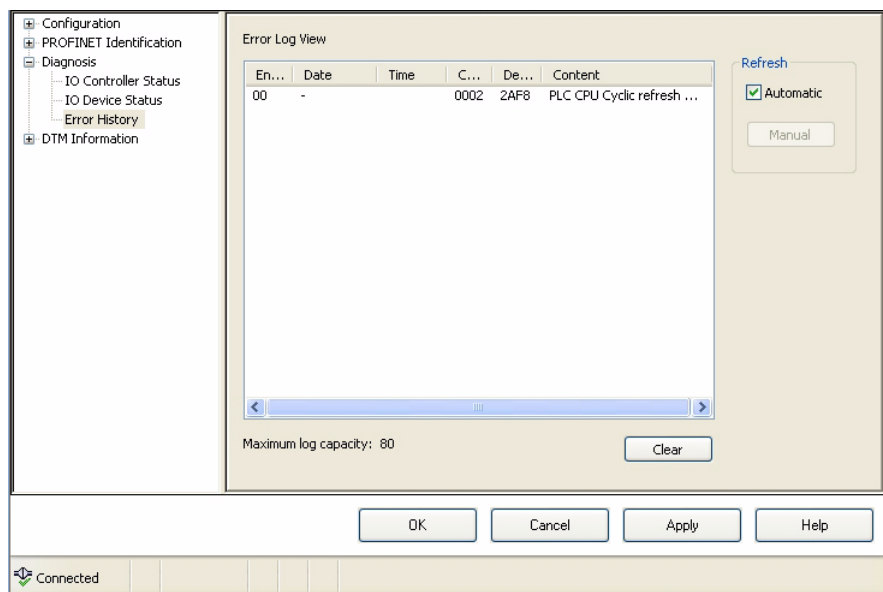
Figure 4.14: Error history

4-3-5   Firmware Upgrade

In the rare occasion a firmware upgrade is needed for the CJ1W-PNT21 PROFINET IO Controller this can be done in the Firmware Upgrade item. The IO Controller DTM must be set online to perform the upgrade.

The Current Firmware Version box shows the current firmware version of the IO Controller.

1   Click the **Browse** button and select the new firmware file from the standard Windows File Selection window.

2   When the firmware file is opened by clicking the **Open** button, it will be checked for consistency. The new version number is shown in the Upgrade Firmware Version box.

3   The firmware upgrade process is started with the **Upgrade Now** button and the Progress is shown in the progress bar.

4   When the firmware upgrade is completed, the new version can be read out by going online with the CX Configurator. The version will be visible in the Current Firmware Version.

Detailed information on the Firmware Upgrade process will be delivered with the new firmware file.

⚠ **Caution**   Do not turn off the power to the IO Controller during firmware upgrade. This may cause fatal and irreversible damage to the IO Controller. Always follow the directions supplied with the firmware file for uprading the IO Controller Unit.

4-4   Generic IO Device DTM

There are two means to represent a PROFINET IO Device for configuration in CX-ConfiguratorFDT.

1   The GSDML file basically describes a IO Device by showing the selectable modules an IO device can contain and its settable parameters. However, online configuration is not possible with a GSDML file.

A GSDML file is mandatory for every PROFINET IO Device, in order to enable any IO Controller to be configured for communication with the IO Device.

A PROFINET GSDML file is comparable to a PROFIBUS GSD file. However, a PROFINET GSDML file is in XML format while a PROFIBUS GSD file is in plain ASCII text format.

2   A DTM (Device Type Manager) is a program that runs in a FDT (Field Device Tool) container. It fulfills the basic function of a GSDML file by supplying the module and parameter information to the IO Controller. In addition it can also go directly online with the actual IO Device and allow online configuration. To accommodate the user, normally a DTM has intuitive screens to help the user configuring the IO Device.

The module and parameter information is passed to the IO Controller DTM so it can be used to build a configuration file. When this file is downloaded into the IO Controller it can perform I/O Data-exchange with the IO Devices.

4-4-1   Installing GSDML file

Install Device Description File

The **Device Catalogue** window contains a **Install Device Description File** button. Clicking the button opens a file selection box from where different types of files can be imported. For the moment only GSD-files for PROFIBUS devices and GSDML files for PROFINET IO Devices can be selected.

The GSDML files are stored in a separate sub-directory under CX-ConfiguratorFDT. Upon updating the Device Catalogue, the Generic IO Device DTM will scan this sub-directory and present an entry in the Device Catalogue for each of the GSDML files found.

Upon adding the GSDML based IO Device to the network, an instance of the Generic IO Device DTM is created in PC memory, used for reading the GSDML file contents and for providing the user interface necessary to make the settings for the associated slave device.

4-4-2   Configuration User Interface

Opening the Configuration DTM

The open the configuration DTM:
*   Select and double-click the IO Device DTM entry in the Network view or,
*   Right-click the IO Device DTM in the Network view, and select **Configuration** from the context menu.

The IO Device DTM Configuration User Interface, which is displayed in the CX-ConfiguratorFDT DTM view is shown below. The figure shows the user interface for an PROFINET IO Device Unit. By default the Configuration tab is opened.
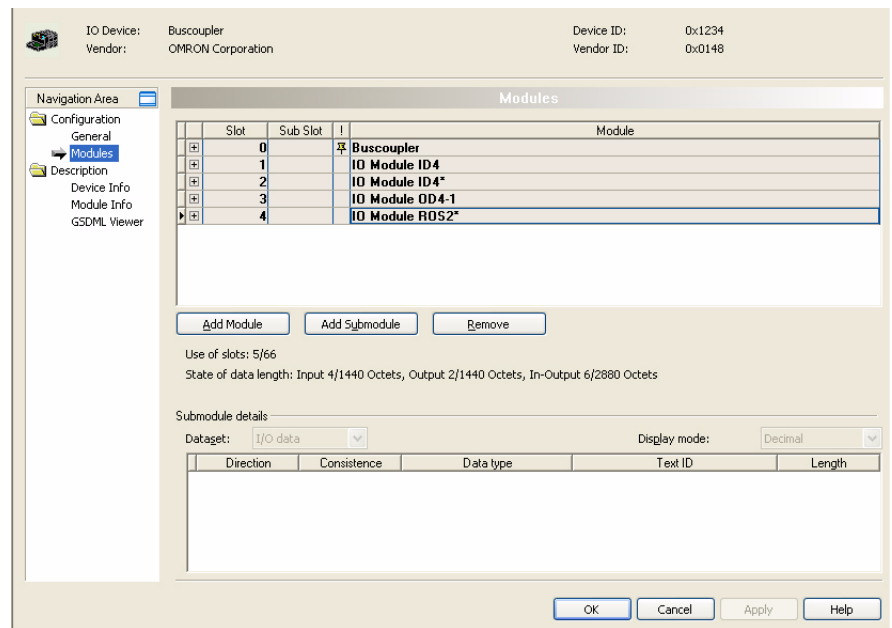
Figure 4.15: Generic IO Device

In general, the Configuration User Interface for the Generic IO Device DTM contains two items. The upper part always displays the IO Device and Vendor name plus the Device ID and Vendor ID.

The main and sub-items are:

Configuration and Description item

1 Configuration item with the following two sub-items:
   • General, showing only general information.
   • Modules, displaying the module selected in the IO Device from where the IO Device can be configured.
2 Description item, showing information about the IO Device, with the following sub-items:
   • Device Info, showing information of the device.
   • Module Info, displaying information about the modules selected for the device.
   • GSDML viewer, displaying the content of the GSDML file. Note that the contents of a GSDML file are XML based.

General sub-item

The General sub-item shows information the IO Controller DTM assigns to the IO Device at startup of PROFINET IO communication, such as the PROFINET IO Name and IP Address.
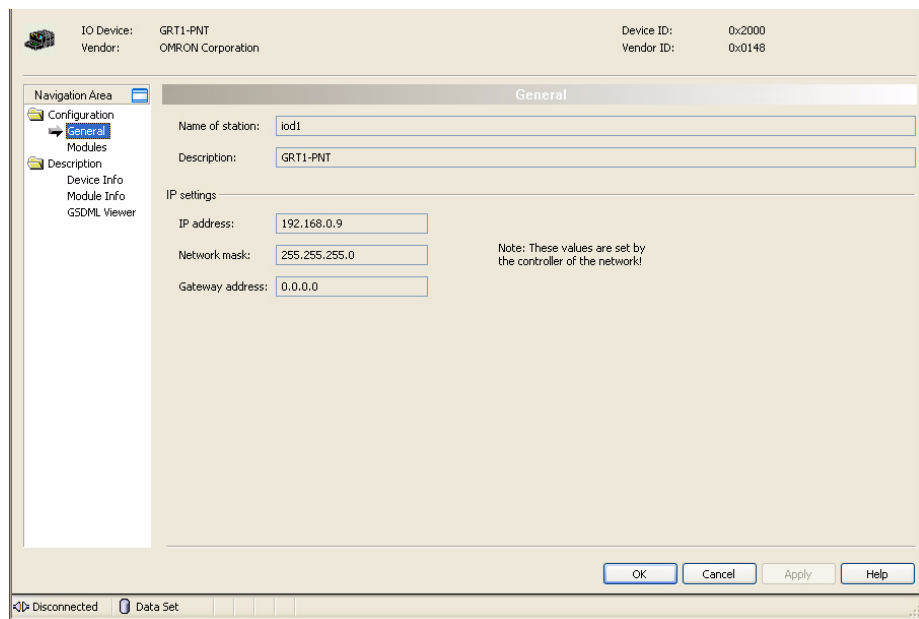
Figure 4.16: General information

The user can not set any items in this screen.

Modules sub-item

In the Modules sub-item the user needs to enter the actual module configuration of the IO device. It must be exactly match the modules used by the IO Device or the IO Device should accept the module configuration as its actual configuration.

A list of available modules is read from the GSDML file of the IO Device.

The figure below shows an example of a module selection for a Omron GRT1-PNT PROFINET IO device.
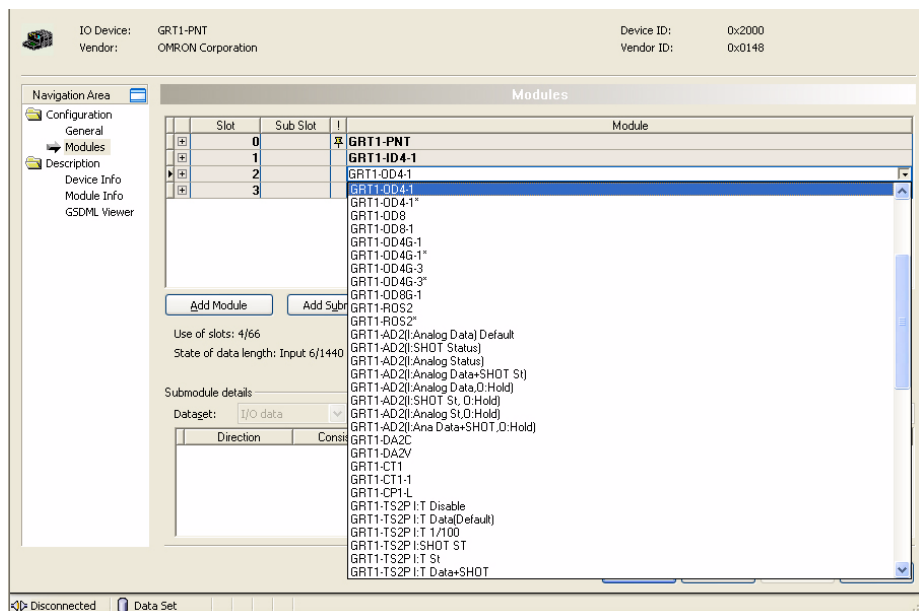
Figure 4.17: Selecting modules

Defining the I/O Configuration

To define the I/O configuration the user must select each I/O module in the same sequence as they are physically connected to the IO Device, while observing the following prerequisites:

- Digital Units can occupy 2 or 4 bits of I/O data. Adjacent digital Input Units or Output Units must be assembled into 1 word.
- To assemble multiple Digital Units, first select the appropriate Unit listed in the available Modules list, which is not marked with a asterisk. This will indicate the start of a new word. For the subsequent units the I/O modules marked with an asterisk must be selected until a word has been filled up.
- When using Digital Input (or Output) Units following an Analog Input (or Output Unit), a new word has to be allocated. Select a module which is not marked with an asterisk.
- After a word has been filled up, a new word must be started by again selecting the next I/O module not marked with an asterisk.
- Do not attempt to put Input Units and Output Units in one and the same word. This will result in a parameterization error after downloading the configuration to the Master Unit.
- Analog Units normally occupy 1, 2 or 3 words.

To further explain the mapping sequence, an example is given below. The example is based on the Omron GRT1-PNT PROFINET IO Device.

Example

To illustrate how the Digital and Analog SmartSlice I/O Units are mapped to I/O words, and how to do the implementation using the GSD File, consider the table below:

SmartSlice	Selected I/O Module	I/O Word/Bit
GRT1-PNT	COM Status	Input Word #1
GRT1-ID4-1	GRT1-ID4-1	Input Word #2 / Bit 0~3
GRT1-ID4-1	GRT1-ID4-1*	Input Word #2 / Bit 4~7
GRT1-OD4-1	GRT1-OD4	Output Word #1 / Bit 0~3
GRT1-ROS2	GRT1-RO2*	Output Word #1 / Bit 4~5
GRT1-ID4-1	GRT1-ID4-1*	Input Word #2 / Bit 8~11
GRT1-AD2	GRT1-AD2 (I: Analog Data) Default	Input Word #3 and #4

The table above lists the physical configuration in the left-most column, the I/O Module (selected from the list of available I/O modules) in the middle column and the I/O words onto which the modules are mapped in the right-most column.

SECTION 5
Allocated CIO and DM Words

This section describes the words allocated to the CJ1W-PNT21 PROFINET IO Controller Unit in the CIO and DM Areas. These words facilitate controlling the Unit and accessing the Unit and network statuses.

SECTION 5
Allocated CIO and DM Words   63

5-1 Overview of Word Allocations

The words shown in the following diagram are allocated according to the unit number setting. For each CPU Bus Unit, there are 25 words allocated in the CIO Area and 100 words allocated in the DM Area.

First word allocated in the CIO Area: n = CIO 1,500 + (25 x unit number)
First word allocated in the DM Area: m = D30,000 + (100 x unit number)
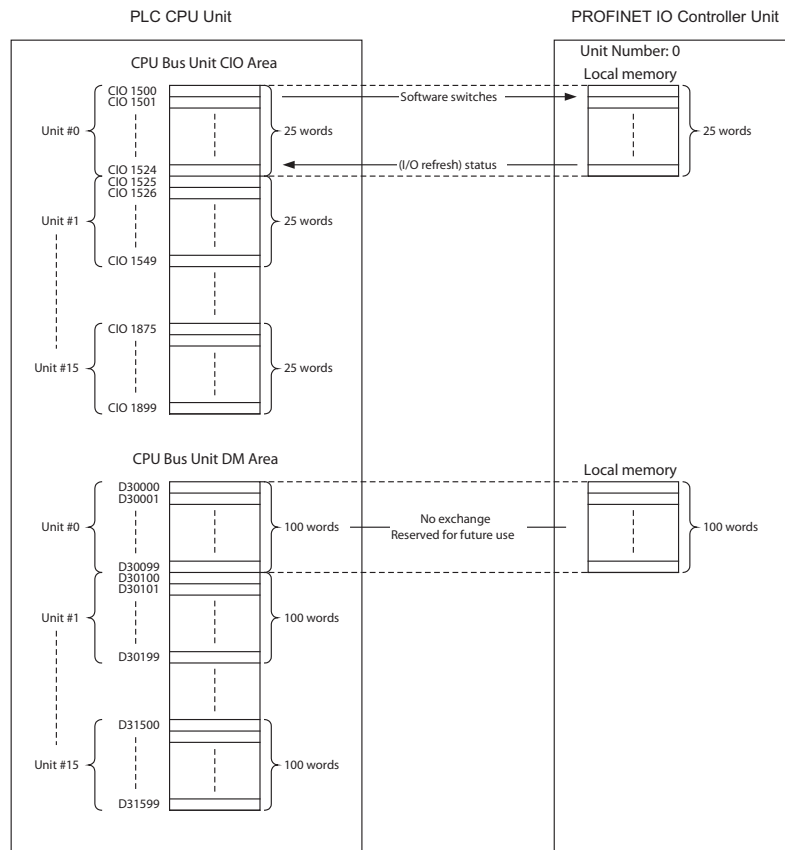
Figure 5.1: Memory allocations overview

Note The allocated DM words are not used by the PROFINET IO Controller Unit. However, exchange of data to the allocated DM words is reserved for future use, and it is therefore not recommended to use the allocated DM words for other purposes.

5-1-1 CIO Area Word Allocations

Software switches, PROFINET IO Controller Unit status, and Slave Status data are allocated in the CIO Area according to the unit number, as shown below. Software switches are bits used as commands from the PLC CPU to the PROFINET IO Controller Unit to enable executing Unit functions.

Unit No. (decimal)	Allocated words	Unit No. (decimal)	Allocated words
0 (0)	CIO1500 to CIO1524	8 (8)	CIO1700 to CIO1724
1 (1)	CIO1525 to CIO1549	9 (9)	CIO1725 to CIO1749
2 (2)	CIO1550 to CIO1574	A (10)	CIO1750 to CIO1774

Unit No. (decimal)	Allocated words	Unit No. (decimal)	Allocated words
3 (3)	CIO1575 to CIO1599	B (11)	CIO1775 to CIO1799
4 (4)	CIO1600 to CIO1624	C (12)	CIO1800 to CIO1824
5 (5)	CIO1625 to CIO1649	D (13)	CIO1825 to CIO1849
6 (6)	CIO1650 to CIO1674	E (14)	CIO1850 to CIO1874
7 (7)	CIO1675 to CIO1699	F (15)	CIO1875 to CIO1899

5-1-2   DM Area Word Allocations

The DM area words which are allocated for the PROFINET IO Controller Unit are not used, i.e. no data is exchanged between an allocated DM area and the Unit. However, the allocated area is reserved for use in a future extension of the Unit. Therefore, using this area for user data is not recommended.

Unit No. (decimal)	Allocated words	Unit No. (decimal)	Allocated words
0 (0)	D30000 to D30099	8 (8)	D30800 to D30899
1 (1)	D30100 to D30199	9 (9)	D30900 to D30999
2 (2)	D30200 to D30299	A (10)	D31000 to D31099
3 (3)	D30300 to D30399	B (11)	D31100 to D31199
4 (4)	D30400 to D30499	C (12)	D31200 to D31299
5 (5)	D30500 to D30599	D (13)	D31300 to D31399
6 (6)	D30600 to D30699	E (14)	D31400 to D31499
7 (7)	D30700 to D30799	F (15)	D31500 to D31599

5-2   Allocated CIO Area Words

For each CPU Bus Unit, the CJ-series PLC allocates up to 25 words in the CIO area. First word n = CIO 1500 + (25 x Unit number).

CIO WORDS

Word	Bit 15	Bit 00	Data direction
n	Software switches 1		
n+1	Reserved		
n+2	Reserved		CPU Unit to PROFINET IO Unit
n+3	Reserved		
n+4	Unit status word		
n+5	IO Controller status word 1		
n+6	IO Controller status word 2		
n+7	IO Device status word		
n+8	Reserved		
n+9			
n+10			
n+11			
n+12	IO Device Data-Exchange Active flags		
n+13			
n+14			
n+15			PROFINET IO Unit to CPU Unit
n+16			
n+17			
n+18			
n+19			
n+20	IO Device New-Alarm flags		
n+21			
n+22			
n+23			
n+24			

Figure 5.2: CIO words

CIO Word n+1 to n+3 and CIO Word n+8 are reserved for future use, and can't be used because the CJ1W-PNT21 clears these words every PLC cycle.. The other CIO Words are explained in the following sections.

5-2-1   Software Switches 1 (Word n)

The switches of Software Switch 1 execute a function when turned ON by the user (in any PLC mode). The Unit state is not restored after a Power-Down of the PLC.

```
        15  14  13  12  11  10  9   8   7   6   5   4   3   2   1   0
Word n [   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   ]
                        |                   |
                        |                   └──── Clear all alarms flags
                        └──────────────────────── Set Output Data valid
```
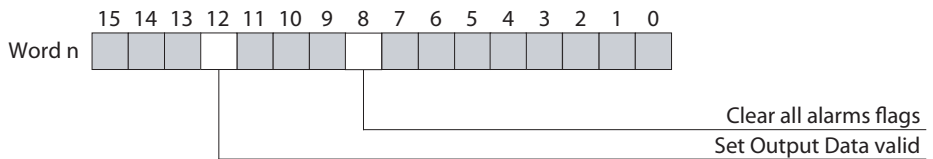
Figure 5.3: Word n

Bit	Name	Status	Unit operation
01~07	Reserved	---	These bits are ignored in the unit. If set, they will be turned OFF by the Unit the next PLC cycle.
08	Clear all alarm bits	The clear alarm bits switch will clear all alarm flags for all IODs. It is rising edge triggered. The unit will set the switch to OFF when all alarm flags are cleared.	
		OFF --> ON	Clear alarm bits for all IODs.
		ON --> OFF	No action.
09~11	Reserved	---	These bits are ignored in the unit. If set, they will be turned OFF by the Unit the next PLC cycle.
12	Set Output Data Valid (See Note)	OFF	Mark all output data sent by the IO Controller as invalid. IO Devices will ignore the data.
		ON	Mark all output data send by the IO Controller as valid. IO Devices will accept the data and process it.
13~15	Reserved	---	These bits are ignored in the unit. If set, they will be turned OFF by the Unit the next PLC cycle.

Note The Set Output Data Valid switch controls the Provider Status in the Output Data sent from the IO Controller to the IO Device. If the IO Device is receiving Output Data with the Provider Status bit set to invalid then the IO device will discard the Output Data.

The Provider Status can be used in a redundant IO Controller setup where the Active IO Controller sents it Output Data with the Provider Status set to valid. The other IO Controller is then in Standby mode and has its Provider Status set to invalid.

To change from Active to Standby and vice versa only the Set Output Data Valid switch must be set or reset. The IO Device will only use the output data that is valid.

As there is no need to first open connections and sent configurations as this already has been done this changeover is very fast.

When the Output Data Valid flag is PLC mode dependent, the Output Data Valid flag in this word will be ignored.

For more information see Appendix A PROFINET IO technology.

5-2-2   Unit Status (Word n+4)

The Unit status word contains fundamental status and error flags concerning the Unit. If needed, further details can be found in the IO Controller and IO Device Status Words. All flags are controlled by the Unit.
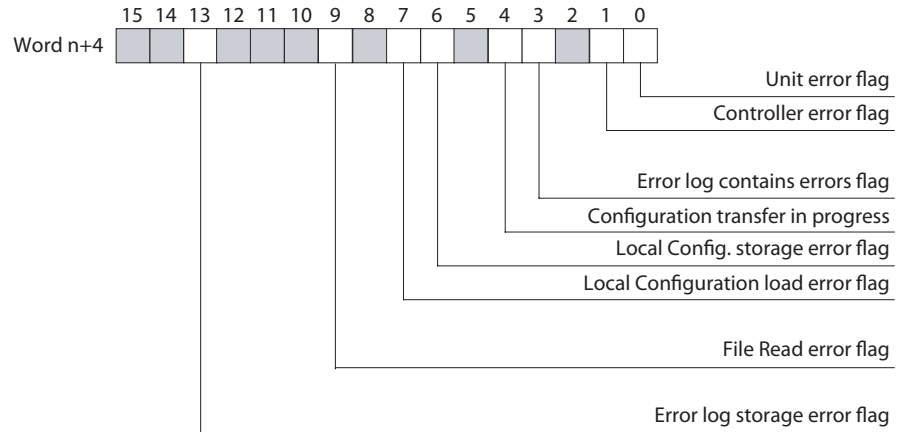
Figure 5.4: Word n+4

Bit	Name	Status	Unit operation
00	Unit error flag	OFF	Bit 00 is turned OFF by the Unit if Bit 01, Bit 03, Bit 06, Bit 07, Bit 09 and Bit 13 in CIO Word n+4 are OFF
		ON	The Unit error flag combines the status of all error flags in CIO Word n+4. The bit flag is turned ON by the Unit if Bit 01, Bit 03, Bit 06, Bit 07, Bit 09 or Bit 13 in CIO Word n+4 is ON.
01	Controller error flag	OFF	Bit 01 is turned OFF if none of the flags in Master status word 2, i.e. CIO Word n+6 is ON..
		ON	The Master error flag combines the error flags in the Master status 2 Word, i.e. CIO Word n+5. Master status word 2 contains all error flags related to the PROFINET IO Controller functions. Bit 01 is turned ON if any of the flags in IO Controller status word 2, i.e. CIO Word n+6 is ON
02	Reserved	---	This bit is always set to OFF by the Unit.
03	Error log contains new errors	OFF	The bit flag is set to OFF at unit restart or by the Unit if the error log is • cleared using the ERROR LOG CLEAR FINS command, or • read, using the ERROR LOG READ FINS command
		ON	The bit flag is set to On by the Unit if a new error is added to the error log.

Bit	Name	Status	Unit operation
04	Parameter transfer in progress	OFF	When OFF, this bit indicates that no Configuration data transfer is in progress.
		ON	The Parameter transfer in progress indicates: • Retrieval of internally stored configuration and set-up data. • Storing of configuration and set-up data sent by the configuration software in progress. During this transfer no other transfer of data can be started in parallel.
05	Reserved by system	---	This bit will be set to OFF by the Unit.
06	Local parameter storage error	OFF	When OFF, this bit indicates that the Configuration and setup data has been transferred to the non-volatile memory successfully.
		ON	The local parameter storage error flag will be ON if an error occurred during the storage of the data transferred from the configuration software to the CJ1W-PNT21.nal non-volatile memory. If the error occurred, the data in the non-volatile memory may be corrupted and a new Configuration must be downloaded to the Unit.
07	Local parameter load error	OFF	The flag will be OFF if the Configuration and setup data has been successfully transferred from non-volatile to volatile memory.
		ON	The Local parameter load error flag will be ON if the internally stored Configuration and setup data is corrupted or erased.
08	Reserved	---	This bit will be set to OFF by the Unit.
09	File read error	OFF	The flag will be OFF if the Configuration and setup data has been successfully transferred from CompactFlash Memory Card in the PLC CPU.
		ON	The File read error flag will be ON if an error occurred during the transfer of the Configuration and setup data from a CompactFlash Memory Card in the PLC CPU to the Unit's non-volatile memory. The error can be caused by an error in the File or an error during transfer.
10~12	Reserved	---	This bit will be set to OFF by the Unit.
13	Error log storage error	OFF	When OFF, this bit indicates that the Error log has been transferred to the non-volatile memory successfully.
		ON	The Error log storage error flag will be ON if an error occurred during an attempt to write the Error log to internal non-volatile memory. If the error occurred, the Error log data in the non-volatile memory may be corrupted. Upon a restart the Unit will reinitialise the Error log.
14~15	Reserved	---	This bit will be set to OFF by the Unit.

5-2-3   IO Controller status 1 (Word n+5)

The 'IO Controller status 1' word provides all status information related to the CJ1W-PNT21 PROFINET IO Controller function. Any errors in the behaviour of the CJ1W-PNT21 are presented in the 'IO Controller status 2' word.
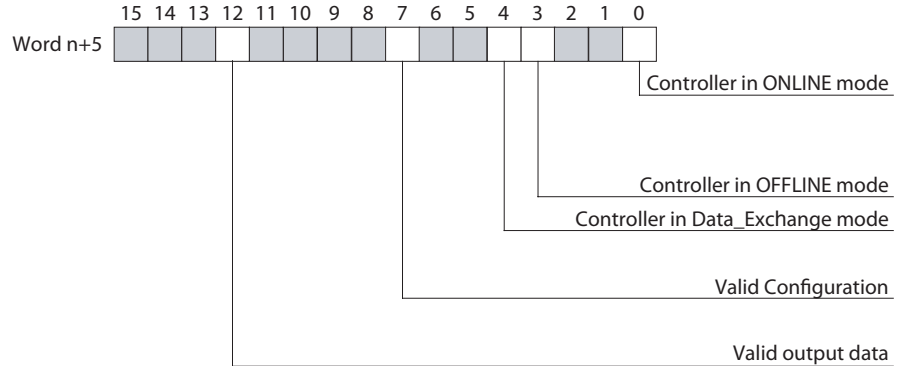
Figure 5.5: Word n+5

Bit	Name	Status	Unit operation
00	Controller in ONLINE mode	The Controller in ONLINE mode flag will be ON if the CJ1W-PNT21 is in ONLINE mode. In this case bit 03 will be OFF. ONLINE means that the CJ1W-PNT21 is currently capable of communicating on the network. The unit can not communicate on the network if hardware errors occur during startup or normal operation.	
		OFF	Unit is currently not in ONLINE mode
		ON	Unit is currently in ONLINE mode.
01~02	Reserved	---	This bit will be set to OFF by the Unit.
03	Controller in OFFLINE mode	The Controller in OFFLINE mode flag will be ON if the CJ1W-PNT21 is in OFFLINE mode. In this case bit 00 will be turned OFF. OFFLINE means that the CJ1W-PNT21 is currently not capable of communicating on the network. The unit can not communicate on the network if hardware errors occur during startup or normal operation.	
		OFF	Unit is currently not in OFFLINE mode.
		ON	Unit is currently in OFFLINE mode.
04	Controller in Data Exchange mode.	If the CJ1W-PNT21is receiving valid input data from at least one of its allocated active IO Devices, this flag will be ON. If none of the IO Devices is providing valid input data to the CJ1W-PNT21 this flag will be OFF.	
		OFF	None of the IO Devices is providing valid input data to the Unit.
		ON	At least one of the IO Devices is providing valid input data to the Unit.
05~06	Reserved	---	This bit will be set to OFF by the Unit.
07	Unit contains a valid configuration	This flag indicates that the Unit contains valid PROFINET IO Configuration data. With this Configuration data the IO Controller can parameterize the allocated IO Devices and start exchanging IO data.	
		OFF	The unit has not been configured (correctly).
		ON	The Unit is able to use the internally stored configuration data.

Bit	Name	Status	Unit operation
08~11	Reserved	---	This bit will be set to OFF by the Unit.
12	Valid output data	This flag indicates whether or not the data sent to the IO Devices is currently marked as valid.	
		OFF	The data sent to the IO Devices is marked as invalid.
		ON	The data sent to the IO Devices is marked as valid.
13~15	Reserved	---	This bit will be set to OFF by the Unit.

5-2-4   IO Controller status 2 (Word n+6)

The 'IO Controller status 2' word combines all error information on the CJ1W-PNT21 PROFINET IO Controller function. The status information is provided in the 'IO Controller status 1' word.

Contents of the 'IO Controller status 2' word (Word n+6):
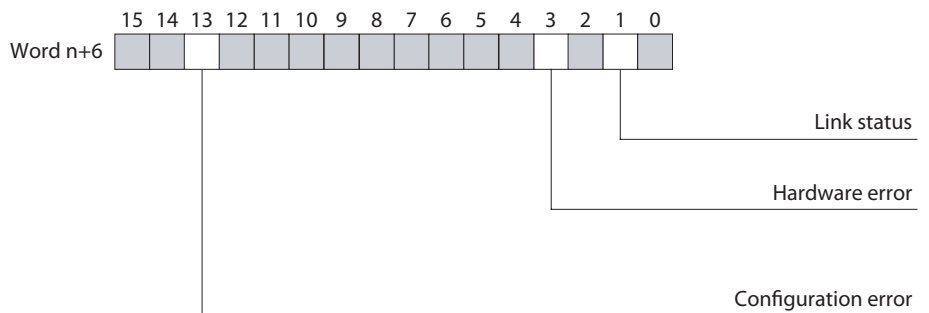
Figure 5.6: Word n+6

Bit	Name	Status	Unit operation
00	Reserved	---	This bit will be set to OFF by the Unit.
01	Link status	The Ethernet Link status of the IO Controller is shown here. If the Unit can not establish a link with another device at 100Mbps full-duplex then this bit will be set.	
		OFF	There is an Ethernet cable connected to the port of the IO Controller and a link was successfully created to an IO Device, switch or other Ethernet device.
		ON	There is no Ethernet cable connected to the port of the IO Controller or a link could not successfully created to an IO Device, switch or other Ethernet device.
02	Reserved	---	This bit will be set to OFF by the Unit.
03	Hardware error	The Hardware error flag will be ON if an error has occurred on the bus, e.g. faults when accessing the Ethernet controller or interrupted data streams, and broken messages.	
		OFF	No hardware errors have occurred.
		ON	Hardware errors have occurred.
04~12	Reserved	---	This bit will be set to OFF by the Unit.

Bit	Name	Status	Unit operation
13	Configuration error	The Configuration error flag will be turned to ON if an error has been detected in the contents of the Configuration set.	
		OFF	No Configuration error has been detected.
		ON	One or more Configuration errors have been detected.
14~15	Reserved	---	This bit will be set to OFF by the Unit.

5-2-5   IO Device status (Word n+7)

The IO Device status word presents all information on the IO Devices allocated to the CJ1W-PNT21 Controller. Detailed information on the IO Devices can be obtained by reading the alarm messages.

Contents of the 'IO Device status' word (Word n+7):
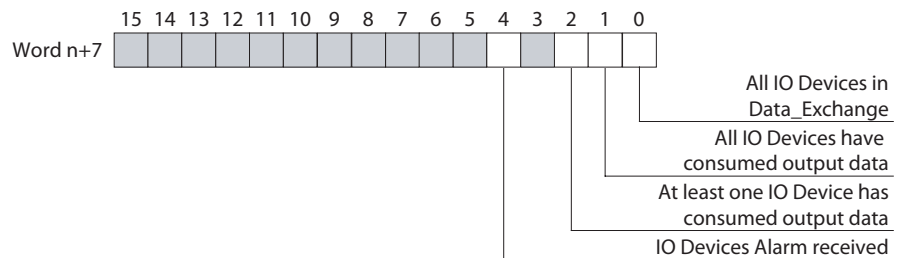
Figure 5.7: Word n+7

Bit	Name	Status	Unit operation
00	All IO Devices are in Data Exchange	If all Active IO Devices allocated to the CJ1W-PNT21 provide valid input data, this flag will be ON. If one of the IO Devices does not provide data or its data is marked as invalid, this flag will be OFF.	
		OFF	• CJ1W-PNT21 does not receive data from one or more IO Devices • CJ1W-PNT21 receives invalid input data from one or more IO Devices
		ON	CJ1W-PNT21 receiving valid data from all IO Devices.
01	All IO Devices have consumed output data.	If all IO Devices allocated to the CJ1W-PNT21 have processed the sent output data, this flag will be ON. If one of the IO Devices does not process output data this bit will be OFF.	
		OFF	One or more IO Devices have not processed the sent output data.
		ON	All IO Devices have processed the sent output data.
02	At least one IO Device has consumed output data	If at least one of the IO Devices allocated to this IOC has processed the sent output data this flag will be ON. If none of the IO Devices has processed the sent output data this flag will be OFF.	
		OFF	None of the IO Devices have processed the sent output data
		ON	At least one of the IO Devices has processed the sent output data.
03	Reserved	---	This bit will be set to OFF by the Unit.

Bit	Name	Status	Unit operation
04	IO Device Alarm received	If an IO Device Alarm has been received by the IO Controller this flagg will be ON. It will be OFF if all alarms have been read or cleared.	
		OFF	No new IO Device Alarms have been received.
		ON	One or more new IO Device Alarms have been received.
05~15	Reserved	---	This bit will be set to OFF by the Unit.

5-2-6 IO Device Input Valid flags (Word n+9 ~ Word n+16)

The IO Device Data Exchange Active flags indicate for each IO device if it is in Data Exchange mode with the PROFINET IO Controller Unit. The flags are allocated to a block of eight CIO words, and each bit in the block corresponds to a IO Device number as set in the DTM (IO Device Setup tab).

Figure 5.8: Word n+9 ~ Word n+16

Bit	Name	Status	Unit operation
01~126	IO Device Input Data Valid	When an IO Device is in Data Exchange with the PROFINET IO Controller Unit to which it has been allocated, it will exchange input and output data with the allocated memory of the PLC CPU.	
		OFF	The IO Controller is not in Data Exchange with the IO Device due to the fact that: • the corresponding station does not provide data at all. • the corresponding station 's inputs are invalid. • the corresponding station is (another) IO Controller station. • the corresponding station is not allocated to this IO Controller.
		ON	The corresponding station is in Data Exchange with valid inputs.

Note The bits for station 0 and 127 are not used.

⚠ **WARNING** ALWAYS make sure the IO Device Data Exchange Active flag is ON before processing the slave's input data. The last data from the slave will remain in the PLC memory if data exchange is stopped,

5-2-7   IO Device New Alarm flags (Word n+17 ~ Word n+25)

The IO Device New Alarm flags indicate for each IO device if it has sent a new alarm message to the PROFINET IO Controller Unit. The flags are allocated to a block of eight CIO words, and each bit in the block corresponds to the IO Device number as set in the DTM (IO Device Setup tab).

The New Alarm flag indicates that alarm information should be read with FINS 0101 to retrieve the alarm data and clear the Alarm flag.

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Word n+17	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1		IO Device 01 ~ 15
Word n+18	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	IO Device 16 ~ 31
Word n+19	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	IO Device 32 ~ 47
Word n+20	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	IO Device 48 ~ 63
Word n+21	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	IO Device 64 ~ 79
Word n+22	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	IO Device 80 ~ 95
Word n+23	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	IO Device 96 ~ 111
Word n+24		126	125	124	123	122	121	120	119	118	117	116	115	114	113	112	IO Device 112 ~ 126

Figure 5.9: Word n+17 ~ Word n+25

Bit	Name	Status	Unit operation
01~126	IO Device New Alarm	Each bit indicates if the corresponding IO Device has sent new alarm information to the CJ1W-PNT21.	
		OFF	The corresponding IO Device has no new alarm data.
		ON	The corresponding IO Device has sent new alarm information which should be read by the user with FINS 0101. Failing to do so may cause the alarm data to be overwritten should the device generate another alarm. Alternatively, the New Alarm flag can be cleared using the IO Controller DTM Diagnostics view.

SECTION 6
Troubleshooting and maintenance

This section describes the troubleshooting procedures and maintenance operations for the PROFINET IO Communication Unit, needed to keep the PROFINET IO network working optimally. We recommend reading through the error processing procedures before operation so that operating errors can be identified and corrected more quickly.

SECTION 6
Troubleshooting and maintenance   75

6-1 Overview

The CJ1W-PNT21 PROFINET IO Controller Unit and the Configuration software package provides extensive means for troubleshooting, which can be used to quickly determine errors in the Unit, in the configuration, in the network, and/or in IO Devices, allocated to the Unit.

Troubleshooting on the IO Controller Unit

For troubleshooting purposes, the following error indicators can be used:
- LED indicators on the front of the Unit
  Two red/green and two yellow status LED indicators to show the Unit's and PROFINET IO network status and errors.
- PROFINET IO errors
  The PROFINET IO Configurator or DTMs can be used to find detailed information about the errors on the PROFINET IO network.
- CIO Words
  Unit Status (CIO Word n + 4) containing status and error flags of the Unit, and IO Controller Status 1 and 2 (CIO Word n+5 and n+6) containing error information about the PROFINEt IO network and the PROFINET IO functions of the Unit.
- The Error Log collects error codes for various error events. Serious errors are stored in non-volatile memory and can be retrieved, even after a Unit power down.
- FINS command provide defined response codes, which can indicate specific errors.

Note n = CIO 1500 + (25 x unit number)

This section provides a number of procedures for troubleshooting, based on the error indicators listed above.

Troubleshooting the Configuration Software

The Configuration software, i.e. CX-ConfiguatorFDT, the PROFINET IO Controller DTM and the Generic IO Device DTM provide several mechanisms for error detection and correction:
- Errors occurring in CX-ConfiguratorFDT are displayed in pop-up message windows and/or the error log window. The contents of the error log window can be copied to the clipboard to allow analysis afterwards.
- CX-ConfiguratorFDT provides a FDT communication log window, which can be copied to the clipboard. Analysis of this communication may provide additional information in case errors occur.

Troubleshooting the network

The PROFINET IO Controller DTM and the Generic IO Device DTM provide diagnostics information windows, which can display:
- Indications of errors in the PROFINET IO interface of the Unit
- Indications of errors in the communication between the PROFINET IO Controller Unit and IO Devices.
- Indications of errors in the IO Devices, allocated to the PROFINET IO Master Unit.

6-2 Troubleshooting using the IO Controller indicators

6-2-1 Determining Operating Status from the Indicators

This section presents a number of easy to use procedures to troubleshoot possible errors using the LED indicators on the front of the Unit (see figure below).
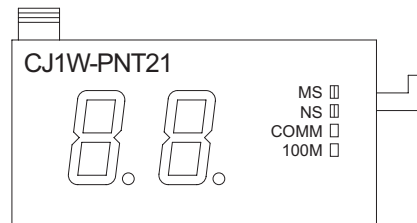
Figure 6.1: Indicators

The LEDs on the Communication Unit (1) have the following functions:

LED	Indicates the
MS	PROFINET IO Controllers Module Status
NS	PROFINET IO Controllers Network Status
COMM	PROFINET IO Controllers Communication Status
100	PROFINET IO Controllers IO Data Exchange Status

The LED indicators can be used to determine the following categories of errors:
- Normal operation
  This is the normal startup procedure and operation of the PROFINET IO Controller. Any other indication means the Unit is an abnormal state.
- Start-up errors
  These include errors in the PLC CPU, as well as errors in the Unit, which prevents the combination from starting up correctly.
- Operational errors
  These include PLC errors, PLC Bus errors, and error log problems, all during operations.
- Configuration problems
  These include errors during or after downloading a new configuration as well as errors in the configuration after startup.
- PROFINET IO errors
  These include errors in the PROFINET IO interface or on the network.

6-2-2 Normal Operating Status

The following table shows the status of the MS, NS , COMM and 100M indicators and the 7-segment display during normal operation

Indicator status					Network/Unit status	Comments
MS	**NS**	**COMM**	**100M**	**7-segment**		
OFF	OFF	OFF	OFF	- -	Booting and initializing with the PLC	Bootup and initialization with the PLC in progress. Restart the PROFINET IO Controller unit if this status continues for an extended period of time. Replace the CPU Unit and/or PROFINET IO Controller Unit if the problem is not corrected by restarting.
ON (green)	OFF	OFF	OFF	r dot flashing	Valid configuration detected	The PROFINET IO Configuration downloaded from the configuration tool is evaluated during startup of the unit.
ON (green)	Flashing (green)	OFF	OFF	r dot flashing	PROFINET IO core software started	The PROFNET IO Controller has started its core communciation software and is ready to start communciation with PROFINET IO Devices.
ON (green)	Flashing (green)	ON (yellow)	OFF	r dot ON	Relations to PROFINET IO Devices are set up	Before PROFINET IO Communication is fully running a relation between each IO Device and the IO Controller is esthablished.
ON (green)	Flashing (green)	ON (yellow)	ON (yellow)	r dot ON	Data Exchange with at least one IO Device	At least one IO Device is exchanging IO Data with the IO Controller
ON (green)	ON (green)	ON (yellow)	ON (yellow)	r dot ON	Data Exchange with at all configured IO Devices	All configured IO Devices are detected by the IO Controller and to all IO Data Exchange is esthablised.

On smaller PROFINET IO Networks the sequence from starting the PROFINET IO core software to being in full Data Exchange with all the IO Devices can be very fast that the individual steps can not be distinguished.

6-2-3 Troubleshooting Errors Occurring in the IO Controller Unit

Unit errors are errors which occur at starting or normal operation of the system and which prevent the Unit from functioning correctly in the PLC system. Usually these errors also cause the CS/CJ PLC CPU ERR/ALM indicator to be lit or flashing. For more information on error indications in the PLC, refer to the CS1 Series CPU Unit Operation Manual (W339) or the CJ Series CPU Unit Operation Manual (W393) for more details.

Unit errors

Error category	Error	Indicators			Error log (Hex)
		7-segment	**MS**	**NS**	
Unit errors	Startup errors	1 to 6	ON (red)	OFF	--

Error category	Error	Indicators			Error log (Hex)
		7-segment	MS	NS	
IO Controller function	PROFINET configuration set invalid	C7	ON (green)	Flashing (red)	0202
PROFINET Network errors	Ethernet failure	E3	ON (red)	OFF	020C
	Bus hardware error	E5			0219
Memory access errors	Special Unit error	--	ON (red)	OFF	0601
	Memory access error	E9			0602
CPU Unit Exchange	Backplane bus error	H0	Flashing (red)	OFF	000E
	Unit number duplication	H1			--
	CPU Unit faulty	H6			--
	I/O table not registered	H7			--
	CPU Unit service monitoring error	HE			0001
	CPU Unit watchdog timer error	HF			0002

Note If Module Status is Red lit or flashing then refer to the displayed error code on the 7-segment display for further information.

6-2-3-1 Unit errors
Startup errors

7-segment	MS indicator	NS indicator	Error log (Hex)
1 to 6	ON (red)	OFF	--

Likely cause
During startup of the IO Controller it encountured a problem and can not continue

IO Controller Unit response
The Unit will stop processing. There will be no error logged in the errorlog.

CIO Area Flags allocated to the IO Controller Unit
None of the bits is set.

Correction
Restart the IO Controller. Replace the IO-Controller if the error recurs.

6-2-3-2 IO Controller Functions
PROFINET configuration
set invalid

7-segment	MS indicator	NS indicator	Error log (Hex)
C7	ON (green)	Flashing (red)	0202

Likely cause
During startup of the IO Controller encountered a problem interpreting the PROFINET IO Configuration file. This could be because the Unit started for the first time and does not contain a configuration file yet. Also the Configuartion file could have been damaged.

IO Controller Unit response

The Unit is started and is capable to receive a PROFINET Configuration. It will not initiate PROFINET IO Communication. Records the error in the errorlog.

CIO Area Flags allocated to the IO Controller Unit

IO Controller status 1 (word n+5) bit 07 will be OFF

Correction

Use Cx-ConfiguratorFDT to download a valid PROFINET IO Configuration in the IO Controller. Or restore the Configuration from a Compact Flash memory card. Replace the IO-Controller if the error recurs.

6-2-3-3   PROFINET Network errors

Ethernet failure

7-segment	MS indicator	NS indicator	Error log (Hex)
E3	ON (red)	OFF	020C

Likely cause

The PROFINET IO controller could not esthablish a Ethernet link to the connected switch or IO Device.

IO Controller Unit response

The Unit is not capable to communicate on the PROFINET network and therefore control to the IO Devices will be lost. The Unit will stop processing. Records the error in the errorlog.

CIO Area Flags allocated to the IO Controller Unit

IO Controller status 2 (word n+6) bit 03 will be ON

Correction

Check the Ethernet cable and switch or IO DeviceRestart the IO Controller.

Bus hardware error

7-segment	MS indicator	NS indicator	Error log (Hex)
E5	ON (red)	OFF	0219

Likely cause

Disturbance on the Ethernet network causes the Ethernet interface to fail.

IO Controller Unit response

The Unit is not capable to communicate on the PROFINET network and therefore control to the IO Devices will be lost. he Unit will stop processing. Records the error in the errorlog.

CIO Area Flags allocated to the IO Controller Unit

IO Controller status 2 (word n+6) bit 03 will be ON

Correction

Check the Etehernet network for prossible causes of disturbance. This can be EMC influences, broken or shorted Ethernet cable, faulty connectors, defective Ethernet switches or IO Devices and grounding problems to name a few. This will result in interrupted data streams or broken messages.

6-2-3-4   Memory access errors

Special Unit error

7-segment	MS indicator	NS indicator	Error log (Hex)
--	ON (red)	OFF	0601

Likely cause
The PROFINET IO controller encountered an internal error and can not continue.

IO Controller Unit response
The Unit will stop processing. Records the error in the errorlog.

CIO Area Flags allocated to the IO Controller Unit
None of the bits is set.

Correction
Restart the IO Controller. Replace the IO-Controller if the error recurs.

Memory access error

7-segment	MS indicator	NS indicator	Error log (Hex)
E9	ON (red)	OFF	0602

Likely cause
The PROFINET IO Controller encountered accessing its internal memory.

IO Controller Unit response
The Unit will stop processing. Records the error in the errorlog.

CIO Area Flags allocated to the IO Controller Unit
None of the bits is set.

Correction
Restart the IO Controller. Replace the IO-Controller if the error recurs.

6-2-3-5   CPU Unit exchange

Backplane Bus error

7-segment	MS indicator	NS indicator	Error log (Hex)
H0	Flashing (red)	OFF	000E

Likely cause
The PROFINET IO controller encountered an error while aceesing the backplane bus of the PLC.

IO Controller Unit response
The Unit will stop processing. Records the error in the errorlog.

CIO Area Flags allocated to the IO Controller Unit
None of the bits is set.

Correction
Restart the PLC. Check the PLC for faults in the backplane bus. Replace the IO-Controller or other Units if the error recurs.

Unit number duplication

7-segment	MS indicator	NS indicator	Error log (Hex)
H1	Flashing (red)	OFF	--

Likely cause
At startup the PROFINET IO Controller detected that there is another Unit having the same Unit number set.

IO Controller Unit response
The Unit will stop processing.

CIO Area Flags allocated to the IO Controller Unit
None of the bits is set.

Correction
Correct the Unit number of the IO Controller or the other Unit. Restart the PLC.

CPU Unit fault

7-segment	MS indicator	NS indicator	Error log (Hex)
H6	Flashing (red)	OFF	--

Likely cause
The PROFINET IO Controller detected that PLC CPU Unit is faulty.

IO Controller Unit response
The Unit will stop processing.

CIO Area Flags allocated to the IO Controller Unit
None of the bits is set.

Correction
Replace the CPU Unit if the error recurs when the CPU Unit is restarted.

Backplane bus error

7-segment	MS indicator	NS indicator	Error log (Hex)
H7	Flashing (red)	OFF	--

Likely cause
The PROFINET IO Controller detected that an error on the backplane bus.

IO Controller Unit response
The Unit will stop processing. Records the error in the error log. (The time information is set to all zeroes.)

CIO Area Flags allocated to the IO Controller Unit
None of the bits is set.

Correction
Replace the CPU Unit if the error recurs when the CPU Unit is restarted.

**Cyclic refresh monitor
timeout**

7-segment	MS indicator	NS indicator	Error log (Hex)
HE	Flashing (red)	OFF	0001

Likely cause
During normal operation the cyclic referesh to the PLC CPU timed out.

IO Controller Unit response
The Unit will stop processing. Records the error in the error log.

CIO Area Flags allocated to the IO Controller Unit
None of the bits is set.

Correction
Replace the CPU Unit if the error recurs when the CPU Unit is restarted.

Watchdog timer error

7-segment	MS indicator	NS indicator	Error log (Hex)
H7	Flashing (red)	OFF	0002

Likely cause
The PROFINET IO Controller detected a watchdog timer error with the PLC
CPU unit.

IO Controller Unit response
The Unit will stop processing. Records the error in the error log.

CIO Area Flags allocated to the IO Controller Unit
None of the bits is set.

Correction
Replace the CPU Unit if the error recurs when the CPU Unit is restarted.

6-3 Troubleshooting the Network

6-3-1 Troubleshooting Parameter Download

The PROFINET IO Controller DTM provides clear error messages if downloading of the parameters to the PROFINET IO Controller Unit fails. Failure can be due to either

• Errors or inconsistencies in the slave parameter sets, which are checked prior to download.
• The IO Controller DTM being unable to establish communication with the CJ1W-PNT21 PROFINET IO Controller Unit.
• A communication interruption of the process during download.

Errors in Slave Parameter Sets

The error messages displayed will provide a clear indication of the problem.
A download initiated by the user, starts with a check on the IO Device parameter sets. The IO Controller DTM will check

• The total number of IO Devices assigned, which must be at least one slave device.
• The total number of I/O modules per IO Device, which must be at least one I/O module per IO Device.
• The maximum size of the I/O data size, which must not exceed 7168 words.
• Any existing overlap in the I/O Areas configured.
• Any existing overlap in the allocated PLC memory areas.
• Availability of EM banks should any of the I/O Areas be mapped to one of the EM Banks. Availability of the EM banks depends on the PLC CPU type.

Any of these errors will abort the download process without consequences for the CJ1W-PNT21 PROFINET IO Controller Unit.

Errors when Establishing Communication

If no errors occurred during the checking phase, the IO Controller DTM will try to establish communication with the CJ1W-PNT21 PROFINET IO Controller Unit through CX-Server. If this fails, an error message will be displayed, indicating a communication problem. A failure to establish communication prior to download will have no consequences for the CJ1W-PNT21 PROFINET IO Controller Unit.

Errors During Download

If none of the first two processes result in a failure, downloading will commence. As soon as downloading has started, the configuration data in the CJ1W-PNT21 PROFINET IO Controller Unit will be overwritten.

Recovery After Failing Download

If a failure occurs during the download process, which prevents the IO Controller DTM from completing the process, the user must restart the Unit manually. Restarting the IO Controller Unit will abort the download process in the Master Unit and recover the previous configuration from its memory.

6-3-2 Troubleshooting the Network using Cx-ConfiguratorFDT

CX-ConfiguratorFDT provides several means to troubleshoot either the CJ1W-PNT21 PROFINET IO Controller Unit, the IO Devices or the network. The means all rely on features discussed in the previous section.

Troubleshooting the IO Controller Unit

To troubleshoot the IO Controller Unit or the network, the IO Controller DTM Diagnosis User Interface provides a help in determining problems. The figure below shows the Diagnosis - IO Controller Status item of the IO Controller DTM Diagnosis User Interface.
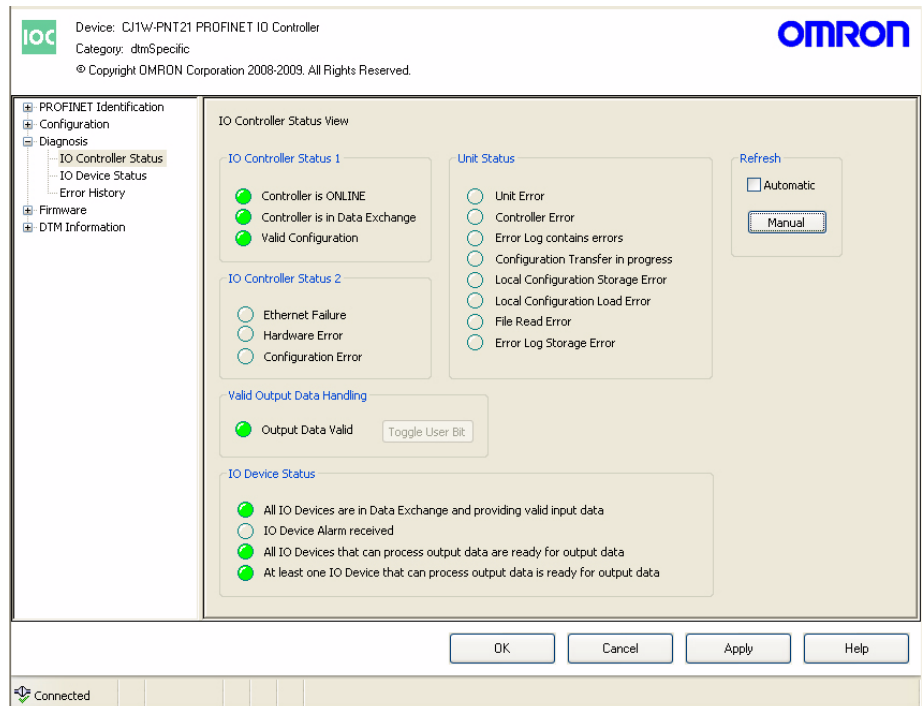
Figure 6.2: IO Controller status view

The LED indicators shown in the (example) figure above are all related to bit flags in the Unit Status Word, the IO Controller Status Word 1 and Word 2, and the IO Device Status Word.

Unit Status   The table below lists combinations of LED indicators with information on possible problems. They are derived from the Unit Status word. If one of the errors occur then there is a problem with the IO Controller itself. Probably the Unit needs to be replaced.

LED Indicators	Description/Correction
Unit Error	The Unit Error flag is ON if the unit has an error. That is if one of the other error flags in the Unit Status is ON.
Controller Error	The Controller Error Flag is On if one of the IO Controller Status 2 error flags is ON.
Error Log contains errors	When a new error is logged in the Error Log then this flag is ON. After reading or clearing the Error Log this flag is OFF. Reading or Clearing the Error Log can be done or by the Diagnosis Error History of the IO Controller DTM or by using the appropriate FINS commands.
Configuration Transfer in progress	During download of a new configuration from the IO Controller DTM to the IO controller this flag is ON

LED Indicators	Description/Correction
Local Configuration Storage Error	After the download of a new configuration or a restore from the Compact Flash card in the PLC CPU the IO Controller will store the configuration in its memory. If it does not succeed then this flag is ON. Try to download the configuration again. If the problem persists the replace the IO Controller.
Local Configuration Load Error	During startup of the IO Controller loads the configuration from memory. If it does not succed then this flag is ON. Try to download the configuration again. If the problem persists the replace the IO Controller.
File Read Error	If the IO Controller restores a configuration from Compact Flash card in the PLC CPU and it can not access the configuration file on the Compact Flash card then this flag is ON.
Error Log Storage Error	If a new error needs to be written to the Error Log and the IO Controller does not succeed in storing this error in the Error Log then this flag is ON.

IO Controller Status 1   The IO Controller Status 1word displays the state of the Unit. It shows if the IO Controller can go on the network and communicate with the current configuration with the IO devices.

LED Indicators	Description/Correction
Controller is ONLINE	Normally the IO Controller is always Online. If the IO Controller has gone Offline then a severe error has occured. Check the Unit Status and the Error History to see the cause. Eventually replace the Unit.
Controller is in Data Exchange	The IO Controller is in Data Exchange when it can reach at least one of the configured IO devices. This shows that the network connection to the IO Devices works. If some of the IO Devices can not be reached it is a network issue and not an issue of the IO controller. If the IO Controller is out of Data Exchange it means that their is something wrong with the network connection from the Io Controller to the IO Devices.

LED Indicators	Description/Correction
Valid Configuration	At startup the IO Controller checks if the stored configuration is valid. A new IO Controller contains no configuration yet so therefore it will show it has no valid configuration. If a configuration is not valid it means that means the file could be damaged. It is possible to download the configuration again with Cx-ConfiguratorFDT. If downloading the configuration to the Unit does not solve the issue then replace the unit.

IO Controller Status 2   The IO Controller Status 2 word displays the state of the Unit's network interface. It shows if the Ethernet cable is correctly inserted in the IO Controller and an Ethernet Link could be esthablished to the connected switch or IO Device. Or that the Ethernet interface of the Unit itself encountered a problem.

LED Indicators	Description/Correction
Link Status	The Unit could not esthablish an ethernet link at 100Mbps, Full Duplex to the connected switch or IO device. It could be that the Ethernet cable is damaged or not correclty inserted. Or that the connected device has a fault.
Hardware Error	The Ethernet controller of the Unit encountered a problem. It could be because of faulty access or there where broken messages orinterrupted data streams from the network. This could be caused by external influences on the network.
Configuration Error	At startup the IO Controller checks if the stored configuration is valid. A new IO Controller contains no configuration yet so therefore it will show it has no valid configuration. If a configuration is not valid it could be that the file is damaged. It is possible to download the configuration again with Cx-ConfiguratorFDT. If downloading the configuration to the Unit does not solve the issue then replace the unit.

IO Device Status   The IO Device Status word displays the state of the Unit's communication to its assigned IO Devices. Whether all or at least one IO Device that can process output data are connected. And if all IO Devices configured are supplying valid input data.
If one or more IO Devices have an Alarm then this will also be signaled.

LED Indicators	Description/Correction
All IO Devices are in Data Exchange and providing valid input data.	The Unit could esthablish an connection to all configured IO devices. All these IO Devices are now in Data Exchange and are providing valid input data. If one of the IO Devices sets it input data to be invalid then there could be something wrong with that IO Device. For more information refer to the IO Device Status item or to the IO Device DTM itself for further information. Also when an IO Device is simply turned off it is signaled here also.
IO Device Alarm received.	One of the IO Devices signaled it has a alarm available. Refer to the IO Device status item or the IO Device DTM to retreive further.
All IO Devices that can process output data are ready for output data.	The IO Controller has found all configured IO Devices with output data and succesfully created a connection to them. Now the output data must be activated by setting the state of the output data to valid. Output data is set valid by the IO Controller depending on the setting Valid Output Data Handling in the IO Controller Setup item. It could be or PLC Mode Dependent or User Bit Controlled.
At least one IO Device that can process output data is ready for output data.	The IO Controller has found at least one configured IO Devices with output data and succesfully created a connection to it. If the IO Controller can reach at least one but not all IO Devices this could mean that something is wrong with the network connection to that part of the network. To see which IO devices can not be reached refer to the IO Device Status item.

Valid Output Data Handling

The IO Controlller signals to the IO Devices that the output data it is sends is valid or not. The IO Devices use the state of the output data to active their outputs. If the output data is set to invalid it is up to the settings of the IO Device what will happen.Normally the IO Device will go to an failsafe state. the PROFINET IO connection between the IO Controller and IO Device will stay intact.

The Toggle User Bit button will be accessible if the setting in the IO Controller Setup item for the Valid Output Data Handling is set to User Bit Controlled. Now it is possible to manipulate the Set Output Data Valid in Software Switches 1 (word N bit 12). Normally this bit would be controlled by the PLC program.

LED Indicators	Description/Correction
Output Data Valid.	If set the IO Controller sends valid output data to the IO Devices. The IO Devices should normally operate their outputs. If not set the IO Devices will set their outputs to a safe state. The IO Controller handles the state of the output data depending on the setting if it is: • PLC Mode Dependent • User Bit Controlled If IO Devices do not operate their outputs please check the setting of the Valid Output Data Handling and the according handling in the PLC program.

Troubleshooting IO Devices

The IO Device Status item gives an overview which IO Devices are in Data Exchange and which of them have reported new errors. By selecting a IO Device or in the New Alarm & Data Exchange Active Flags Area or by the Selected IO Device menu more information about the alarm is displayed.
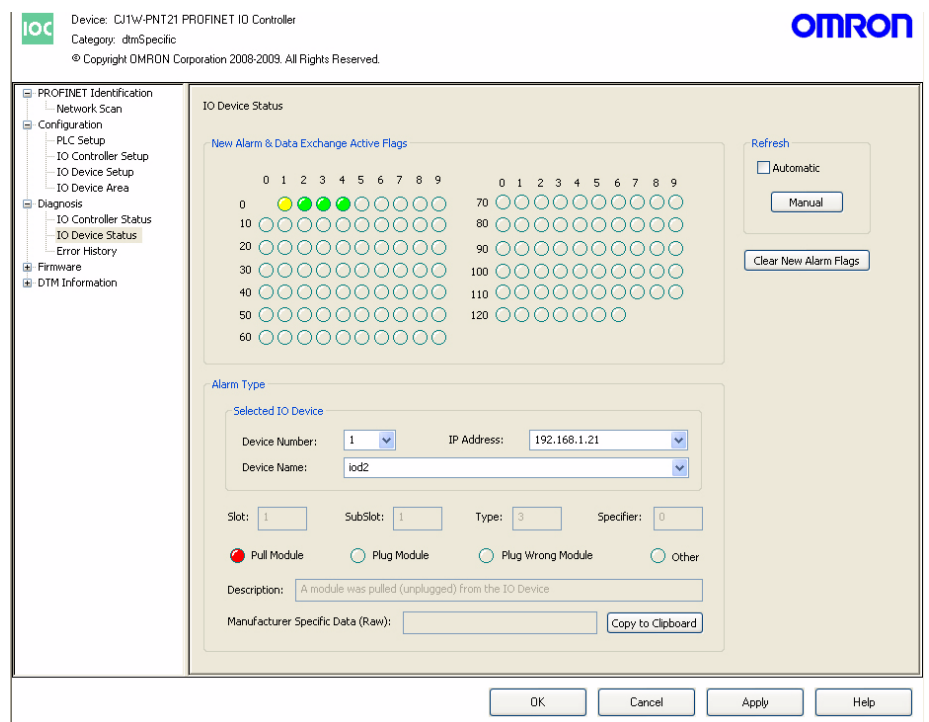
Figure 6.3: IO Device status

Missing IO Devices will be marked will be marked Red.
IO Devices that signaled an alarm will be Yellow.
The standard PROFINET alarms are implemented:
• Pull Module
• Plug Module
• Plug Wrong Module
• Other

When the type of Alarm is Other then additional information can be found in the Description and the Mananufacturer Specific Datat (Raw) fields.

The additional information can be copied to the Clipboard for further analysis.

When selecting an IO Device either in the New Alarms & data Exchange Active Flags or the Selected IO Device area will show the last known alarm of the IO Device. It does not necessarily mean that the alarm is still active. If a IO Device has an active alarm that this willbe displayed in the colour of the IO Device (Yellow).

Alarms can be acknowledged with the Clear new Alarm Flags button.

Error History

The Error History item is reading the Error Log in the IO Controller. The IO Controller stores up to 80 errors in its Error Log. Information on the errors logged can be found in the list of errors.

Below the Error Log View is displayed.

Figure 6.4: Error history

6-4   Maintenance

This section describes the routine cleaning and inspection recommended as regular maintenance.

6-4-1   Cleaning

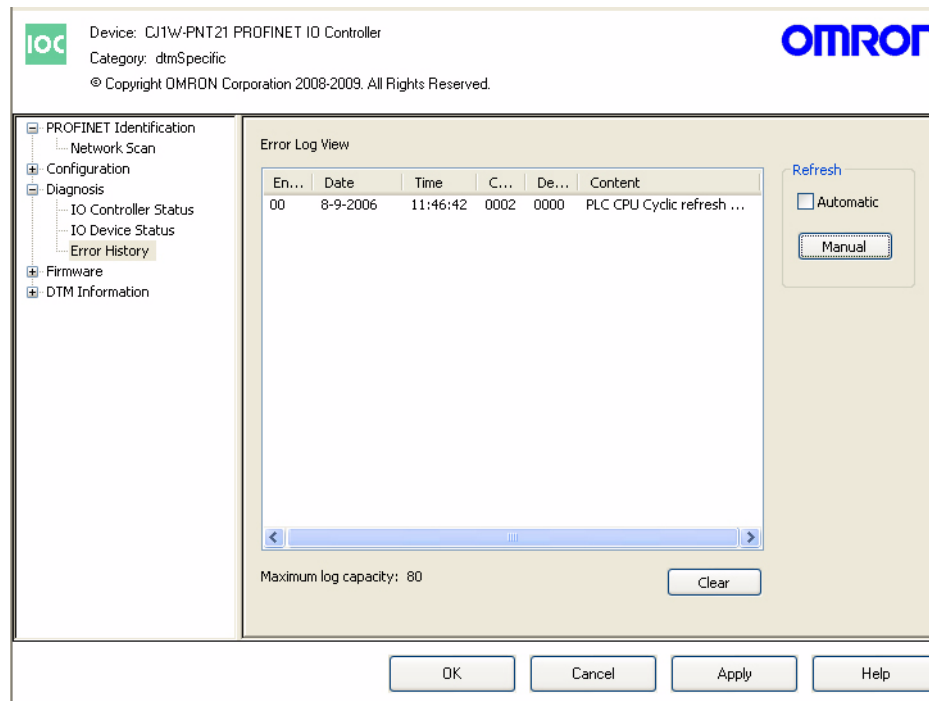Clean the PROFINET IO Controller Unit regularly as described below in order to keep it in an optimum operating condition.
- Regularly wipe the Unit with a dry, soft cloth.
- If a spot cannot be removed with a dry cloth, dampen the cloth with a neutral cleaner, wring out the cloth and wipe the Unit.

⚠ **Caution** Never use volatile solvents such as paint thinner, benzine or chemical wipes. These substances could damage the surface of the Unit.

6-4-2   Inspection

Be sure to inspect the system periodically to keep it in optimum operating condition. In general, inspect the system once or twice a year, but more frequently if the system is used in high temperature or high humidity environments or dirty/dusty conditions.

Inspection Equipment Prepare the following equipment before inspecting the system.

Required Equipment
Alcohol, and a clean cloth.

Optional Test Equipment
Depending on system conditions, a synchroscope, oscilloscope, thermometer or hygrometer (to measure humidity) might be needed.

Inspection Procedure Check the items in the following table and correct any that are below standard.

Item		Standard	Equipment
Environmental conditions	Ambient temperature	0 °C to 55 °C	Thermometer
	Ambient humidity	10 % to 90 %	Hygrometer
	Dust/dirt accumulation	None	---
Installation	Are the units installed securely?	No looseness	---
	Are the communication connectors fully inserted?	No looseness	---
	Are the external wiring screws tight?	No looseness	---
	Are the connecting cables undamaged?	No damage	---

6-5   Replacing the Unit

6-5-1   Replacement Precautions

The PROFINET IO Controller Unit is a network device. If the Unit is damaged, it will affect the entire network, so always ensure repairs are undertaken immediately. It is recommended to have a spare PROFINET IO Controller Unit at hand so that repairs may be conducted quickly.

Replacement Precautions   Observe the following precautions when replacing the Unit.

- Always turn OFF the power before replacing the Unit.
- Ensure that the new Unit is not faulty.
- When returning a faulty Unit for repair, always attach a detailed fault report to the Unit and return it to the nearest OMRON dealer.

Note   1   In order to prevent faulty operation be sure to turn off the power to all IO Controller and IO Devices before replacing the Unit.
2   When replacing the Unit, do not reconnect it to the network before carrying out the procedures listed below.

6-5-2   Setting up the Unit after Replacement

Setting up the IO Controller Unit again after replacement can be done in two ways. Anyway the IO Controller needs to have a configuration loaded to operate.

The configuration can be stored in the new Unit by:
- Downloading it from Cx-ConfiguratorFDT.
  Refer to the section that handles the download of the configurator
- Using the backup functionality of the CJ1 PLC.
  Refer to the J1 PLC operation manual.

Re-connect the IO Controller to the network, and restart operation.

Appendix A
PROFINET IO technology

A-1   Introduction to PROFINET

As a common solution for the industrial communication, the PROFIBUS International organisation introduced the PROFINET Industrial Ethernet standard. PROFINET is the next step for building on the current:
- PROFIBUS DP, the well-known and established fieldbus;
- Industrial Ethernet.

PROFINET is the innovative and open standard for Industrial Ethernet. PROFINET satisfies all requirements for automation technology. With PROFINET, solutions can be implemented for factory and process automation, for safety applications and for motion control. PROFINET is now standardized in IEC 61158 and IEC 61784.

The use of PROFINET minimizes the cost of installation, engineering and commissioning.

PROFINET IO
Distributed field or I/O Devices are integrated through PROFINET IO. This uses the usual IO view of PROFIBUS DP, whereby the IO data of field devices are cyclically transmitted to the process image of the PLC.

The PROFINET IO device model is based on the PROFIBUS implementation, consisting of insertion (slots) and groups of I/O channels (subslots). The characteristics of the field devices are described via a General Station Description (GSD) on an XML basis.

The installation, monitoring and maintenance of PROFINET IO will be familiar to engineers accustomed to PROFIBUS DP. The distributed field devices are allocated to a controller during configuration.

PROFINET CBA
The PROFINET component model has its application in distributed automation systems. This is mainly used for intelligent field devices with programmable functionality as well as controllers. PROFINET CBA divides distributed, complex applications into autonomous units of manageable size.

A distributed automation system based on these autonomous units simplifies the modularization of plants and machines, permitting separate and cross-vendor development.

PROFINET based on a component model is described using a PROFINET Component Description (PCD), which is XML-based.

A-2 PROFINET Communication

PROFINET uses Ethernet and TCP, UDP and IP as basis for the communication between the devices.

TCP/IP and UDP/IP

For non-time critical messaging PROFINET uses standard Ethernet mechanisms over TCP/IP and UDP/IP.

Field devices are addressed using a MAC and IP address. This is similar to the standard Ethernet communication. In these protocols, the networks are identified based on the IP address. Within a single network the MAC address is used for the addressing of the target devices.

This addressing features enables integration with the IT world without limitation. The OMRON I/O Devices can accordingly support the OMRON Ethernet protocols, enabling additional communication with OMRON PROFINET devices.

TCP provides an error-free transmission of data from sender to receiver. It establishes a connection between the two stations before the transmission is complete. This connection is monitored during operation and disconnected after the transmission is complete.

UDP does not guarantee an error-free transmission of data. However, the UDP is connectionless. Each message is an individual transmission. Because of the lack of overhead (connection establishment, monitoring, etc.), this protocol is more suitable for time-critical applications.

RT and IRT

The TCP/IP and UDP/IP communication protocols apply a considerable amount of control overhead which will slow down data transmission speed which is required for PROFINET applications. To facilitate Real-Time capabilities for data exchange, the PROFINET uses a specific protocol of Real-Time (RT) Communication. This protocol cancels some of the flow control and addressing in comparison with the TCP/IP and UDP/IP.

For the prioritized transmission of RT-frames, Real-Time communication uses the VLAN tag as defined in IEEE 802.1Q.

For demanding communication tasks of high performance within PROFINET, for instance Motion Control, the Isochronous Real Time (IRT) has been developed. This communication requires specific hardware to establish integrated switch functionality and cycle synchronization.

A-3   PROFINET Distributed I/O

The focus of PROFINET IO is to have cyclic data exchange between a controller and multiple often simple communication devices. The aim is to have high performance and ease to use. The experience of the PROFIBUS fieldbus has been integrated into the PROFINET IO from user's point of view.

The PROFINET IO distinguishes the following different device roles. Please note a single device can have multiple roles.
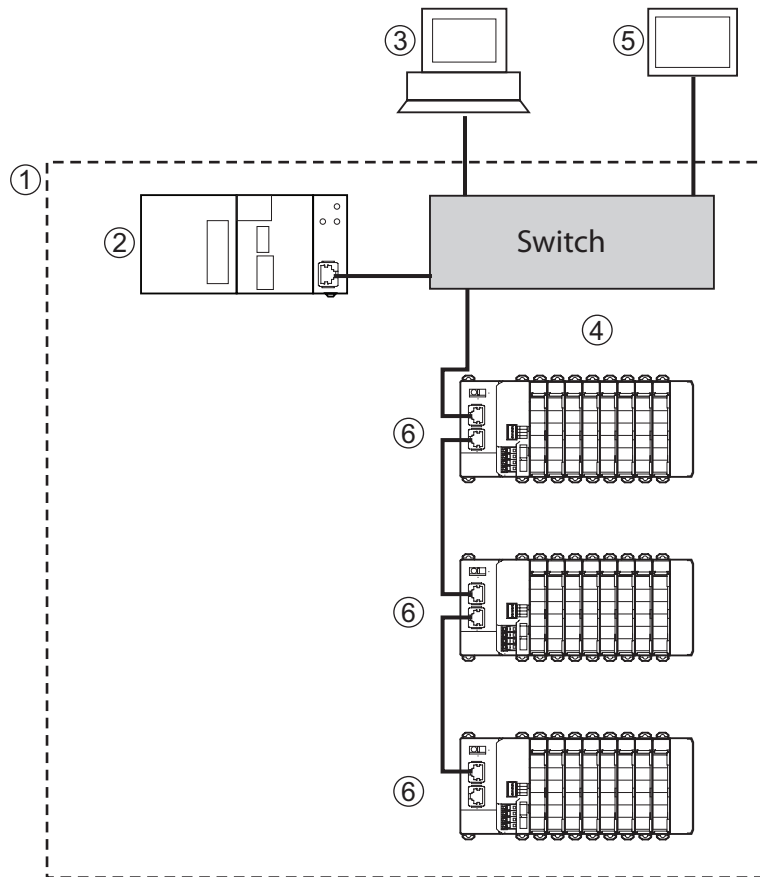
Number	PROFINET	PROFIBUS	Comment
1	IO System	DP master system	
2	IO Controller	DP Master	Device that addresses the connected IO units by exchanging input and output signals with them. This controller normally runs the automation program.
3	IO Supervisor	PG/PC Class 2 DP master	Device (e.g. a PC) for commissioning and diagnostics.
4	Ethernet	PROFIBUS	Network infrastructure.
5	User Interface	HMI	Device for operating and monitoring the functions of the system.
6	IO device	DP slave	Device for receiving sensor signals and controlling actuators like valves, switches and frequency converters.

IO Controller
A PROFINET IO Controller is the central device in the PROFINET network. It has the control over the state of the network and processes the data and alarms. The IO Controller typically is a PLC Unit that processes the data and alarms in the user program. It establishes the connection to the devices on the network during system start-up.

IO Supervisor
A PROFINET IO Supervisor is an optional device in the network, which has temporary access to the field devices. It is typically an engineering station for monitoring or commissioning of the system.

IO Device
A PROFINET IO Device is a remotely connected field device, close to the manufacturing process. It is configured by the IO Controller to cyclically interchange process data with the IO Controller. The IO Device can have multiple connections to different IO Controllers / IO Supervisors in the network and will generate alarms if problems occur with the communication or the manufacturing process.

Device Model
The PROFINET IO application layer describes the modules of an IO Device in a similar way as for PROFIBUS DP. A PROFINET IO Device consists of slots for which the modules/submodules can be inserted. The technical data concerning the slots and subslots are defined in the GSD file of a device.

Slot
A Slot is the physical place of insertion of a module in an IO Device. Various subslots are located in the various slots, which contain data for cyclic data exchange.
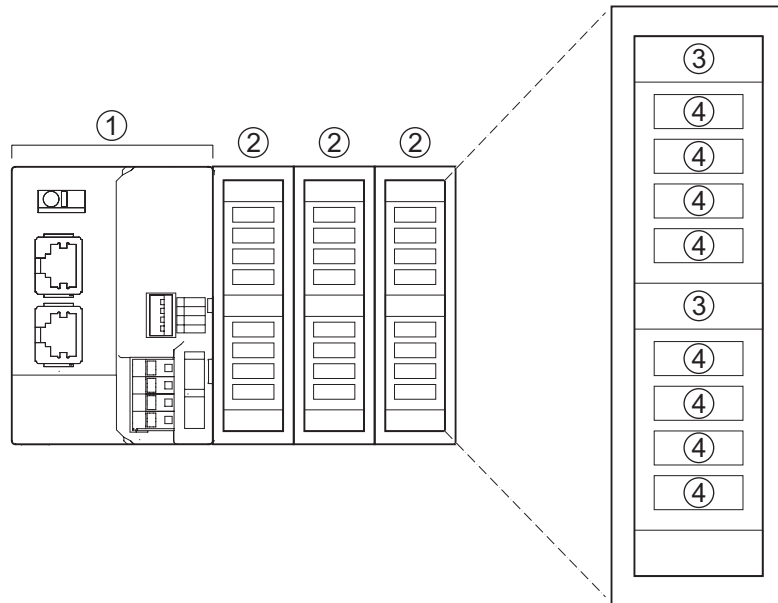
Subslot
Subslots provide an additional addressing layer. They enable grouping of similar channels within a slot. Each slot has to comprise at least one subslot with [1:n] I/O channels.

Index
The index specifies the data related to a specific subslot, to be read or written acyclically.

The device model is shown in the following graph:

Number	Description
1	Communication Unit
2	I/O Module
3	Submodule
4	Channel

Provider/Consumer Model
The data exchange between IO Controller and the IO Devices is carried out based on the provider-consumer model. The provider sends its data to the consumer without a request from the other device. The consumer processes the data. The provider (as the consumer) is either the IO Controller or the IO Device.

The Input Output Provider Status (IOPS) indicates the status of the data source (valid or invalid) for each of the modules as part of the data exchange message. This can be the Output data for the IO Controller and the Input data for the IO Device. The provider status is either bad or good, implying the received data is either invalid or valid for use. For example the Output data of the IO Controller is set to bad in case the PLC is in Program mode.

The Input Output Consumer Status (IOCR) indicates the feedback on the provided data received before. This status (Bad or Good) is indicated in the Input data for the IO Controller and the Output data for the IO Device. As an example when considering the IO Controller Redundancy: an IO Device will only feedback to the active IO Controller it has consumed its output (status Good). The standby IO Controller will get IOCR Bad status as response.

A-4   PROFINET Communication Services

The IO Controller establishes a connection to its IO Devices based on the configuration which has been given by the user. The Application Relation (AR) includes all data needed to achieve this data exchange. A single AR can include multiple Communication Relations (CRs). For implementation of different communication profiles, such as PROFIdrive, the PROFINET IO contains special addressing elements. These elements are called Application Process Identifier (APIs).

The following CRs are possible for each API.
*   IOCR, consisting of input, output or multicast
*   Record data CR for exchange of acyclic data
*   Alarm-CR for communicating alarms and other events

The data exchange between the IO Device and the IO Controller occurs in a poll cycle as configured by the IO Controller. The user is capable to set this update cycle in the IO Controller configuration for each of the IO Devices. This results in mutual monitoring of functional operability (watchdog function). All cyclic data is provided with a status that encodes the validity of the data.

A-5   Alarms

PROFINET IO is capable of sending events within the automation process as alarms. These alarms have to be acknowledged by the application process. These include both system-defined events (i.e. Removal of slices) or user-defined events (i.e. Input voltage out of range).

The following events are distinguished:

Type	Description
Process alarms	Events from the process, which are sent to the control system.
Diagnostics alarms	Events indicating a malfunction of a field device.
Maintenance alarms	Events relating to preventive maintenance to avoid device breakdown.
Manufacturer-specific diagnostics	Events relating to events specific for the manufacturer.

PROFINET defines a standard set of alarm causes, like

Type	Description
Pull and plug alarms	Events related to modular IO Devices, such as the GRT1-PNT. A slice module is removed or plugged in.
Plug wrong submodule	Events indicating an incorrect submodule has been configured or inserted.

Alarms are always identified by the indication of the slot/subslot.

A-6   FDT/DTM Technology

The FDT/DTM concept specifies the interface between the engineering systems called Field Device Tools (FDT), and the device-specific software components called Device Type Managers (DTM). FDT/DTM is the most recent advancement in Configurators.

The FDT/DTM concept separates the device-dependent functionality (which is in the DTM) from the application. It provides separate interfaces for device configuration, monitoring and maintenance solutions, which before largely depended on the manufacturer of the application. Because of this concept, any type of network can be configured and accessed, provided the appropriate DTMs are available.

An FDT container application facilitates configuration of network devices and parameterizing and/or manipulating their operational modes. All device-dependent functionality is concentrated in the DTM.

FDT container applications can be stand-alone tools or can be part of other engineering tools such as web browsers providing FDT interfaces. Since FDT standardizes the interfaces, it allows devices from different manufacturers to be integrated in any automation system, regardless of the fieldbus system.

CX-ConfiguratorFDT is an example of an FDT container application.

DTMs are provided by the manufacturer of the device. A DTM is comparable to a printer driver, which allows interactive configuration and diagnostics. The DTM provides not only the configuration, manipulation and monitoring functions for a device including the user interface functions, it also provides the connection technology to the device.

A DTM provides all the options for configuration and monitoring of a device, which it can present to the user through its own user interface. The user interface for a DTM is provided using ActiveX windows. In general multi-language user interface windows, including DTM-specific Help files are supported by the DTM.

In general, a device configuration DTM is accompanied by a communication DTM. This specific DTM facilitates device-specific communication, e.g. for downloading a configuration to a PROFINET IO Controller Unit and/or for retrieving monitoring information from a PROFINET IO Controller Unit. It may incorporate the specific communication protocol or rely on other available drivers.

Appendix B
PROFINET IO alarm messages

B-1 Introduction

PROFINET IO Devices supports sending PROFINET IO Alarm message for different error conditions. The IO Device supports the following alarm events:

Alarm type	Description
Pull Alarm	When a Slice I/O Unit is removed during normal operation a Pull Alarm event is generated (see note 1).
Plug Alarm	When the (correct) Slice I/O Unit is placed back at the correct position a Plug Alarm event is generated.
Plug Wrong Submodule	In case the configuration downloaded to the PROFINET IO Controller does not match the physical Slice I/O Unit configuration of the Unit a Plug Wrong Submodule alarm event is generated (see note 2).

Note 1 In case multiple alarm events (more than two) are generated at the same time, it is possible alarm events will be discarded.
2 When multiple Slice I/O Units do not match with the PROFINET IO Configuration, only one Plug Wrong Submodule alarm event is generated for the first mismatching Slice I/O Unit.

B-2 Alarm messages

Byte	Name	Description
0 to 1	Reference	The reference number of the sender.
2	Priority	The priority of the alarm.
3	Alignment	Reserved.

4 to 5	Type	The alarm type:
		  value 0003 Hex: Pull Alarm,
		  value 0004 Hex: Plug Alarm,
		  value 000A Hex: Plug Wrong Submodule.

6 to 9	API	The API.
10 to 11	Slot	The number of the slot having the alarm.
12 to 13	Subslot	The number of the subslot having the alarm.
14 to 17	ModuleIdent	The Ident number of the slot.
18 to 21	SubmoduleIdent	The Ident number of the subslot.
22 to 23	Specifier	The specifier of the alarm. The following bits are defined. **Bit:** **Description:** 0 to 10: Sequence number 11: Channel Diag exists (value 1 is exists) 12: Manufacturer Diag (value 1 is exists) 13: SubmoduleDiagState (value 0 is no error) 14: Reserved 15: AR Diag State (value 0 is no error)
24 to 25	Length	The length of additional data for Channel Related Diagnosis.

Appendix C
Explicit messages

C-1   Basic format of explicit messages

Explicit messages sent from the IO Controller Unit to a GRT1 Series PROFINET IO Communication Unit can be used to read or write any parameter of a specified GRT1 Series PROFINET IO Communication Unit.

The PROFINET IO Communication Units process the commands sent from the Controller and then return responses.

The basic format of each command and response is shown below.

Command Block					
Destination station address	Service code	Class ID	Instance ID	Attribute ID	Data

Destination station address
The station address of the Unit that is sending the explicit messages (commands) is specified as a single-byte hexadecimal number.

Service code, Class ID, Instance ID, Attribute ID
The parameters used for specifying the command, processing object, and processing content.

> **Note**   The number of bytes designated for Class ID, Instance ID, and Attribute ID depend on the Controller Unit. When sent from an OMRON Controller, the Class ID and Instance ID are 2 bytes (4 digits), and Attribute ID is 1 byte (2 digits).

Data
Data is not required when the Read command is used.

Response blocks

Normal Response Block			
Number of bytes received	Source station address	Service code	Data

Error Response Block			
Number of bytes received: 0004 Hex (fixed)	Source station address	Service code	Error code

Number of bytes received
The number of bytes received from the source station address is returned in hexadecimal. When an error response is returned for an explicit message, the number of bytes is always 0004 Hex.

Source station address
The station address of the Unit from which the command was sent is returned in hexadecimal.

Service Code

For normal completion, the value when the left-most bit of the service code specified in the command turns ON is stored as shown in the following table.

Function	Command service code	Response service code
Write data	10 Hex	90 Hex
Read data	0E Hex	8E Hex
Reset	05 Hex	85 Hex
Save	16 Hex	96 Hex

When an error response is returned for an explicit message, the value is always 94 Hex.

Data

Read data is included only when a read command is executed.

Error Codes

The explicit message error codes as listed in the following table.

Response code	Error name	Cause
08FF	Service not supported	The Service code is incorrect.
09FF	Invalid Attribute value	The specified Attribute value is not supported. The data written was outside valid range.
16FF	Object does not exist	The specified Instance ID is not supported.
15FF	Too much data	The data is larger than the specified size.
13FF	Not enough data	The data is smaller than the specified size.
0CFF	Object state conflict	The specified command cannot be executed due to an internal error.
20FF	Invalid parameter	The specified operation command data is not supported.
0EFF	Attribute not settable	An Attribute ID supported only for reading has been executed for a write service code.
10FF	Device state conflict	The specified command cannot be executed due to an internal error.
14FF	Attribute not supported	The specified Attribute is not supported.
19FF	Store operation failure	The data cannot be stored in memory.
2AFF	Group 2 only server general failure	The specified command or Attribute is not supported or the Attribute was not set.

C-2   Explicit messages common to all IO devices

Alarm information read

Explicit message	Read / Write	Function	Command					Response
			Service code	Class ID	Instance ID	Attribute ID	Data size	
Alarm Information Read	Read	Reads the SmartSlice I/O Unit's alarm data.	0E Hex	9C Hex	01 Hex	73 Hex	-	32 bytes (See note.)

> **Note**   The following tables show the alarm data details.

Word offset	Bit							
	15	12	11	8	7	4	3	0
+0	SmartSlice I/O Node #4		SmartSlice I/O Node #3		SmartSlice I/O Node #2		SmartSlice I/O Node #1	
+1	SmartSlice I/O Node #8		SmartSlice I/O Node #7		SmartSlice I/O Node #6		SmartSlice I/O Node #5	
+2	SmartSlice I/O Node #12		SmartSlice I/O Node #11		SmartSlice I/O Node #10		SmartSlice I/O Node #9	
:	:		:		:		:	
+13	SmartSlice I/O Node #56		SmartSlice I/O Node #55		SmartSlice I/O Node #54		SmartSlice I/O Node #53	
+14	SmartSlice I/O Node #60		SmartSlice I/O Node #59		SmartSlice I/O Node #58		SmartSlice I/O Node #57	
+15	SmartSlice I/O Node #64		SmartSlice I/O Node #63		SmartSlice I/O Node #62		SmartSlice I/O Node #61	

The 4 bits allocated to each SmartSlice I/O Node have the following functions:

Bit 0	Warning (Minor error)
Bit 1	Alarm (Major error)
Bit 2	Reserved
Bit 3	Reserved

> **Note**   The Warning/Alarm details depend on the Communication Unit. Refer to the Unit's operation manual.

C-3 Example of using explicit messages

The following example shows how to use explicit messages with a PROFINET IO Communication Unit connected to a PROFINET IO Controller Unit.

Sending a **Unit Maintenance Present Value Read** command to the PROFINET IO Communication Unit.
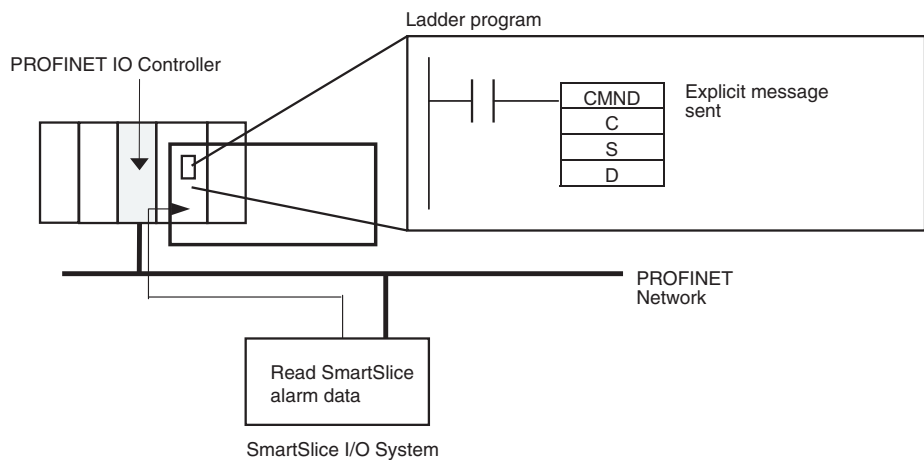
Configuration
PROFINET IO Controller Unit's station address: 00
Unit number: 0
Unit address: 11 Hex
GRT1-PNT Communication Unit's Device Number: 65

Operation
Reads the Alarm data of the connected SmartSlice I/O Unit from the PROFINET IO Communication Unit.
The data is read using the **Explicit Message Send** command (2801).
The command data is written in words starting from D01000 in the PLC and the response data is stored in words starting from D02000.
If the command does not end normally, the end code is stored in D00006 and the **Send** command is re-executed.

> **Note** The maximum length of the **Explicit Message Send** command (2801) when used for sending data over PROFINET IO is limited to 1004 bytes.

Command Details
[CMND S D C]
S: D01000
D (first response word): D02000
C: D00000

Contents of S

Address	Contents (Hex)	Meaning
D01000	28 01	Command code
D01001	41 0E	PROFINET IO Communication Unit Device Number: 65 Service code: 0E Hex
D01002	00 9C	Class ID: 009C Hex
D01003	00 01	Instance ID: 0001 Hex
D01004	73 **	Attribute ID: 73 ** Hex (Set any value for the blank boxes.)

Contents of C

Address	Contents (Hex)	Meaning
D00000	00 09	Number of bytes of command data
D00001	00 2A	Number of bytes of response data
D00002	00 00	Destination PROFINET IO Controller Unit's Device Number: 0
D00003	00 11	Destination PROFINET IO Controller Unit's unit address: 11 Hex
D00004	00 00	Response required Communication port number: 0 Number of retries: 0
D00005	00 3C	Response monitoring time: 6 s

Contents of D
Response

Address	Contents (Hex)	Meaning
D02000	28 01	
D02001	00 00	
D02002	00 24	
D02003	41 8E	Response source station Device Number: 65 (41 Hex) Normal completion: 8E Hex
D02004 to D02020	20 00	Number of slave alarm data: 32 (20 Hex) Status of slave #4, Status of slave #3 (2 bits each)
D02005	00 00	Status of slave #8, slave #7, slave #1, slave #2 (2 bits each)
D02006 to D02020	...	(continue)

Appendix D
Memory Card Backup Functions

D-1   Outline of Function

The PROFINET IO Controller Unit stores the following setup data in the internal non-volatile memory (Flash ROM).
- PROFINETIO Connection Parameters set;
- Allocated IO Device Parameter sets.

All these parameter sets can be backed up to and restored from a Memory Card mounted to the CPU Unit. If the parameter data of a good functioning PROFINET IO Controller Unit has been saved on a Memory Card, this saved data can be used to perform a quick configuration, when replacing the PROFINET IO controller Unit, without the direct use of the Configuration software. The data can be backed up to a Memory Card only. It cannot be backed up to a EM file.

The backup process does not only involve the backup of the PROFINET IO Controller parameter data, but also the parameter data of any other Special CPU Bus Unit on the same PLC, as well as the PLC program, parameter area data, and I/O memory data. This function can be executed in any operating mode.

When performing a backup from the PROFINET IO Controller Unit to the Memory Card, the parameter sets are stored in the file BACKUPnn.PRM, where nn is the Unit number in 2-digit hexadecimal.

D-2 Backing Up Unit Setup Files

In order to save the Unit's parameter sets to the Memory Card mounted to the CPU Unit, perform the following procedure (see figure below).

1 Make sure that the parameter sets in the Unit are correct and that the Unit starts up normally, and insert a Memory Card into the Card slot.

2 Turn ON pin 7 of the DIP switch on the front of the CPU Unit (behind the cover above the Memory Card slot).

3 Press and hold the Memory Card power supply switch for 3 seconds. When the switch is pressed, the MCPWR Indicator on the front of the CPU Unit will flash once and then remain lit while the data is being written. The indicator will go OFF after the data has been written properly. During the transfer to the Memory Card, the Parameter Transfer in Progress bit in Unit Status Word (CIO Word n+4) will turn ON.

Pin 7: ON

Press the Memory Card Power Supply Switch for three seconds.
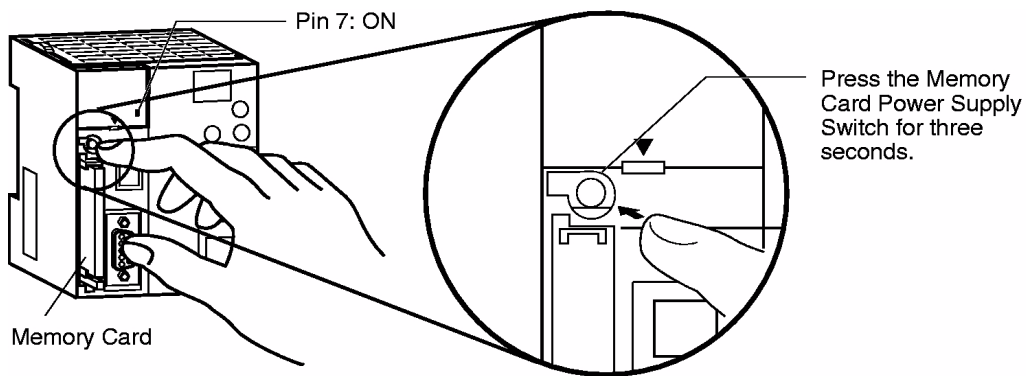
Memory Card

D-3 Restoring Unit Setup Files

In order to restore the Unit's parameter sets from the Memory Card mounted to the CPU Unit, perform the following procedure.

1 Power down the PLC and insert a Memory Card into the Card slot.
2 Turn ON pin 7 of the DIP switch on the front of the CPU Unit (behind the cover above the Memory Card slot).
3 Turn ON the PLC's power supply.
4 When the PLC's power is turned ON, the MCPWR Indicator on the front of the CPU Unit will light and flash once. The MCPWR Indicator will remain lit while the data is being read. The Indicator will go OFF after the data has been read properly. During the Data Transfer, the PRM LED on the front of the Unit will flash, and the Parameter Transfer in Progress bit in Unit Status Word (CIO Word n+4) will turn ON.
5 Restart the PLC.

Note 1 Data will not be read from the Memory Card to the CPU Unit if pin 1 of the DIP switch is ON (write-protecting program memory).

2 A CJ1-H, or CJ1M CPU Unit will remain in PROGRAM mode after the simple backup operation has been performed and cannot be changed to MONITOR or RUN mode until the power supply has been cycled. After completing the backup operation, turn OFF the power supply to the CPU Unit, change the settings of pin 7, and then turn the power supply back ON.

3 File backups may take from several seconds to several minutes. Refer to CS/CJ-series Programming Manual (W394) for information on execution times.

4 If an error occurred in the transfer from the Memory Card to the Unit, the File Read Error bit in Unit Status Word (CIO Word n + 4, bit 09) will turn ON. To correct this, re-perform the Restore action. If the problem persist, use CX-Profibus to download the original settings from the PC.

Revision history

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.

Cat. No. W12E-EN-01

Revision code

The following table outlines the changes made to the manual during each revision. The page numbers of a revision refer to the previous version.

Revision code	Date	Revised content
01	20090623	First version

OMRON