

**SYSMAC
CS Series**

**CS1W-FLN02 (10Base-5)
CS1W-FLN12 (10Base-T)
FL-net (Ver. 2.00) Units**

OPERATION MANUAL

OMRON

**CS1W-FLN02 (10Base-5)
CS1W-FLN12 (10Base-T)
FL-net (Ver. 2.00) Units**


Operation Manual


Produced November 2003


Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

 **DANGER** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

 **Caution** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

OMRON Product References

All OMRON products are capitalized in this manual. The word “Unit” is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation “Ch,” which appears in some displays and on some OMRON products, often means “word” and is abbreviated “Wd” in documentation in this sense.

The abbreviation “PLC” means Programmable Controller.

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.

1,2,3... 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

© OMRON, 2003

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form, or by any means, mechanical, electronic, photocopying, recording, or otherwise, without the prior written permission of OMRON.

No patent liability is assumed with respect to the use of the information contained herein. Moreover, because OMRON is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, OMRON assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.

TABLE OF CONTENTS

PRECAUTIONS	xiii
1 Intended Audience	xiv
2 General Precautions	xiv
3 Safety Precautions.....	xiv
4 Operating Environment Precautions	xv
5 Application Precautions	xv
6 Conformance to EC Directives	xvii

SECTION 1

Features and System Configuration	1
1-1 FL-net Overview.....	2
1-2 System Configuration	6
1-3 Devices Required in a Network	7
1-4 Related Programming Devices	10
1-5 Specifications	11
1-6 Precautions	13

SECTION 2

Communications Functions	15
2-1 FL-net (Ver. 2.00)	16
2-2 Cyclic Transmission	21
2-3 Message Transmission	22
2-4 FINS Communications Service.....	22

SECTION 3

Startup Procedure	25
3-1 Before Operation.....	26
3-2 Initial Setup	27
3-3 Nomenclature and Functions	28
3-4 Hardware Setup.....	30
3-5 Mounting to the PLC.....	33
3-6 Network Installation	34
3-7 Connecting to the Network	44
3-8 Creating an I/O Table	49
3-9 Creating Routing Tables	50
3-10 System Setup.....	55
3-11 Checking Communications.....	55

TABLE OF CONTENTS

SECTION 4

System Setup and Memory Allocations 57

- 4-1 Allocated Words 58
- 4-2 CPU Bus Unit System Setup 59
- 4-3 Allocated Words in the CIO Area 61

SECTION 5

Data Link 67

- 5-1 Data Link Overview 68
- 5-2 Setting Data Link Tables 72

SECTION 6

Message Transmission 85

- 6-1 Message Transmission 86
- 6-2 Details of Supported Messages 88

SECTION 7

FINS Communications 93

- 7-1 Overview of FINS Communications 94
- 7-2 Sending Commands From a PLC 96
- 7-3 Command Codes and Response Codes 107
- 7-4 CS-series Memory Areas and Virtual Addresses 108
- 7-5 Command/Response Reference 109
- 7-6 Message Buffer Configuration Chart 135

SECTION 8

Communications Timing 137

- 8-1 Network Communications System 138
- 8-2 Communications Cycle Time 138
- 8-3 Calculating the Data Link I/O Response Time 140
- 8-4 Message Service Transmission Delays 140

SECTION 9

Testing Communications 143

- 9-1 Communications Testing Functions 144
- 9-2 PING Command 144
- 9-3 Internode Test 145

TABLE OF CONTENTS

SECTION 10

Troubleshooting	149
10-1 Troubleshooting with Indicators	150
10-2 Error Status	151
10-3 Error Log	152
10-4 Troubleshooting Procedures	155

SECTION 11

FL-net Unit Support Tool	161
11-1 FL-net Unit Support Tool Overview	162
11-2 Installation	164
11-3 Connecting the Computer to the PLC	166
11-4 Using Support Tool Functions	168

Revision History	187
-------------------------------	------------

About this Manual:

This manual describes the installation and operation of the SYSMAC CS-series CS1W-FLN02 (10Base-5) and CS1W-FLN12 (10Base-T) FL-net (Ver. 2.00) Units.

FL-net (Ver. 2.00) Units are used to connect to FL-net version-2.0 networks.

Please read this manual and all related manuals listed in the following table carefully and be sure you understand the information provided before attempting to install and operate an FL-net Unit.

Name	Cat. No.	Contents
SYSMAC CS-series CS1W-FLN02/FLN12 FL-net Units Operation Manual (this manual)	---	Describes the installation and operation of the CS1W-FLN02 (10Base-5) and CS1W-FLN12 (10Base-T) FL-net Units. Refer to the <i>Communications Commands Reference Manual (W342)</i> for information on FINS commands that can be addressed to CS/CJ-series CPU Units.
SYSMAC CS/CJ-series CS1W-ETN01/ETN11 CJ1W-ETN11 Ethernet Units Operation Manual	W343-E1-□	Describes the installation and operation of the CS1W-ETN01 (10Base-5), CS1W-ETN11 (10Base-T), and CJ1W-ETN11 Ethernet Units. Refer to the <i>CX-Programmer User's Manual</i> for information on setting the CPU Bus Unit Setup for the Ethernet Unit. Refer to the <i>Communications Commands Reference Manual (W342)</i> for information on FINS commands that can be addressed to CS/CJ-series CPU Units.
SYSMAC CS/CJ-series CS1G/H-CPU□□-E, CJ1G-CPU□□, CS1W-SCB21/41, CS1W- SCU21, CJ1W-SCU41 Communications Commands Reference Manual	W342-E1-□	Describes the C-series (Host Link) and FINS communications commands used with CS/CJ-series PCs.
SYSMAC CS/CJ-series CS1G/H-CPU□□-E, CJ1G-CPU□□ Programmable Controllers Programming Manual	W394-E1-□	Describes programming as well as tasks, file memory, and other functions for CJ-series PCs. Use together with the <i>Operation Manual (W393)</i> .
SYSMAC CS/CJ-series CS1G/H-CPU□□-E, CJ1G-CPU□□ Programmable Controllers Instructions Reference Manual	W340-E1-□	Describes the ladder diagram programming instructions supported by CS-series and CJ-series PCs. Use together with the <i>Operation Manual (W393)</i> and <i>Programming Manual (W394)</i> to perform programming.
SYSMAC WS02-CXP□□-EV2 CX-Programmer Operation Manual	W361	Provides information on how to use the CX-Programmer, a Windows-based programming device, offline. Use together with the <i>Operation Manual (W393)</i> , <i>Programming Manual (W394)</i> , and <i>Instructions Reference Manual (W340)</i> to perform programming.
SYSMAC WS02-CXP□□-EV2 CX-Server User Manual	W362	Provides information on how to use the CX-Programmer, a Windows-based programming device, and CX-Net, a Windows-based network configuration tool, online.
SYSMAC CS/CJ-series C200H-PRO27-E, CQM1H-PRO01-E CQM1-PRO01-E Programming Consoles Operation Manual	W341-E1-□	Provides information on how to program and operate CS/CJ-series PCs using a Programming Console. Use together with the <i>Operation Manual (W393)</i> , <i>Programming Manual (W394)</i> , and <i>Instructions Reference Manual (W340)</i> to perform programming.
SYSMAC CS/CJ-series CS1W-SCB21/41, CS1W-SCU21 CJ1W-CSU41 Serial Communications Boards and Serial Communications Units Operation Manual	W336-E1-□	Describes the use of Serial Communications Units and Boards to perform serial communications with external devices, including the usage of standard system protocols for OMRON products.

About this Manual, Continued

This manual contains the following sections.

Section 1 introduces the overall structure of an FL-net (Ver. 2.00) network, outlines the features of the FL-net (Ver. 2.00) Unit, describes the communications protocols used by an FL-net (Ver. 2.00) network, and provides basic precautions for use of the network.

Section 2 describes the communications functions that can be used with the FL-net (Ver. 2.00) Units.

Section 3 explains the procedure for starting up the FL-net (Ver. 2.00) Unit, including mounting to the PLC, making the required settings, and checking communications.

Section 4 explains the System Setup and the words allocated in the CIO Area and the DM Area for FL-net (Ver. 2.00) Units.

Section 5 explains the Data Link function, including an overview and examples of how to make the required settings.

Section 6 describes the message transmission used by an FL-net (Ver. 2.00) network.

Section 7 provides information on communicating on FL-net Systems and interconnected networks using FINS commands. The information provided in the section deals only with FINS communications in reference to FL-net (Ver. 2.00) Units.

Section 8 describes the communications system, communications cycle time, communications cycle time calculation, data link I/O response time, data link I/O response time calculation, and message service transmission delays.

Section 9 describes functions that allow you to test communications.

Section 10 describes information and procedures that can be used to troubleshoot problems that sometimes occur with FL-net (Ver. 2.00) Unit and FL-net communications.

Section 11 describes the Support Tool used to make settings for the FL-net Units.



WARNING Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

PRECAUTIONS

This section provides general precautions for using the CS/CJ-series Programmable Controllers (PLCs) and related devices.

The information contained in this section is important for the safe and reliable application of Programmable Controllers. You must read this section and understand the information contained before attempting to set up or operate a PLC system.

1	Intended Audience	xiv
2	General Precautions	xiv
3	Safety Precautions	xiv
4	Operating Environment Precautions	xv
5	Application Precautions	xv
6	Conformance to EC Directives	xvii

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.


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 programming and operating the Unit. Be sure to read this manual before attempting to use the Unit and keep this manual close at hand for reference during operation.


 **WARNING** It is extremely important that a PLC and all PLC Units be 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 applying a PLC System to the above-mentioned applications.


3 Safety Precautions


 **WARNING** Do not attempt to take any Unit apart while the power is being supplied. Doing so may result in electric shock.

 **WARNING** Do not touch any of the terminals or terminal blocks while the power is being supplied. Doing so may result in electric shock.

 **WARNING** Do not attempt to disassemble, repair, or modify any Units. Any attempt to do so may result in malfunction, fire, or electric shock.

 **WARNING** Do not touch the Power Supply Unit while power is being supplied or immediately after power has been turned OFF. Doing so may result in electric shock.


 **Caution** Tighten the screws on the terminal block of the AC Power Supply Unit to the torque specified in the operation manual. The loose screws may result in burning or malfunction.

-  **Caution** Execute online edit only after confirming that no adverse effects will be caused by extending the cycle time. Otherwise, the input signals may not be readable.


4 Operating Environment Precautions

-  **Caution** Do not operate the control system in the following places:

- Locations subject to direct sunlight.
- Locations subject to temperatures or humidity 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.


-  **Caution** Take appropriate and sufficient countermeasures when installing systems in the following locations:

- Locations subject to static electricity or other forms of 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 PLC System can have a large effect on the longevity and reliability of the system. Improper operating environments can lead to malfunction, failure, and other unforeseeable problems with the PLC System. Be sure 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.


5 Application Precautions

Observe the following precautions when using the PLC System.

-  **WARNING** Always heed these precautions. Failure to abide by the following precautions could lead to serious or possibly fatal injury.

- Always connect to a ground of 100 Ω or less when installing the Units. Not connecting to a ground to a ground of 100 Ω or less may result in electric shock.
- A ground of 100 Ω or less must be installed when shorting the GR and LG terminals on the Power Supply Unit.
- Always turn OFF the power supply to the PLC before attempting any of the following. Not turning OFF the power supply may result in malfunction or electric shock.

- Mounting or dismounting I/O Units, CPU Units, Inner Boards, or any other Units.
- Assembling the Units.
- Setting DIP switches or rotary switches.
- Connecting cables or wiring the system.

 **Caution** Failure to abide by the following precautions could lead to faulty operation of the PLC or the system, or could damage the PLC or PLC Units. Always heed these precautions.

- 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.
- Interlock circuits, limit circuits, and similar safety measures in external circuits (i.e., not in the Programmable Controller) must be provided by the customer.
- Always use the power supply voltages specified in the operation manuals. An incorrect voltage may result in malfunction or burning.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied. Be particularly careful in places where the power supply is unstable. An incorrect power supply may result in malfunction.
- Install external breakers and take other safety measures against short-circuiting in external wiring. Insufficient safety measures against short-circuiting may result in burning.
- Be sure that all the mounting screws, terminal screws, and cable connector screws are tightened to the torque specified in the relevant manuals. Incorrect tightening torque may result in malfunction.
- Leave the label attached to the Unit when wiring. Removing the label may result in malfunction if foreign matter enters the Unit.
- Remove the label after the completion of wiring to ensure proper heat dissipation. Leaving the label attached may result in malfunction.
- Use crimp terminals for wiring. Do not connect bare stranded wires directly to terminals. Connection of bare stranded wires may result in burning.
- Wire all connections correctly.
- Double-check all wiring and switch settings before turning ON the power supply. Incorrect wiring may result in burning.
- Mount Units only after checking terminal blocks and connectors completely.
- Be sure that the terminal blocks, Memory Units, expansion cables, and other items with locking devices are properly locked into place. Improper locking may result in malfunction.
- Check the user program for proper execution before actually running it on the Unit. Not checking the program may result in an unexpected operation.
- Do not lay communications cables near power lines or high-voltage lines.
- Always lay communications cables in ducts.

- Do not pull on the communications cables or bend the communications cables beyond their natural limit. Doing either of these may break the cables.
- Do not place objects on top of the communications cables or other wiring lines. Doing so may break the cables.
- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static built-up. Not doing so may result in malfunction or damage.
- When transporting or storing Units, place them in special packing boxes and do not allow them to be subject to excessive shock or vibration during transportation.
- Confirm that no adverse effect will occur in the system before attempting any of the following. Not doing so may result in an unexpected operation.
 - Changing the operating mode of the PLC.
 - Force-setting/force-resetting any bit in memory.
 - Changing the present value of any word or any set value in memory.

6 Conformance to EC Directives

6-1 Applicable Directives

- EMC Directives
- Low Voltage Directive

6-2 Concepts

EMC Directives

OMRON devices that comply with EC Directives also conform to the related EMC standards so that they can be more easily built into other devices or the overall machine. The actual products have been checked for conformity to EMC standards (see the following note). Whether the products conform to the standards in the system used by the customer, however, must be checked by the customer.

EMC-related performance of the OMRON devices that comply with EC Directives will vary depending on the configuration, wiring, and other conditions of the equipment or control panel on which the OMRON devices are installed. The customer must, therefore, perform the final check to confirm that devices and the overall machine conform to EMC standards.

Note Conformance with the EMC (Electromagnetic Compatibility) standards for EMS (Electromagnetic Susceptibility) and EMI (Electromagnetic Interference) vary with the model in the way shown below.

FL-net (Ver. 2.00) Unit	EMS	EMI
CS1W-FLN02/12	EN61131-2	EN50081-2 (Radiated emission: 10-m regulations)

Low Voltage Directive

Always ensure that devices operating at voltages of 50 to 1,000 VAC and 75 to 1,500 VDC meet the required safety standards for the PLC (EN61131-2).

SECTION 1

Features and System Configuration

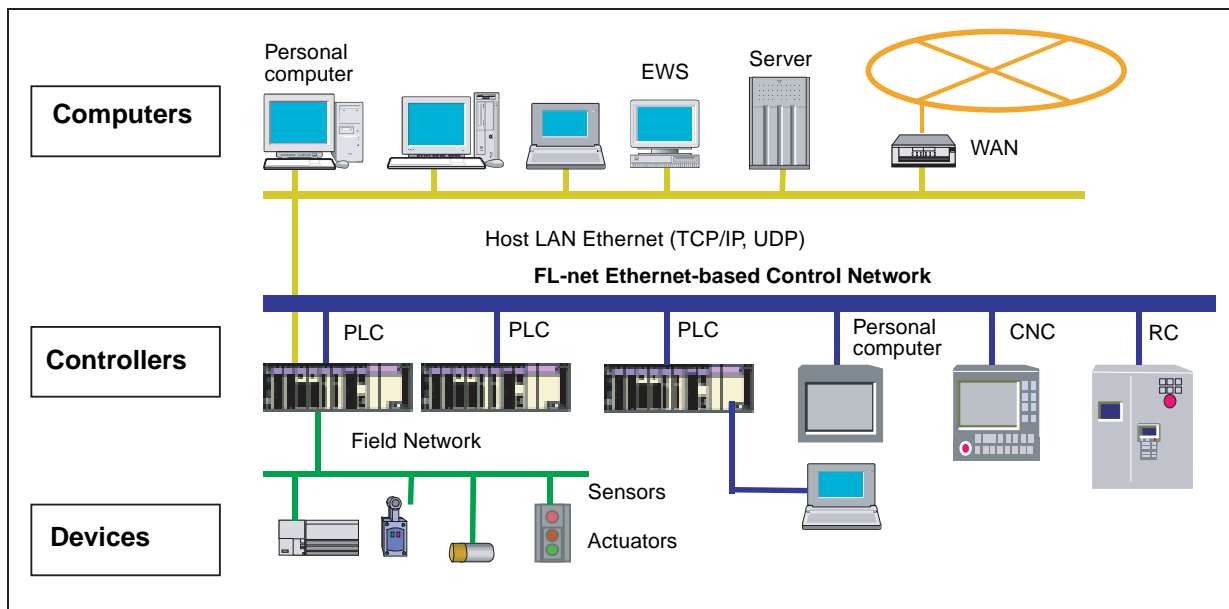
This section introduces the overall structure of an FL-net (Ver. 2.00) network, outlines the features of the FL-net (Ver. 2.00) Unit, describes the communications protocols used by an FL-net (Ver. 2.00) network, and provides basic precautions for use of the network.

1-1	FL-net Overview	2
1-2	System Configuration	6
1-2-1	Device Configuration	6
1-2-2	Node Connections.	7
1-3	Devices Required in a Network	7
1-3-1	10Base-5 FL-net (Ver. 2.00) Systems.	7
1-3-2	10Base-T FL-net (Ver. 2.00) Systems.	9
1-4	Related Programming Devices	10
1-5	Specifications	11
1-6	Precautions	13
1-6-1	Installation	13
1-6-2	Ethernet and IEEE802.3 Standards.	13

1-1 FL-net Overview

FL-net is an open FA network that was standardized by the Japan FA Open Systems Promotion Group (JOP) of the Manufacturing Science and Technology Center (MSTC) under the Ministry of International Trade and Industry (MITI). It has been established in the Japan Electrical Manufacturers standards (JEM 1479) and is becoming very popular.

FL-net enables personal computers and FA controllers, such as programmable controllers (PLCs) or computerized numeric controllers (CNCs), by different manufacturers to be interconnected, controlled, and monitored, as shown in the following diagram.



FL-net (Ver. 2.00) Positioning

FL-net (Ver. 2.00) Unit specifications have been designed to conform to Japan Electrical Manufacturers standards (JEM 1479: 2001). It cannot be connected to communications devices based on the previous standards (JEM 1479: 2000).

The most recent FL-net specifications can be downloaded from the home page of the Japan Electrical Manufacturers Association (<http://www.jema-net.or.jp/index.htm>).

The following table shows the relationship between these standards and the FL-net Units manufactured and sold by OMRON.

Unit name	Model	Applicable standards	Manufacture and sales
FL-net Unit	CS1W-FLN01 (See note 1.)	JEM 1479: 2000	Under the guidance of the JEMA, communications devices conforming to JEM 1479: 2000 specifications cannot be manufactured or sold after April, 2001.
FL-net (Ver. 2.00) Unit, 10Base-5	CS1W-FLN02 (See note 2.)	JEM 1479: 2001	Planned to be available from April, 2001, onwards.
FL-net (Ver. 2.00) Unit, 10Base-T	CS1W-FLN12 (See note 2.)	JEM 1479: 2001	Planned to be available from April, 2001, onwards.

- Note**
1. The CS1W-FLN01 FL-net Unit cannot be connected to a network based on CS1W-FLN02 or CS1W-FLN12 FL-net (Ver. 2.00) Units.
 2. CS1W-FLN02 or CS1W-FLN12 FL-net (Ver. 2.00) Units cannot be connected to a network based on the CS1W-FLN01 FL-net Unit.

FL-net Features

FL-net systems have the following features.

1. FL-net is an open system.
2. FL-net enables a multi-vendor network.
3. FL-net enables personal computers and FA controllers, such as programmable controllers (PLCs) or computerized numeric controllers (CNCs), by different manufacturers to be interconnected, controlled, and monitored.

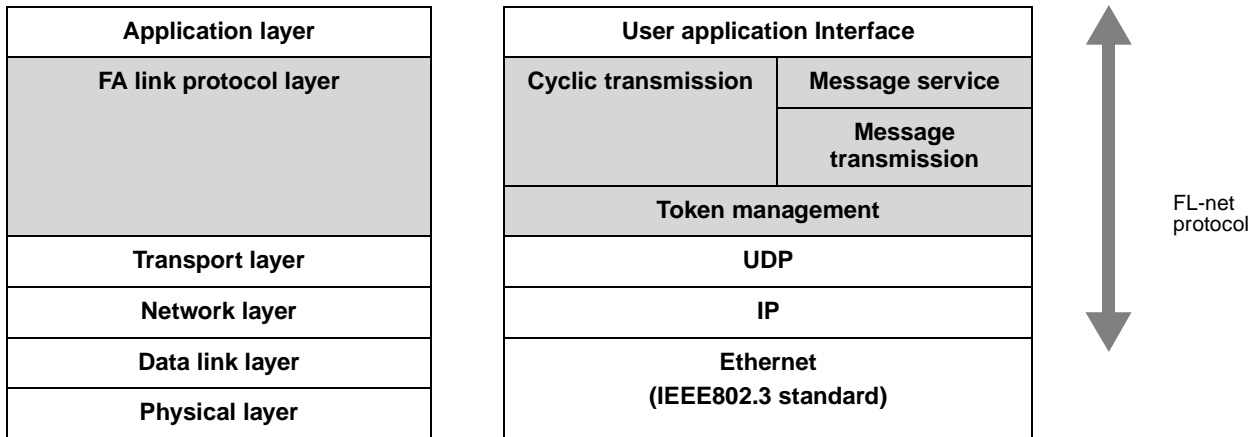


Figure 1 Basic Configuration of FL-net Protocol

Conforms to Widely Used Standards

Efficient communications can be achieved by this system based on Ethernet, which has become the standard particularly for OA devices, combined with standard UDP/IP. The use of Ethernet offers the following benefits.

1. Low cost
Configurations allowing the application of widely used communications devices reduces costs.
2. Compatible with existing network devices
Transceivers, hubs, cables, LAN cards for personal computers, and other network devices widely used for Ethernet can be used.
3. Higher speeds
Baud rates are expected to improve in the future, increasing to 10 Mbps, 100 Mbps, and 1 Gbps.
4. Optical communications
By using devices such as optical repeaters, which are widely used with Ethernet, optic fiber can be used for necessary components to enable long-distance transmission of over 500 m, improved noise resistance, and measures against lightning surge on outdoor wiring.

Supports Required Functions between FA Controllers

User-defined specifications allow the following range of features that are required for FA systems.

1. Large-scale network
Up to 254 devices (nodes) can be connected in the physical layer of the network.
2. Dual communications functions to suit application
The Common Memory function uses cyclic transmission so that each node can always share the same data with other nodes on the network. FL-net also supports message communications for use when handling only essential data is required.
3. Large-capacity Common Memory
The Common Memory is provided with a large capacity of 8 Kbits and 8 Kwords.
4. High-speed response
High-speed response time of 50 ms/32 nodes (for 2 Kbits and 2 Kwords) is provided.
The absence of a master in the FL-net network enables nodes to be added or removed readily without affecting any other nodes. This allows any node to be turned ON or OFF easily and facilitates maintenance.

FL-net FAQ

	Question	Answer
1	What is Ethernet?	Ethernet is a standard defining a type of cable. It is used in a local area network (LAN). An Ethernet network transmits data between computers at a baud rate of between 10 Mbps and 100 Mbps. Currently, the most commonly used Ethernet in offices and other OA systems is twisted-pair cable (UTP) that uses 10 Mbps. Ethernet communications are possible using software protocols provided by many vendors.
2	What is FL-net?	The FL-net is a network to which programmable controllers (PLCs), computerized numeric controllers (CNCs), and other FA controllers are connected, and on which control data is exchanged between controllers at high speed. FL-net uses the same cables that are used for Ethernet.
3	What is the difference between FL-net and Ethernet?	With Ethernet, the host computer, personal computers, and controllers are connected to the network for data exchange and control applications, such as executing production instructions and compiling results. The FL-net is used to connect controllers together and allow high-speed control data exchange. Be sure to connect cables properly when installing both Ethernet for communications with the host and FL-net for communications between controllers for the same controllers.
4	How are FL-net Units used?	FL-net Units are installed in FA controllers, such as programmable controllers (PLCs) and computerized numeric controllers (CNCs). By simply setting link allocations for the local node address (node number) and Common Memory (also called link registers), FL-net Units transmit data between controllers cyclically in the same way as CPU Link Units in standard PLCs. This method does not require special communications programs for the PLC and other Units on the network. Such programs are also not required by the PLC for operations conducted via the personal computer, including reading or writing data, such as the PLC memory or communications parameters. Separate programs are required for each controller, however, when transmitting data between controllers using message communications.
5	What does "protocol" mean and what protocols does FL-net support?	Protocol refers to rules for communications. The protocols supported by FL-net are UDP/IP and FA Link Protocol. (The FA Link Protocol is located in the layer above UDP/IP and is a special protocol for use on FL-net networks.)

	Question	Answer
6	Can FL-net be connected to a standard personal computer?	The FL-net Unit, which is mounted to FA controllers such as programmable controllers (PLCs) and computerized numeric controllers (CNCs), is an intelligent unit with a processor on its board. The Ethernet Card in the personal computer is a non-intelligent format called a “dumb board,” so its capacity depends on the performance and functions of the personal computer. Generally, an intelligent FL-net board is recommended.
7	What does “topology” mean?	Networking topology refers to the wiring formation of the network. The three main formations are star (or tree), bus, and ring. Rather than physical wiring formations, however, it is easier to understand them as theoretical formations. An FL-net system has star topology when using 10Base-T cables and bus topology when using 10Base-5 cables.
8	What type and length of network cables are used, and how many Units can be connected?	The most commonly used Ethernet cable standards and some of their characteristics and limitations are listed below. The figures in parentheses are applicable when repeaters are used. <ul style="list-style-type: none"> • 10Base-T: Twisted-pair cables (UTP), maximum transmission distance is 100 m (500 m) per segment, maximum number of Units is 254 per segment. • 10Base-5: Thick coaxial cables (yellow cables), maximum transmission distance is 500 m (2,500 m) per segment, and maximum number of Units that can be connected is 100 (254) per segment. • 10Base-FL: Optic fiber cable, maximum transmission distance is 2,000 m per segment, and maximum number of Units that can be connected is 254 per segment.
9	Do systems using FL-net require special Ethernet specifications?	No. FL-net systems are configured using Ethernet (conforming to the IEEE802.3 standard). Special specifications are not required.
10	How do you connect to FL-net?	Ethernet cables for different types of Ethernet media can be connected to each other using repeaters, media adapters, and other devices. These products are available from many vendors.
11	What type of cables should be used when configuring an FL-net system?	In general, use the following cables. <ul style="list-style-type: none"> • Basic wiring: 10Base-5 Thick coaxial cables; yellow cables. • In the control panel and in offices: 10Base-T twisted-pair cables; UTP category 5. • High-voltage wiring and noise-prone environments: 10Base-FL optic-fiber cables.
12	How is the FL-net IP address set?	The FL-net IP address is set as follows: Network address: 192.168.250 Host number (node number): 1 to 254 is standard. Nodes 250 to 254, however, are reserved for maintenance devices.
13	How compatible and inter-connectable are devices that support FL-net?	FL-net has a certification system whereby compatibility and inter-connectivity tests are performed. Certification documents are provided for those devices that pass the tests, so devices supporting FL-net can be used safely on the network.

OMRON FL-net (Ver. 2.00) Unit Features

FINS Message Communications

The FL-net (Ver. 2.00) Unit also supports FINS message communications, OMRON’s standard communications service, so other OMRON PLCs can be accessed by using SEND(090), RECV(098), and CMND(490) instructions in ladder programs. In addition, the FINS gateway function can be used to allow access to other PLCs on not only the same FL-net (Ver. 2.00) network but also on other networks such as Ethernet or Controller Link.

24-VDC Power Supply for Transceiver

For the CS1W-FLN02 (10Base-5), a 24-VDC power supply can be used as the power supply for the transceiver. The voltage output provides for a voltage

drop in the transceiver cables, so there is no need to adjust the power supply voltage.

Controller Link Network Connection

Ethernet, the information-system network, can be connected to Controller Link, the control-system network, using the FINS communications service. This allows a PLC on the Ethernet or Controller Link network to be monitored from an OMRON PLC on the FL-net (Ver. 2.00) network, and, conversely, for data to be exchanged between a PLC on the Ethernet or Controller Link network and an OMRON PLC on the FL-net (Ver. 2.00) network.

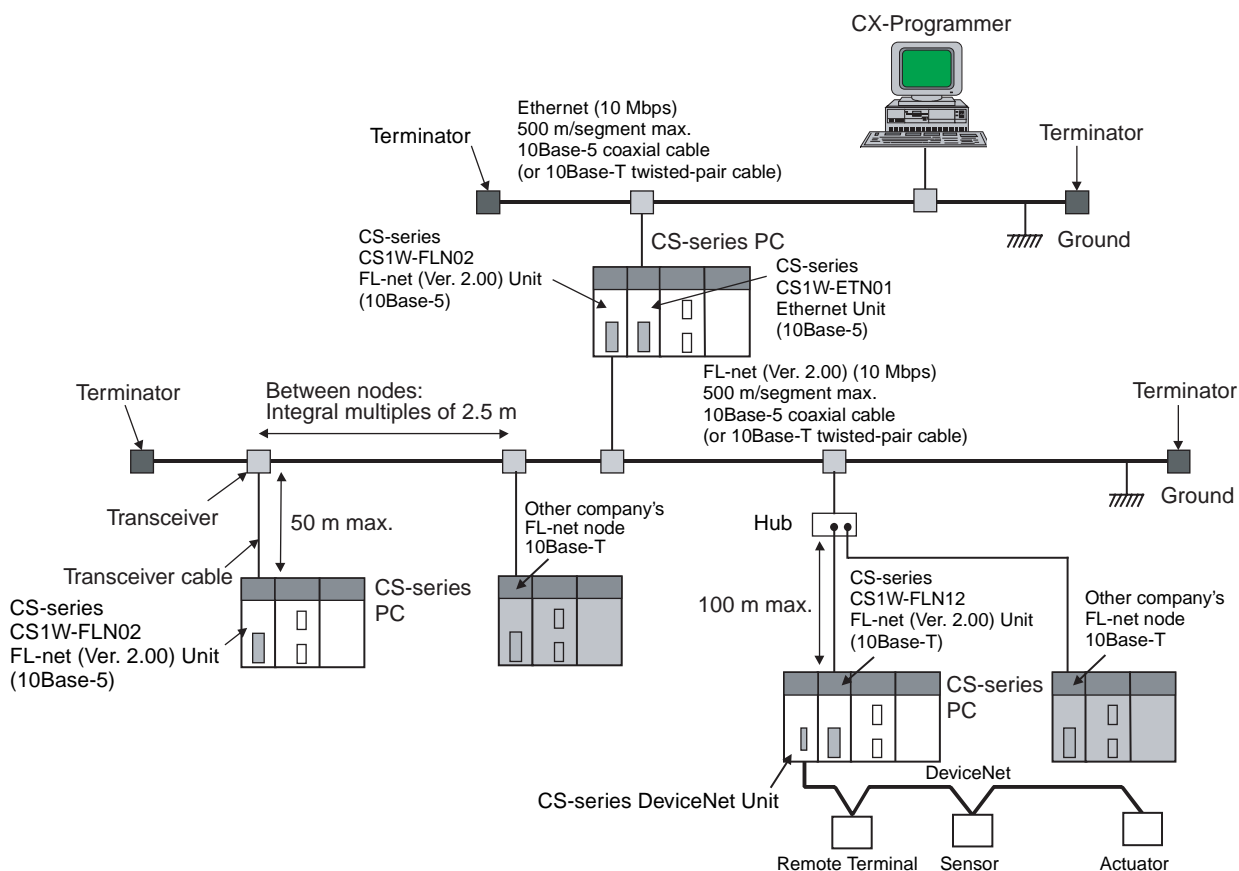
Abundant Troubleshooting Functions

The Ethernet Unit is provided with a variety of troubleshooting functions for prompt recovery in case of errors.

- Self-diagnostic function at startup
- PING command for checking other nodes
- Inter-nodal tests for checking other nodes
- Error log for recording error history data

1-2 System Configuration

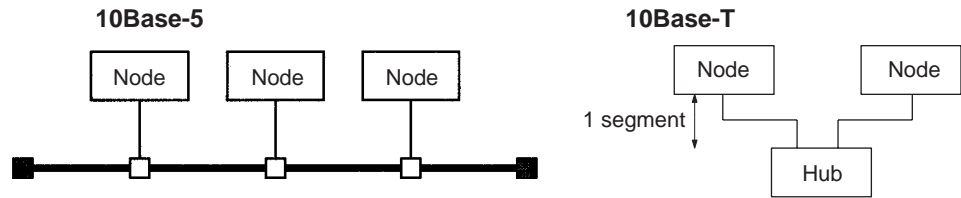
1-2-1 Device Configuration



- Note**
1. Transmission distance (from Terminator to Terminator): 500 meters/segment max.
 2. When segments are indirectly connected by a repeater: 2.5 km/network
 3. Node interval (from transceiver to transceiver): Integral multiples of 2.5 m
 4. Transceiver cable length: 50 m max.

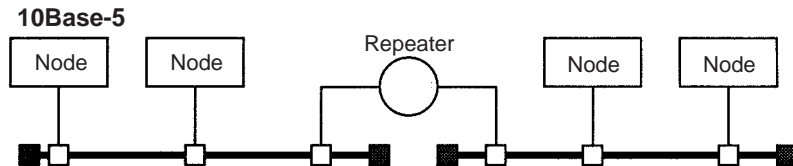
1-2-2 Node Connections

Minimal Configuration: 1 Segment



Configuration With Segment Extension

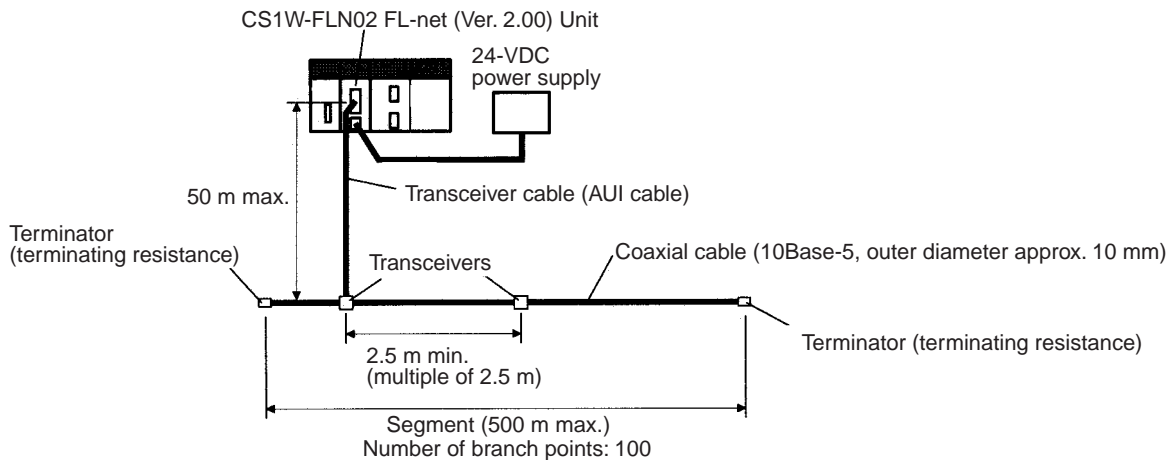
Use repeaters to extend the distance between nodes or to increase the number of connected nodes.



1-3 Devices Required in a Network

1-3-1 10Base-5 FL-net (Ver. 2.00) Systems

The basic configuration of a 10Base-5 FL-net (Ver. 2.00) System consists of a single coaxial cable together with the transceivers, transceiver cables, nodes, and so on, that are connected to it. This basic configuration is called a “segment.”

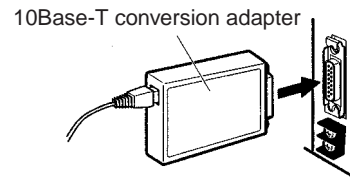


The devices shown in the following table must be obtained to configure a network using a 10Base-5 CS1WFLN02 FL-net (Ver. 2.00) Unit, so prepare them

in advance. Use only devices in the network that conform to IEEE802.3 standards.

Network device	Contents
CS-series FL-net (Ver. 2.00) Unit (CS1W-FLN02)	The 10Base-5 FL-net (Ver. 2.00) Unit is a Communications Unit that connects a CS-series PLC to a 10Base-5 FL-net (Ver. 2.00) network.
24-VDC power supply	This is an external 24-VDC power supply for the purpose of providing power to the transceivers via transceiver cable. Use a power supply with an output current of at least 0.3 A per node. The power is converted within the Unit to the transceiver power supply voltage, and is provided to the transceiver.
Transceiver	The transceiver is a device for interfacing between the coaxial cable and the nodes. Note: The FL-net (Ver. 2.00) Unit can provide a maximum current of 0.4 A to the transceiver, so use a transceiver with a current consumption of not more than 0.4 A. Check with the manufacturer for information regarding transceiver current consumption.
Transceiver cable (AUI cable)	This is the cable for connecting between transceivers and nodes.
Coaxial cable	The coaxial cable comprises the main line of the FL-net (Ver. 2.00) System.
Terminator for coaxial cable (terminating resistance)	The Terminators connect to both ends of the coaxial cable.

- Note**
1. It is also possible to use 10Base-T twisted-pair cable by connecting the FL-net (Ver. 2.00) Unit to a 10Base-T conversion adapter.
 2. A 24-VDC power supply is required even if a 10Base-T conversion adapter is used.



Recommended Transceivers, Cables, and Power Supply

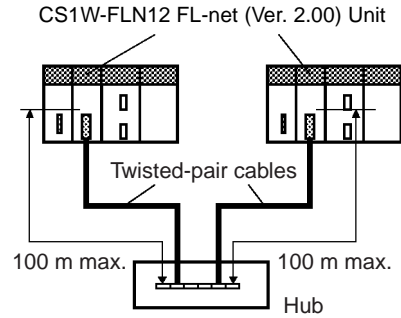
The following table shows the recommended transceivers, transceiver cable (AUI cable), and 24-V DC power supply.

Device	Maker	Model
Transceiver	Hirakawa Hewtech Corp.	MTX-210TZ
	Mitsubishi Cable Industries, Ltd.	ET-10081
Transceiver cable	Mitsubishi Cable Industries, Ltd.	Transceiver cable (molded type)
Power supply 24 V DC)	OMRON	S82J Series

The products recommended here have been checked for use with the FL-net (Ver. 2.00) Unit. The operating environment must conform to the individual product specifications.

1-3-2 10Base-T FL-net (Ver. 2.00) Systems

The basic configuration of a 10Base-T FL-net (Ver. 2.00) System consists of one hub to which nodes are attached in star form through twisted-pair cable.



The devices shown in the following table must be obtained to configure a network using a 10Base-T FL-net (Ver. 2.00) Unit, so prepare them in advance.

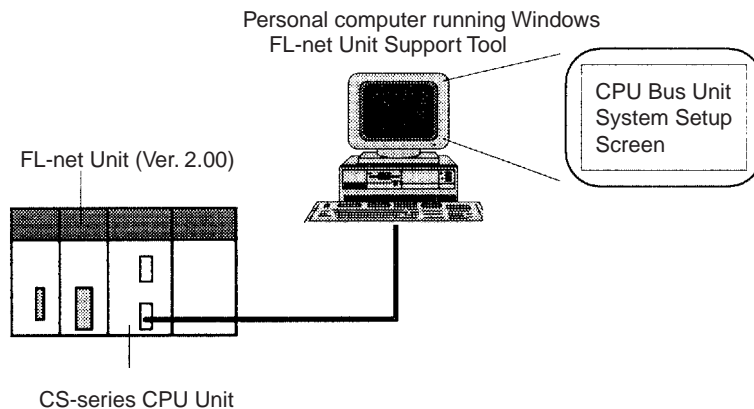
Network device	Contents
CS-series FL-net (Ver. 2.00) Unit (CS1W-FLN12)	The 10Base-T FL-net (Ver. 2.00) Units are Communications Units that connect CS-series PLCs to FL-net (Ver. 2.00) networks.
Twisted-pair cable	A twisted-pair cable that connects the 10Base-T FL-net (Ver. 2.00) Unit to the hub. The twisted-pair cable must have an RJ45 Modular Connector attached to each end. Use a category 3, 4, or 5 UTP (unshielded twisted-pair) cable.
Hub	A relay devices that connect multiple nodes in as star LAN.

Recommended Hub

Manufacturer	Model number	Specifications
Allied Telesis	RH509E	9-port hub
	MR820TLX	9-port hub with 10Base-5 backbone port

1-4 Related Programming Devices

The FL-net (Ver. 2.00) Unit functions as a node on the FL-net (Ver. 2.00) network. The basic settings for operation are made in the CPU Bus Unit System Setup in the CS-series CPU Unit. Use the FL-net Unit Support Tool (Ver. 1.51 or later) to make the settings.



The following items are included in the System Setup.

Screen	Item	Default
Setup Screen	FA Link mapping table storage method	PLC built-in method
	FA Link startup method	Automatic participation method
	Message protocol check	Yes
	Broadcast setting	***.***.***.255
	IP address setting method	192.168.250.node number
	Subnetwork mask	255.155.155.0
	Local node setting area	Not set.
	Other node setting area	Not set.

When using the default values that are already stored in the CS-series CPU Unit, there is no need to make any settings with the FL-net Unit Support Tool. Refer to 4-2 CPU Bus Unit System Setup for details on the above settings.

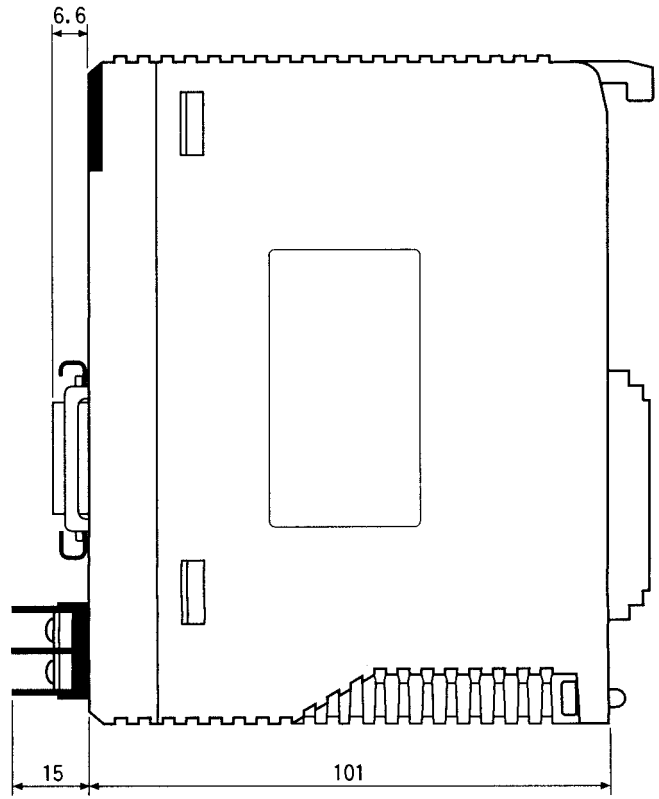
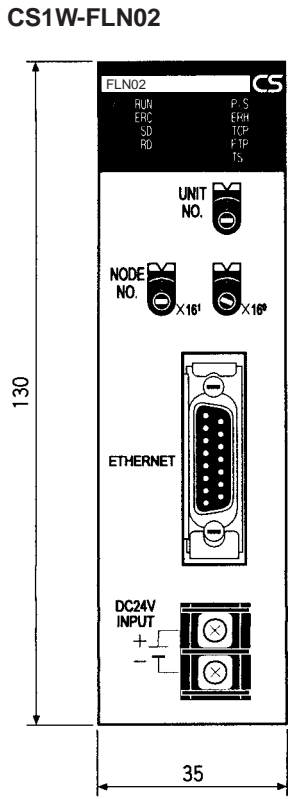
1-5 Specifications

CS-series FL-net (Ver. 2.00) Units

Item		Specifications		
Model number		CS1W-FLN02	CS1W-FLN12	
Type		10Base-5	10Base-T	
Applicable PLCs		CS-series PLCs		
Unit classification		CS-series CPU Bus Unit		
Mounting location		CPU Rack or Expansion Rack		
Number of Units that can be mounted		4 max. (including Expansion Racks)		
Transfer specifications	Media access method	CSMA/CD		
	Modulation	Baseband		
	Transmission paths	Bus	Star	
	Baud rate	10 Mbps		
	Transmission media	Coaxial cable	Unshielded twisted-pair (UTP) cable	
	Transmission distance	Segment length	500 m max.	100 m max.
		Distance between nodes	2,500 m max.	---
	Number of connectable nodes	100/segment max.	---	
	Distance between nodes	Multiples of 2.5 m	---	
	Transceiver cable length	50 m max.	---	
Current consumption (Unit)	400 mA max. at 5 VDC	400 mA max. at 5 VDC		
External power supply	Capacity: 0.3 A min. at 24 VDC (per node) Inrush current: 2.5 A max. (24-VDC startup time of 5 ms) Permissible voltage fluctuation range: 20.4 to 26.4 VDC (24 VDC -15% to +10%) Recommended power supply: OMRON S82J-series	---		
Power supply to transceiver	Capacity: 0.4 A at 12 V Voltage fluctuation range: 13.05 to 14.48 VDC Ripple: 2% p-p	---		
Vibration resistance	Conforms to JIS 0040. 10 to 57 Hz, 0.075-mm amplitude, 57 to 150 Hz, acceleration: 9.8 m/s ² in X, Y, and Z directions for 80 minutes each (Time coefficient; 8 minutes × coefficient factor 10 = total time 80 minutes)			
Shock resistance	Conforms to JIS 0041. 147 m/s ² three times each in X, Y, and Z directions			
Ambient temperature	Operating: 0 to 55°C Storage: -20 to 75°C			
Humidity	10% to 90% (with no condensation)			
Atmosphere	Must be free from corrosive gas.			
Weight	300 g max.			
Dimensions	35 x 130 x 101 mm (W x H x D)			

Dimensions

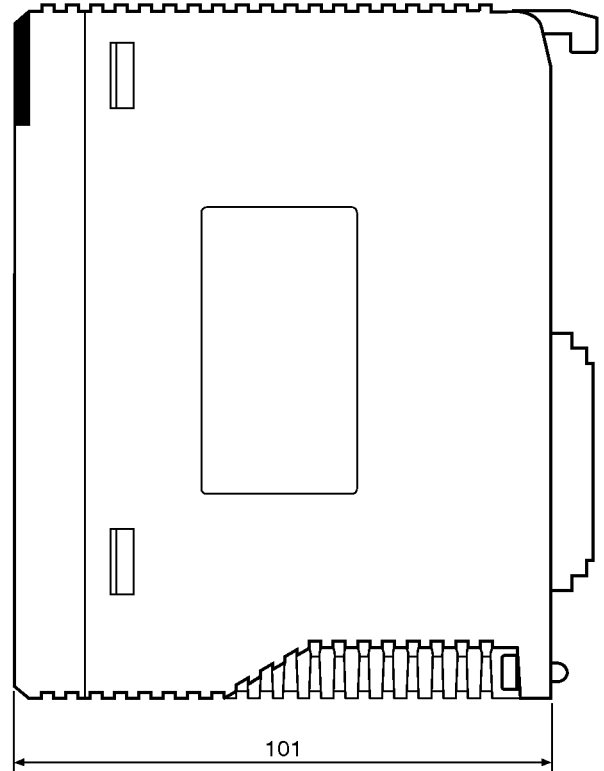
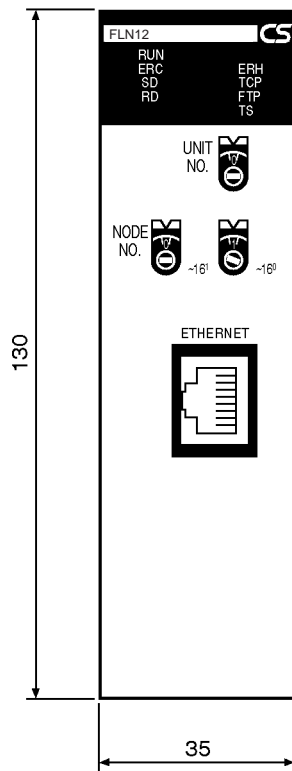
CS1W-FLN02



(16.5 including cover)

(Unit: mm)

CS1W-FLN12



(Unit: mm)

1-6 Precautions

Be sure to observe the following precautions when installing and using an FL-net (Ver. 2.00) Unit.

1-6-1 Installation

Observe the following precautions when installing an FL-net (Ver. 2.00) Unit.

- 1,2,3...**
1. Use transceiver cable that meets IEEE802.3 standards to ensure high noise resistance.
 2. Use a transceiver with a current consumption of not more than 0.4 A per port.
 3. Always turn off the power supply to the PLC before connecting or disconnecting the transceiver cable.
 4. Be sure not to exceed the current capacity of the Power Supply Unit on the Rack to which the FL-net (Ver. 2.00) Unit is mounted. The current consumption of the CS-series FL-net (Ver. 2.00) Unit is 400 mA maximum. This value added to the current consumption of all other Units mounted to the same Rack must not exceed the capacity of the Power Supply Unit.
 5. Do not install the transceiver cables or coaxial cables of the network near power supply lines. If installation near possible sources of noise is unavoidable, install the cables in grounded metal ducts or take other measure to eliminate noise interference.

1-6-2 Ethernet and IEEE802.3 Standards

The FL-net (Ver. 2.00) Unit was designed based on Version-2.0 Ethernet standards and not on the international IEEE802.3 standards, which were developed based on Ethernet specifications. Although these two sets of standards are similar, they are not necessarily the same. Particularly, different frame formats are used, making direct communications impossible between systems that do not support the same standards. Standards for equipment used to configure networks are the same, allowing IEEE802.3-standard equipment to be used with the FL-net (Ver. 2.00) Unit. In particular, the transceiver cable for the IEEE802.3 standards provides superior noise resistance and should be used for the FL-net (Ver. 2.00) Unit.

Terminology also differs between Version-2.0 Ethernet and IEEE802.3 standards. These differences are shown in the following table. Version-2.0 Ethernet terminology is used in this manual.

Ethernet	IEEE802.3
Transceiver	MAU
Transceiver cable	AUI
Ethernet address	MAC address
Ethernet	10Base-5/10Base-T

SECTION 2

Communications Functions

This section describes the communications functions that can be used with the FL-net (Ver. 2.00) Units.

2-1	FL-net (Ver. 2.00)	16
2-2	Cyclic Transmission	21
2-3	Message Transmission	22
2-4	FINS Communications Service.	22

2-1 FL-net (Ver. 2.00)

FL-net (Ver. 2.00) Concept

FL-net (Ver. 2.00) is an Ethernet-based FA control network.

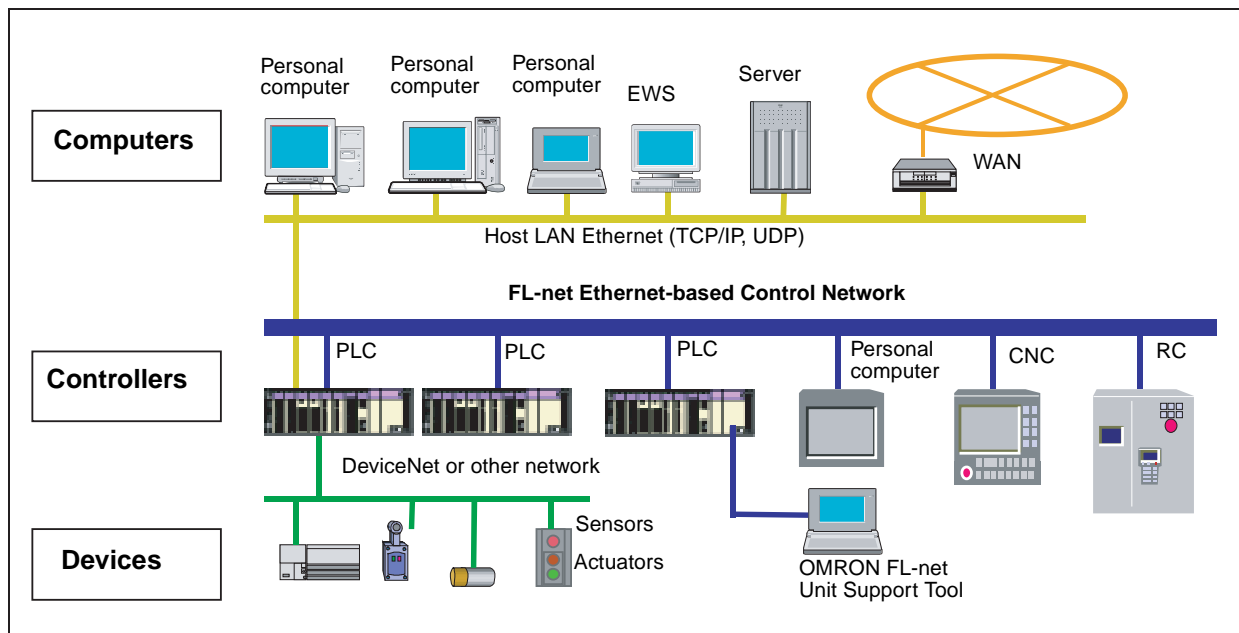
FL-net (Ver. 2.00) supports both cyclic transmission and message transmission functions.

The basic concepts of FL-net (Ver. 2.00) are as follows:

- 1,2,3...
1. To use Ethernet as the medium for communications between FA controllers.
 2. To offer UDP/IP, which are widely used protocols in Ethernet communications, as the basic means for data communications.
 3. To manage and control access of each node in the network to the communications media (to avoid collisions) and to ensure transmission within a fixed time period, while using the above-mentioned basic means for data communications.

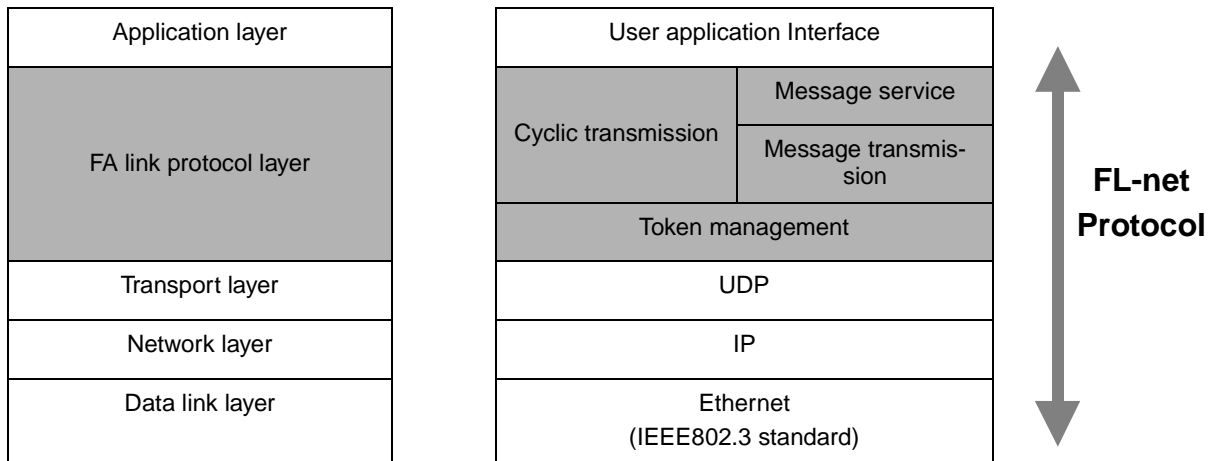
FL-net (Ver. 2.00) is an FA control network enabling the exchange of data between control devices in manufacturing systems, such as programmable controllers (PLCs), robot controllers (RCs), and computerized numeric controllers (CNCs), and personal computers used for controlling them.

The following diagram shows the location of devices in an FL-net system.



FL-net (Ver. 2.00) Protocol

FL-net (Ver. 2.00) consists of six protocol layers, as shown in the following diagram.



Note The transport and network layers use UDP/IP, whereas Ethernet is used as the protocol for the data link and physical layers.

FL-net (Ver. 2.00) Transmission Features

FL-net (Ver. 2.00)'s FA link protocol layer is characterized by the following features.

- 1,2,3...**
1. Collisions are avoided by transmission control that uses the token method that does not use a master.
 2. The refresh cycle time can be regulated by fixing the cycle time of the token.
 3. The designated token is transmitted together with cyclic data.
 4. The token is transmitted first by the node that has the smallest number at startup.
 5. When no token is transmitted in a specified period of time, the next node in the token rotation order sends a new token.
 6. This token method prevents the network from stopping when there is a failure of only some of the nodes.
 7. The information management tables provide useful information, such as operation mode (RUN/STOP) and hardware malfunctions (ALARM), that can be referenced to monitor the operating status of other nodes.

FL-net (Ver. 2.00) IP Addresses

Unique class-C IP addresses must be assigned to each node in the FL-net (Ver. 2.00) network.

An IP address is an address identifying each node (station) for transmission using IP (internet protocol). Therefore, IP addresses must be set and managed so that no two nodes have the same IP address. FL-net (Ver. 2.00) uses Class-C IP addresses. The default IP address for FL-net (Ver. 2.00) is 192.168.250.***, with *** representing the remote node number.

FL-net (Ver. 2.00) IP address

Network address	Host number (node number)
192.168.250	n (n: 1 to 254)

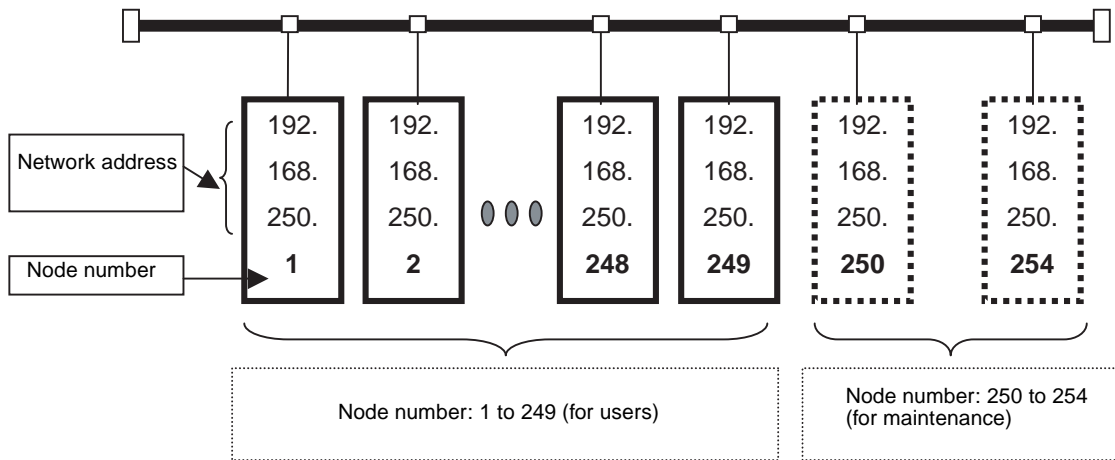
Number of Connectable Nodes and Node Numbers

Up to 254 nodes can be connected to an FL-net network. Each node is assigned a node number from 1 to 254.

Node number	Applications
1 to 249	Used for standard FL-net (Ver. 2.00) devices.
250 to 254	Used for FL-net (Ver. 2.00) maintenance purposes.
255	Reserved for internal system use. (See notes 1 and 2.)
0	Reserved for internal system use. (See note 1.)

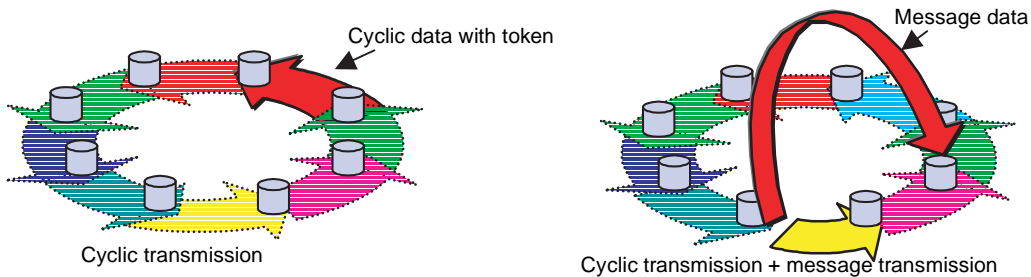
- Note**
1. Not available to users.
 2. Used for broadcasting.

FL-net (Ver. 2.00)



Data Communications

FL-net (Ver. 2.00) supports data communications by cyclic transmission and message transmission.

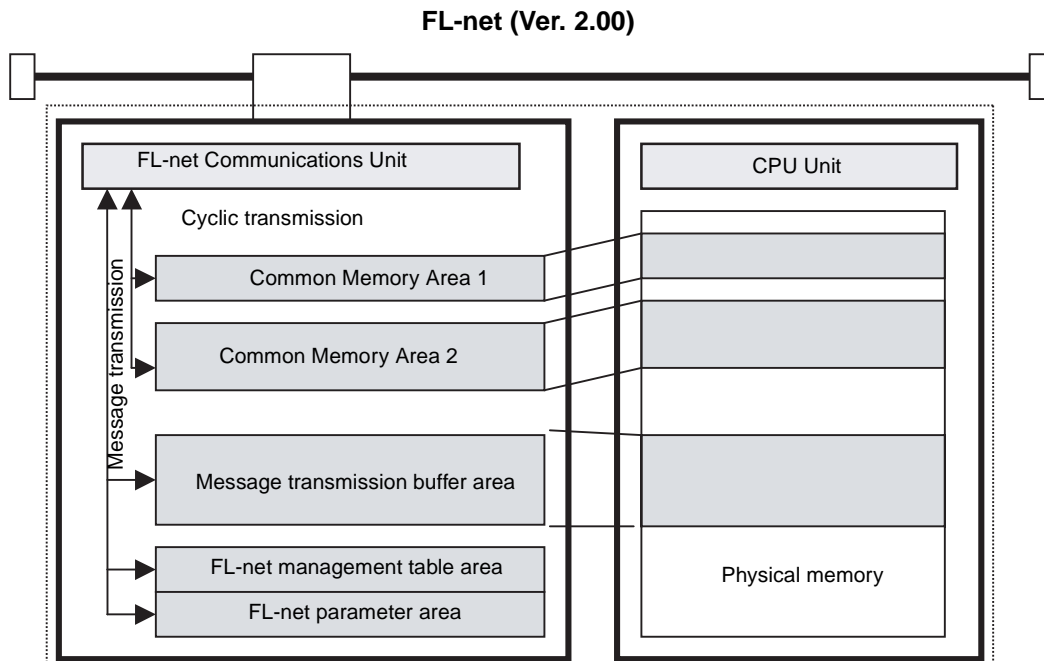


Transmission Cycle

With cyclic communications, the Common Memory is refreshed on a fixed cycle time. Message communications are controlled so that the Common Memory refresh time does not exceed the allowable refresh cycle time.

Each node constantly monitors the message communications frames that travel through the network from the time it receives one local-node-directed token until it receives the next local-node-directed token. When no message communications frame travels through the network in a single cycle, 120% of the cycle time value becomes the allowable refresh cycle time. In this way the allowable refresh cycle time is actively determined according to the number of nodes in the network.

Data Areas and Memory



Communications Management Tables

Node status is managed using three types of management tables: Local node management tables, participating node management tables, and network management

Local Node Management Table

The local node management table manages the local node settings.

Item	Bytes	Contents (data range)
Node number	1 byte	1 to 249
Common Memory Area 1 first word	2 bytes	Word address (0 to 0xff)
Common Memory Area 1 data size	2 bytes	Size (0 to 0x200)
Common Memory Area 2 first word	2 bytes	Word address (0 to 0x2000)
Common Memory Area 2 data size	2 bytes	Size (0 to 0x200)
Upper layer status	2 bytes	RUN/STOP /ALARM/WARNING/NORMAL
Token monitoring time	1 byte	Unit: 1 ms
Minimum allowable frame interval	1 byte	Unit: 100 μs
Vendor code	10 bytes	Vendor code
Manufacturer model	10 bytes	Manufacturer model, device name
Node name (equipment name)	10 bytes	User-defined node name
Protocol version	1 byte	0x80 (fixed)
FA link status	1 byte	Participating, not participating, etc.
Local node status	1 byte	Duplicate node number detection, etc.

Note "0x0012ab" refers to hexadecimal 0012AB.

Participating Node Management Table

The participating node management table manages information on the nodes in the network.

Item	Bytes	Contents (data range)
Node number	1 byte	1 to 254
Upper layer status	2 bytes	RUN/STOP /ALARM/WARNING/NORMAL
Common Memory Area 1 data first word	2 bytes	Word address (0 to 0x1ff)
Common Memory Area 1 data size	2 bytes	Size (0 to 0x200)
Common Memory Area 2 data first word	2 bytes	Word address (0 to 0x1fff)
Common Memory Area 2 data size	2 bytes	Size (0 to 0x2000)
Minimum allowable refresh cycle time	2 bytes	Unit: 1 ms
Token monitoring time	1 byte	Unit: 1 ms
Minimum allowable frame interval	1 byte	Unit: 100 ms
Link status	1 byte	Participating, not participating, etc.

Note "0x0012ab" refers to hexadecimal 0012AB.

Network Management Table

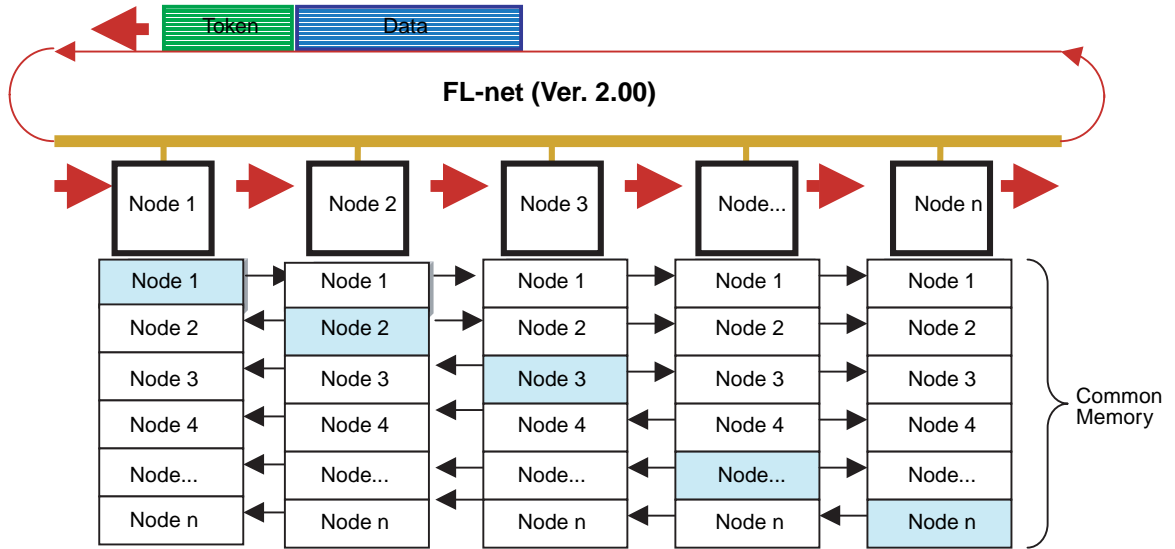
The network management table manages information that is shared by all nodes on the network.

Item	Bytes	Contents (data range)
Token holding node number	1 byte	Node currently holding the token
Minimum allowable frame interval	1 byte	Unit: 100 μs
Allowable refresh cycle time	2 bytes	Unit: 1 ms
Refresh cycle measurement value (current)	2 bytes	Unit: 1 ms
Refresh cycle measurement value (maximum)	2 bytes	Unit: 1 ms
Refresh cycle measurement value (minimum)	2 bytes	Unit: 1 ms

2-2 Cyclic Transmission

Cyclic transmission is used to transmit cyclic data.

The data is shared by each node through the Common Memory (shared memory) function.

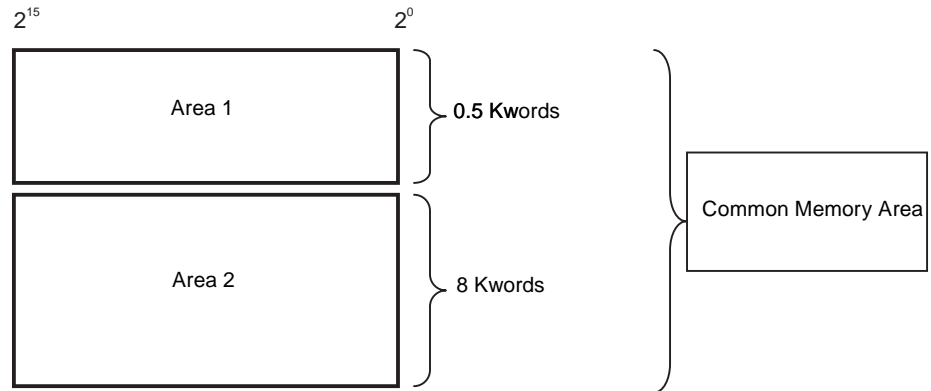


Note Cyclic transmission allows PLCs made by OMRON to communicate with PLCs made by other companies.

Volume of Transmission Data

An area of 0.5 Kwords + 8 Kwords = 8.5 Kwords is provided for the whole network.

The maximum quantity of data that can be transmitted by a single node is 8.5 Kwords. One word is equal to two bytes.

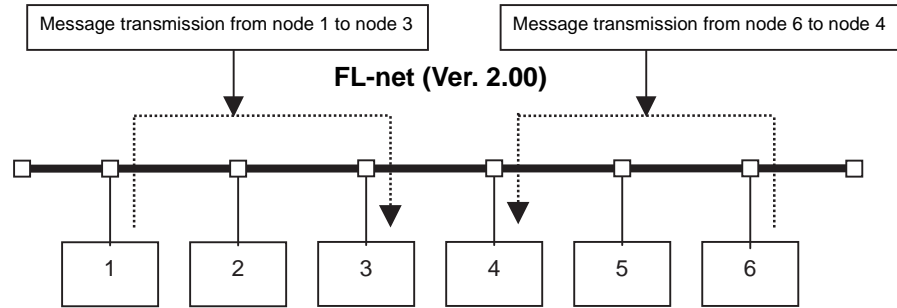


Note With an FL-net Unit, the maximum amount of data that can be transmitted for each node is 512 words for Area 1 and 7,677 words for Area 2 with a total of 7,677 words for the combined size of Areas 1 and 2.

2-3 Message Transmission

Message transmission is used to transmit non-cyclic data.

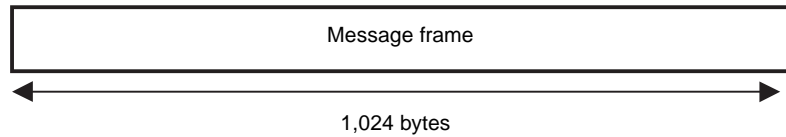
Normally, when a send request is generated, data is transmitted to a specific node.



- Note**
1. Message transmission allows OMRON PLCs to communicate with other manufacturer's PLCs.
 2. Message transmission is performed between OMRON PLCs by executing the SEND(090), RECV(098), and CMND(490) instructions.
 3. Message transmission is performed between OMRON PLCs and other manufacturer's PLCs by executing the CMND(490) instruction.

Message Transmissions

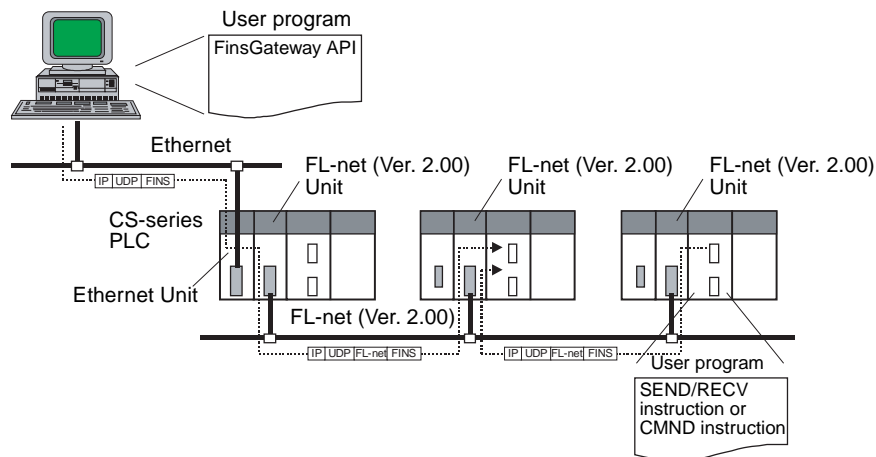
The maximum size of one message frame is 1,024 bytes (not including the header).



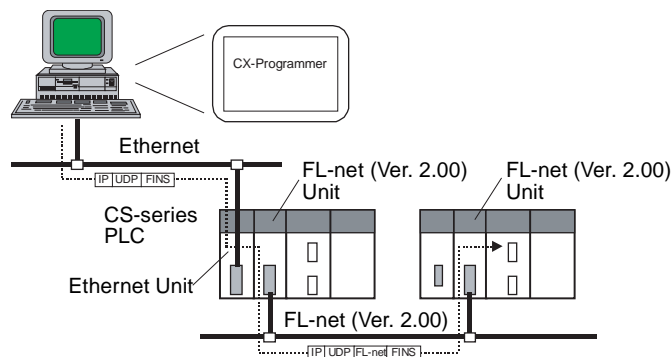
2-4 FINS Communications Service

FINS commands or data can be sent to or received from other manufacturer's PLCs on the same FL-net (Ver. 2.00) network by executing SEND(090), RECV(098), or CMND(490) instructions in the user's ladder diagram program in the CPU Unit. This enables control operations such as the reading and writing of I/O memory between PLCs, mode changes, and file memory operations. (When a FINS message is sent on an Ethernet network, a UDP/IP header is automatically added to the message.)

The FINS gateway function allows access not only to OMRON PLCs on the same FL-net (Ver. 2.00) network, but also to PLCs on other networks such as SYSMAC LINK or Controller Link.



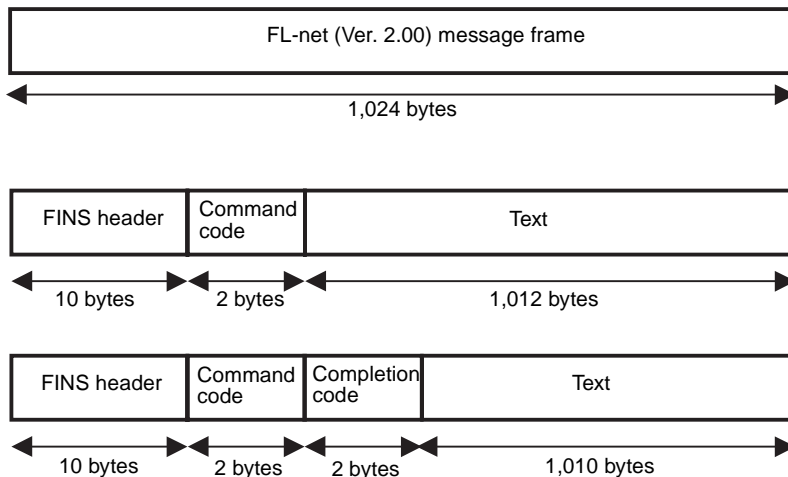
The FINS communications service allows PLC Programming Devices like the CX-Programmer to be used with a remote PLC.



- Note**
1. The FINS communications service can send messages between OMRON PLCs.
 2. It cannot send messages to other manufacturer's PLCs.

Message Data Length

The FL-net (Ver. 2.00) Unit creates FINS communications messages through FL-net (Ver.2.00) message transmission. Maximum length for a FINS communications message is 1,024 bytes (including the FINS header and text).



SECTION 3

Startup Procedure

This section explains the procedure for starting up the FL-net (Ver. 2.00) Unit, including mounting to the PLC, making the required settings, and checking communications.

3-1	Before Operation	26
3-2	Initial Setup	27
3-3	Nomenclature and Functions	28
3-4	Hardware Setup	30
3-5	Mounting to the PLC	33
3-6	Network Installation	34
3-7	Connecting to the Network	44
3-7-1	Connecting the Cable	45
3-7-2	Connecting the Power Supply (CS1W-FLN02 Only)	47
3-8	Creating an I/O Table	49
3-8-1	I/O Table Overview	49
3-8-2	Connecting Programming Devices to the PLC	49
3-8-3	Procedure for Creating an I/O Table	50
3-9	Creating Routing Tables	50
3-9-1	Routing Table Overview	51
3-9-2	Connecting and Using a Peripheral Device for the PLC	52
3-10	System Setup	55
3-10-1	When Settings are Required	55
3-10-2	Using the FL-net Unit Support Tool (for OMRON FL-net Units Only)	55
3-10-3	CPU Bus Unit System Setup Defaults	55
3-11	Checking Communications	55
3-11-1	PING Command and Internode Testing	56
3-11-2	PING Command	56
3-11-3	Internode Test	56

3-1 Before Operation

Precautions

Observe the following precautions when installing and using an FL-net (Ver. 2.00) Unit.

Installation Precautions

Observe the following precautions when installing an FL-net (Ver. 2.00) Unit.

- Make sure that all of the nodes in the network support FL-net version 2.00. Connection will not be possible with FL-net version 1.00.
- Use a transceiver cable that complies with the IEEE802.3 standards to ensure high noise resistance.
- Use a transceiver with a current consumption of not more than 0.4 A per port.
- Always turn OFF the power supply to the PLC before connecting or disconnecting the transceiver cable.
- The current consumption of the FL-net Unit is 400 mA maximum. Make sure that the total current consumption of all Units mounted to the PLC is mounted does not exceed the capacity of the Power Supply Unit.
- Do not lay the coaxial cables and transceiver cables of the network near power lines. If installation near possible noise sources is unavoidable, be sure to take adequate measures against noise interference, such as installing cables in metal ducts.

Restrictions on Number of Data Link Nodes

The maximum number of data link nodes that can be used with the FL-net (Ver. 2.00) Unit is 96 when links are stored in the CPU Unit, and 128 when links are stored in the FL-net (Ver. 2.00) Unit.

Restrictions on Data Link Capacity for Each Node

In the Data Link Area for each FL-net (Ver. 2.00) Unit node up to 512 words can be allocated in Area 1 and up to 7,677 words can be allocated in Area 2. The total number of words that can be allocated in Areas 1 and 2 combined is 7,677 words.

Restrictions on Data Link Data Synchronicity

Synchronicity of data within each node is assured, but synchronicity of data between all nodes is not assured. If a communications packet is corrupted for some reason, the data prior to the packet being sent will be retained. When four consecutive token holding timeouts are detected, the respective node in the Status Area will leave the network and then rejoin, but the PLC data will be held in its previous state.

Restrictions on Message Transmissions

When sending messages to other manufacturer's FL-net units, set the message procedure confirmation setting to no confirmation.

Mounting FL-net (Ver. 2.00) Units

- Up to four FL-net (Ver. 2.00) Units can be mounted to a single PLC.
- The current consumption of the FL-net (Ver. 2.00) Unit is 400 mA maximum. (The power supply to the transceiver is not included; it is supplied by the 24-VDC power supply connected to the power supply terminals on the Unit.)
Make sure that the total current consumption of all Units mounted to the CPU Backplane or Expansion Backplane to which the FL-net (Ver. 2.00) Unit is mounted does not exceed the capacity of the Power Supply Unit.
- When other CPU Bus Units are mounted at the same time as the FL-net (Ver. 2.00) Unit, make sure that the combined total number of words allocated in the CPU Bus Unit System Setup for each CPU Bus Unit does not exceed the capacity of the System Setup of the CS-series CPU Unit (approximately 5 Kwords = 10,752 bytes).

The size of the CS-series CPU Unit's System Setup Area in an FL-net (Ver. 2.00) system depends on the operating conditions.

Allocated Size when Remote Node Allocation Data is Stored in CPU Unit

Size = $32 + 10 \times$ Number of remote nodes set (96 nodes max.)
Maximum size: 992 bytes (per Unit)

Allocated Size when Remote Node Allocation Data is Stored in FL-net (Ver. 2.00) Unit

Size = 32 (Number of remote nodes set: 128 nodes max.)
Maximum size: 32 bytes (per Unit)
When the allocation data for remote nodes is stored in the FL-net (Ver. 2.00) Unit, the CPU Unit System Setup size is 32 bytes per Unit regardless of the number of remote nodes set.

3-2 Initial Setup

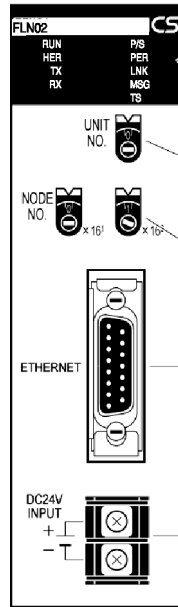
Item	Procedure	References
Set the unit number.	Set a unique number for the Unit so it can operate as a CPU Bus Unit.	3-4 <i>Hardware Setup</i>
Set the IP Address (node address).	Set the IP address either by the hardware method or software method (using the Support Tool). Select the setting method in the System Setup.	3-4 <i>Hardware Setup</i> 4-2 <i>CPU Bus Unit System Setup</i>
Mount the Unit to the Backplane.	Mount the Unit to the Backplane.	3-5 <i>Mounting to the PLC</i>
Connect to the network.	Connect the Unit to the network using the transceiver cable.	3-7 <i>Connecting to the Network</i>
Connect to the 24-VDC power supply.	Connect a 24-VDC external power supply to the power supply terminals on the front of the Unit.	3-7 <i>Connecting to the Network</i>
Turn ON the CPU Unit.	Turn ON the power supply to the CS-series CPU Unit.	---
Create I/O tables.	Register the FL-net (Ver. 2.00) Unit in the CPU Unit using the CX-Programmer.	3-8 <i>Creating an I/O Table</i>
Create routing tables.	Always create routing tables for using message communications when multiple CPU Bus Units are mounted to the same PLC.	3-9 <i>Creating Routing Tables</i>
System Setup	Set the operating parameters for the FL-net (Ver. 2.00) Unit using the FL-net Unit Support Tool.	SECTION 11 <i>FL-net Unit Support Tool</i>
Restart the Unit.	Restart the Unit (turn ON the power again) so that the data in the System Setup can be read.	---

3-3 Nomenclature and Functions

This section explains FL-net (Ver. 2.00) Unit part names, settings, and LED indicators.

Part Names

CS1W-FLN02, 10Base-5 (Front)



LED Indicators (page 29)
Display the operating status of the Unit.

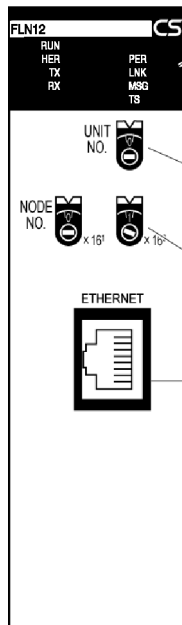
Unit Number Switch (page 30)
Sets the unit number in one digit hexadecimal.

Node Number Switches (page 31)
Set the Unit's FINS node number in two digits hexadecimal.

Ethernet Connector (page 44)
Connects the Ethernet transceiver cable.

Power Supply Terminals (page 47)
Connects the external power supply (24 V DC) for the transceiver.

CS1W-FLN12, 10Base-T (Front)



LED Indicators (page 29)
Display the operating status of the Unit.

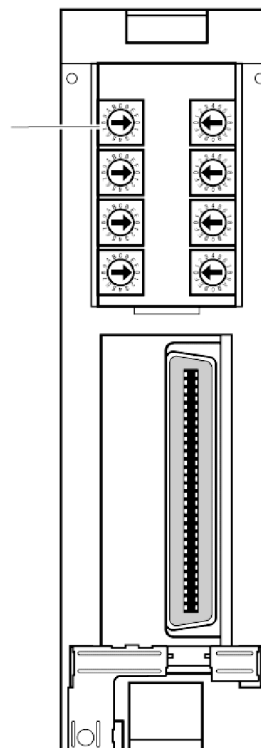
Unit Number Switch (page 30)
Sets the unit number in one digit hexadecimal.

Node Number Switches (page 31)
Set the Unit's FINS node number in two digits hexadecimal.

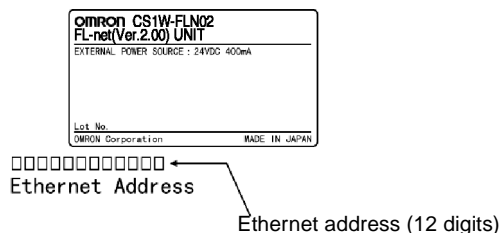
Ethernet Connector (page 44)
Connects the Ethernet twisted-pair cable.

CS1W-FLN02/12 (Back)

Local IP Address Setting Switches
 Set the Unit's IP address in 16 digits hexadecimal.
 For details refer to Section 3-4.



Individual Ethernet addresses are assigned to all communications devices connected to an Ethernet system. With the FL-net (Ver. 2.00) Unit, the Ethernet address is shown in 12 digits, hexadecimal, on the right side of the Unit.



Note The Ethernet address can also be checked by means of the FINS command CONTROLLER DATA READ (page 109).

LED Indicators

The following table shows the meanings of the LED indicator status.

CS1W-FLN02 (10Base-5)

CS1W-FLN12 (10Base-T)

FLN02		CS
RUN	■	P/S
HER	■	PER
TX	■	LNK
RX	■	MSG
		TS

FLN12		CS
RUN	■	
HER	■	PER
TX	■	LNK
RX	■	MSG
		TS

Indicator	Name	Color	Display	Operating status
RUN	RUN	Green	Not lit.	Operation stopped. Unit hardware error.
			Lit.	Normal operation.

Indicator	Name	Color	Display	Operating status
P/S (See note.)	External Power Supply	Green	Not lit.	Not supplying 24-V power to power supply terminals.
			Lit.	Supplying 24-V power to power supply terminals.
HER	Unit Error	Red	Not lit.	Unit normal.
			Lit.	Hardware error in Unit or EEPROM error. Communications cable error (at Unit start-up).
			Flashing.	IP address setting error. Node address setting error. Node number duplication. Disabled because connected to FL-net (Ver. 1.00) network.
PER	CPU Unit Error	Red	Not lit.	CPU Unit normal.
			Lit.	CPU Unit error. I/O table error, system setup data error, or routing table error. Unit number setting error
TX	Sending Data	Yellow	Not lit.	Not sending data. (Ready to send.)
			Lit.	Sending data.
RX	Receiving Data	Yellow	Not lit.	Not receiving data. (Ready to receive.)
			Lit.	Receiving data.
LNK	Servicing FA Link	Yellow	Not lit.	Not connected to FA Link Network.
			Lit.	Connected to FA Link Network.
MSG	Transferring messages	Yellow	Not lit.	Not transferring messages.
			Lit.	Transferring messages.
TS	Internode Testing	Yellow	Not lit.	Not running internode test.
			Lit.	Running internode test.

Note CS1W-FLN02 only.

3-4 Hardware Setup

This section explains how to set the various switches on the FL-net (Ver. 2.00) Unit.

Setting the Unit Number

The unit number is used to identify individual CPU Bus Units when more than one CPU Bus Unit is mounted to the same PLC. Use a small screwdriver to make the setting, taking care not to damage the rotary switch. The unit number is factory-set to 0.



Setting range
0 to F

- Note**
1. Turn OFF the power supply before setting the unit number.
 2. If the unit number is being set for the first time or changed, then an I/O table must be created for the PLC.

■ Unit Number and CPU Bus Unit Allocations

With CS-series PLCs, words are automatically allocated in the CIO Area and the DM Area according to the unit numbers that are set. The FL-net (Ver. 2.00) Unit uses these words for receiving control data from the CPU Unit and for notifying the CPU Unit of FL-net (Ver. 2.00) Unit and communications sta-

tus. The word addresses in the allocated areas for the CPU Bus Unit are important in creating the user program for using the FL-net (Ver. 2.00) Unit, so be careful to take them into account when setting the unit number.

The following table shows the areas allocated for the CPU Bus Unit by unit number. This table only shows the correspondences between unit numbers and the words allocated for the CPU Bus Unit. For details, refer to *SECTION 4 System Setup and Memory Allocations*.

Words Allocated in CIO Area

Unit No. (decimal)	Allocated words	Unit No. (decimal)	Allocated words
0 (0)	CIO 1500 to CIO 1524	8 (8)	CIO 1700 to CIO 1724
1 (1)	CIO 1525 to CIO 1549	9 (9)	CIO 1725 to CIO 1749
2 (2)	CIO 1550 to CIO 1574	A (10)	CIO 1750 to CIO 1774
3 (3)	CIO 1575 to CIO 1599	B (11)	CIO 1775 to CIO 1799
4 (4)	CIO 1600 to CIO 1624	C (12)	CIO 1800 to CIO 1824
5 (5)	CIO 1625 to CIO 1649	D (13)	CIO 1825 to CIO 1849
6 (6)	CIO 1650 to CIO 1674	E (14)	CIO 1850 to CIO 1874
7 (7)	CIO 1675 to CIO 1699	F (15)	CIO 1875 to CIO 1899

Words Allocated in DM Area

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 (15)	D31400 to D31499
7 (7)	D30700 to D30799	F (16)	D31500 to D31599

Setting the Node Number

Set the node number, which is the least significant digit of the FL-net (Ver. 2.00) Unit's IP address. Use the Node Number Switches to set the node number to a hexadecimal number from 01 and F9 (1 to 249 decimal). Do not set a number that has already been set for another FL-net (Ver. 2.00) Unit on the same network.



The left switch sets the leftmost digit (most significant digit) and the right switch sets the rightmost digit (least significant digit). The node number is factory-set to 01.

If the System Setup is selected as the IP address setting method in the System Setup, the rotary switch settings are not used. To set the rotary switch values for the node number, the value must be set between 01 and F9 hexadecimal. If values outside the specified range are set, the HER indicator will flash.

Note Turn OFF the power supply before setting the node number.

■ Relationship between Node Numbers and IP Addresses

OMRON FL-net (Ver. 2.00) Units are provided with four methods for setting IP addresses. The setting method is selected in the CPU Bus Unit System Setup allocated in the CPU Unit.

For details on setting methods, refer to *4-2 CPU Bus Unit System Setup*.

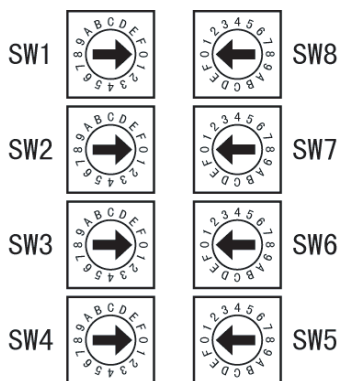
Be sure to read and understand all of the following information for each setting method before setting the IP addresses.

IP address setting method	Node number setting method	Details
192.168.250 + node number	Rotary switches on front of Unit (Node Number Switches)	This is the default FL-net network address. The node number is set using the rotary switches on the front of the Unit.
Rotary switches on back of Unit.	Rotary switches SW7 and SW8 on back of Unit	The entire IP address is set using the rotary switches on the back of the Unit. The node number cannot be changed by altering the settings of the rotary switches on the front of the Unit. Use this method when the IP address that was set when the Unit was installed does not require changing.
Rotary switch on back of Unit + node number	Rotary switches on front of Unit (Node Number Switches)	The network address is set using the rotary switches on the back of the Unit and the node number is set using the rotary switches on the front of the Unit. Use this method when not using the default network address. (Rotary switches SW7 and SW8 on the back of the Unit are not used.)
System Setup	Fourth octet of IP address (rightmost eight bits of the IP address)	The IP address can be set when writing the System Setup data using the FL-net Unit Support Tool. The values set on the rotary switches on the front and back of the Unit are ignored. Use this method when frequently changing IP addresses after installing the FL-net (Ver. 2.00) Unit, or when the FL-net (Ver. 2.00) Unit is not easily accessible.

Note After changing IP addresses or other settings with any of these setting methods, restart the FL-net (Ver. 2.00) Unit.

Setting the Local IP Address

The nodes on an FL-net (Ver. 2.00) network are identified by IP addresses. Each IP address is set with 32 bits of binary data. These 32 bits are divided into four 8-bit fields called octets, and the address is expressed as four decimal numbers separated by dots. At the FL-net (Ver. 2.00) Unit, four bits are expressed as a hexadecimal digit, and the eight hexadecimal rotary switches (the Local IP Address Switches) on the back of the Unit are used to set the local IP address. Set the eight switches in hexadecimal as shown below, combining SW1 and SW2, SW3 and SW4, SW5 and SW6, and SW7 and SW8. Each switch can be set from 0 to F



Setting range
0 to F

SW No. _____

Local IP Address . . .

The switches are all factory-set to 0 (00.00.00.00). The FL-net (Ver. 2.00) Unit cannot be used with this setting; a proper IP address must be set. The following settings cannot be made for the IP address, or the HER indicator will flash.

All bits in the network number field set to 0 or 1.

All bits in the host number field set to 0 or 1.

All bits in the subnet number field set to 1.

The beginning of the IP address set to 127 (7F Hex)

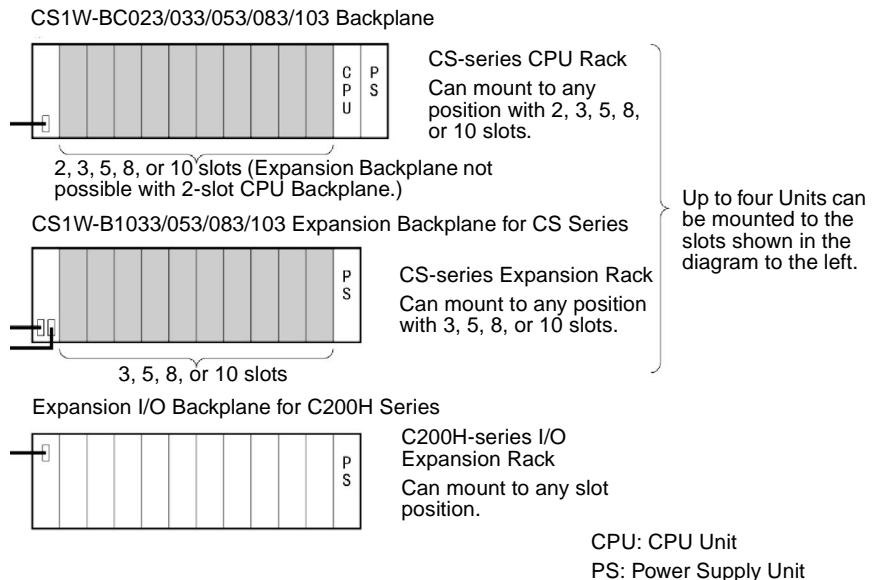
Example: 127.35.21.16

Note If a subnet mask is to be set, use the Support Tool to set it in the CPU Bus Unit Setup Area. For details, refer to *SECTION 11 FL-net Unit Support Tool*.

3-5 Mounting to the PLC

FL-net (Ver. 2.00) Units can be mounted to any slots in either a CS-series CPU Rack or a CS-series Expansion Rack, but the number of slots to which they can be mounted depends on the Backplane. Up to four FL-net (Ver. 2.00) Units can be mounted to a single PLC. If an FL-net (Ver. 2.00) Unit is mounted in combination with other CPU Bus Units (e.g., Controller Link Units), the maximum total number of CPU Bus Units that can be mounted is 16.

Note PLC Backplane mounting screws to a torque of 1.2 N·m, and the Unit's mounting screws to a torque of 0.8 N·m.



- Note**
- The current consumption of the CS1W-FLN02 or CS1W-FLN12 FL-net (Ver. 2.00) Unit is 400 mA maximum (not including the power supply to the transceiver, which is supplied by the 24-VDC power supply connected to the power supply terminals).
 Make sure that the total current consumption of all Units mounted to the CPU Rack or Expansion Rack to which the FL-net (Ver. 2.00) Unit is mounted does not exceed the capacity of the Power Supply Unit.
 - When other CPU Bus Units are mounted to the same PLC as the FL-net (Ver. 2.00) Unit, make sure that the total number of words allocated in the CPU Bus Unit System Setup of all CPU Bus Units does not exceed the capacity of the CS-series CPU Unit System Setup (approximately 5 Kwords = 10,752 bytes). When more than one FL-net (Ver. 2.00) Unit with 50 or more nodes registered are mounted to the same PLC, set the system to store settings in the FL-net (Ver. 2.00) Units.

3-6 Network Installation

Basic Installation Precautions

- Take the greatest care when installing the Ethernet System, being sure to follow ISO 8802-3 specifications. You must obtain a copy of these specifications and be sure you understand them before attempting to install an Ethernet System. Unless you are already experienced in installing communications systems, we strongly recommend that you employ a professional to install your system.
- Do not install Ethernet equipment near sources of noise. If noise-prone environments are unavoidable, be sure to take adequate measures against noise interference, such as installing network components in grounded metal cases, using optical links in the system, etc. Further information on measures that can be taken against noise is given later in this section.

Recommended Products

The following products are recommended for use with the FL-net (Ver. 2.00) Unit.

CS1W-FLN02 (10Base-5)

Part	Company	Model
Transceiver	Hirakawa Hewtech Corp.	MTX-210TZ
	Mitsubishi Cable Industries, Ltd.	ET-10081
Transceiver cable	Mitsubishi Cable Industries, Ltd.	Transceiver cables (molded type)
24-VDC Power Supply	OMRON	S82J Series

CS1W-FLN12 (10Base-T)

Part	Maker	Model number	Specifications
Hub	Allied Telesis	RH509E	9-port hub
		MR820TLX	9-port hub with 10Base-5 backbone port
Twisted-pair cable	---	---	Category 3, 4, or 5 UTP (unshielded twisted-pair) cable

CS1W-FLN02 (10Base-5) Precautions

Coaxial Cable Installation Precautions

Basic Precautions

- As a rule, always lay coaxial cables indoors. Laying coaxial cables outdoors requires special measures that should be performed only by a professional. If coaxial cable must be used outdoors, request the work from a professional.
- Attach a terminator to each end of the coaxial cable.
- Cover all exposed metal portions of the coaxial cable except ground points with protective covers or PVC tape to prevent contact with grounds or other metal objects.
- Ground the external shield of the coaxial cable to 100 W or less using AWG 14 wire (cross-sectional area of 2 mm²) or better and a ground cable length of 20 m or less. Ground each segment of the network at one location only. Do not use the same ground for other equipment.
- The physical properties (e.g., minimum bending radius) of coaxial cable vary with the manufacturer. Follow all recommendations and specifications of the manufacturer.

Environmental Precautions

- Do not install coaxial cables together with power cables.
- Do not install coaxial cable near sources of noise.
- Do not install coaxial cable in environments subject to excessive dirt, dust, oil mist, etc.
- Do not install coaxial cable in environments subject to high temperatures or high humidity.

Terminator Installation Precautions

Basic Precautions

- You must attach a Terminator to each end of the coaxial cable for communications to be possible.
- Insulate Terminators when attaching them to be sure they do not come into contact with metal objects.

Transceiver Installation Precautions**Basic Precautions**

- Transceivers can be attached to coaxial cables only at intervals of 2.5 m. These locations should be marked on the cable.
- Connection methods can vary with the manufacturer of the cable. Follow all recommendations and specifications of the manufacturer.
- Mount the transceiver onto an insulating object, such as a wooden board.
- Ground the transceiver through the shield of the transceiver cable and through the FL-net (Ver. 2.00) Unit.

Environmental Precautions

- Do not install transceivers near sources of noise.
- Do not install coaxial cable in environments subject to excessive dirt, dust, oil mist, etc.
- Do not install coaxial cable in environments subject to high temperatures or high humidity.

Transceiver Cable Installation Precautions**Basic Precautions**

- Make sure that the transceiver cable is firmly and completely connected to both the transceiver and the FL-net (Ver. 2.00) Unit. Be sure that the slide latches are engaged.

Environmental Precautions

- Do not install transceiver cables together with power cables.
- Do not install transceiver cable near sources of noise.
- Do not install transceiver cable in environments subject to high temperatures or high humidity.

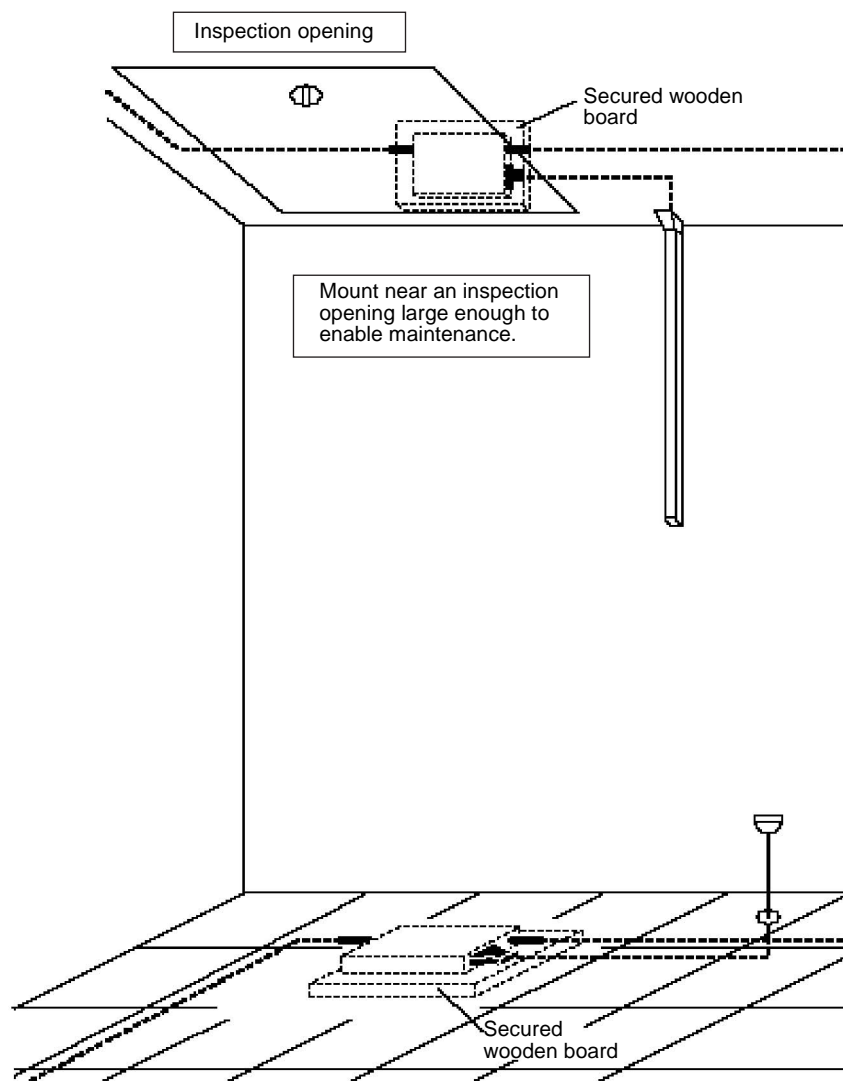
Grounding

- Ground all devices requiring grounding to 100 W or less using AWG 14 wire (cross-sectional area of 2 mm²) or better and a ground cable length of 20 m or less. Electrical shock can occur between ungrounded devices in the system. The lack of proper grounds can also corrupt data.
- Use one safety ground on each segment of the network.
- Inductive voltages can be generated due to lightning surges when coaxial cable is installed outdoors, requiring special measures. Request outdoor installation from a professional.

Transceiver Installation Examples

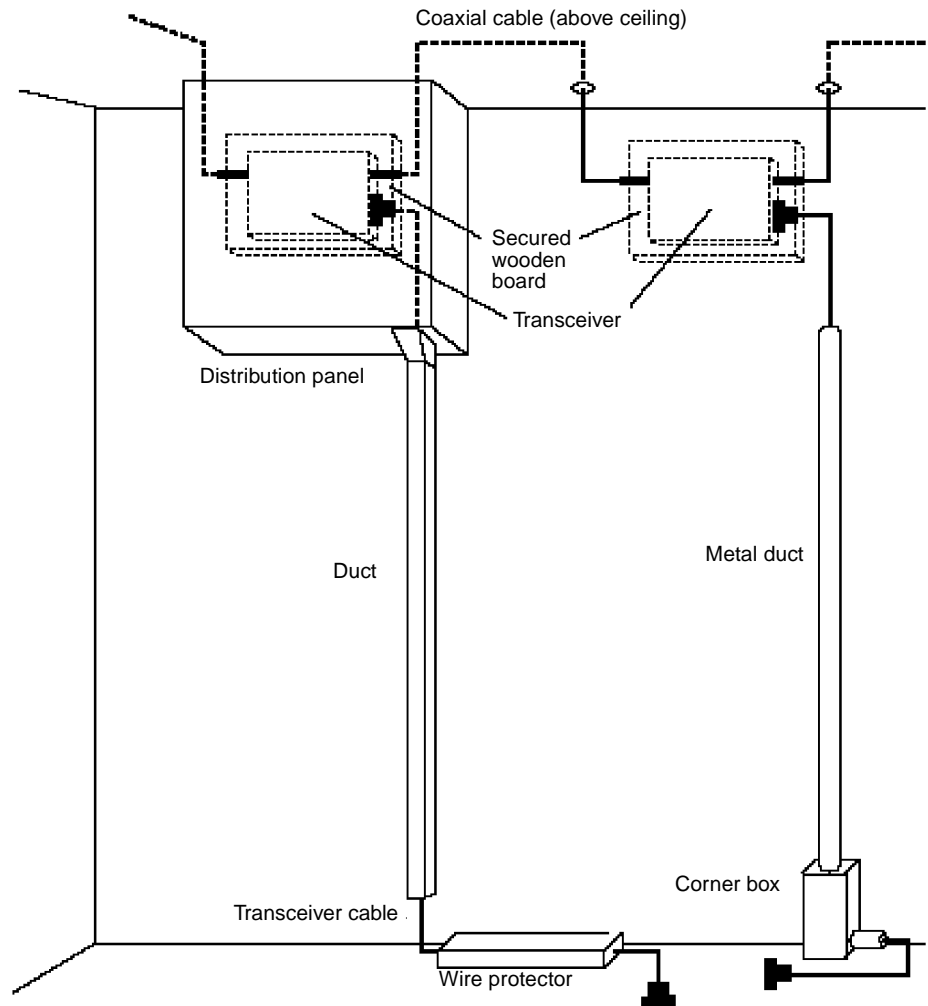
The following illustrations show examples of installing transceivers in the ceiling and under the floor.

Ceiling and Floor Installation



Free-access Floor Installation

Ceiling Installation

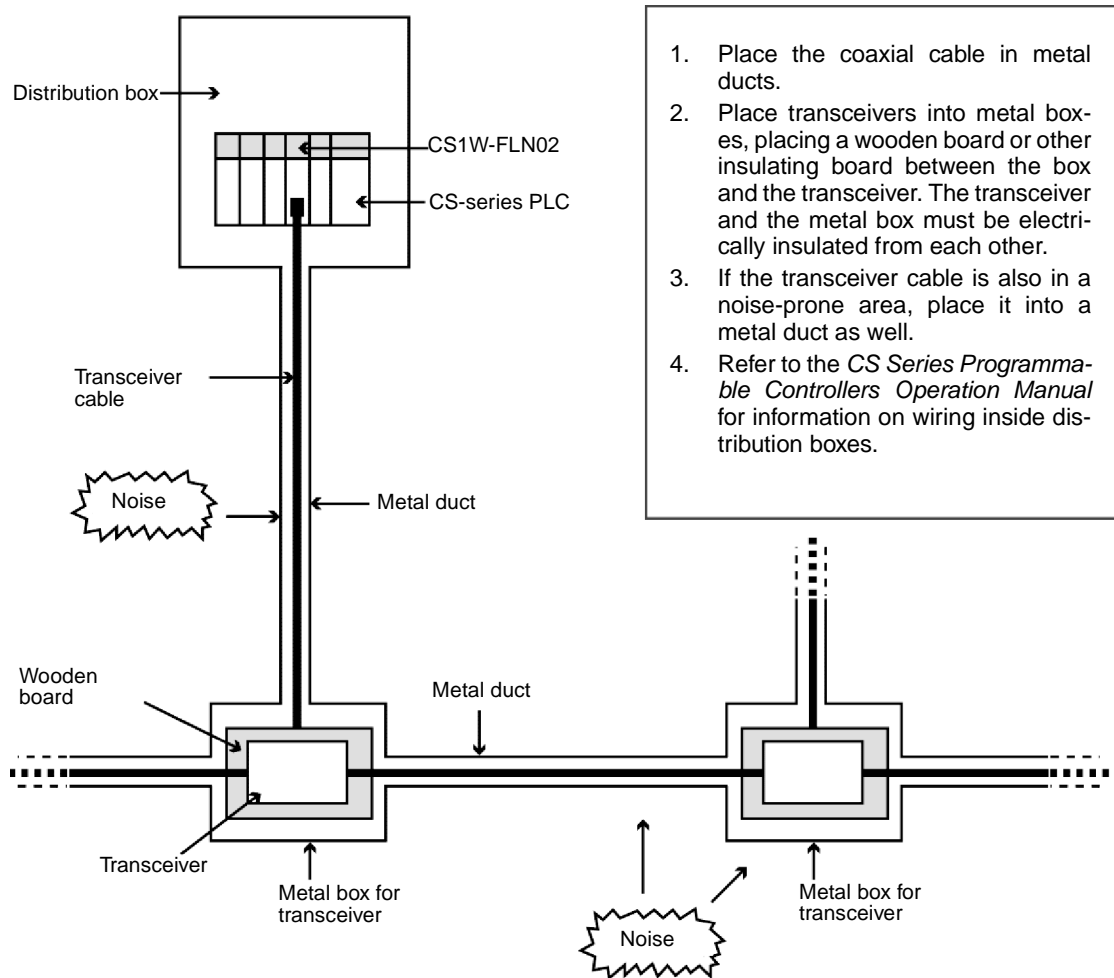


Installation Examples for Noise-prone Environments

Ethernet networks do not withstand noise very well and require special installation measures if installed where subject to noise. The examples provided here show measures for dealing with noise.

The message service function does not guarantee that the message will arrive at the other node. To ensure that the message is received when using the message service function, resend processing is normally executed at the node sending the instruction. With the SEND(090), RECV(098), and CMND(490) instructions, resend processing is executed automatically for the specified number of resends, so be sure to specify a number other than 0.

Metal Ducts



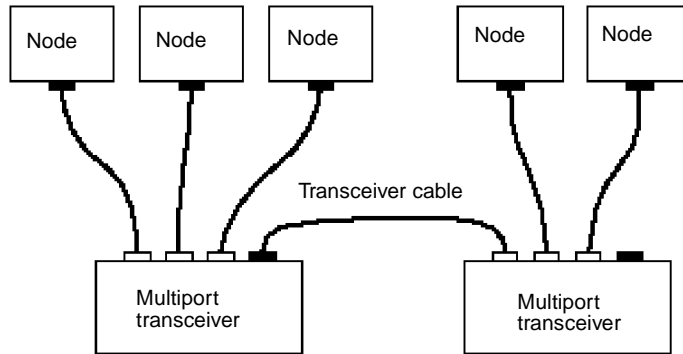
1. Place the coaxial cable in metal ducts.
2. Place transceivers into metal boxes, placing a wooden board or other insulating board between the box and the transceiver. The transceiver and the metal box must be electrically insulated from each other.
3. If the transceiver cable is also in a noise-prone area, place it into a metal duct as well.
4. Refer to the *CS Series Programmable Controllers Operation Manual* for information on wiring inside distribution boxes.

- Note**
1. Cover all metal portions of cables with insulating tape to be sure they do not come into contact with the metal ducts or boxes.
 2. Securely ground all distribution boxes and metal boxes around transceivers. The lower the ground resistance, the more effective the shields will be.
 3. The twisted-pair cable for 10Base-T is not shielded, and the hub is designed for use in OA environments. In environments subject to noise, we recommend the use of 10Base-5 Ethernet.

Multiport Transceivers

Multiport transceivers can be used to eliminate the need for coaxial cable (which is easily affected by noise) and replace it with transceiver cable as shown in the following diagram. This will increase overall system resistance to noise.

Note Up to two sets of multiport transceivers can be used in a network. The length of the network will be limited to the maximum length of transceiver cable.

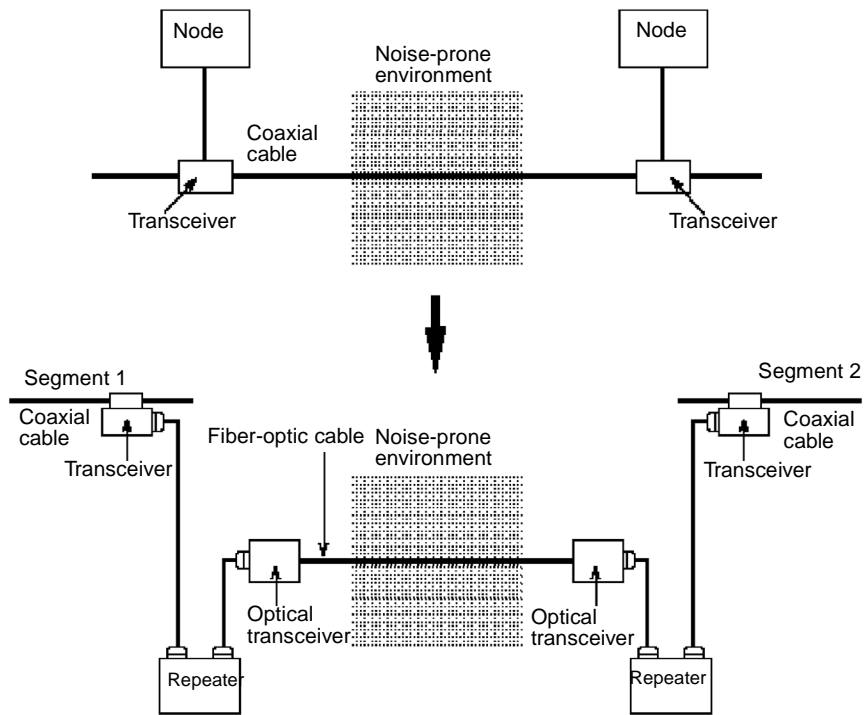


Optical Ethernet Systems

Some manufacturers provide optical fiber components for Ethernet networks to provide high resistance to noise. The following illustrations show some simple examples of optical installations.

Use as Noise Countermeasure

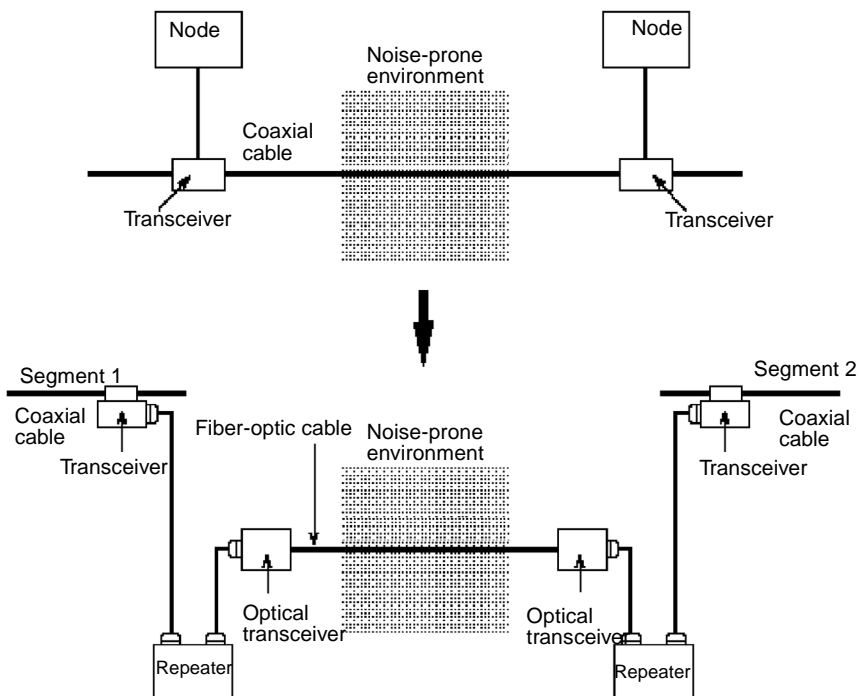
The following illustration shows how optical components can be used to convert to fiber-optic cable through areas highly prone to noise.



- Note**
1. Install the transceiver itself in a noise-free location.
 2. Contact the manufacturer for details on optical fiber devices.

Outdoor Installations

The following example shows how fiber-optic cable can be used to connect a network between two buildings, eliminating possible adverse affects of lightning.



Note Contact the manufacturer for details on optical fiber devices.

CS1W-FLN12 (10Base-T) Precautions

Precautions on Laying Twisted-pair Cable

Basic Precautions

- Press the cable connector in firmly until it locks into place at both the hub and the FL-net (Ver. 2.00) Unit.
- After laying the twisted-pair cable, check the connection with a 10Base-T cable tester.

Environment Precautions

- The twisted-pair cable for 10Base-T is not shielded, and the hub is designed for use in OA environments. In environments subject to noise, we recommend the use of 10Base-5 Ethernet.
- Do not lay the twisted-pair cable together with high-voltage lines.
- Do not lay the twisted-pair cable near devices that generate noise.
- Do not lay the twisted-pair cable in locations subject to high temperatures or high humidity.
- Do not lay the twisted-pair cable in locations subject to excessive dirt and dust or to oil mist or other contaminants.

Hub Installation Precautions

Environment Precautions

- Do not install the hub near devices that generate noise.
- Do not install the hub in locations subject to high temperatures or high humidity.
- Do not install the hub in locations subject to excessive dirt and dust or to oil mist or other contaminants.

Hub Connection Methods

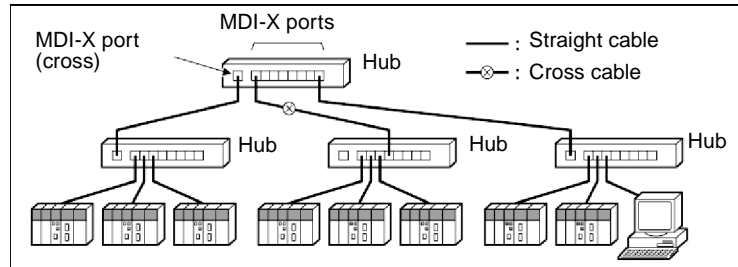
If more hub ports are required, they can be added by connecting more than one hub. There are two possible connection methods for hubs: Cascade and stacked.

■ **Cascade Connections**

- Connect two hubs to each other as follows: Connect an MDI port to an MDI-X port with a straight cable; connect two MDI ports with a cross cable; and connect two MDI-X ports with a cross cable.

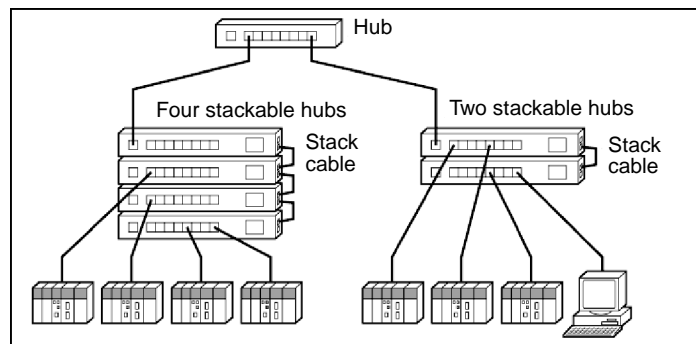
Note It is very difficult to distinguish cross cables and straight cables by appearance. Incorrect cables will cause communications to fail. We recommend using straight cables whenever possible.

- With cascade connections, up to 5 segments can be connected using up to 4 repeaters (i.e., 4 hubs).



■ **Stack Connections**

- Connect the hubs using special cables or special racks.
- Normally there is no limit to the number of hubs in a stack, and each stack is treated as one hub. Some hubs, however, are limited in the number of hubs per stack.

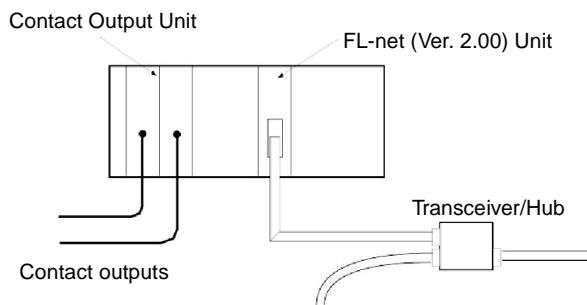


Using Contact Outputs (Common to All Units)

Due to noise generated by the contact outputs, communications errors can occur when Contact Output Units are mounted to the same Rack or connected to the same PLC as an FL-net (Ver. 2.00) Unit. Use one or more of the following measures when installing Contact Output Units and FL-net (Ver. 2.00) Units on the same Rack.

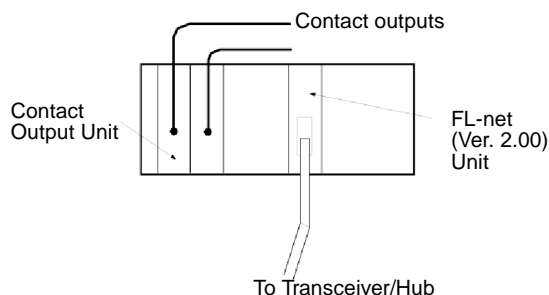
Mounting Location

Mount (or connect) any Contact Output Units as far away from the FL-net (Ver. 2.00) Unit as possible.



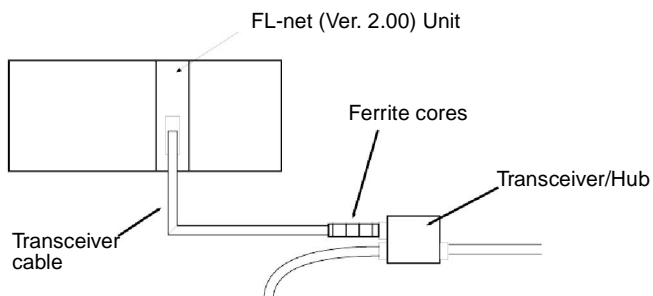
Cable Location

Separate the transceiver cable or twisted-pair cable connecting the Unit as far from the wiring to the Contact Output Units as possible. The coaxial cable must also be placed as far away from the Contact Output Units and their wiring as possible.



Transceiver/Hub Measures

Attach several ferrite cores designed for EMI countermeasures on the transceiver cable or twisted-pair cable near the transceiver/hub. The transceiver must also be placed as far away from the Contact Output Units and their wiring as possible.



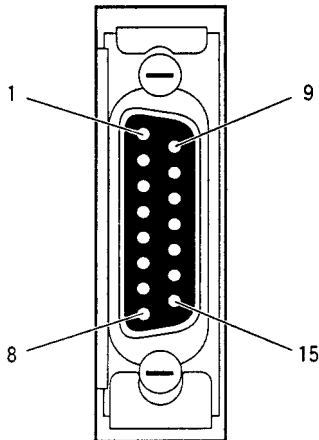
3-7 Connecting to the Network

Ethernet Connectors

CS1W-FLN02

The following standards and specifications apply to the connectors for the Ethernet transceiver cable.

- Electrical specifications: Conforming to IEEE802.3 standards
- Lock structure: IEEE802.3 standards for slide latches

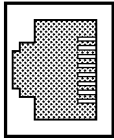


Connector pin	Signal name	Abbr.	Signal direction
1	Signal ground	GND	---
2	Collision detection signal +	COL+	Input
3	Send data +	TX+	Output
4	Signal ground	GND	---
5	Receive data +	RX+	Input
6	Power ground (common with signal ground)	VC	---
7	Not used	---	---
8	Signal ground	GND	---
9	Collision detection signal -	COL-	Input
10	Send data -	TX-	Output
11	Signal ground	GND	---
12	Receive data -	RX-	Input
13	Transceiver +12 VDC power supply	+12 V	Output
14	Signal ground	GND	---
15	Not used	---	---
Connector hood	Frame ground	FG	---

CS1W-FLN12

The following standards and specifications apply to the connectors for the Ethernet twisted-pair cable.

- Electrical specifications: Conforming to IEEE802.3 standards.
- Connector structure: RJ45 8-pin Modular Connector (conforming to ISO 8877)



Connector pin	Signal name	Abbr.	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
7	Not used.	---	---
8	Not used.	---	---

3-7-1 Connecting the Cable

Transceiver Cable (for CS1W-FLN02)

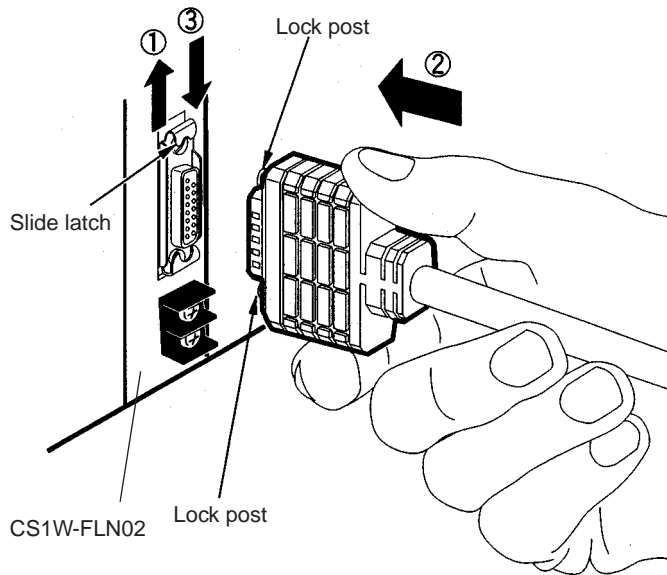
⚠ Caution Turn OFF the PLC's power supply before connecting or disconnecting transceiver cable.

- 1,2,3...**
1. Prepare a coaxial cable.
 2. Connect the transceivers to the coaxial cable.
 - Mark the coaxial cable at intervals of 2.5 meters. Then connect the transceivers at those marks.
 - The transceiver connection method depends on the type of transceiver, so refer to the transceiver operation manual.
 3. Prepare the transceiver cable, and then connect it to the transceivers.

The cable preparation should be performed by an experienced professional.

4. Connect the transceiver cable to the FL-net (Ver. 2.00) Unit connector. The FL-net (Ver. 2.00) Unit connector has a slide latch conforming to IEEE802.3 specifications that serves as a lock mechanism. To connect the transceiver cable, operate the slide latch as described below.
 - a) First push the slide latch upwards.
 - b) Insert the cable connector into the FL-net (Ver. 2.00) Unit's connector with the two locking posts at the end of the cable connector aligned with the holes in the slide latch.

c) Then push the slide latch down to lock the cable connector in place.

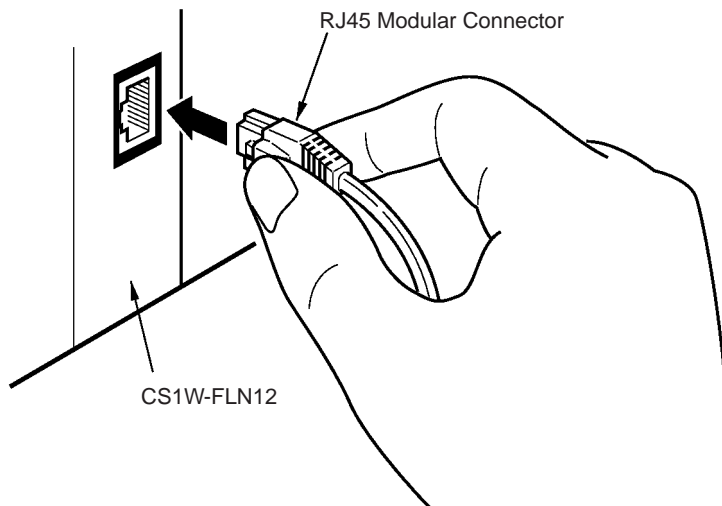


Twisted-pair Cable (for CS1W-FLN12)

⚠ Caution Turn OFF the PLC's power supply before connecting or disconnecting twisted-pair cable.

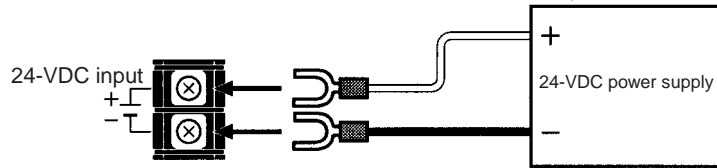
- 1,2,3...**
1. Lay the twisted-pair cable.
 2. Connect the cable to the hub. Be sure to press in the cable until it locks into place.
Examples of the above two steps are provided in *Appendix A*. Request cable installation from a qualified professional.
 3. Connect the cable to the connector on the FL-net (Ver. 2.00) Unit. Be sure to press in the cable until it locks into place.

Example: CS1W-FLN12



3-7-2 Connecting the Power Supply (CS1W-FLN02 Only)

Connect a 24-VDC power supply to the power supply terminals. The FL-net (Ver. 2.00) Unit converts this 24-VDC power supply to the power supply voltage for the transceivers and provides it through the transceiver cable.



Crimp terminals must be used for the power supply cable. The applicable M3 crimp terminals and recommended products are shown below.



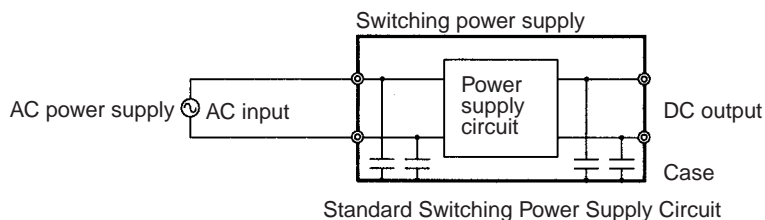
Maker	Model	Specifications	Applicable power line range (stranded wire)
J.S.T.MFG.CO., LTD	V1.25-N3A	Fork terminal with vinyl insulation	0.25 to 1.65 mm ² (AWG: #22 to #16)
	V1.25-MS3	Ring terminal with vinyl insulation	
MOLEX JAPAN CO.,LTD	VSY1.25-3.5L	Fork terminal with vinyl insulation	0.3 to 1.65 mm ² (AWG: #22 to #16)
	RAV1.25-M3	Ring terminal with vinyl insulation	

Caution Be sure to turn OFF the power supply to the PLC before connecting to the power supply terminal block.

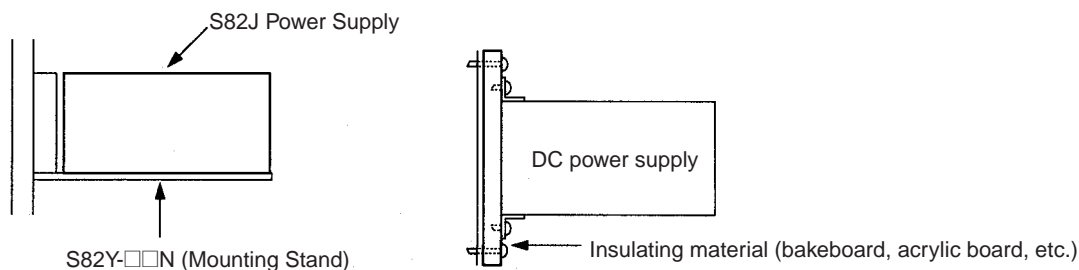
- Note**
- Do not connect a power supply with a voltage other than 24 VDC.
 - To reduce the effects of noise, wire the power supply cable separately from power lines and high-voltage lines.
 - Crimp terminals must be used for wiring. Do not just twist loose wire strands.
 - Use the recommended crimp terminals.
 - Use the proper tools and procedure for installing the crimp terminals. Consult with the terminal manufacturers for instructions. If the proper tools and procedure are not used, it may cause the cable to become disconnected.
 - When installing the crimp terminals, use a length of cable that will not need to be bent too much when combined with the terminals. Also, cover the terminal and the end of the cable with insulating tape and heat-absorbing tubing.
 - Be careful not to mistake the plus and minus terminals when connecting the power supply.
 - Tighten the terminal block screws to a torque of 0.5 N·m. If the screws are too loose, it may result in short-circuiting, malfunctioning, or fire damage.
 - Check the wiring carefully before turning ON the power.
 - Use a dedicated power supply, and do not use the same power supply for the I/O power supply, motor power lines, or control power lines.
 - Position the power supply as close as possible to the Unit, and separate the power supply cable by at least 20 cm from other power lines in order to avoid adverse effects from high-voltage lines.

12. Noise influence may be reduced by installing a noise filter near the primary side of the power supply.
13. Carefully twist the power supply cable that is to be connected to the Unit.
14. Do not excessively bend or stretch the cable.
15. Do not place anything on top of cables.
16. If errors occur due to noise related to an external power supply, it may be possible to solve the problem by not grounding the communications power supply. Normally the switching power supply is connected to the case and capacitor, as shown in the following diagram, so along with isolating the FG terminal it is necessary to insulate the power supply itself from the control panel.

General Switching Power Supply Configuration



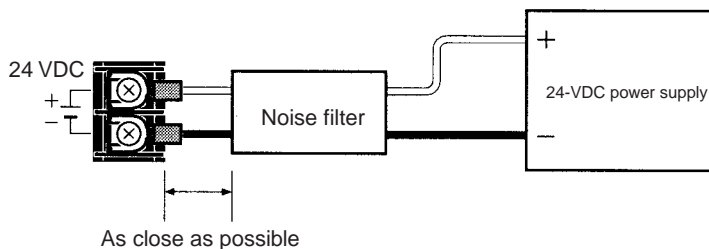
Communications Power Supply Isolation Method



(1) When S82J is used.

(2) When another power supply is used.

17. If communications are adversely affected by noise from the Unit's power supply terminals, the problem may be solved by implementing the measures shown below.
 - a) Add to the communications retry processing at the application. In particular, noise resistance capacity can be improved by increasing the number of retries for applications using UDP.
 - b) Insert a noise filter right next to the Unit's power supply terminals.



Recommended filter: MAS-1206-33 by Nemic-Rambda K.K.

Specifications

Rated voltage: 250 V (AC, DC)
Rated current: 6 A

Dimensions

105.5 x 52.5 x 40 mm (W x H x D)
(Not including connector.)

Power Supply Specifications

The following table shows the power supply specifications. Make sure that these specifications are met.

Item	Specifications
Power supply voltage	24 VDC
Allowable power supply voltage fluctuation	20.4 VDC to 26.4 VDC (24 VDC -15% + 10%)
Current consumption	300 mA max. at 24 VDC (per node)
Inrush current	2.5 A max. (24 VDC when rise time is 5 ms)

OMRON's S82J Series is recommended for the power supply.

- Note**
1. Use a power supply that meets these specifications.
 2. If the power supply is separate from a node, make sure that these specifications are met at the node's terminal block.
 3. Turn ON the Unit's power supply either before or at the same time as the CPU Unit's power supply. If the CPU's power is turned ON first, a communications error may be generated.
 4. Use a power supply with double or reinforced insulation.
 5. Confirm that the Power Status Bit is ON before starting communications. (Refer to *Power Status (Bit 15)* in *4-3 Allocated Words in the CIO Area*.)
 6. In the IEEE802.3 standards, the transceiver power supply specifications require a voltage of 11.28 V (12 V - 6%) to 15.75 V (15 V + 5%) at the transceiver inputs. The voltage output by the FL-net (Ver. 2.00) Unit takes into account a voltage drop at the transceiver cable.

3-8 Creating an I/O Table

After the hardware settings and connections have been completed, turn ON the power supply to the PLC and create an I/O table.

3-8-1 I/O Table Overview

An I/O table is used to identify Units connected to the PLC and to allocate I/O to them. If any change is made to the Unit configuration of a CS-series PLC, an I/O table must be created to register the Units to the CPU Unit.

3-8-2 Connecting Programming Devices to the PLC

To create the I/O table, connect a Programming Device (such as a Programming Console or CX-Programmer) to the PLC.

Applicable Programming Devices

The following Programming Devices can be used with CS-series PLCs.

Programming Console

Model number	Key Sheet (required)	Recommended cable (required)
C200H-PRO27-E	CS1W-KS001-E	CS1W-CN224 (cable length: 2.0 m)
		CS1W-CN624 (cable length: 6.0 m)
CQM1-PRO01-E		CS1W-CN114 (cable length: 0.1 m)

CX-Programmer and CX-Net

Model number: WS02-CXP□□-EV2

The operations are explained here using a Programming Console. For details regarding the CX-Programmer and the CX-Net, refer to the *CX-Programmer User's Manual*.

CX-Net is software that comes with CX-Programmer and is automatically installed when CX-Programmer is installed.

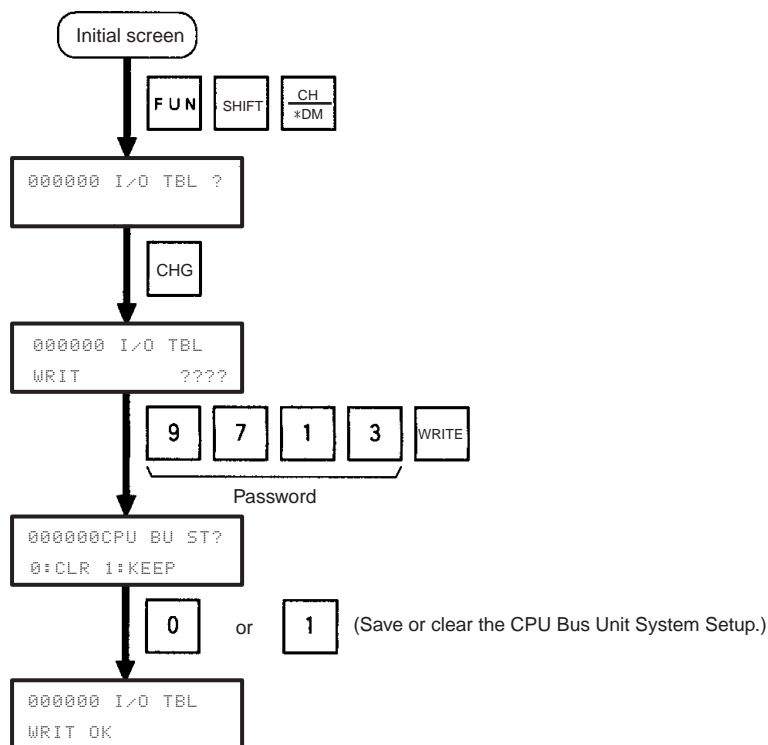
Connecting Programming Devices

To connect a Programming Console, attach a CS-series Key Sheet and then connect the Console to the CPU Unit's peripheral port. (It cannot be connected to the RS-232C port.)

3-8-3 Procedure for Creating an I/O Table

The procedure for creating an I/O table is shown here, taking as an example an I/O table that is generated automatically for a PLC connected online. In this example, a Programming Console is used for creating the I/O table. For an explanation of how to create an I/O table using a CX-Programmer, refer to the *CX-Programmer User's Manual*.

Use the following procedure to create the I/O table.



3-9 Creating Routing Tables

When the FINS communications service is used, routing tables must be created in advance. Routing tables are required in the following circumstances.

- When the FINS communications service is used on an FL-net (Ver. 2.00) network (including when communications are only carried out between FA networks via an FL-net (Ver. 2.00) network).
- When there are multiple Communications Units mounted to the PLC, and FA Link protocol messages, such as writing or reading word blocks, etc., are executed by the CMND(490) instruction.

If neither of these circumstances apply, then a routing table is not required. In that case, proceed to *3-10 System Setup*.

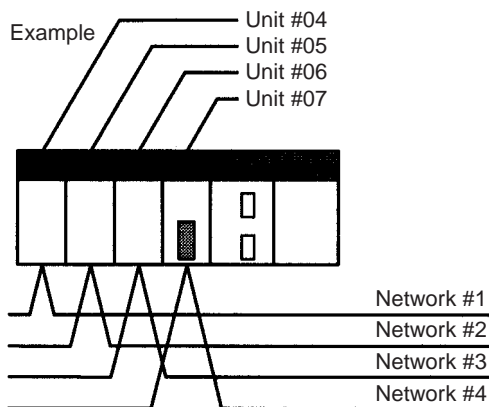
The routing table is required not only for nodes communicating via the FINS communications service but for all relay nodes on the network.

3-9-1 Routing Table Overview

The routing tables describe the transmission path for FINS messages when the FINS communications are used. It consists of two tables: A local network table and a relay network table.

Local Network Table

The local network table is a table describing the correspondences among unit numbers of the Communications Units and Boards mounted to each node (PLC or FA Computer).



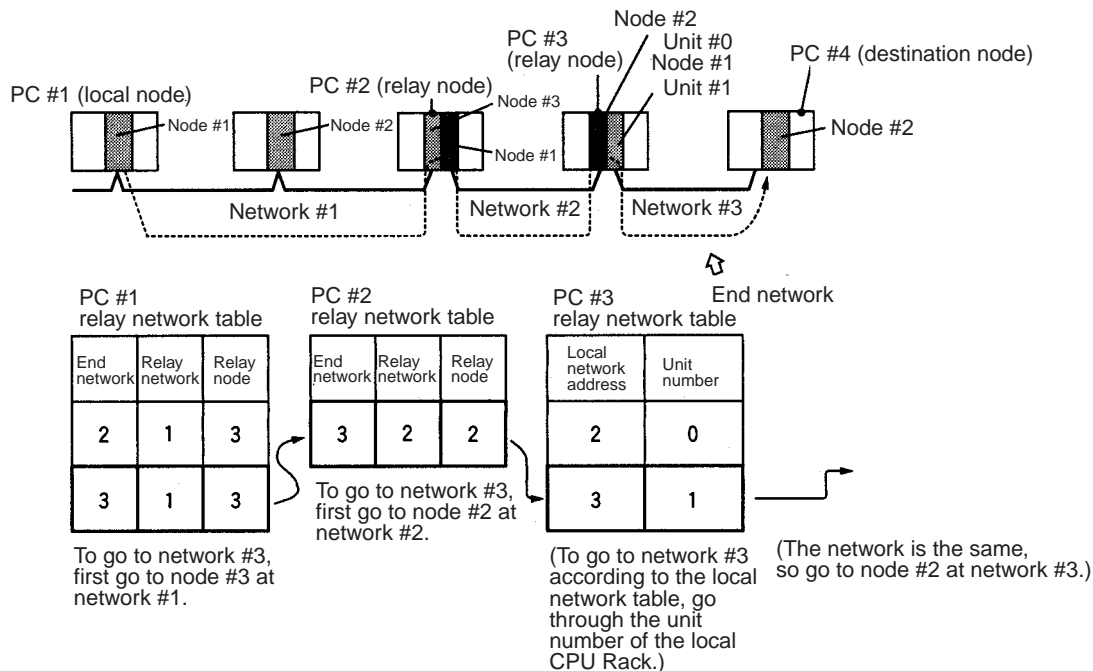
Local network address	Unit number
1	04
2	05
3	06
4	07

- Note**
1. The unit number is set (from 0 to F: 1 to 15) by the rotary switch on the front of the FL-net (Ver. 2.00) Unit.
 2. The network address is the number of the network (from 1 to 127) to which the Communications Unit or Board is connected. It is set when the local network table is created.

Relay Network Table

A relay table is a table that shows the nodes to which data should be sent first in order to send data to a network that is not connected to the local node. It shows the correspondence between the address of the final destination network, and the network address and node number of the first relay point of the path to reach there. When internetwork communications are carried out, the end network can be reached by following the relay points.

The following example shows a routing table for sending data from PLC #1 (the local node: network address 1, node number 1) to PLC #4 (the destination node: network address 3, node number 2).



3-9-2 Connecting and Using a Peripheral Device for the PLC

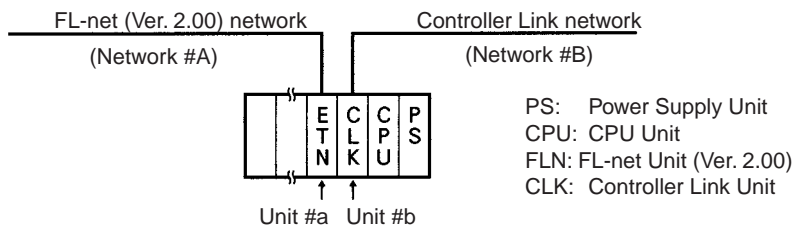
Routing tables must be created by a CX-Net connected to the PLC. (They cannot be created using a Programming Console.) For details on how to connect and use a CX-Net, refer to the *CX-Programmer User's Manual*. (CX-Net is automatically installed when CX-Programmer is installed.)

- Note**
1. To transfer routing tables for multiple nodes to a PLC in one batch, connect the CX-Net to a PLC with only one Communications Unit mounted. Routing tables cannot be transferred to other nodes from a PLC with multiple Communications Units mounted.
 2. Routing tables can only be transferred as a batch to multiple nodes within the same network as the PLC to which the CX-Net is connected.

Routing Table Setting Examples

Example 1: Local Network Table for a PLC With Multiple Units Mounted

This example shows the local network table settings for a PLC to which multiple CPU Bus Units are mounted.

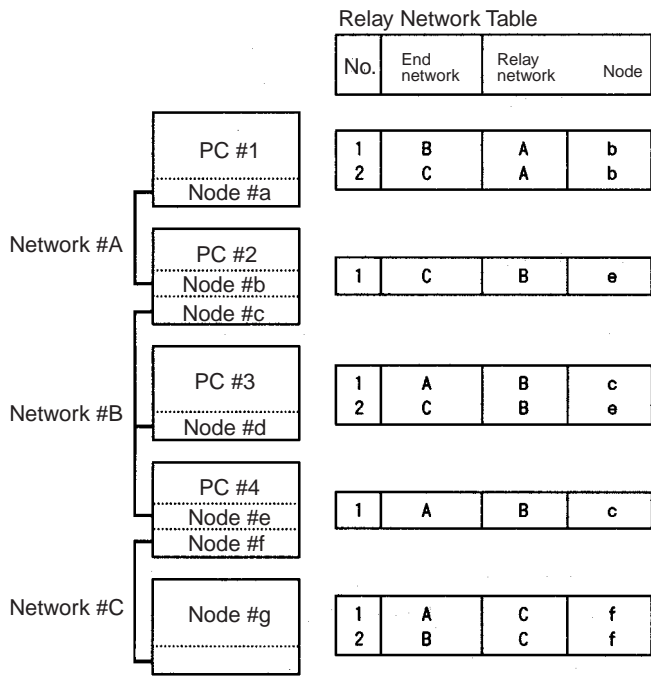


Local Network Table

No.	Local network	CPU Bus Unit
1	A	a
2	B	b

Example 2: Three Interconnected Networks

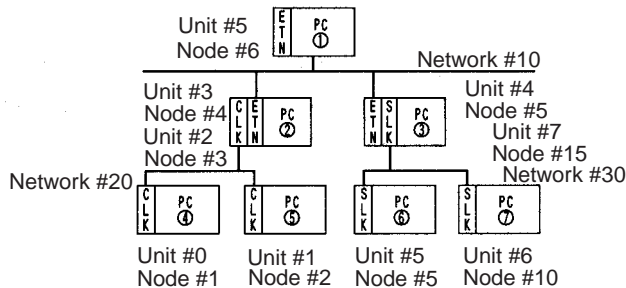
This example shows the relay network table settings for three different interconnected networks.



In the table for PLC #3, for example, if network #A is taken as the end network, then network #B becomes the relay network and node #c becomes the relay node. If network #C is taken as the end network, then network #B still becomes the relay network and node #e becomes the relay node.

Example 3: All Nodes

This example uses the following configuration to show the routing tables for all nodes.



PC #1 Routing Table
(Local network table)

No.	Local network	CPU Bus Unit No.
1	010	05
2		
3		

(Relay network table)

No.	End network	Relay network	Relay node
1	020	010	004
2	030	010	005
3			

PC #2 Routing Table
(Local network table)

No.	Local network	CPU Bus Unit No.
1	010	03
2	020	02
3		

(Relay network table)

No.	End network	Relay network	Relay node
1	030	010	005
2			
3			

PC #3 Routing Table
(Local network table)

No.	Local network	CPU Bus Unit No.
1	010	04
2	030	07
3		

(Relay network table)

No.	End network	Relay network	Relay node
1	020	010	004
2			
3			

PC #4 Routing Table
(Local network table)

No.	Local network	CPU Bus Unit No.
1	020	00
2		
3		

(Relay network table)

No.	End network	Relay network	Relay node
1	010	020	003
2	030	020	003
3			

PC #5 Routing Table
(Local network table)

No.	Local network	CPU Bus Unit No.
1	020	01
2		
3		

(Relay network table)

No.	End network	Relay network	Relay node
1	010	020	003
2	030	020	003
3			

PC #6 Routing Table
(Local network table)

No.	Local network	CPU Bus Unit No.
1	030	05
2		
3		

(Relay network table)

No.	End network	Relay network	Relay node
1	010	030	015
2	020	030	015
3			

PC #7 Routing Table
(Local network table)

No.	Local network	CPU Bus Unit No.
1	030	06
2		
3		

(Relay network table)

No.	End network	Relay network	Relay node
1	010	030	015
2	020	030	015
3			

3-10 System Setup

The settings for the FL-net (Ver. 2.00) Unit's basic and special functions are made in the CPU Bus Unit System Setup. These settings, and the situations in which the settings must be made, are shown in the following table. For details on how to make the settings, refer to *4-2 CPU Bus Unit System Setup*.

3-10-1 When Settings are Required

Settings	When settings are required
FA Link mapping table method	When the number of nodes assigned to the table exceeds 96.
FA Link startup method	When using a ladder program to control communications participation after powerup.
Confirm message protocol	When executing message communications with an FL-net (Ver. 2.00) node by another manufacturer.
Broadcast type	When changing the broadcast address for any reason.
IP address set method	When making settings, for any reason, outside of the range of the default IP address setting method.
Sub-net mask	When changing the sub-net mask for any reason.
Local node setup	When using the Data Link function.
Other node setup	When using the Data Link function.

3-10-2 Using the FL-net Unit Support Tool (for OMRON FL-net Units Only)

The settings for the CPU Bus Unit System Setup are made using an FL-net Unit Support Tool connected to the PLC. The settings cannot be made using a Programming Console or a CX-Programmer.

3-10-3 CPU Bus Unit System Setup Defaults

The following table shows the items in the CPU Bus Unit System Setup, and their default settings.

Item	Default
FA Link mapping table method	PLC built-in method
FA Link startup method	Automatic participation method
Confirm message protocol	Confirm
Broadcast type	***.***.***.255
IP address set method	192.168.250.node number
Sub-net mask	255.255.255.0
Local node setup	None
Other node setup	None

3-11 Checking Communications

The FL-net (Ver. 2.00) Unit supports the PING command, which is also widely supported by host computers. It also supports a function for internode testing in the FINS communications service by simply manipulating bits with a Programming Device.

After the settings and connections have been completed, use either the PING command or the internode test function as required to check communications with the remote nodes.

Networking checks using the PING command and internode testing can be executed regardless of the PLC's operating mode, but it may have an effect on

operation by increasing network traffic and adding more internal processing for the FL-net (Ver. 2.00) Unit.

It is recommended that the testing be performed with the tested node in PROGRAM Mode, or in an environment in which message servicing is not executed.

3-11-1 PING Command and Internode Testing

The following table outlines the points of difference between the PING command and internode testing.

Item	PING command	Internode testing
Main application	Testing communications as an Ethernet node.	Testing as an FL-net (Ver. 2.00) node.
Test objects	FL-net (Ver. 2.00) Units and Ethernet devices that support PING.	FL-net (Ver. 2.00) Units and devices supporting FL-net (Ver. 2.00).
Network classification	Within Ethernet networks (including between segments).	Within FL-net (Ver. 2.00) networks.
Address system used	IP addresses	Node numbers
Transmission from FL-net (Ver. 2.00) Unit	Cannot be sent from this Unit.	From Programming Devices for PLC, set the required parameters in CIO words allocated to CPU Bus Units and turn ON the Start Bit.
Reception at FL-net (Ver. 2.00) Unit	When PING command is received, it is automatically returned.	When internode test message is received, it is automatically returned.

3-11-2 PING Command

The PING command checks communications with another node by sending an echo back request packet and receiving a response packet. Use the PING command as required to check communications. Using the PING command from a personal computer on an Ethernet network makes it possible to check whether Ethernet internode communications are normal.

3-11-3 Internode Test

The internode test is a function for checking a network by sending data to and from specified nodes and checking the responses. Use the internode test as required to check the communications between FL-net (Ver. 2.00) nodes. Use it as required to check message communications.

Note The internode test can be easily carried out by manipulating dedicated control switches for the FL-net (Ver. 2.00) Unit. For details, refer to 9-3 *Internode Test*.

SECTION 4

System Setup and Memory Allocations

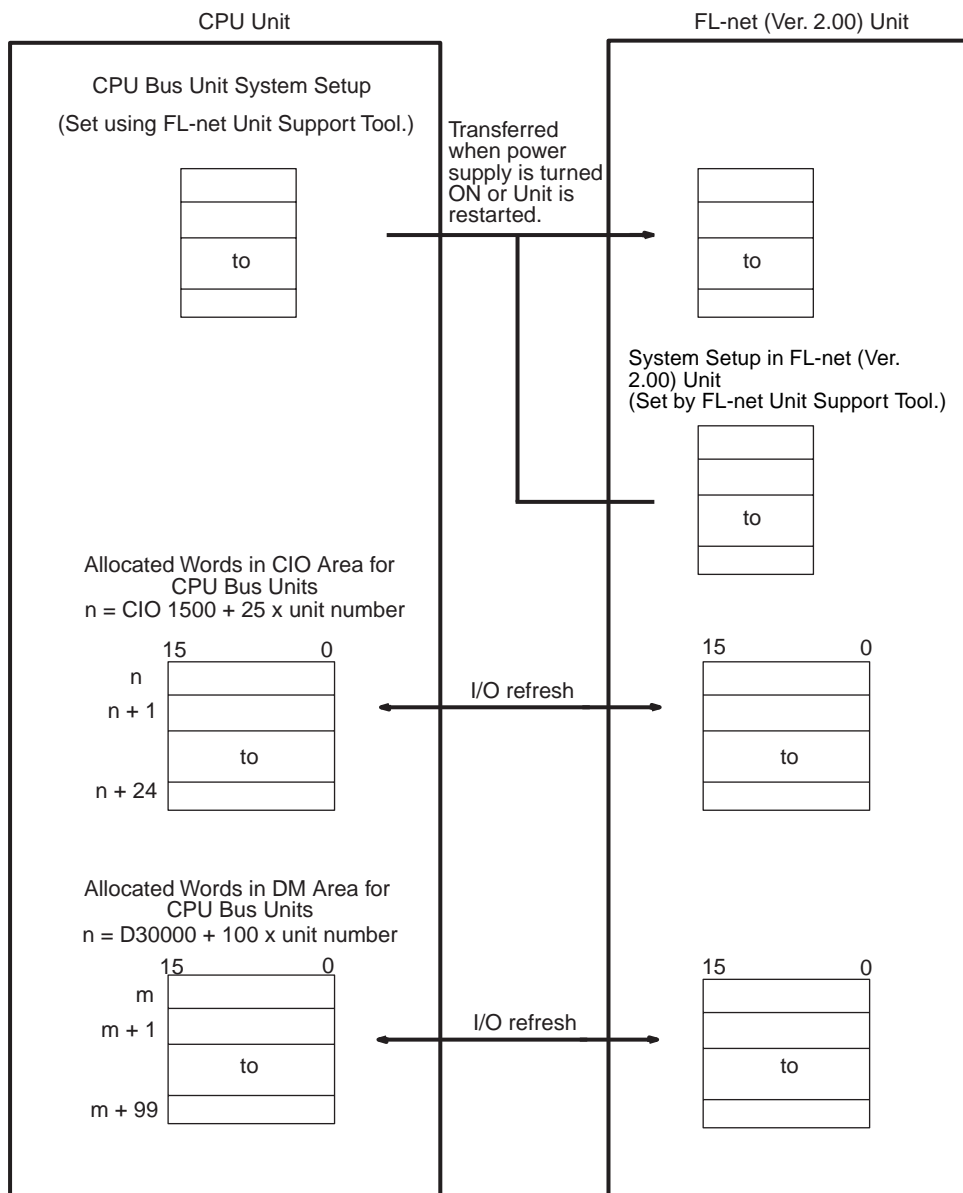
This section explains the System Setup and the words allocated in the CIO Area and the DM Area for FL-net (Ver. 2.00) Units.

4-1	Allocated Words	58
4-2	CPU Bus Unit System Setup	59
4-2-1	FL-net Unit Support Tool and CPU Bus Unit Setup Area Screen . .	60
4-3	Allocated Words in the CIO Area	61
4-3-1	Unit Control Bits (CPU Unit to FL-net Unit)	62
4-3-2	Internode Test Destination Address (CPU Unit to FL-net Unit) . . .	62
4-3-3	Internode Test Monitoring Time (CPU Unit to FL-net Unit)	62
4-3-4	Internode Test Status (CPU Unit to FL-net Unit)	62
4-3-5	No. of Internode Test Runs (FL-net Unit to CPU Unit)	63
4-3-6	No. of Internode Test Timeout Errors (FL-net Unit to CPU Unit) . .	63
4-3-7	No. of Internode Test Response Errors (FL-net Unit to CPU Unit) .	63
4-3-8	No. of Internode Test Transmission Errors (FL-net Unit to CPU Unit)	64
4-3-9	No. of Times Internode Test Data Did Not Match (FL-net Unit to CPU Unit)	64
4-3-10	Unit Status (FL-net Unit to CPU Unit)	64
4-3-11	Network Status (FL-net Unit to CPU Unit)	65
4-3-12	Refresh Cycle Time (FL-net Unit to CPU Unit)	66

4-1 Allocated Words

The FL-net (Ver. 2.00) Unit is allocated words in the following four areas for reading settings and status.

- System Setup for CPU Bus Units
Stores initial setup for the FL- net (Ver. 2.00) node.
- System Setup in FL- Unit (Ver. 2.00)
Stores Data Link data when the FL-net (Ver. 2.00) Unit's Data Link function is used with the Unit built-in method.
- Allocated Words in the CIO Area
Stores software switches and status information for functions.
- Allocated Words in the DM Area
Stores software switch and status information for functions.



The words in the CIO Area and DM Area are allocated according to the unit number as shown in the following tables. The 25 words are allocated per Unit in the CIO Area and 100 word are allocated per Unit in the DM Area.

CIO Area Allocations

Unit No. (decimal)	Allocated words	Unit No. (decimal)	Allocated words
0 (0)	CIO 1500 to CIO 1524	8 (8)	CIO 1700 to CIO 1724
1 (1)	CIO 1525 to CIO 1549	9 (9)	CIO 1725 to CIO 1749
2 (2)	CIO 1550 to CIO 1574	A (10)	CIO 1750 to CIO 1774
3 (3)	CIO 1575 to CIO 1599	B (11)	CIO 1775 to CIO 1799
4 (4)	CIO 1600 to CIO 1624	C (12)	CIO 1800 to CIO 1824
5 (5)	CIO 1625 to CIO 1649	D (13)	CIO 1825 to CIO 1849
6 (6)	CIO 1650 to CIO 1674	E (14)	CIO 1850 to CIO 1874
7 (7)	CIO 1675 to CIO 1699	F (15)	CIO 1875 to CIO 1899

DM Area Allocations

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

4-2 CPU Bus Unit System Setup

To operate the FL-net (Ver. 2.00) Unit as a node on an Ethernet network, the required parameters must be set in the CPU Bus Unit System Setup, part of the CPU Unit's Parameter Areas. If any of the following items apply, then the system parameters must be set.

- The Data Link function is used. The Data Link table is stored in either the CPU Bus Unit System Setup (PLC built-in method) or the FL-net Unit System Setup (Unit built-in method). (Default: PLC built-in method)
- The startup method is changed. (Default: Automatic participation method)
- Message protocol confirmation is changed. (Default: Confirm)
- The broadcast method is changed. (Default: `***.***.***.255`)
- The IP address is set. (Default: `192.168.250 + node number`)
- The sub-net mask is changed. (Default: `255.255.255.0`)

Newly set parameters go into effect after the FL-net (Ver. 2.00) Unit has been restarted or after the CPU Unit is started again.

The settings are made using the CPU Bus Unit Setup Area from the FL-net Unit Support Tool.

Note The CPU Bus Unit Setup Area is located in the CPU Unit's Parameter Area, and not in I/O Memory; parameters cannot be written using instructions or by editing I/O Memory. The settings can be made only by using the FL-net Unit Support Tool.

4-2-1 FL-net Unit Support Tool and CPU Bus Unit Setup Area Screen

Note For details on FL-net Unit Support Tool operations, refer to *SECTION 11 FL-net Unit Support Tool*.

FA Link mapping table method (Default: PLC built-in method)

Selects the method (PLC built-in method or FA Link Unit built-in method) for storing the FA Link mapping table. Normally the default should be selected.

FA Link startup method (Default: Auto-participating method)

Selects the method (auto-participating or manual-participating) for starting the FA Link. Normally the default should be selected.

Confirm message protocol (Default: Confirmed)

Selects the protocol (confirmed or unconfirmed) for when messages are used. Select "Confirmed" for a network with OMRON FL-net Units only. Select "Unconfirmed" for a network in which units from other manufacturers are connected.

Broadcast type (Default: *.***.***.255)**

Selects the broadcast type (***.***.***.255, 255.255.255.255). Normally the default should be selected.

IP address set method (Default: 192.168.250 + node number)

Selects the IP address setting method (192.168.250 + node number, rotary switch on back panel of Unit, rotary switch on back panel of Unit + node number, or System Setup Area). Normally the default should be selected.

Sub-net mask (Default: 255.255.255.0)

Sets the sub-net mask (user setting). Normally the default should be selected.

- IP address (Default: None)** Sets the IP address (user setting).
The IP address does not need to be set except when the IP address set method is "System Setup Area."
- No. of the other nodes in FA Link (Default: None)** The number of remote nodes (user setting) in the FA Link configuration is displayed.
This does not normally need to be set.
- Local Node Setup Area** Refer to *SECTION 5 Data Link*.
- Other Node Setup Area** Refer to *SECTION 5 Data Link*.

Note In order to circulate a token among nodes connected to the network, match the uppermost three digits of the IP address, the sub-net mask, and the broadcast type to those of the other connected nodes.

4-3 Allocated Words in the CIO Area

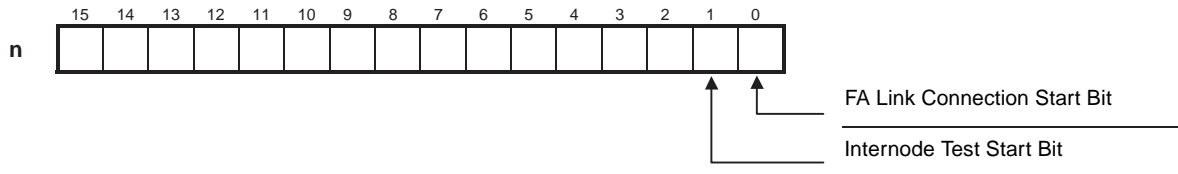
Data is stored from the beginning word in the area for each Unit, according to the offset positions shown in the following table.

Beginning word n can be calculated by means of the following equation
:Beginning word n = 1,500 + (25 x unit number)

Offset	D15	D8	D7	D0	Data direction
n	1. Unit control bits				CPU Unit ↔ FL-net Unit
n+1	2. Internode test destination address				CPU Unit to FL-net Unit
n+2	3. Internode test response monitoring time				
n+3	4. Internode test status		5. Number of internode test runs		FL-net Unit to CPU Unit
n+4	6. Number of internode test timeout errors		7. Number of internode test response errors		
n+5	8. Number of internode test transmission errors		9. Number of times internode test data did not match		
n+6	10. Unit status				FL-net Unit to CPU Unit
n+7	11. Network status				
n+8	12. Refresh cycle time				
n+9	13. Node connection information (256 nodes)				
n+10					
n+11					
n+12					
n+13					
n+14					
n+15					
n+16					
n+17					
n+18					
n+19					
n+20					
n+21					
n+22					
n+23					
n+24					
n+25					

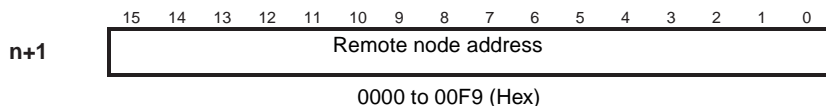
4-3-1 Unit Control Bits (CPU Unit to FL-net Unit)

FL-net (Ver. 2.00) Unit operation is started by turn control bits ON and OFF.



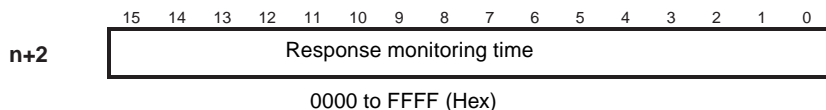
Bit	Bit name	Status	Manipulated by	Unit operation
0	FA Link Connection Start Bit	ON	User	Connects to network when turned from OFF to ON.
		OFF	User	Disconnects from network when turned from ON to OFF.
1	Internode Test Start Bit	ON	User	Executes internode test while ON.
		OFF	User Unit	Stops internode test. Test completed (255 times).
2 to 15	(Not used.)	---	---	---

4-3-2 Internode Test Destination Address (CPU Unit to FL-net Unit)



Set the remote node address for the internode test in hexadecimal.

4-3-3 Internode Test Monitoring Time (CPU Unit to FL-net Unit)

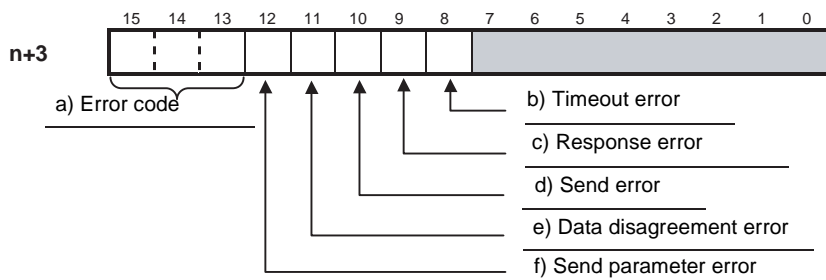


Set the time period, in the ranges shown below (in units of 10 ms, hexadecimal), to wait for a response in the internode test.

0000 (Hex): 2 s

0001 to FFFF: 0.01 to 655.35 s

4-3-4 Internode Test Status (CPU Unit to FL-net Unit)



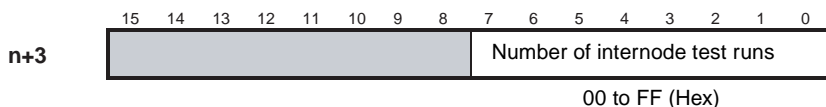
The internode test results are reflected here. (When the internode test is started, all bits are turned back OFF.)

- a) Error codes
The applicable error code is stored in bits 13 to 15.

Bit			Meaning
15	14	13	
0	0	0	Normal completion.
1	1	1	Insufficient memory error:

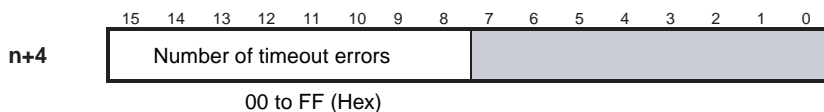
- b) Timeout error
Turns ON if no response is returned within the response monitoring time.
- c) Response error
Turns ON if the response frame is abnormal.
- d) Send error
Turns ON if there is a timeout at the start of transmission, or if the transmission is abnormal for any reason.
- e) Data disagreement error
Turns ON if the data received is different from the data sent, or if the data length does not match.
- f) Send parameter error
Turns ON if the address setting is incorrect.

4-3-5 No. of Internode Test Runs (FL-net Unit to CPU Unit)



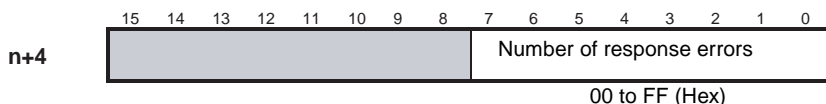
Internode tests are executed repeatedly as long as the Internode Test Start Bit, one of the Unit Control Bites in the CIO area, remains ON.
In this word, specify in hexadecimal the number of times that the internode test is actually to be executed

4-3-6 No. of Internode Test Timeout Errors (FL-net Unit to CPU Unit)



The number of timeout errors that have occurred in the internode test is stored in this word in hexadecimal.
00 to FF (Hex): 0 to 255 times
When the count reaches FF (Hex), it will not go any further. The count value will be retained until the internode test is restarted.

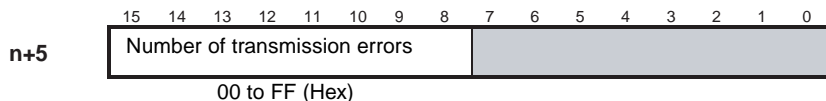
4-3-7 No. of Internode Test Response Errors (FL-net Unit to CPU Unit)



The number of response errors that have occurred in the internode test is stored in this word in hexadecimal.
00 to FF (Hex): 0 to 255 times

When the count reaches FF (Hex), it will not go any further. The count value will be retained until the internode test is restarted.

4-3-8 No. of Internode Test Transmission Errors (FL-net Unit to CPU Unit)

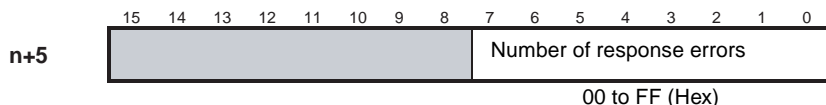


The number of transmission errors that have occurred in the internode test is stored in this word in hexadecimal.

00 to FF (Hex): 0 to 255 times

When the count reaches FF (Hex), it will not go any further. The count value will be retained until the internode test is restarted.

4-3-9 No. of Times Internode Test Data Did Not Match (FL-net Unit to CPU Unit)

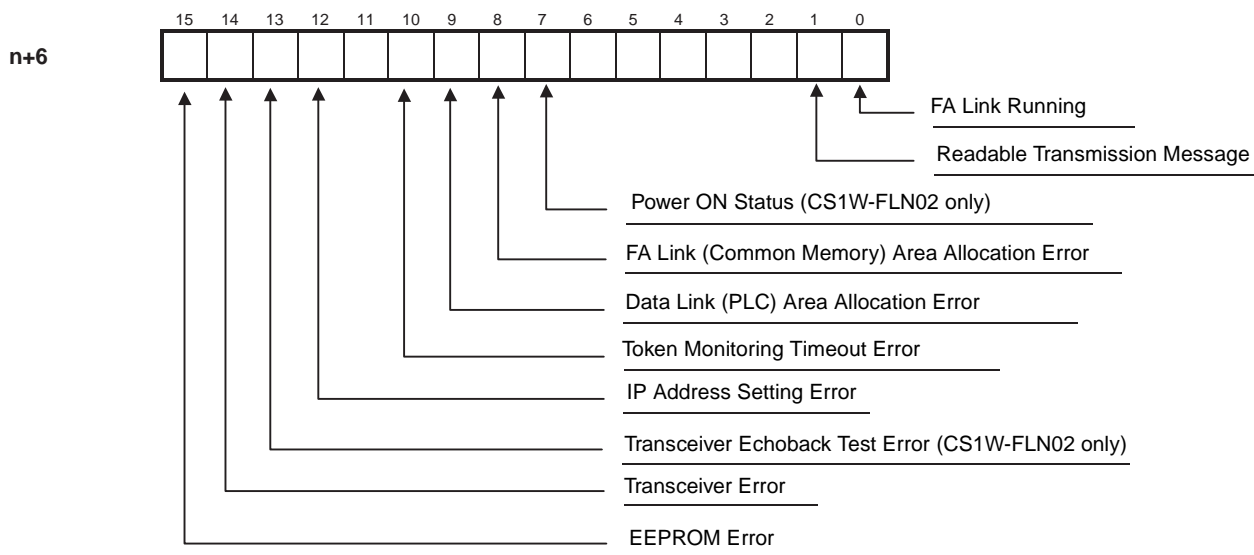


The number of data disagreement errors that have occurred in the internode test is stored in this word in hexadecimal.

00 to FF (Hex): 0 to 255 times

When the count reaches FF (Hex), it will not go any further. The count value will be retained until the internode test is restarted.

4-3-10 Unit Status (FL-net Unit to CPU Unit)

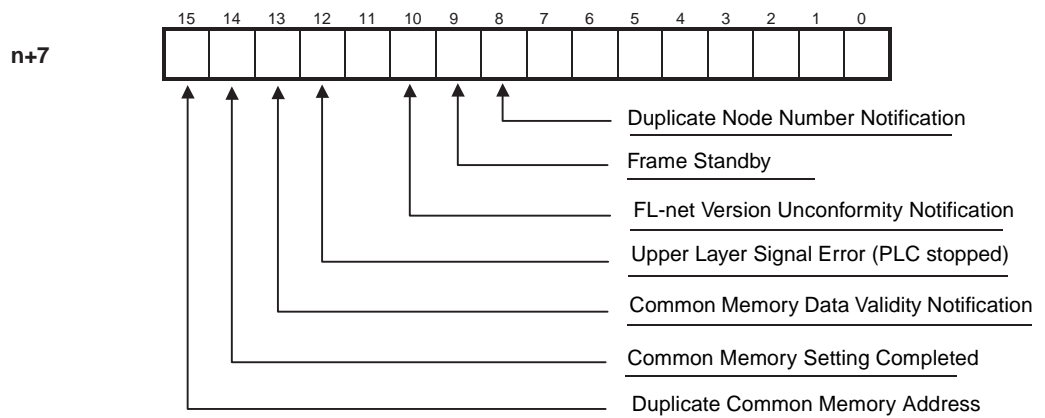


Bits	Name	Status		Unit operation
0	FA Link Running	ON	Running	ON when participating in FA link.
		OFF	Stopped	OFF when not participating in the FA link or when node numbers have been duplicated.

Bits	Name	Status		Unit operation
1	Readable Transmission Message	ON	Yes	ON when transmission of a transparent message is completed normally.
		OFF	No	OFF when a transparent message is read and disappears from the communications buffer.
2 to 6	(Not used.)	---	---	
7	Power ON Status (CS1W-FLN02 only)	ON	Power ON	ON when power is being supplied to the transceiver.
		OFF	Power OFF	OFF when power is not being supplied to the transceiver.
8	FA Link (Common Memory) Area Allocation Error	ON	Error	ON when an error occurs in FA Link (Common Memory) Area allocations.
		OFF	Normal	OFF when FA Link (Common Memory) Area allocations are normal.
9	Data Link (PLC) Area Allocation Error	ON	Error	ON when an error occurs in Data Link (PLC) Area allocations.
		OFF	Normal	OFF Data Link (PLC) Area allocations are normal.
10	Token Monitoring Timeout Error	ON	Error	ON when a token monitoring timeout occurs while the local node is holding the token.
		OFF	Normal	OFF when a token monitoring timeout does not occur while the local node is holding the token.
11	(Not used.)	---	---	
12	IP Address Setting Error	ON	Error	ON when an error occurs in the IP address setting.
		OFF	Normal	ON when the IP address setting is normal.
13	Transceiver Echoback Test Error (CS1W-FLN02 only)	ON	Error	ON when transmission is not completed normally for some reason.
		OFF	Normal	OFF when transceiver echoback test is normal.
14	Transceiver Error	ON	Error	ON when transmission is not possible due to external factors.
		OFF	Normal	OFF after recovery from transceiver error.
15	EEPROM Error	ON	Error	ON when an EEPROM error occurs or when writing to EEPROM is frequently not possible.
		OFF	Normal	OFF when EEPROM is normal.

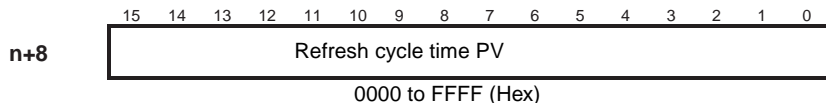
Note With the CS1W-FLN12, the transceiver is built-in, so when this bit turns ON it indicates an error at the FL-net (Ver. 2.00) Unit.

4-3-11 Network Status (FL-net Unit to CPU Unit)



Bits	Name	Status		Unit operation
0 to 7	(Not used.)	---	---	
8	Duplicate Node Number Notification	ON	Error	ON when duplicated node numbers are detected.
		OFF	Normal	OFF when duplicated node numbers are not detected.
9	Frame Standby	ON	Standby	ON when a reception frame cannot be detected.
		OFF	Off standby	OFF when a reception frame can be detected.
10	FL-net Version Unconformity Notification	ON	Error	ON when attempting to participate in FL-net (Ver. 1.00) network.
		OFF	Normal	OFF when participating in FL-net (Ver. 2.00) network.
11	(Not used.)	---	---	
12	Upper Layer Signal Error (PLC stopped)	ON	Stopped	ON when an error occurs between the Unit and the PLC.
		OFF	Not stopped	OFF when communications between the Unit and the PLC are normal.
13	Common Memory Data Validity Notification	ON	Valid	ON when Common Memory data is valid.
		OFF	Invalid	OFF when Common Memory data is invalid.
14	Common Memory Setting Completed	ON	Completed	Common Memory Setting Completed.
		OFF	Not completed	OFF when error occurs in Common Memory settings.
15	Duplicate Common Memory Address	ON	Error	ON when local node has same Common Memory address as a remote node.
		OFF	Normal	ON when local node does not have same Common Memory address as any remote node.

4-3-12 Refresh Cycle Time (FL-net Unit to CPU Unit)



Determines the token frame transmission interval, which is the time measured from when a token is sent until when it is received, and displays it in hexadecimal in units of 10 ms.

0000 to FFFF (Hex): 0 to 65,535 ms

SECTION 5

Data Link

This section explains the Data Link function, including an overview and examples of how to make the required settings.

5-1	Data Link Overview	68
5-1-1	FL-net (Ver. 2.00) Cyclic Transmission and Common Memory ...	68
5-1-2	Data Link Specifications.....	71
5-2	Setting Data Link Tables.....	72
5-2-1	Setting Data Link	72
5-2-2	Settings Examples.....	75

5-1 Data Link Overview

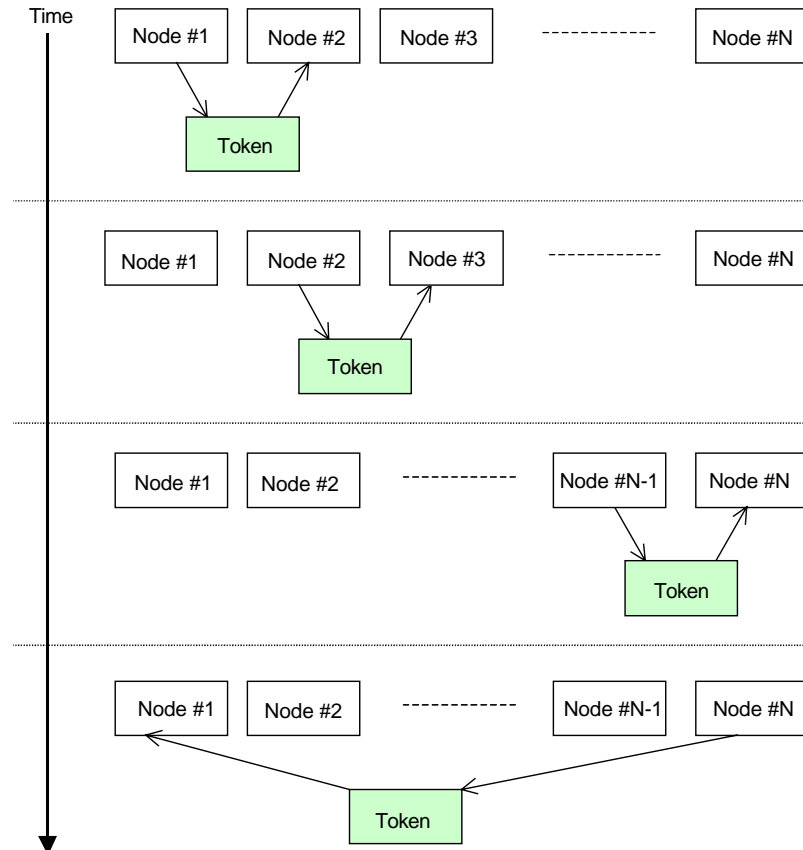
The data link function uses FL-net (Ver. 2.00) cyclic transmission for automatically exchanging data, from preset areas, between nodes on a single network (between two PLCs or between a PLC and an FA computer). The CS1W-FLN02 or CS1W-FLN12 can also be used for exchanging data between CS-series PLCs or between FL-net (Ver. 2.00) nodes by other manufacturers.

5-1-1 FL-net (Ver. 2.00) Cyclic Transmission and Common Memory

1. Cyclic Transmission Overview

Cyclic transmission supports the exchange of cyclic data between nodes.

- a) Cyclic transmission uses common memory as an interface.
- b) When a node is holding the token the node transmits cyclic data.
- c) Not all nodes participating in the network must support cyclic transmission.
- d) The node holding the token transmits all cyclic data that should be sent.



Token: There is basically only one token in a network. If more than one token exists in a network, the token whose destination node has the smallest node number will be given priority and the other tokens will be discarded.

Token frame: the token frame is a frame that includes the token. It consists of the token's destination node number and source node number. Each node becomes the token holding node when its node number matches the token destination node number in the received token frame.

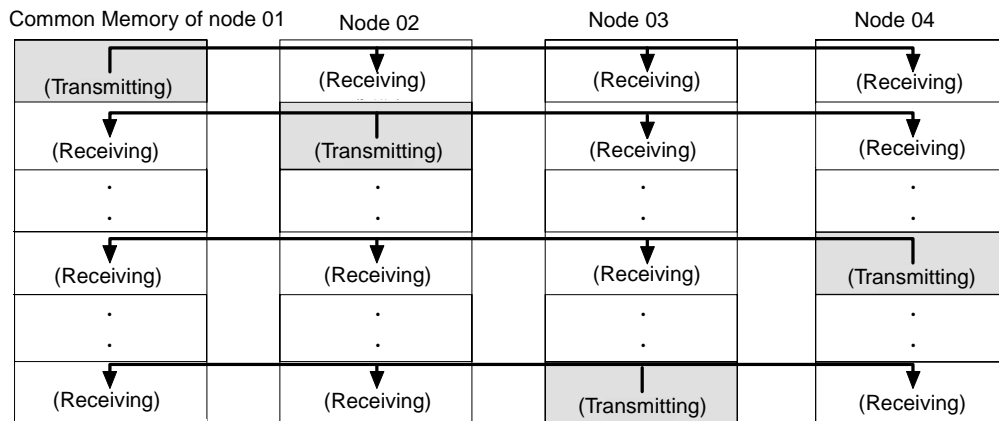
Token flow: The token rotation order is determined by the node numbers. Each node circulates the token among the nodes registered in the participat-

ing node management table in ascending order. The node with the largest node number in the network passes the token to the node with the smallest node number in the network.

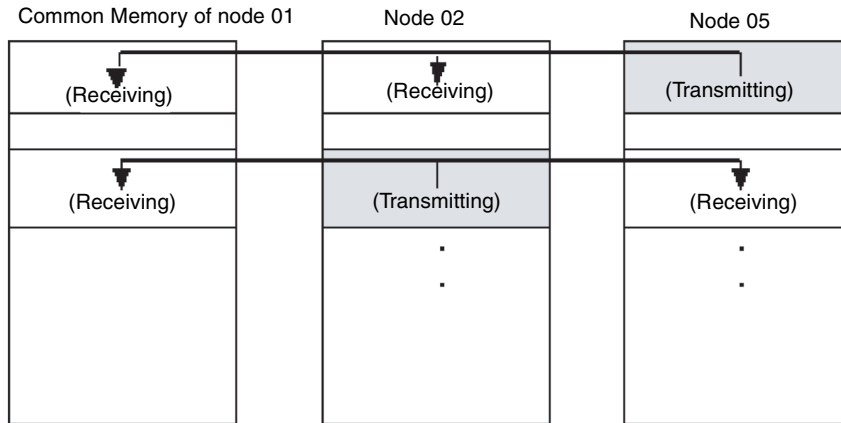
2. Common Memory

The concept of Common Memory is as follows:

- a) Common Memory provides a service that functions as shared memory between nodes transmitting cyclic data.
- b) Two areas (Area 1 and Area 2) are assigned for each node.
- c) When the area transmitted by a node exceeds the transmission size limit for a single frame, which is 1,024 bytes, the data is fragmented into multiple frames and then transmitted.
- d) In the case of item c), when the fragmented data frames are received, the Common Memory is not refreshed until all frames from the one node have been received, thereby ensuring the concurrence of the data at individual nodes.
- e) The capacity reserved as Common Memory for communications in a single node is a fixed size of 8 Kbits + 8 Kwords = 8.5 Kwords.
- f) Within Common Memory, the size of the transmission area of Area 1 and Area 2 for each node can be set freely within the maximum area range.
- g) By broadcasting data, each node in the network shares the same data for a specific period. Each node in the FL-net network is allocated a specific transmission area that does not overlap with that of the other nodes, and data is exchanged among them. In Common Memory operations, the transmission area allocated to one node is the receiving area for the other nodes.

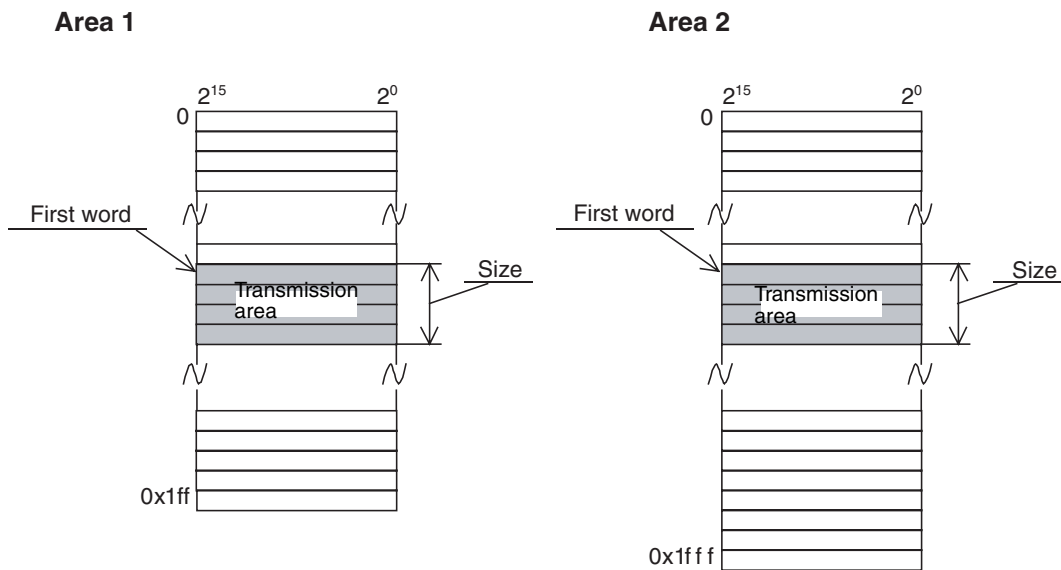


A node can also use the whole Common Memory as a receiving area only.



3. Areas 1 and 2

Common Memory is configured of two data areas: Area 1 and Area 2. The area is accessed by the word address. Area 1 consists of 0.5 Kword, and Area 2 consists of 8 Kwords. The transmission area is defined by its first word and size.



4. Data Synchronicity

In cyclic transmission, the transmission data is fragmented into multiple frames depending on the size of the data. The following procedure ensures synchronicity of the Common Memory for each node.

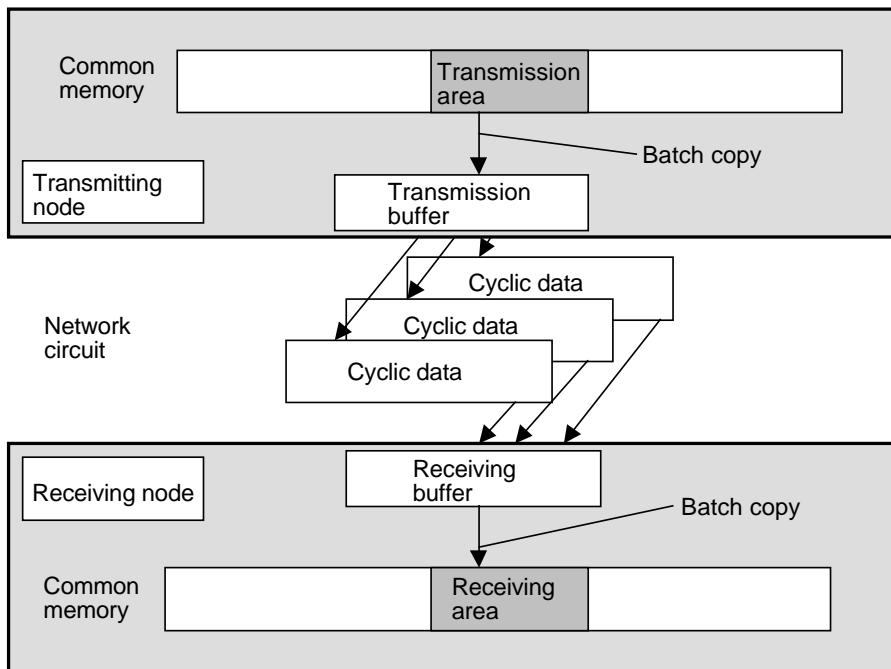
5. Transmission Timing

When there is a data transmission request from the upper layer, the cyclic data from the local node is copied into the buffer, prepared for transmission, and then transmitted in order. If the size of the data held in the transmitting node is greater than the maximum capacity that can be sent in one frame (1,024 bytes), the data in the buffer is fragmented into multiple frames before transmitting.

6. Refresh Timing when Receiving Data

As soon as the receiving node has received all the cyclic data from one node, the relevant area in Common Memory is refreshed in synchroniza-

tion with the upper layer. When a node receives cyclic data in multiple frames, the area is refreshed as soon as all the frames being transmitted by the one node have been received. If all the frames that were transmitting the fragmented data from the node are not received, all the data that was transmitted from the node is discarded.



5-1-2 Data Link Specifications

The memory used in common by nodes executing cyclic transmission is called "Common Memory." The FL-net (Ver. 2.00) Unit has 8,704 words of Common Memory (including Area 1 and Area 2).

Item	Specifications				
Number of data blocks	Two areas max. per node (Area 1 and Area 2)				
Total Data Link capacity	8,704 words max. <ul style="list-style-type: none"> Area 1 (bit area): 512 words Area 2 (word area): 8,192 words 				
Areas that can be allocated	<ul style="list-style-type: none"> CIO (I/O bits, etc.): CIO 0 to CIO 6143 Work Area: W0 to W511 HR Area: H0 to H511 DM Area: D0 to D32,767 EM Area: Bank 0 to 12, E0 to E32,767 				
Unit of data exchange	Words				
Data configuration	The following diagram shows the configuration of one word of data. <div style="text-align: center;"> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">MSB</td> <td style="text-align: center;">LSB</td> </tr> <tr> <td style="text-align: center;">Word</td> <td style="text-align: center;">D0</td> </tr> </table> </div>	MSB	LSB	Word	D0
MSB	LSB				
Word	D0				

In the CS Series, there is a limit (7,677 words) to the amount of data that can be exchanged at once. Therefore, when setting the Data Link table, the following conditions must be satisfied.

- a) Number of words in local node setup area (Area 1 and Area 2): 7,677 words
- b) Number of words in local node setup area (Area 1 and Area 2) + Number of words for maximum node size in remote node setup area (Area 1 and Area 2): 7,677 words

If not all of the data can be exchanged at once, it will be divided into two CPU Unit scans.

5-2 Setting Data Link Tables

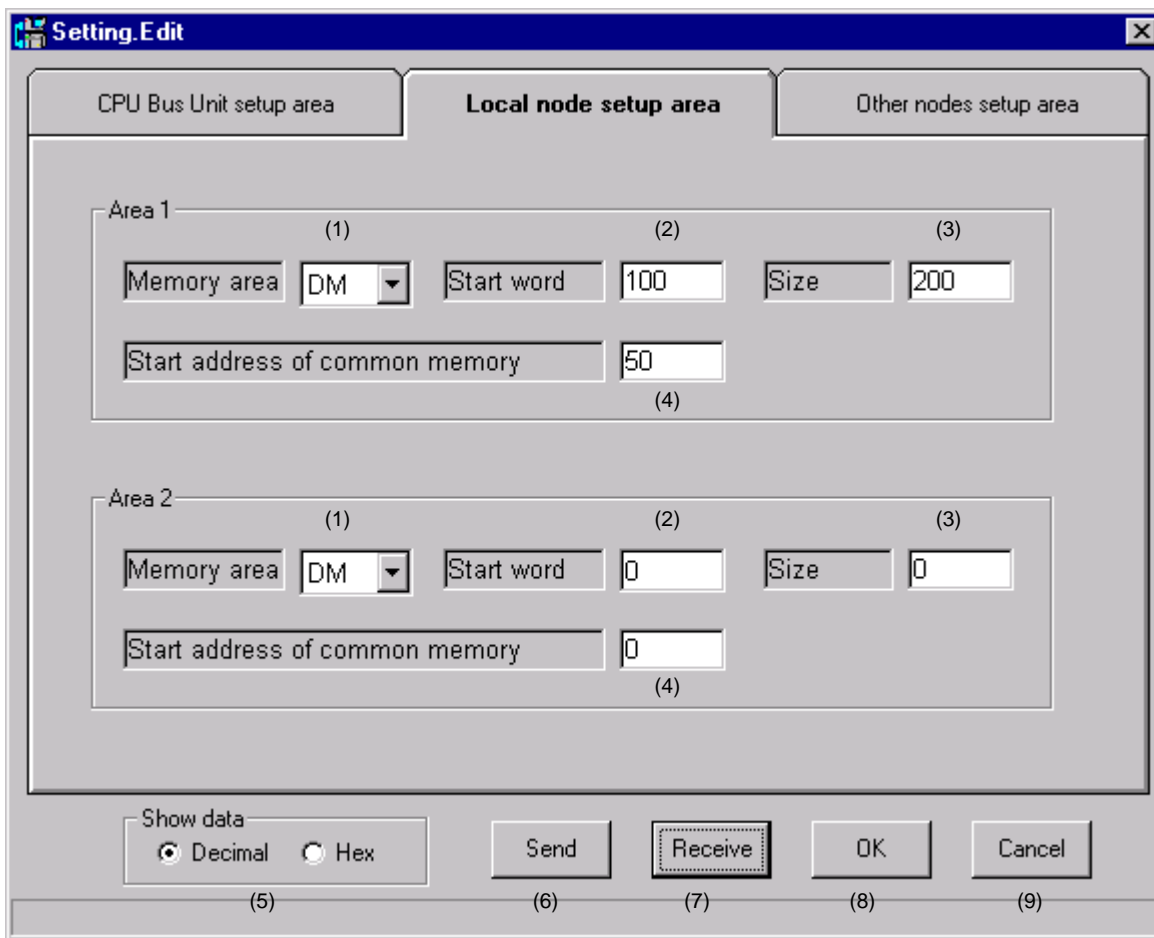
5-2-1 Setting Data Link

The method for setting Data Link is explained by means of the FL-net Unit Support Tool.

- Note**
1. The FL-net Unit Support Tool, a support tool designed especially for OMRON FL-net Units, is used for setting Data Link tables.
 2. In order to enable the Data Link table settings once they have been made by the FL-net Unit Support Tool, it is necessary to either turn the PLC power OFF and back ON again or restart the FL-net (Ver. 2.00) Unit.

Local Node Setup Area

The Local Node Setup Area can be set so that data from any PLC area can be used as the send data from the local node.



Area 1 (Area 2) Memory Area (Default: DM)
Sets the PLC area in which Cyclic Data Areas 1 and 2 for the local node are stored.

The following areas are set: CIO, WR, HR, DM, and EM0 to EMC.

Area 1 (Area 2) start word (Default: 0)

Sets the beginning word of the PLC area in which Cyclic Data Areas 1 and 2 for the local node are stored.

Area 1 (Area 2) size (Default: 0)

Sets the size of the PLC area in which Cyclic Data Areas 1 and 2 for the local node are stored. This setting also determines the size allocated to this node in common memory.

Area 1 (Area 2) Start address of common memory (Default: 0)

Sets the beginning address of the Common Memory allocated to Area 1 (or Area 2).

Show data

Selects whether data is to be given in decimal or hexadecimal.

Send

Writes set data to the System Setup Area of the specified Unit.

Receive

Reads the contents of the System Setup Area of the specified Unit to the FL-net Unit Support Tool.

OK

Validates the changed settings and closes the window.

When the System Setup Window is next opened, the changed settings will be displayed.

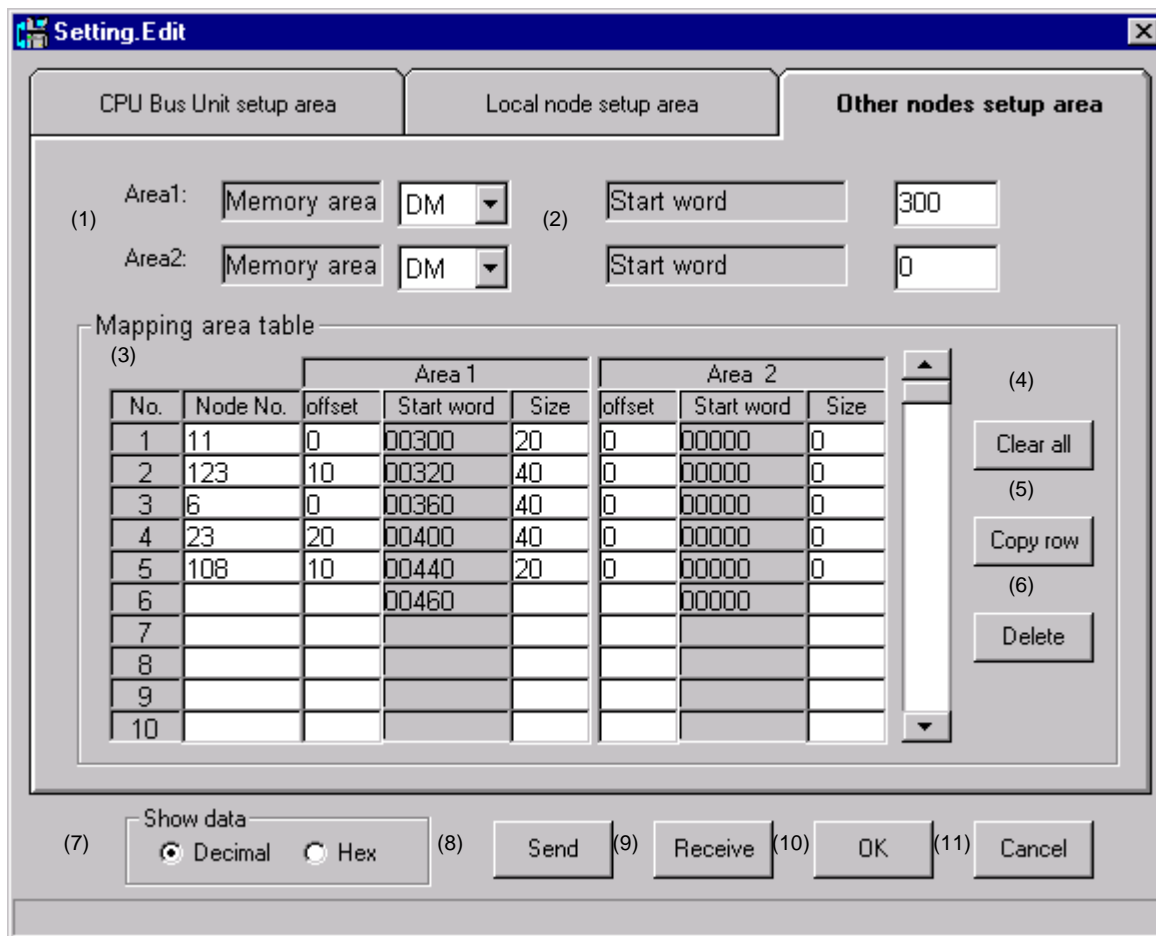
Cancel

Cancels the changes to the settings and closes the window.

When the System Setup Window is next opened, the settings prior to the changes will be displayed.

Other Node Setup Area

The Other Node Setup Area are be set so that Common Memory data for remote nodes can be read to the local PLC areas.



Area 1 (Area 2) Memory Area (Default: DM)

Sets the PLC area in which Cyclic Data Areas 1 and 2 for the remote nodes are stored.

The following areas are set: CIO, WR, HR, DM, and EM0 to EMC.

Area 1 (Area 2) start word (Default: 0)

Sets the beginning word of the PLC area in which Cyclic Data Areas 1 and 2 for the remote nodes are stored.

Mapping area table

Sets the offset, size and mapped node numbers of the PLC area in which Cyclic Data Areas 1 and 2 for the remote nodes are stored.

- Note**
1. Do not assign the local node to this area.
 2. If the settings are made for only Area 1 (or Area 2), set the offset and size for the other area to 0.

Clear all

Clears all entries in the mapped area table.

Copy row

Copies the contents of the row in which the cursor is placed, and adds it as a new row.

Delete

Deletes the contents of the row in which the cursor is placed. Any settings after the deleted row are moved forward in the table.

Show data

Selects whether data is to be displayed in decimal or hexadecimal.

Send

Writes set data to the System Setup Area of the specified Unit.

Receive

Reads the contents of the System Setup Area of the specified Unit to the FL-net Unit Support Tool.

OK

Validates the changed settings and closes the window.

When the System Setup Window is next opened, the changed settings will be displayed.

Cancel

Cancels the changes to the settings and closes the window.

When the System Setup Window is next opened, the settings prior to the changes will be displayed.

Note The “offset” designation is the designation of how much data to receive of the data sent from a given node (i.e., which word to begin receiving from, and how many words to receive). The number of words from the beginning of the sent data until the beginning of the received data is called the “offset.” The offset function can be used to receive only a portion of the data sent from a given node to enable using the Data Link Memory Areas efficiently.

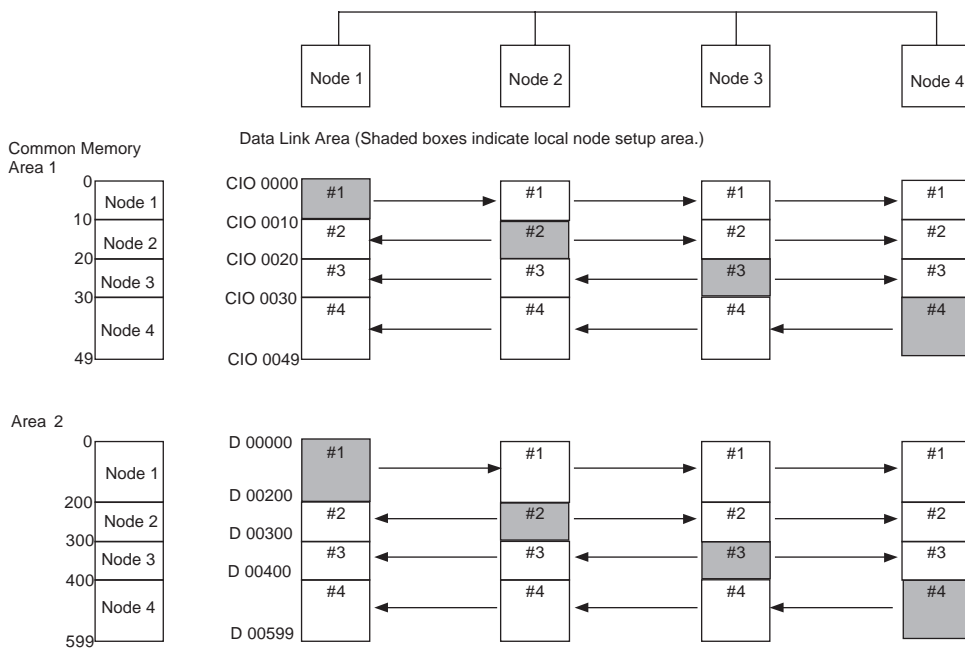
5-2-2 Settings Examples

This section provides examples of Data Link tables set by the FL-net Unit Support Tool, and shows the Common Memory Area and Data Link Area, for each node, that are created.

Data Link Table Setting Example 1

In this example, the allocation for all nodes is the same as Common Memory.

Common Memory and Data Link Area Configuration



Local Node Setup Areas

Node 1

Area	Beginning address of Common Memory allocation	Classification	Beginning word	Size
1	0	CIO	0	10
2	0	DM	0	200

Node 2

Area	Beginning address of Common Memory allocation	Classification	Beginning word	Size
1	10	CIO	10	10
2	200	DM	200	100

Node 3

Area	Beginning address of Common Memory allocation	Classification	Beginning word	Size
1	20	CIO	20	10
2	300	DM	300	100

Node 4

Area	Beginning address of Common Memory allocation	Classification	Beginning word	Size
1	30	CIO	30	20
2	400	DM	400	200

Other Node Setup Area

Node 1

Area	Classification	Beginning word
1	CIO	10
2	DM	200

Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
2	0	10	0	100
3	0	10	0	100
4	0	20	0	200

Node 2

Area	Classification	Beginning word
1	CIO	0
2	DM	0

Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
1	0	10	0	200
2	0	10	0	100
0 (See note.)	0	10	0	100
4	0	20	0	200

Node 3

Area	Classification	Beginning word
1	CIO	0
2	DM	0

Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
1	0	10	0	200
2	0	10	0	100
0 (See note.)	0	10	0	100
4	0	20	0	200

Node 4

Area	Classification	Beginning word
1	CIO	0
2	DM	0

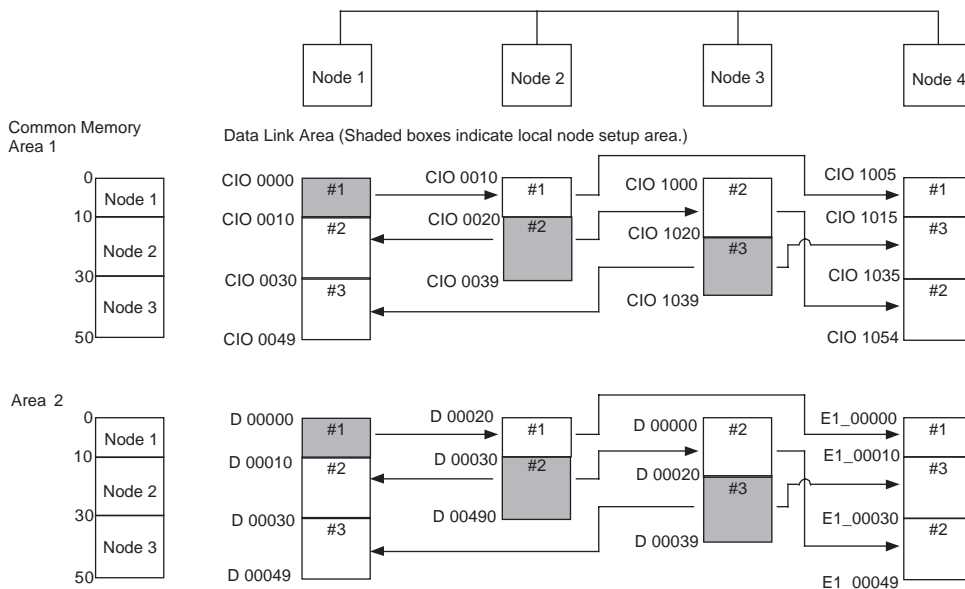
Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
1	0	10	0	200
2	0	10	0	100
3	0	10	0	100

Note If the local node setup area is in a consecutive area of the other node setup areas, set the node number to 0.

Data Link Table Setting Example 2

In this example, the allocations are different for each node.

Common Memory and Data Link Area Configuration



Local Node Setup Area

Node 1

Area	Beginning address of Common Memory allocation	Classification	Beginning word	Size
1	0	CIO	0	10
2	0	DM	0	10

Node 2

Area	Beginning address of Common Memory allocation	Classification	Beginning word	Size
1	10	CIO	20	20
2	10	DM	30	20

Node 3

Area	Beginning address of Common Memory allocation	Classification	Beginning word	Size
1	30	CIO	1020	20
2	30	DM	20	20

Node 4

Area	Beginning address of Common Memory allocation	Classification	Beginning word	Size
1	0	CIO	0	0
2	0	DM	0	0

Other Node Setup Area

Node 1

Area	Classification	Beginning word
1	CIO	10
2	DM	10

Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
2	0	20	0	20
3	0	20	0	20

Node 2

Area	Classification	Beginning word
1	CIO	10
2	DM	20

Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
1	0	10	0	10

Node 3

Area	Classification	Beginning word
1	CIO	1000
2	DM	D0

Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
2	0	20	0	20

Node 4

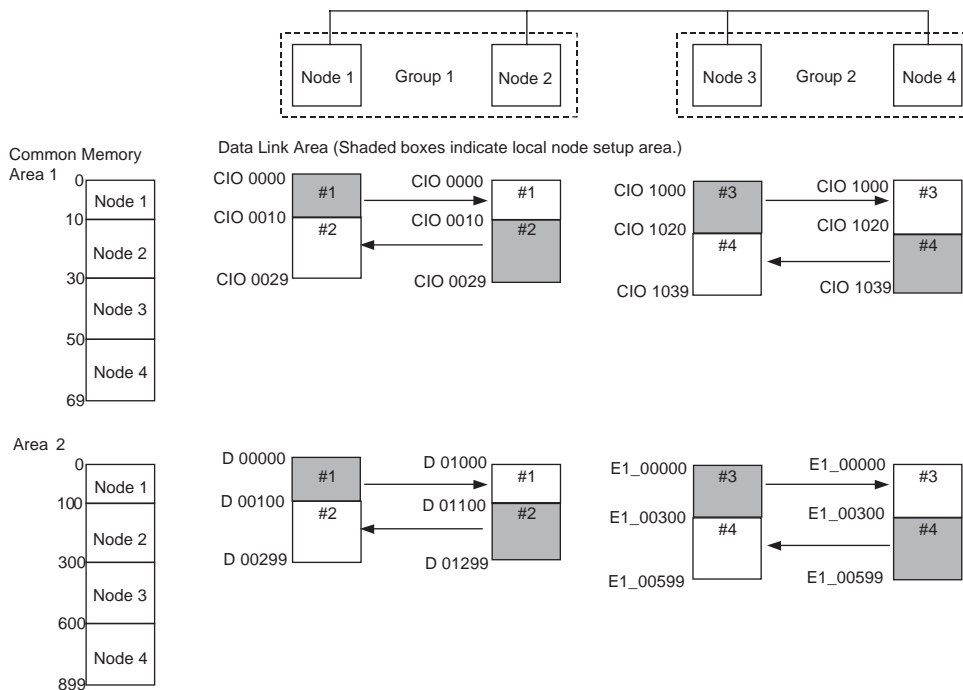
Area	Classification	Beginning word
1	CIO	1005
2	DM	0

Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
1	0	10	0	10
3	0	20	0	20
2	0	20	0	20

Data Link Table Setting Example 3

In this example, Data Link is executed for two or more groups on the same network. By means of Data Link table settings, it is possible to create data links for multiple groups. As shown in the following diagram, if communications words are set for nodes in groups only, the same settings can be made for multiple Data Link groups.

Common Memory and Data Link Area Configuration



Local Node Setup Area

Node 1

Area	Beginning address of Common Memory allocation	Classification	Beginning word	Size
1	0	CIO	0	10
2	0	DM	0	100

Node 2

Area	Beginning address of Common Memory allocation	Classification	Beginning word	Size
1	10	CIO	10	20
2	100	DM	1100	200

Node 3

Area	Beginning address of Common Memory allocation	Classification	Beginning word	Size
1	30	DM	1000	20
2	300	EM0	0	300

Node 4

Area	Beginning address of Common Memory allocation	Classification	Beginning word	Size
1	50	DM	1020	20
2	600	EM1	300	300

Other Node Setup Area

Node 1

Area	Classification	Beginning word
1	CIO	0
2	DM	0

Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
2	0	20	0	200

Node 2

Area	Classification	Beginning word
1	CIO	0
2	DM	1000

Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
1	0	10	0	100

Node 3

Area	Classification	Beginning word
1	DM	1000
2	EM0	0

Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
4	0	20	0	300

Node 4

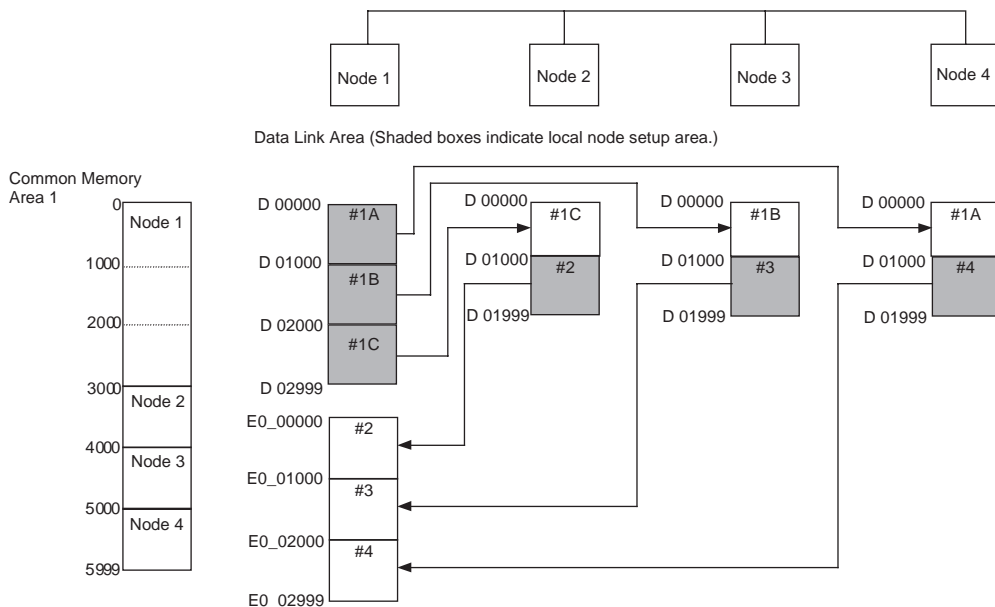
Area	Classification	Beginning word
1	DM	1000
2	EM1	0

Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
3	0	20	0	300

Data Link Table Setting Example 4

In this example, the local and remote setup areas are mapped to different areas (node #1), and only a portion of the transmission data is received. (The offset designation is used: Nodes 2 to 4.)

Common Memory and Data Link Area Configuration



Local Node Setup Area

Node 1

Area	Beginning address of Common Memory allocation	Classification	Beginning word	Size
1	0	CIO (See note.)	0	0
2	0	DM	0	3000

Node 2

Area	Beginning address of Common Memory allocation	Classification	Beginning word	Size
1	0	CIO (See note.)	0	0
2	3000	DM	1000	1000

Node 3

Area	Beginning address of Common Memory allocation	Classification	Beginning word	Size
1	0	CIO (See note.)	0	0
2	4000	DM	1000	1000

Node 4

Area	Beginning address of Common Memory allocation	Classification	Beginning word	Size
1	0	CIO (See note.)	0	0
2	5000	DM	1000	1000

Note Does not need to be set if data writing (transmission) is not required.

Other Node Setup Area

Node 1

Area	Classification	Beginning word
1	CIO	0
2	EM0	0

Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
2	0	0	0	1000
3	0	0	0	1000
4	0	0	0	1000

Node 2

Area	Classification	Beginning word
1	CIO	0
2	DM	0

Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
1	0	0	0	1000

Node 3

Area	Classification	Beginning word
1	CIO	0
2	DM	0

Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
1	0	0	1000	1000

Node 4

Area	Classification	Beginning word
1	CIO	0
2	DM	0

Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
1	0	0	2000	1000

Note If the local node setup area is in a consecutive area of the other node setup areas, set the node number to 0.

SECTION 6

Message Transmission

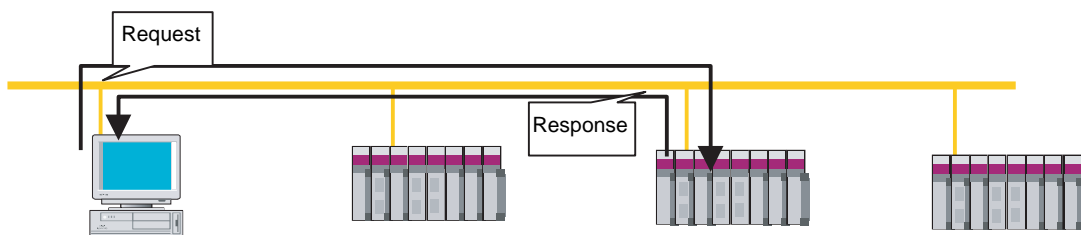
This section describes the message transmission used by an FL-net (Ver. 2.00) network.

6-1	Message Transmission	86
6-2	Details of Supported Messages	88

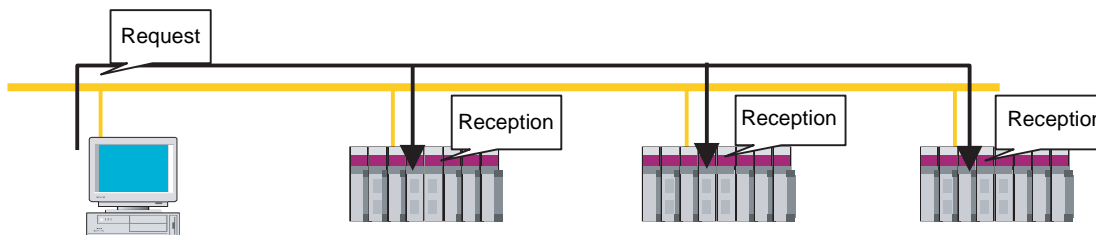
6-1 Message Transmission

Message transmission is a function that supports the asynchronous exchange of data between nodes. The basic functions of message transmissions are explained here.

- 1,2,3...
1. When a node receives the token, it can send one (and only one) message frame before transmitting cyclic data.
 2. The volume of data that can be transmitted in one message frame is 1,024 bytes max.
 3. An algorithm is used so that the allowable refresh cycle time for cyclic transmission is not exceeded.
 4. A message transmission can be sent either to a single destination node as a 1:1 transmission or broadcast to all nodes on the network as a 1:N transmission.
 5. In 1:1 message transmissions, the destination node has an acknowledgement function to check that data has been received successfully. No response is provided by the source node for 1:N message transmissions.



1:1 message transmission



1:N message transmission

Supported Messages

Message	1:1 transmission		1:N transmission	
	Client function	Server function	Client function	Server function
Read byte block	No	No	No	No
Write byte block	No	No	No	No
Read word block	Yes (See note 1.)	Yes	No	No
Write word block	Yes (See note 1.)	Yes	No	No
Read network parameter	No	Yes	No	No
Write network parameter	No	No	No	No
Run/stop command	No	No	No	No
Read profile	No	Yes	No	No
Read communications log data	No	Yes	No	No
Clear communications log data	No	Yes	No	Yes
Echoback message	Yes*	Yes	No	No
Send transparent message frame	Yes (See note 1.)	Yes (See note 1.)	Yes (See note 1.)	Yes (See note 1.)
Vendor message (FINS message)	Yes (See note 1.)	Yes	Yes (See note 1.)	Yes

Yes: Supported

No: Not supported

Yes*: An internode test is provided but the user cannot change the data. For details, refer to 9-3 *Internode Test*.

Note The following table provides a list of messages that are sent from a ladder program in the FL-net (Ver. 2.00) Unit as well as their usage.

Message	Usage	Reference
Read word block data	Sent to another node on the same network.	---
	RECV(098)instruction (See note 1.)	Section 7-2
	WORD BLOCK DATA READ (unspecified node number) (FINS: 2903) (See note 2.)	Section 7-5-7
	WORD BLOCK DATA READ (specified node number) (FINS: 2923) (See note 2.)	Section 7-5-9
	Sent to another node on another FL-net (Ver. 2.00) network.	---
	WORD BLOCK DATA READ (specified node number) (FINS: 2923) (See note 2.)	Section 7-5-9
Write word block data	Sent to another node on the same network.	---
	SEND(090) instruction (See note 1.)	Section 7-2
	WORD BLOCK DATA WRITE (unspecified node number) (FINS: 2904) (See note 2.)	Section 7-5-8
	WORD BLOCK DATA WRITE (specified node number) (FINS: 2924) (See note 2.)	Section 7-5-10
	Sent to another node on another FL-net (Ver. 2.00) network.	---
	WORD BLOCK DATA WRITE (specified node number) (FINS: 2924) (See note 2.)	Section 7-5-10
Send transparent message	TRANSPARENT MESSAGE SEND (FINS: 2901) (See note 2.)	Section 7-5-5
	TRANSPARENT MESSAGE RECEIVE FRAME READ (FINS: 2902) (See note 2.)	Section 7-5-6
Vendor message (FINS message).	SEND(090)/RECV(098)/CMND(490) instruction (FINS communications service) (See note 1.)	SECTION 7

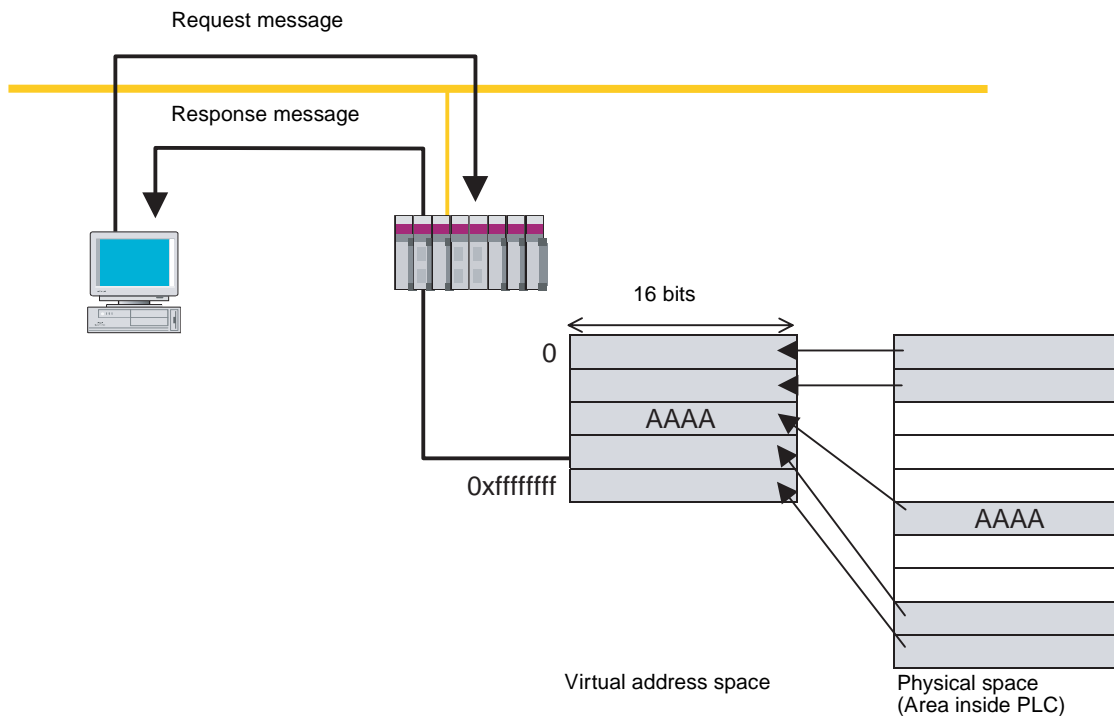
- Note**
1. Messages sent only between OMRON PLCs.
 2. Messages sent between OMRON PLCs or between an OMRON PLC and a node for another manufacturer's unit.

6-2 Details of Supported Messages

Read Word Block Data

This message reads the virtual address space (32-bit address space) of the remote node in word units (16 bits per address). The internal address map varies according to the FL-net Unit being used.

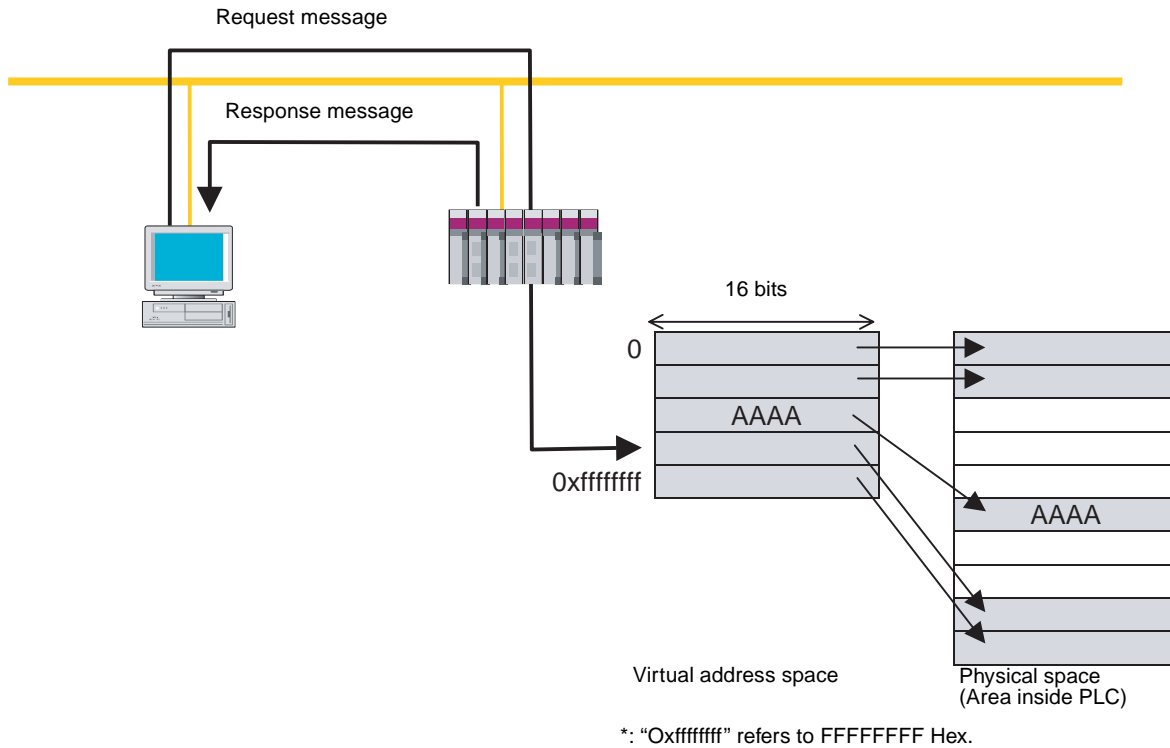
For more information on the FL-net Unit's virtual address space, refer to 7-4 CS-series Memory Areas and Virtual Addresses.



*: "0xffffffff" refers to FFFFFFFF Hex.

Write Word Block Data

This message writes to the virtual address space (32-bit address space) of the remote node in word units (16 bits per address). The internal address map varies with the FL-net Unit being used.

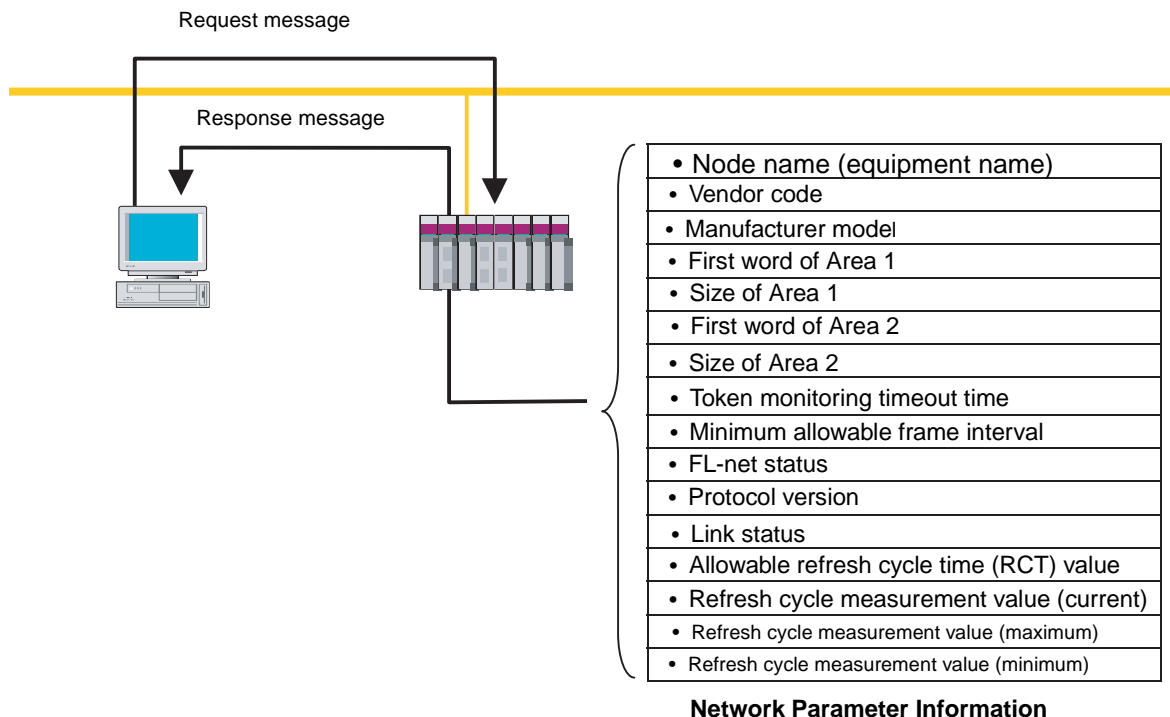


Read Network Parameter

This message reads the following network parameter information for the remote node.

Network Parameter Information

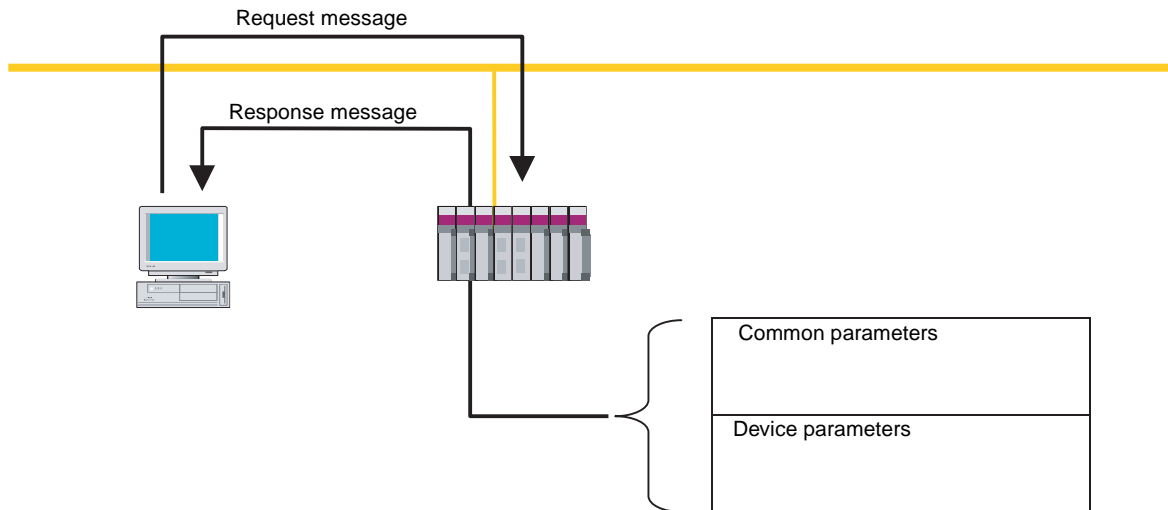
• Node name (equipment name)
• Vendor code
• Manufacturer model
• First word of Area 1
• Size of Area 1
• First word of Area 2
• Size of Area 2
• Token monitoring timeout time
• Minimum allowable frame interval
• FL-net status
• Protocol version
• Link status
• Allowable refresh cycle time (RCT) value
• Refresh cycle measurement value (current)
• Refresh cycle measurement value (maximum)
• Refresh cycle measurement value (minimum)



Read Profile

This message reads the system parameters of the device profile, which provides information on the remote node. The system parameters consist of the following parameter information.

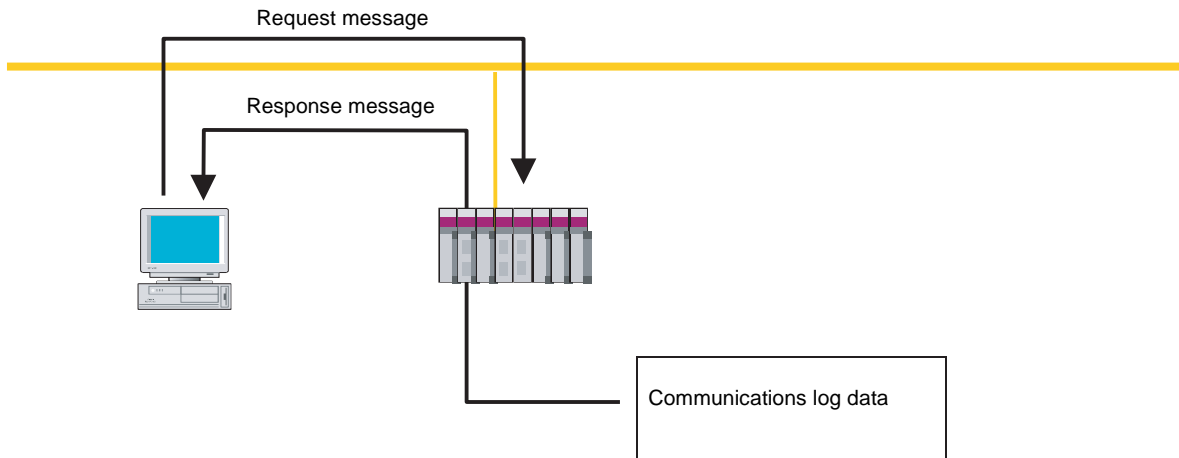
- Common parameters (mandatory)
- Device parameters (optional)



Note For details on the device profile for system parameters, refer to *SECTION 9 Testing Communications*.

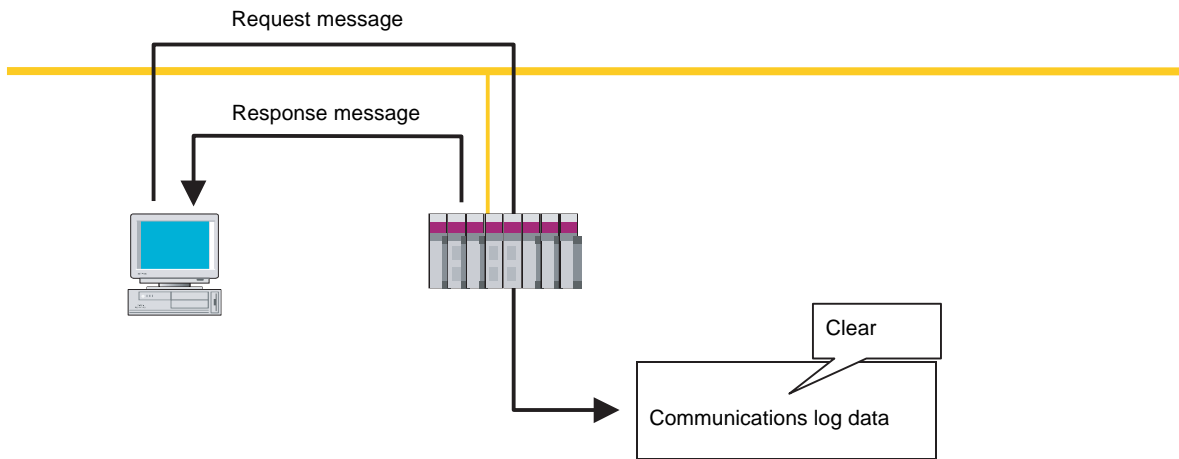
Read Communications Log Data

This message reads the communications log data of the remote node.



Clear Communications Log Data

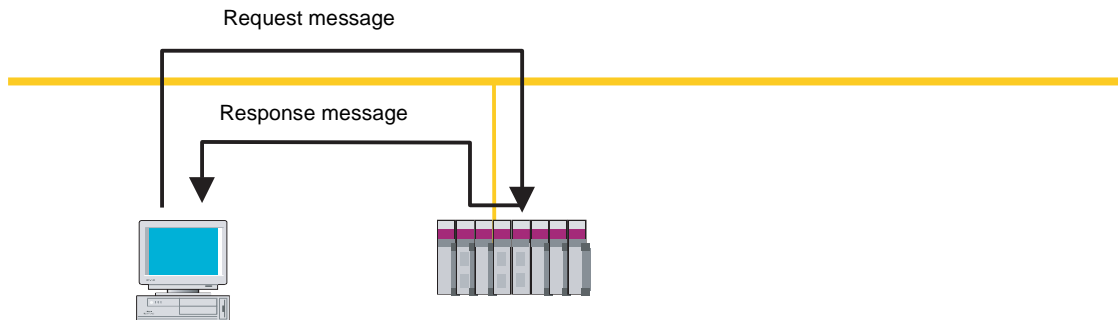
This message clears the communications log data of the remote node.



Echoback Message

This message requests an echoback response for a message that was received.

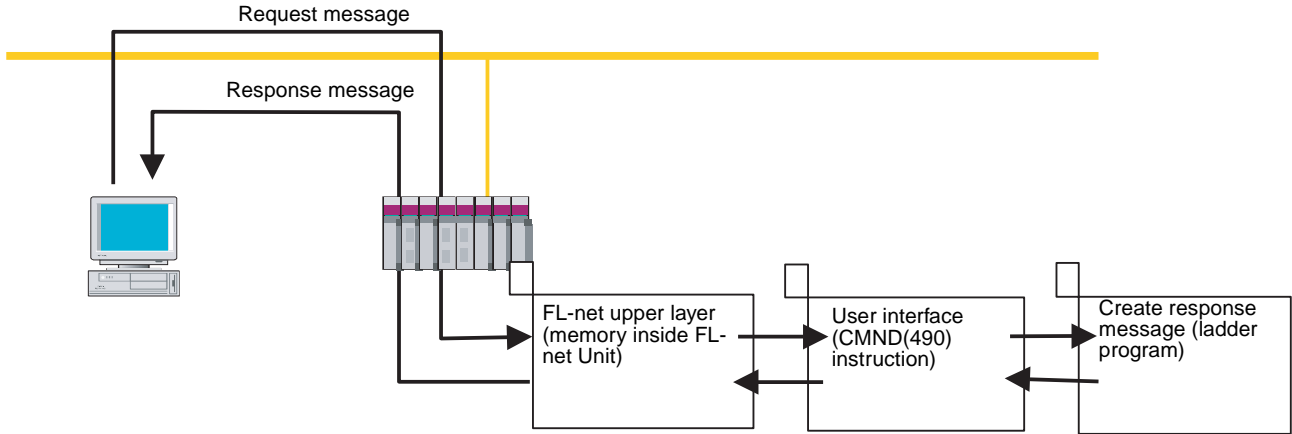
The echoback response occurs automatically in the FL-net Unit.



Note The echoback function is used in the FL-net Unit's internode test. For details, refer to 9-3 Internode Test.

Send Transparent Message Frame

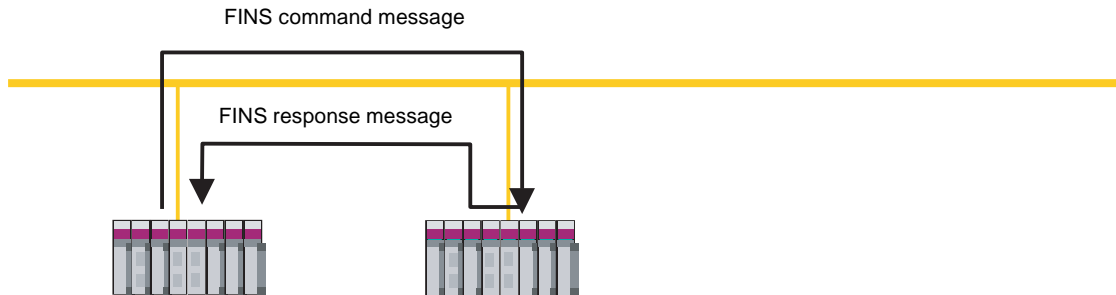
Transparent messages provide a message service in the FL-net's upper layer. The service notifies the FL-net's upper layer of received messages. The FL-net's upper layer notifies the user interface layer. When the user interface layer is notified, a response to the notification must be created and returned.



Note Use the CMND(490) instruction to implement a transparent message through the FL-net Unit. For details, refer to *TRANSPARENT MESSAGE SEND* on page 114 and *TRANSPARENT MESSAGE RECEIVE FRAME READ* on page 119.

Vendor Message (FINS Message)

Vendors can implement their own message service in FL-net (Ver. 2.00). In an OMRON FL-net (Ver. 2.00) Unit, a FINS message service is used for vendor messages.



SECTION 7

FINS Communications

This section provides information on communicating on FL-net Systems and interconnected networks using FINS commands. The information provided in the section deals only with FINS communications in reference to FL-net (Ver. 2.00) Units.

FINS commands from a PLC are sent using the SEND(090), RECV(098), and CMND(490) instructions programmed into the user ladder-diagram program. Although an outline of these instructions is provided in this section, refer to the *CS/CJ-series Programmable Controllers Programming Manual (W340)* for further details on programming these instructions.

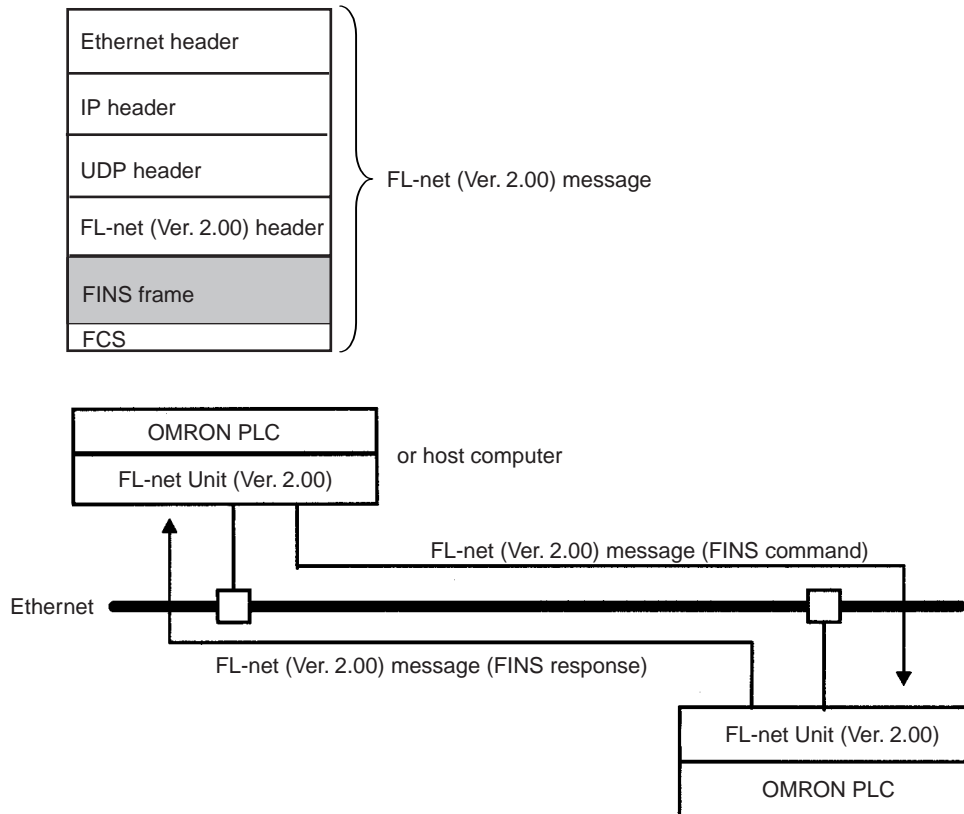
7-1	Overview of FINS Communications	94
7-1-1	Communications On An FL-net (Ver. 2.00) Network	94
7-1-2	FINS Communications Service Features	94
7-2	Sending Commands From a PLC	96
7-2-1	Communications Specifications	96
7-2-2	Program Example	105
7-3	Command Codes and Response Codes	107
7-3-1	Command Code List	107
7-3-2	Response Code List	107
7-4	CS-series Memory Areas and Virtual Addresses	108
7-5	Command/Response Reference	109
7-5-1	CONTROLLER DATA READ	109
7-5-2	CONTROLLER STATUS READ	111
7-5-3	INTERNODE ECHO TEST	112
7-5-4	ERROR LOG READ	113
7-5-5	TRANSPARENT MESSAGE SEND	114
7-5-6	TRANSPARENT MESSAGE RECEIVE FRAME READ	119
7-5-7	WORD BLOCK DATA READ (UNSPECIFIED NODE NUMBER)	124
7-5-8	WORD BLOCK DATA WRITE (Unspecified Node Number)	128
7-5-9	WORD BLOCK DATA READ (Specified Node Number)	129
7-5-10	WORD BLOCK DATA WRITE (Specified Node Number)	134
7-6	Message Buffer Configuration Chart	135

7-1 Overview of FINS Communications

The FINS communications service enables client control of operations such as reading or writing server PLC memory area data without the need to program these operations into the server PLC user program. The FL-net (Ver. 2.00) Unit uses FL-net (Ver. 2.00) message transmissions to execute the FINS communications service. (Refer to *Vendor Message (FINS Message)* on page 92.)

7-1-1 Communications On An FL-net (Ver. 2.00) Network

Data is sent and received as messages on an FL-net (Ver. 2.00) network.



Note A message may be lost during transmission due to factors such as noise. The message service does not guarantee that a message will reach the destination node. To prevent this from occurring when using message services, it is common to set up retry processing at the node from which instructions are sent. With the SEND(090), RECV(098), and CMND(490) instructions, retry processing is executed automatically by specifying the number of retries, so specify a number other than 0.

7-1-2 FINS Communications Service Features

The FINS communications service is a function for controlling operations such as sending and receiving data, changing modes, and so on, between nodes on OMRON factory automation networks. It provides the following features.

- Communications instructions are executed in the user program.
- Writing data, changing modes, reading detailed information about Units, and so on, can be executed without any particular knowledge of communications procedures or network classification.

- Units and Boards that support FINS commands return responses automatically, so there is no need for a program at the receiving end.
- The FINS communications service is mainly used between OMRON CPU Bus Units, CPU Units, and Support Boards for FA Computers. By correctly setting information such as headers, however, it can also be used from ordinary Ethernet communications devices.

The FINS communications service can be used from a PLC with either of the following three instructions:

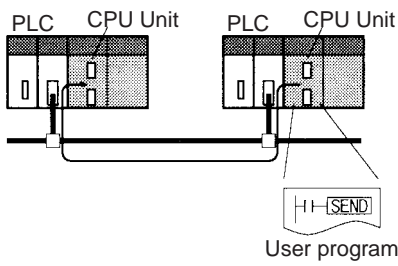
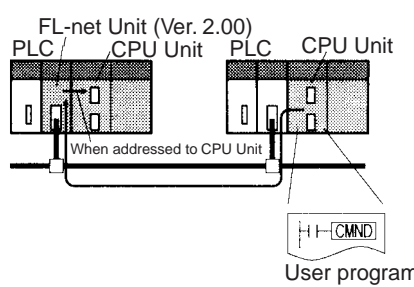
• **SEND(090)/RECV(098)**

SEND(090) and RECV(098) are used to send and receive data (area reading and writing).

• **CMND(490)**

CMND(490) is used to send FINS commands. The particular FINS commands that are supported vary depending of the type of Unit or Board. For details on FINS commands addressed to FL-net (Ver. 2.00) Units, refer to *7-5 Command/Response Reference*. For details regarding FINS commands addressed to CS-series CPU Units, refer to the *CS/CJ-series Programmable Controllers Communications Commands Reference Manual (W342)*.

The following table shows how the FINS communications service is used by the communications source and destination.

Local node to remote node	SEND(090)/RECV(098)	CMND(490) (FINS commands)
PLC to PLC	<ul style="list-style-type: none"> • When the PC executes SEND(090) or RECV(098), a program is not required for receiving a response. • When the PC receives a SEND(090) or RECV(098) instruction, a program is not required for processing the instruction. 	<ul style="list-style-type: none"> • When the PC executes CMND(490), a program is not required for receiving a response. • When the PC receives a CMND(490) instruction, a program is not required for processing the instruction. 

7-2 Sending Commands From a PLC

FINS commands can be sent from the user's ladder-diagram program in the CPU Unit by using the SEND(090), RECV(098), and CMND(490) instructions.

SEND(090): Writes I/O data from the local node to another node.

RECV(098): Reads I/O data from another node to the local node.

CMND(490): Sends FINS commands for controlling operations such as sending and receiving I/O memory data to and from other nodes, reading information regarding other nodes, and so on.

7-2-1 Communications Specifications

The following table shows the specifications for PLC communications using the SEND(090), RECV(098), and CMND(490) instructions.

Item	Specifications
Destination	1:1: SEND(090), RECV(098), CMND(490) instructions 1:N: SEND(090), CMND(490) instructions (broadcasting)
Data length	Addressed to an FL-net node (Ver. 2.00) on the same layer
	SEND(090): 512 words (1,024 bytes) max., including broadcasting
	RECV(098): 512 words (1,024 bytes) max.
	CMND(490): 1,014 bytes max. (after the FINS command code), including broadcasting (after FINS command code)
	Addressed to an FL-net node (Ver. 2.00) on another layer (2nd or 3rd layer)
	SEND(090): 503 words (1,006 bytes) max., including broadcasting
	RECV(098): 505 words (1,010 bytes) max.
	CMND(490): 1,014 bytes max. (after the FINS command code), including broadcasting
Data contents	The following data is sent and received with the execution of each instruction. SEND(090): Sends request for remote node to receive data, and receives response data. RECV(098): Sends request for remote node to send data, and receives response data. CMND(490): Sends any FINS command and receives response data.
Communications port number	Ports 0 to 7 (Eight transmissions can occur simultaneously.)
Response monitoring time	0000: 2 s (default) 0001 to FFFF: 0.1 to 6,553.5 s in 0.1-s increments (specified by user)
Number of retries	0 to 15 retries

- Note**
1. The maximum data length is limited to 512 bytes for data exchange between the PLC and SYSMAC LINK Systems or the PLC and SYSMAC BUS/2 Remote I/O Systems.
 2. When broadcasting, do not request a response.

PLC Communications Data Areas

The following table shows the I/O data areas involved when SEND(090) and RECV(098) are used.

Area	Range
CIO Area	CIO 0000 to CIO 6143
Work Area	W000 to W511
Holding Area	H000 to H511
Auxiliary Area	A000 to A959 (See note 1.)
Timer Area	TIM0000 to 4095
Counter Area	CNT0000 to 4095
DM Area	D00000 to D32767
EM Area	E00000 to E32767 (See note 2.)

- Note**
1. Data cannot be written to words A000 to A447 in the Auxiliary Area.

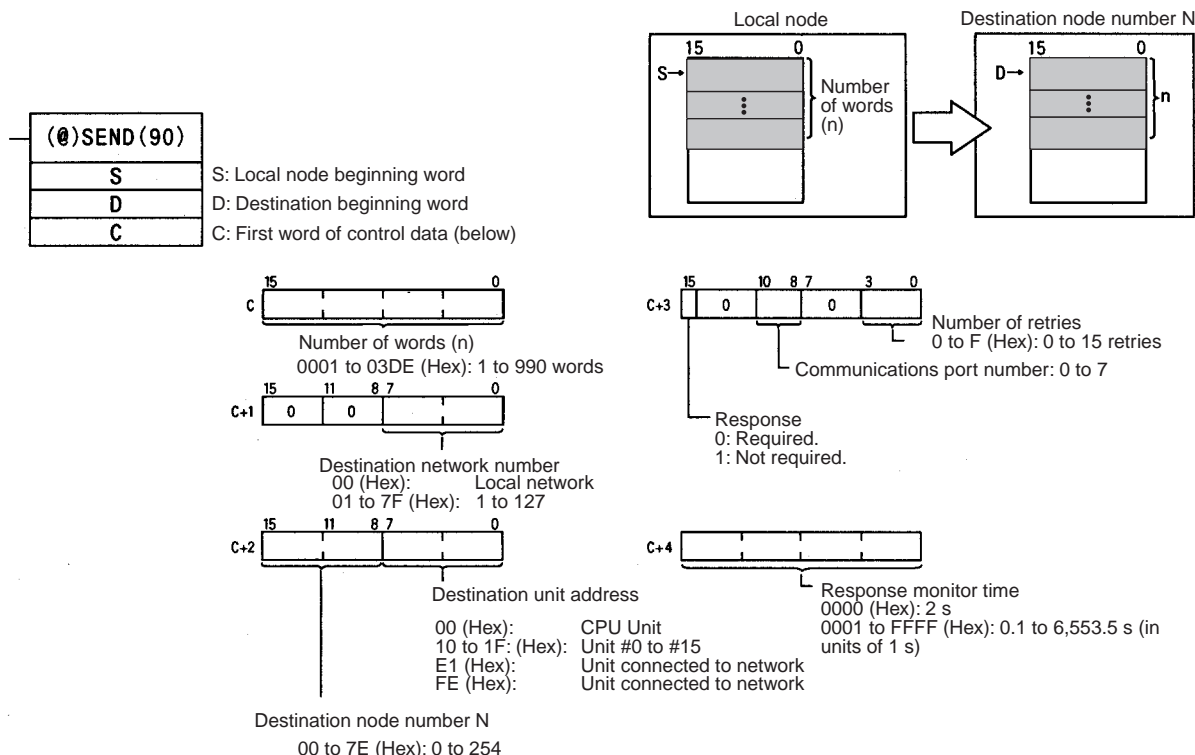
- A maximum of 13 banks in the EM Area can be used. For details regarding the EM Area, refer to the operation manual for the PLC that is used.

Using SEND(090), RECV(098), and CMND(490)

Make the settings shown below when using the SEND(090), RECV(098), and CMND(490) instructions in the user's ladder-diagram program in the CPU Unit.

SEND(090)

The SEND(090) instruction sends the data in n number of words, starting from the beginning word S at the local node, to the words starting from the beginning word D at the remote destination node (node number N).



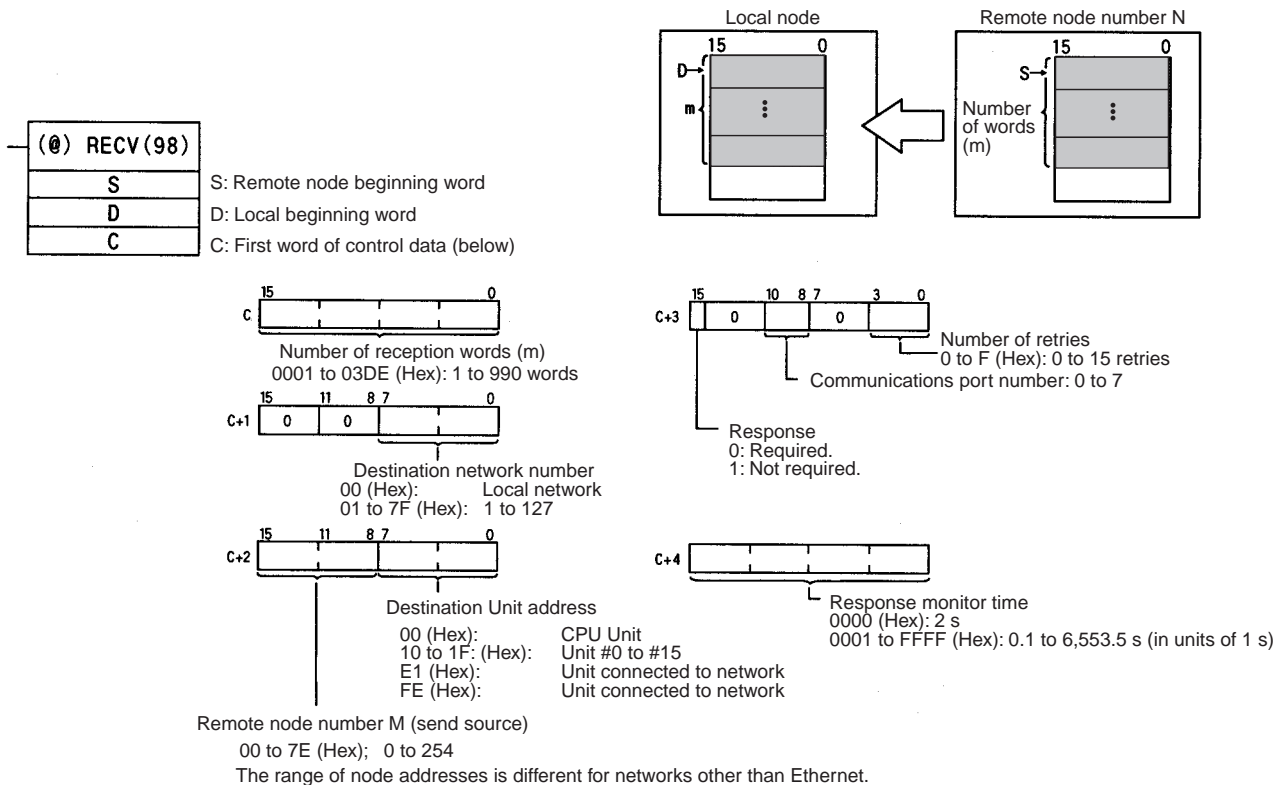
The same data can be broadcast to all nodes on the network by setting the destination node number to FF (Hex).

The range of node addresses is different for networks other than Ethernet.

Note The message service does not guarantee that a message will reach the destination node. A message may be lost during transmission due to factors such as noise. To prevent this from occurring when using message services, it is common to set up retry processing at the node from which instructions are sent. With the SEND(090), RECV(098), and CMND(490) instructions, retry processing is executed automatically by specifying the number of retries, so specify a number other than 0.

RECV(098)

With the RECV(098) instruction, the data in m number of words, starting from the beginning word S at the remote node (node number M), is received at the words starting from the beginning word D at the local node.

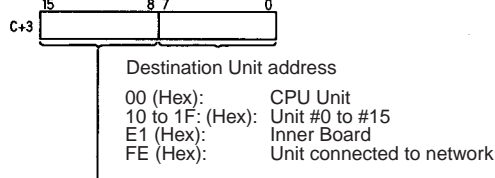
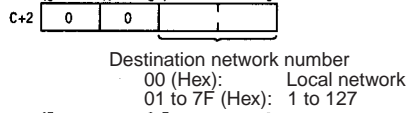
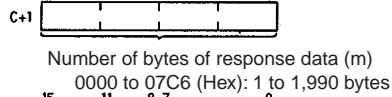
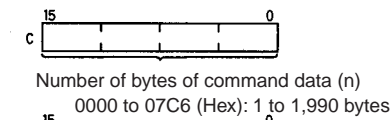


Note The message services function does not guarantee that a message will reach the destination node. A message may be lost during transmission due to factors such as noise. In order to prevent this from occurring when using message services, it is common to set up retry processing at the node from which instructions are sent. With the SEND(090), RECV(098), and CMND(490) instructions, retry processing is executed automatically by specifying the number of retries, so specify a number other than 0.

CMND(049)

The CMND(049) instruction sends n bytes of command data, starting from the beginning word S at the local node, to the node at node number N. The data in m number of words, starting from the beginning word S at the remote node (node number M) is received at the words starting from the beginning word D at the local node.

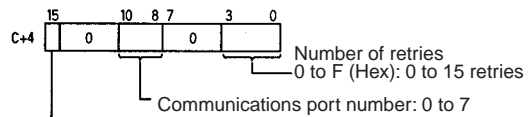
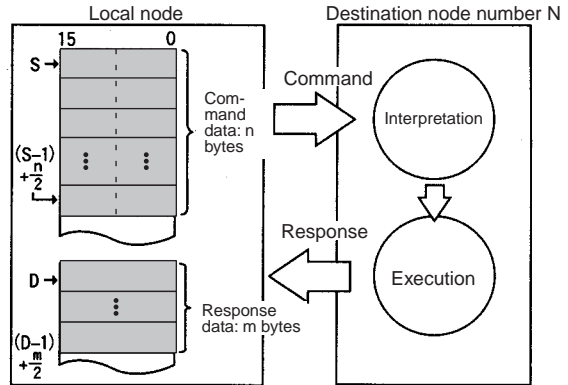
(@)CMND(490)	
S	S: Beginning command storage word
D	D: Beginning response storage word
C	C: First word of control data (below)



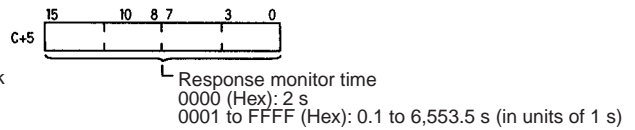
Destination node number N
00 to 7E (Hex); 0 to 254

The same data can be broadcast to all nodes on the network by setting the destination node number to FF (Hex).

The range of node addresses is different for networks other than Ethernet.



Response
0: Required.
1: Not required.



Note The message services function does not guarantee that a message will reach the destination node. A message may be lost during transmission due to factors such as noise. In order to prevent this from occurring when using message services, it is common to set up retry processing at the node from which instructions are sent. With the SEND(090), RECV(098), and CMND(490) instructions, retry processing is executed automatically by specifying the number of retries, so specify a number other than 0.

Commands Addressed to CS-series CPU Units

The following table provides a list of FINS commands that can be processed by a CS-series CPU Unit. For details, refer to the *CS/CJ-series Programmable Controllers Communications Commands Reference Manual (W342)*.

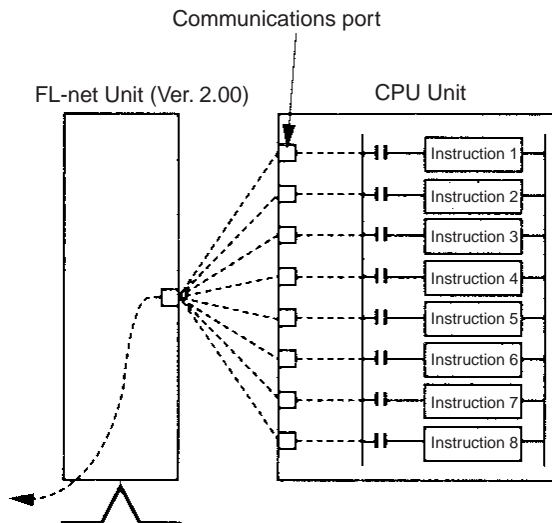
For details on FINS commands that can be processed by the FL-net (Ver. 2.00) Unit, refer to *7-5 Command/Response Reference*.

Usage	Command code		Name	Function
	MR	SR		
I/O memory area access	01	01	MEMORY AREA READ	Reads the contents of consecutive I/O memory area words.
	01	02	MEMORY AREA WRITE	Writes the contents of consecutive I/O memory area words.
	01	03	MEMORY AREA FILL	Writes the same data to the specified range of I/O memory area words.
	01	04	MULTIPLE MEMORY AREA READ	Reads the contents of specified non-consecutive I/O memory area words.
	01	05	MEMORY AREA TRANSFER	Copies the contents of consecutive I/O memory area words to another I/O memory area.
Parameter area access	02	01	PARAMETER AREA READ	Reads the contents of consecutive parameter area words.
	02	02	PARAMETER AREA WRITE	Writes the contents of consecutive parameter area words.
	02	03	PARAMETER AREA FILL (CLEAR)	Writes the same data to the specified range of parameter area words.
Program area access	03	06	PROGRAM AREA READ	Reads the UM (User Memory) area.
	03	07	PROGRAM AREA WRITE	Writes to the UM (User Memory) area.
	03	08	PROGRAM AREA CLEAR	Clears the UM (User Memory) area.
Operating mode changes	04	01	RUN	Changes the CPU Unit's operating mode to RUN or MONITOR.
	04	02	STOP	Changes the CPU Unit's operating mode to PROGRAM.
Machine configuration reading	05	01	CPU UNIT DATA READ	Reads CPU Unit data.
	05	02	CONNECTION DATA READ	Reads the model numbers of the device corresponding to addresses.
Status reading	06	01	CPU UNIT STATUS READ	Reads the status of the CPU Unit.
	06	20	CYCLE TIME READ	Reads the maximum, minimum, and average cycle time.
Time data access	07	01	CLOCK READ	Reads the present year, month, date, minute, second, and day of the week.
	07	02	CLOCK WRITE	Changes the present year, month, date, minute, second, or day of the week.
Message display	09	20	MESSAGE READ/CLEAR	Reads and clears messages, and reads FAL/FALS messages.
Access rights	0C	01	ACCESS RIGHT ACQUIRE	Acquires the access right as long as no other device holds it.
	0C	02	ACCESS RIGHT FORCED ACQUIRE	Acquires the access right even if another device already holds it.
	0C	03	ACCESS RIGHT RELEASE	Releases the access right that has been acquired.
Error log	21	01	ERROR CLEAR	Clears errors or error messages.
	21	02	ERROR LOG READ	Reads the error log.
	21	03	ERROR LOG POINTER CLEAR	Clears the error log pointer.

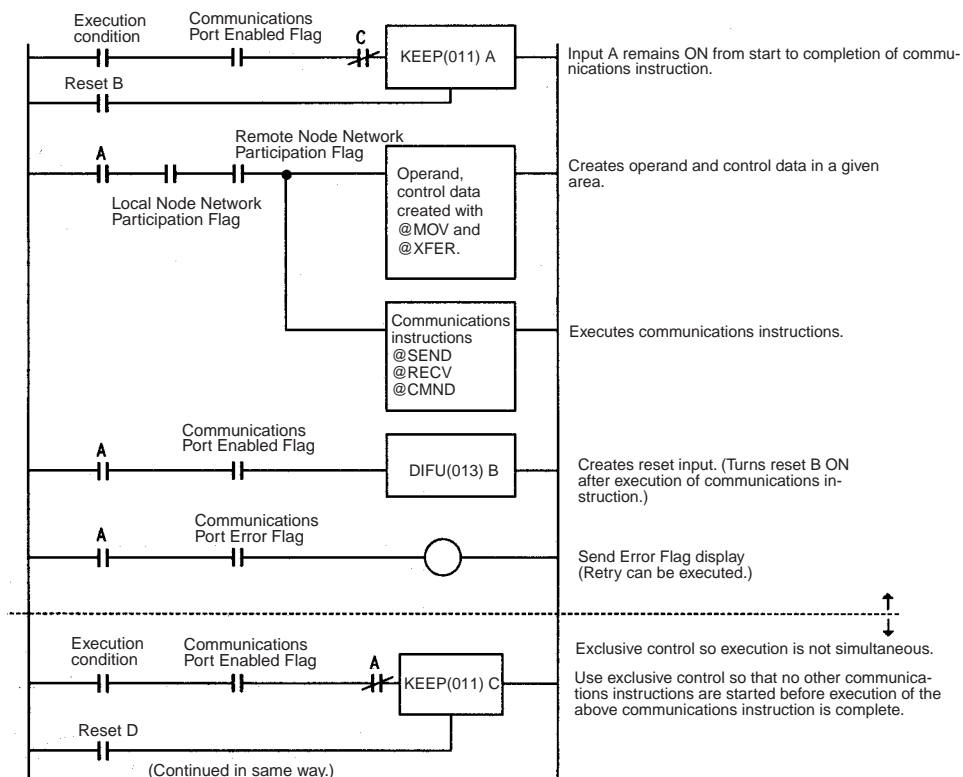
Usage	Command code		Name	Function
	MR	SR		
File memory	22	01	FILE NAME READ	Reads file memory data.
	22	02	SINGLE FILE READ	Reads a specified length of file data from a specified position within a single file.
	22	03	SINGLE FILE WRITE	Writes a specified length of file data from a specified position within a single file.
	22	04	FILE MEMORY FORMAT	Formats (initializes) the file memory.
	22	05	FILE DELETE	Deletes specified files stored in the file memory.
	22	07	FILE COPY	Copies files from one file memory to another file memory in the same system.
	22	08	FILE NAME CHANGE	Changes a file name.
	22	0A	MEMORY AREA-FILE TRANSFER	Transfers or compares data between the I/O memory area and the file memory.
	22	0B	PARAMETER AREA-FILE TRANSFER	Transfers or compares data between the parameter area and the file memory.
	22	0C	PROGRAM AREA-FILE TRANSFER	Transfers or compares data between the UM (User Memory) area and the file memory.
	22	15	CREATE/DELETE DIRECTORY	Creates or deletes a directory.
Debugging	23	01	FORCED SET/RESET	Force-sets or force-resets bits, or releases force-set status.
	23	02	FORCED SET/RESET CANCEL	Cancels all bits that have been force-set or force-reset.

Writing Programs

Programs incorporating the SEND(090), RECV(098), and CMND(490) instructions are generally created using the Communications Port Enabled Flag and the Communications Port Error Flag as input conditions. CS-series CPU Units have eight communications ports. Only one instruction can be executed at any given port at one time, however, so the program must not overlap the use of any of the ports. A program example is provided below.



There are eight communications ports, so up to eight communications instructions can be executed at a time. The number of messages that can be sent or received with a single CPU Bus Unit service, though, is not more than two each for the CPU Unit to the FL-net (Ver. 2.00) Unit and for the FL-net (Ver. 2.00) Unit to the CPU Unit.



Communications Flags

The execution status of the SEND(090), RECV(098), and CMND(490) instructions is always reflected by the communications flags (i.e., the Communications Port Enabled Flag and the Communications Port Error Flag). The CS-series CPU Unit's communications flags are allocated in the Auxiliary Area as shown in the following table.

Flag name	Address		Contents
	Word	Bits	
Communications Port Enabled Flag	A202	Bit 7: Port 7 Bit 6: Port 6 Bit 5: Port 5 Bit 4: Port 4 Bit 3: Port 3 Bit 2: Port 2 Bit 1: Port 1 Bit 0: Port 0	OFF: Execution enabled (being executed) ON: Execution disabled (not being executed)
Communications Port Error Flag	A219	Bit 7: Port 7 Bit 6: Port 6 Bit 5: Port 5 Bit 4: Port 4 Bit 3: Port 3 Bit 2: Port 2 Bit 1: Port 1 Bit 0: Port 0	OFF: Normal completion ON: Abnormal completion

Note With CS-series PLCs, communications ports 0 to 7 are also used for executing the PLCMR(260) (PROTOCOL MACRO) instruction, so these flags are used in common for SEND(090), RECV(098), CMND(490), and PLCMR(260). While PLCMR(260) is being executed, SEND(090), RECV(098), and CMND(490) cannot be executed at the same communications port.

Communications Port Completion Codes

The status of a SEND(090), RECV(098), and CMND(490) instruction after execution is reflected as a communications port completion code, in one word (two bytes) of data as shown in the following table. (The value is 0000 during instruction execution.) The recorded status is saved until execution of the next instruction.

Word	Contents
A203	Communications Port 0 Completion Code
A204	Communications Port 1 Completion Code
A205	Communications Port 2 Completion Code
A206	Communications Port 3 Completion Code
A207	Communications Port 4 Completion Code
A208	Communications Port 5 Completion Code
A209	Communications Port 6 Completion Code
A210	Communications Port 7 Completion Code

The meanings of the communications port completion codes are the same as those for FINS commands and responses (response codes). When CMND(490) is used, however, even if a FINS command has an abnormal completion, it will not be reflected in the communications port completion code. For details, refer to *Communications Port Error Flag and Response Codes CMND(490)* on page 104.

Bits 08 to 15 in the communications port completion code correspond to the first byte of the response code, and bits 00 to 07 correspond to the second byte.

Communications Port Error Flag and Response Codes CMND(490)

Errors that occur when CMND(490) is used generate a Communications Port Error Flag and are recorded in a communications port response code only in the following cases:

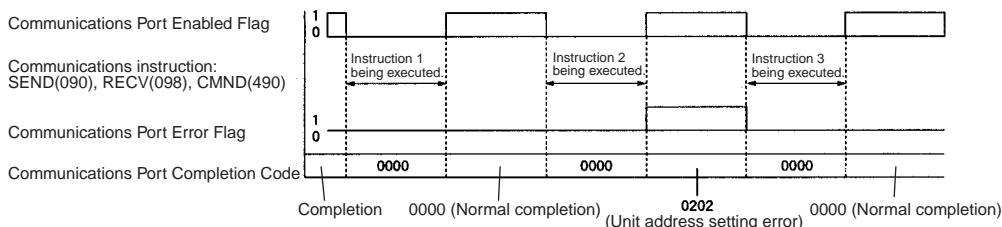
- When a response timeout error has occurred.
- When the number of communications data bytes exceeds the maximum value for the Unit (i.e., more than 1,014 bytes) after the FINS command code for the FL-net (Ver. 2.00) Unit.
- When the actual number of response bytes is greater than the number of reception bytes that has been set. (The response is not stored in this case.)

Errors other than these are recorded in the response codes of the responses stored from the beginning response storage word onwards. Be careful of these, because there are no Communications Port Error Flags and they are not recorded in a communications port response code.

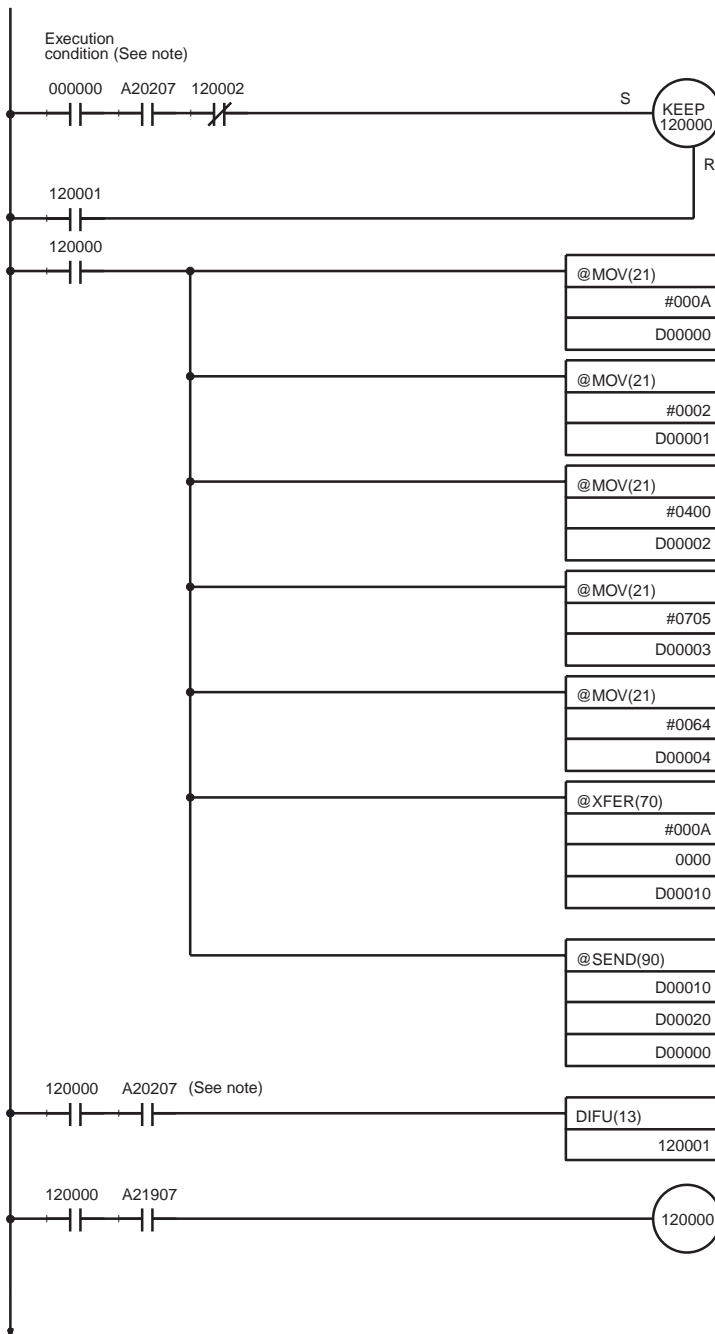
Timing of Communications Flag Changes

- The Communications Port Enabled Flag remains OFF during communications and turns ON when they are completed (regardless of whether or not an error occurs).
- The Communications Port Error Flag retains its status until the next transmission or reception.
- The Communications Port Error Flag turns OFF with the execution of the next communications instruction even if there was an abnormal completion.

Example



7-2-2 Program Example



(Continued on next page.)

When the Communications Port Enabled Flag for port 7 is ON, and RECV(098) is not being executed, the send execution program will start when execution condition CIO 000000 turns ON.

Input CIO 120000 remains ON from the start of SEND(090) execution until completion.

Control Data Creation

Word	Contents	Meaning
D0000	00 0A	Number of send words = 10
D0001	00 02	Destination network number = 2
D0002	04 00	Destination node number = 4 Destination unit address = 0
D0003	07 05	Response required. Communications port No. used = 7 Number of retries = 5
D0004	00 64	Response monitor time = 10 s

Send Data Creation

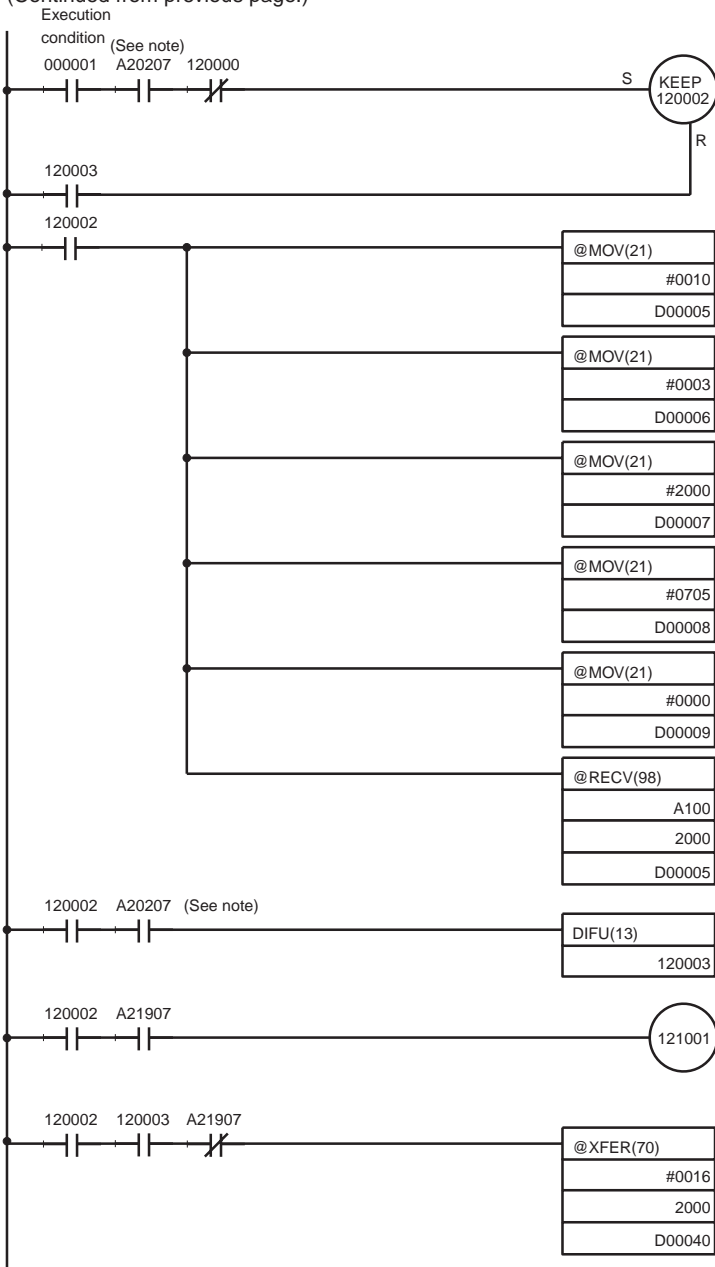
Ten words of data from word CIO 0000 is stored from D00010 onwards.

Ten words of data from D00010 at the local node is sent to D00020 onwards at network number 2, node number 4, unit address 0 (the PC).

Reset Input Creation

Send Error Display

(Continued from previous page.)



When the Communications Port Enabled Flag for port 7 is ON, and SEND(090) is not being executed, the transmission execution program will start when execution condition CIO 000001 turns ON.

Input CIO 120002 remains ON from the start of RECV(098) execution until completion.

Control Data Creation

Word	Contents	Meaning
D0005	00 10	Number of reception words = 16
D0006	00 03	Destination network number = 3
D0007	20 00	Destination node number = 32 Destination unit address = 0
D0008	07 05	Response required. Communications port No. used = 7 Number of retries = 5
D0009	00 00	Response monitor time = Default

A total of 16 words of data beginning from word A100 at network number 3, node number 32, unit address 0 (the PC) is received at word CIO 2000 onwards of the local node.

Reset Input Creation

Reception Error Display

Reception Data Processing

If there is no reception processing completion error, the 16 words of data received from word CIO 2000 onwards is stored at D00040 onwards.

Note The Communications Port Enabled Flags at bits 0 to 7 in word A202 turn OFF even when the PLCMR(260) instruction is being executed using the ports corresponding to those flags.

7-3 Command Codes and Response Codes

7-3-1 Command Code List

The FL-net (Ver. 2.00) Unit supports and therefore automatically returns a response to the command codes listed in the following table (FINS commands addressed to the FL-net (Ver. 2.00) Unit).

Command code		Function name
MRC	SRC	
05	01	CONTROLLER DATA READ
06	01	CONTROLLER STATUS READ
08	01	INTERNODE ECHO TEST
21	02	ERROR LOG READ
29	01	TRANSPARENT MESSAGE FRAME SEND
	02	TRANSPARENT MESSAGE RECEIVED FRAME READ
	03	WORD BLOCK DATA READ (unspecified node number)
	04	WORD BLOCK DATA WRITE (unspecified node number)
	23	WORD BLOCK DATA READ (specified node number)
	24	WORD BLOCK DATA WRITE (specified node number)

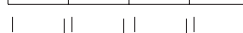
Note The WORD BLOCK DATA READ/WRITE commands with an unspecified node numbers are provided to ensure compatibility with applications created with the CS1W-FLN01. Use the WORD BLOCK DATA READ/WRITE commands with specified node numbers to create new applications.

7-3-2 Response Code List

Response codes are 2-byte codes that indicate the results of command execution. They are returned in the response following the command code.

The first byte of a response code is the MRES (main response code), which categorizes the results of command execution. The second byte is the SRES (sub-response code) which specifies the results.

The relationship between the MRES and the execution results are shown in the table on the next page.



MRC SRC MRES SRES

MRC: Main request code
 SRC: Sub-request code
 MRES: Main response code
 SRES: Sub-response code

The MRES codes are shown in the following table along with the results they indicate. Refer to *10-1 Troubleshooting with Indicators* for details on response codes including the SRES.

MRES	Execution results
00	Normal completion
01	Local node error
02	Remote node error
03	Unit error (controller error)
04	Service not supported
05	Routing error
10	Command format error
11	Parameter error
22	Status error
23	Operating environment error
25	Unit error

7-4 CS-series Memory Areas and Virtual Addresses

Virtual address space is allocated in the Memory Area where messages are read and written in FL-net (Ver. 2.00). The virtual address space in the Memory Area of all manufacturer's FL-net (Ver. 2.00) nodes is allocated in 4-byte hexadecimal within the virtual address space range, so you can read and write between the Memory Areas of different equipment simply by specifying the address.

The following table shows virtual address space allocation for OMRON PLCs (CPU Units). Refer to the manual of other manufacturer's FL-net (Ver. 2.00) nodes for details on their virtual address space allocation.

Virtual Address Space for OMRON CPU Units

Area		Read/Write	Address	
DM Area	D00000 to D32767	R/W	00020000 to 00027FFF	
Timer Area	T000 to T4095	R/W	00090000 to 00090FFF	
Counter Area	C000 to C4095	R/W	000A0000 to 000A0FFF	
EM Area	Bank 0	E0_00000 to E0_32767	R/W	00200000 to 00207FFF
	Bank 1	E1_00000 to E1_32767	R/W	00210000 to 00217FFF
	Bank 2	E2_00000 to E2_32767	R/W	00220000 to 00227FFF
	Bank 3	E3_00000 to E3_32767	R/W	00230000 to 00237FFF
	Bank 4	E4_00000 to E4_32767	R/W	00240000 to 00247FFF
	Bank 5	E5_00000 to E5_32767	R/W	00250000 to 00257FFF
	Bank 6	E6_00000 to E6_32767	R/W	00260000 to 00267FFF
	Bank 7	E7_00000 to E7_32767	R/W	00270000 to 00277FFF
	Bank 8	E8_00000 to E8_32767	R/W	00280000 to 00287FFF
	Bank 9	E9_00000 to E9_32767	R/W	00290000 to 00297FFF
	Bank A	EA_00000 to EA_32767	R/W	002A0000 to 002A7FFF
	Bank B	EB_00000 to EB_32767	R/W	002B0000 to 002B7FFF
Bank C	EC_00000 to EC_32767	R/W	002C0000 to 002C7FFF	
CIO Area	0000 to 6143	R/W	00300000 to 003017FF	
Work Area	W000 to W511	R/W	00310000 to 003101FF	
Holding Area	H000 to H511	R/W	00320000 to 003201FF	
Auxiliary Area	A000 to A447	R	00330000 to 003301BF	
	A448 to A959	RW	003301C0 to 003303BF	

7-5 Command/Response Reference

This section describes the FINS commands that can be sent to FL-net (Ver. 2.00) Units and the responses to each command.

Reading Reference Pages

The reference pages for FINS commands are configured as follows:

- **Command Name**
Gives the command name and code.
- **Function**
Provides a brief description of the command's function.
- **Command Block**
Gives the command format. Each box represents one byte.
- **Response Block**
Shows the response format. Each box represents one byte.
- **Parameters**
Describes parameter details like the setting range.
- **Precautions**
Provides precautions regarding the use of commands.
- **Response Codes**
Provides response codes for command responses.

7-5-1 CONTROLLER DATA READ

Reads the controller data.

Command Block

05	01
----	----

Command code

Response Block

05	01			20 bytes	20 bytes	4 bytes	4 bytes		6 bytes
Command code	Response code		Model	Version	IP address	Subnet mask	Mode setting		Ethernet address

Parameters

Model, Version (Response)

The FL-net (Ver. 2.00) Unit model and version are returned as ASCII characters using 20 bytes each (i.e., 20 characters each). If all bytes are not used, the remaining bytes will be all spaces (ASCII 20 Hex).

Examples

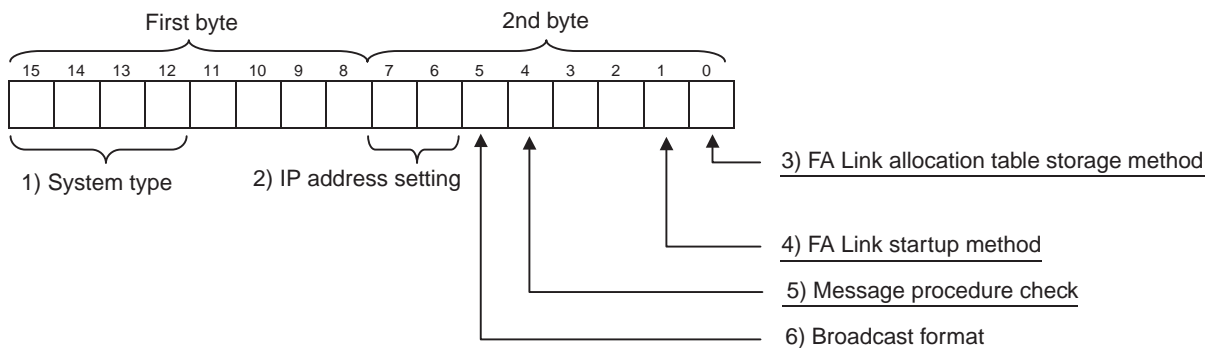
Model: CS1W-FLN02, CS1W-FLN12

Version:V1.00

IP Address, Subnet Mask (Response)

The FL-net (Ver. 2.00) Unit IP address and subnet mask are returned as 4 bytes each.

Mode Setting (Response) The mode set in the system setup is returned.



1. System Type
Bits 12 to 15 show the type of Unit.

Bit				Description
15	14	13	12	
0	0	0	1	FL-net (Ver. 2.00) Unit
Others				Parameter error

2. IP Address Setting
These bits provide details about the type of IP address settings.

Bit		Description
7	6	
0	0	Operates with the IP address switch setting on the back of the Unit.
1	0	Operates with the IP address switch setting on the back of the Unit and the node address switch setting on the front of the Unit.
0	1	Operates with the CPU Bus Unit system setting that is set through the FL-net Unit Support Tool.
1	1	Operates with the default setting (192.168.250. <i>node_address_switch_setting</i>).

3. FA Link Allocation Table Storage Method
This bit provides details about where the data link (FA link allocation) table is stored.

Bit	Description
0	<u>Store in CPU Unit</u> Stores the data link tables (FA link allocations) in the System Bus Unit setup area of the CPU Unit.
1	<u>Store in FL-net Unit</u> Stores the data link tables (FA link allocations) in the FL-net (Ver. 2.00) Unit EEPROM.

4. FA Link Startup Method

This bit provides details about the communications settings (automatic for manual log in) when PLC power is turned ON.

Bit	Description
1	
0	<u>Automatic Log In</u> Communications are enabled automatically by turning ON PLC power.
1	<u>Manual Log In</u> Communications are not enabled by turning ON PLC power. With this setting, communications are enabled instead by turning ON the FA Link Connection Start Bit after the PLC is turned ON. (Refer to <i>Unit Control Bits (CPU Unit to FL-net Unit)</i> on page 62.)

5. Message Procedure Check

This bit provides details about the message procedure settings (checked or not checked).

Bit	Description
1	
0	<u>Checked</u> Select only when sending messages between OMRON FL-net (Ver. 2.00) Units.
1	<u>Not checked</u> Select when connected to another manufacturer's FL-net (Ver. 2.00) node.

6. Broadcast Format

This bit provides details about the broadcast format settings.

Bit	Description
1	
0	***.***.255
1	255.255.255.255

Ethernet Address (Response)

The Ethernet address of the FL-net (Ver. 2.00) Unit is returned.

Note The Ethernet address is marked on the label on the side of the FL-net (Ver. 2.00) Unit.

Response Codes

Response code	Description
0000	Normal
1001	Command too large

7-5-2 CONTROLLER STATUS READ

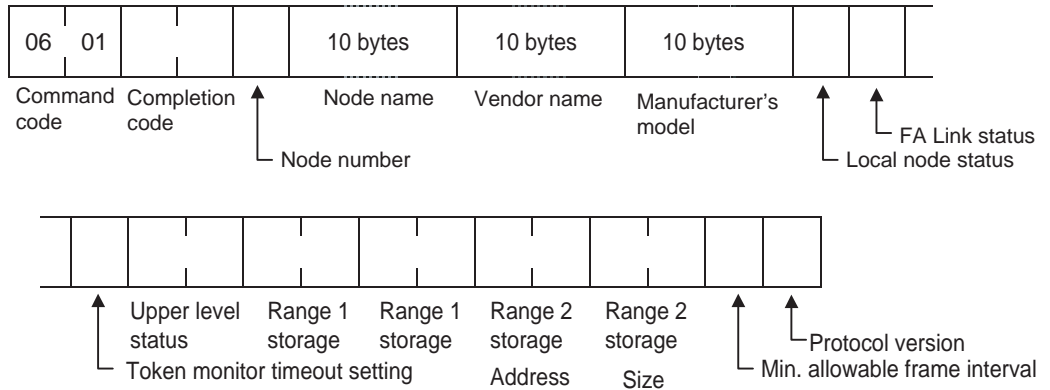
Reads the controller status.

Command Block

06	01
----	----

Command code

Response Block



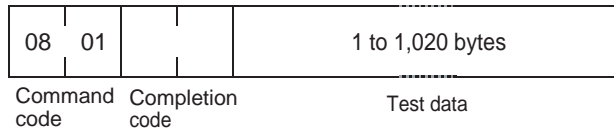
Response Codes

Response code	Description
0000	Normal
1001	Command too large

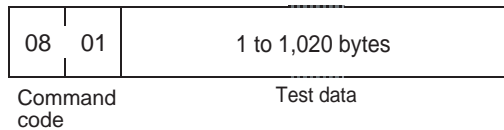
7-5-3 INTERNODE ECHO TEST

Performs the FINS echoback test.

Command Block



Response Block



Parameter

Test Data (Command, Response)

Specifies data sent to a specified node by a command that is 1 to 1,020 bytes long. The response returns test data that is the same as the data sent in the command. There is something clearly wrong if the data in the command does not match the test data in the response.

Precautions

- This command sends a FINS command (0801) message to a remote node by VENDER MESSAGE (request/transaction code: 65016).
- The Unit receiving this command must be an OMRON FL-net (Ver. 2.00) Unit.

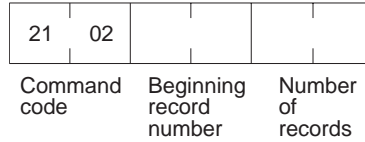
Response Codes

Response code	Description
0000	Normal
1001	Command too large
1002	Command too small

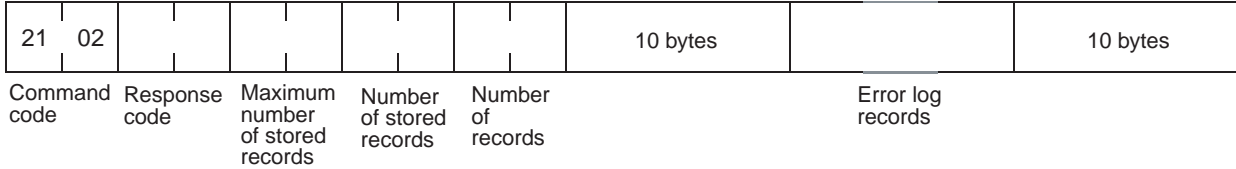
7-5-4 ERROR LOG READ

Reads the error log.

Command Block



Response Block



Parameters

Beginning Record Number (Command)

The first record to be read. The first record number can be specified in the range between 0000 and 003F (0 to 63 decimal) where 0000 is the oldest record.

Number of Records (Command, Response)

The number of records to read is specified between 0001 and 0040 (1 to 64 decimal) in the command. The response returns the actual number of records read.

Maximum Number of Stored Records (Response)

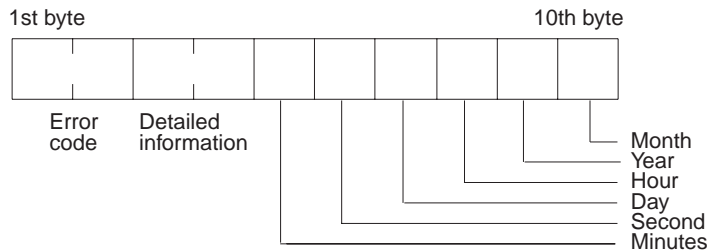
The maximum number of records that can be stored in the error log. Care is required as the error log differs according to the type of PLC or CPU Bus Unit. In an FL-net (Ver. 2.00) Unit, the maximum number of stored records is fixed at 40 (64 decimal).

Number of Stored Records (Response)

The number of records stored at the time the command is executed is returned.

Error Log Data (Response)

The specified number of error log records from the beginning record number is returned sequentially. The total number of bytes in the error log is calculated as the number of records x 10 bytes/record. Each error log record thus comprises 10 bytes, configured as follows:



Error Code, Detailed Information

Details of the error stored in the record. Refer to 10-3-2 Error Log Error Codes for details.

Minute, Second, Day, Hour, Year, Month

Indicate the time at which the error stored in the record occurred.

Precautions

If the error log contains fewer records than the number specified in the number of records parameter, all records stored in the error log at the time the

command is executed will be returned and the command executed will end normally.

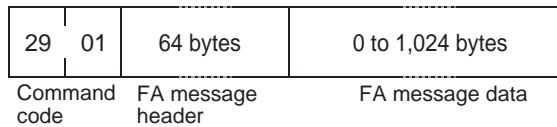
Response Codes

Response code	Description
0000	Normal
1001	Command too large
1002	Command too small
1103	Beginning record number is out of range
110C	The number of read records is 0.

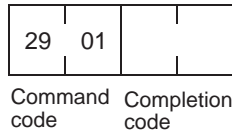
7-5-5 TRANSPARENT MESSAGE SEND

Sends a transparent message frame (transaction codes 00000 to 59999).

Command Block



Response Block



Parameters

FA Message Header (Command)

FA message header for the transparent message frame being sent.

FA Message Data (Command)

FA message data of the transparent message frame being sent. Refer to the following pages for details.

Response Codes

Response code	Description
0000	Normal completion
0101	Local node not part of network.
0104	Reception buffer overflow, queuing not started (reception side).
0107	Unit's internal buffer is full.
0205	No response from remote node
1001	Command length too long
1002	Insufficient command length
1005	Sequence number error, sequence version error
110C	Destination node is local node, TCD > 59999, set to FINS response required
2605	Servicing in progress

Setting Data for FA Message Headers of Transparent Messages

Set the data of the following FA message headers, except for the shaded items. The items in the shaded areas are automatically set by the FL-net (Ver. 2.00) Unit.

Word offset	Symbol	Item	
+0	H_TYPE (Upper)	Header type	Upper: 0x4641 fixed
1	H_TYPE (Lower)		Lower: 0x434E fixed
2	TFL (Upper)	Total byte length of header and data	Upper: 0x0001 fixed
3	TFL (Lower)		Lower: Byte length
4	SNA (Upper)	Source node address (node number)	
5	SNA (Lower)		
6	DNA (Upper)	Destination node address (node number)	Upper: 0x0001 fixed
7	DNA (Lower)		Lower: Destination node address
8	V_SEQ (Upper)	Sequential version number	
9	V_SEQ (Lower)		
10	SEQ (Upper)	Sequence number:	After 0xFFFFFFFF, returns to 0x00000001.
11	SEQ (Lower)		
12	M_CTL (Upper)	Message control	
13	M_CTL (Lower)		
14	ULS	Upper layer status (RUN/STOP/ALARM/WARNIG/NORMAL)	
15	M_SZ	Message data size in virtual address space	
16	M_ADD (Upper)	Offset address in virtual address space	
17	M_ADD (Lower)		
18	MFT	M_RLT	Minimum allowable frame interval/response message type
19	reserved		
20	TCD	Transaction code	Set between 0x0 and 0xEA5F
21	VER	Program version	
22	C_AD1	Common Memory (Area 1) first word of address	
23	C_SZ1	Common Memory (Area 1) size	
24	C_AD2	Common Memory (Area 2) first word of address	
25	C_SZ2	Common Memory (Area 2) size	
26	MODE	Message mode (online/test)	
27	PVER	PRI	Protocol version/message priority

Word offset	Symbol		Item	
28	CBN	TBN	Current fragment block number (CBN)	(0x01 fixed)
			Total number of fragment blocks (TBN)	(0x01 fixed)
29	BSIZE		Current block length (byte) (Note: Same value as TFL)	
30	LKS	TW	Link status/Token monitoring time	
31	RCT		Allowable refresh cycle time	

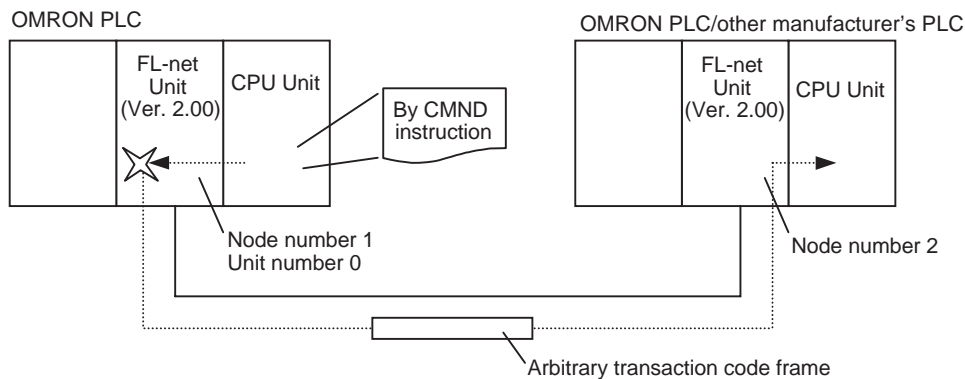
Application Example

This example shows a program with the TRANSPARENT FRAME SEND command.

Sample Configuration



The FINS 2901 command executes at the point indicate by this mark and a transaction code is sent.



Operation

- Set the TRANSPARENT FRAME SEND command starting at D01000 in the CPU Unit.
- Send the transaction code (100) and 10-byte data to node number 2.
- Store the results of the transmission starting at D02000.

Command

[CMND S D C]

S	D01000	+0:	2901 Hex	
		+1:	4641 Hex	(Fixed)
		+2:	434E Hex	(Fixed)
		+3:	0001 Hex	(Fixed)
		+4:	004A Hex	= 64 + 10 = 74 bytes
		:		
		+7:	0001 Hex	
		+8:	0002 Hex	Destination node = 2
		:		
		+21:	0064 Hex	Transaction code = 100
		:		
		+29:	0101 Hex	(Fixed)
		+30:	004A Hex	= 64 + 10 = 74 bytes
		:		
		+33:	Data (10 bytes long)	
		:		
		+37:		
D	D02000:		First word of the stored responses	

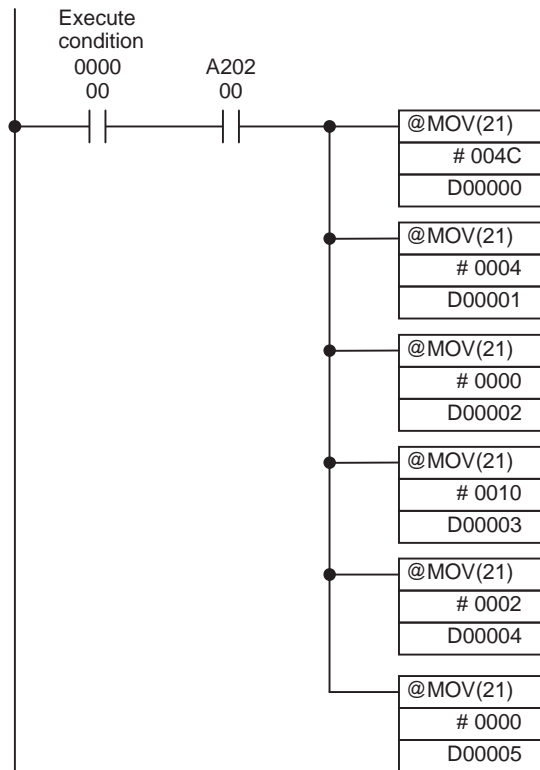
C	D00000	+0:	004C Hex	No. of command data bytes
		+1:	0004 Hex	No. of response data bytes (including command and response codes)
		+2:	0000 Hex	Remote (destination) network address = 0 (local network)
		+3:	0010 Hex	Remote (destination) node number = 0 (local node number) Remote (destination) unit address = 10 Hex
		+4:	0000 Hex	Response required, communication port no. = 0, number of retries = 0
		+5:	0000 Hex	Response monitoring time (default: 2 s)

* Be sure to set the unit address of the FL-net (Ver. 2.00) Unit to the unit number + 10 Hex.

Response

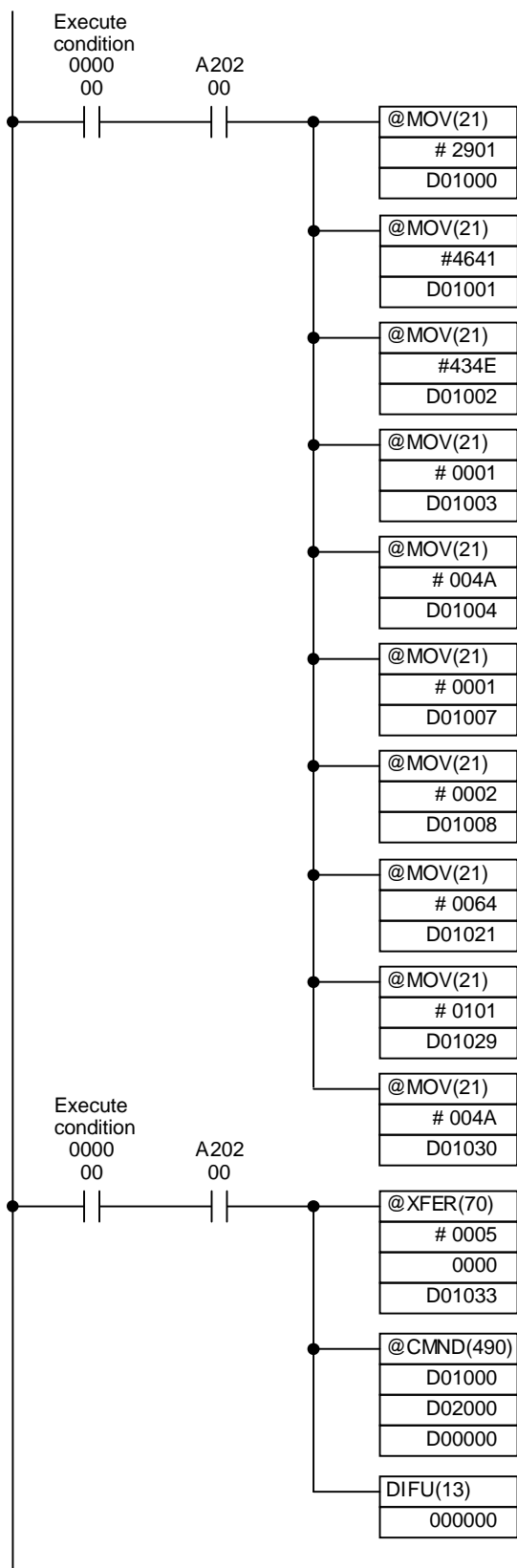
D02000	+0	:2901 Hex	
	+1	:0000 Hex	Response code (completed normally)

- Sends a transparent frame just once when the Network Communications Port Enabled Flag for port 0 and the execute condition (CIO 000000) turn ON.
- Creates control data starting at D00000.



Word	Content	Meaning
D00000	00 4C	Command data length: 76 bytes
D00001	00 04	Response data length: 4 bytes
D00002	00 00	Destination network address = 0
D00003	00 10	Destination node address = 0 Destination unit address = 10 Hex
D00004	00 02	Response required Communications port No. = 0 Retries: 2
D00005	00 00	Response Monitoring Time = 2 s

(Continued next page.)



- Creates control data (command code/FA message header) starting at D01000. Parameters that are generated automatically by the FL-net (Ver. 2.00) Unit do not have to be set.

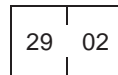
Word	Content	Meaning
D01000	29 01	Command code
D01001	46 41	H_TYPE Upper = (Fixed value)
D01002	43 4E	H_TYPE Lower = (Fixed value)
D01003	00 01	TFL Upper = (Fixed value)
D01004	00 4A	TFL Lower = 74 bytes
D01007	00 01	DNA Upper = (Fixed value)
D01008	00 02	DNA Lower = 2
D01021	00 64	TCD = 100
D01029	01 01	CBN/TBN = (Fixed value)
D01030	00 4A	BSIZE = 74 bytes

- Creating send data: Stores the 10-byte long data (5 words) from word 0000 starting at D01033 (FA message data).
- Sends the TRANSPARENT FRAME SEND command to the FL-net (Ver. 2.00) Unit using the CMND(490) instruction.
- Turns OFF execute condition 000000.

7-5-6 TRANSPARENT MESSAGE RECEIVE FRAME READ

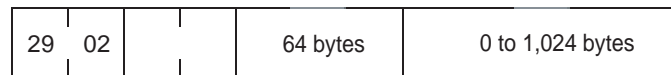
Reads a transparent message (transaction code: 00000 to 59999) that was received. Execute this command when bit 1 (Readable Message Received Flag) of the Unit Status CPU Bus Unit Area in the CIO Area is ON.

Command Block



Command code

Response Block



Command code Completion code FA message header FA message data

Parameters

FA Message Header (Response)

FA message header of response to the transparent message frame that was transmitted.

FA Message Data (Response)

FA message data of the response to the transparent message frame that was transmitted. Refer to the following pages for details.

Response Codes

Response code	Description
0000	Normal completion
0001	Reception buffer overflow, queuing not started (reception side)
1001	Command length too long

Setting Data for FA Message Headers of Transparent Messages

When reading received message frames from a user program, check the non-shaded items from the following FA message header data.

TFL: Total number of bytes of FA message header and FA message data

SNA: Source node number

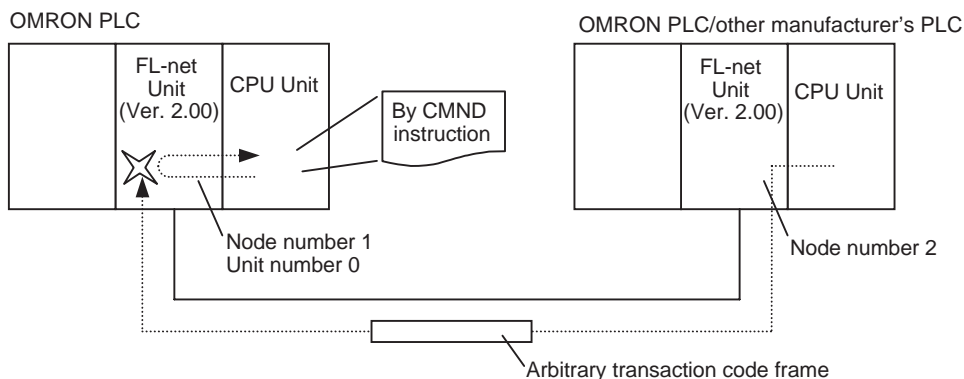
TCD: Transaction code

Offset	Symbol	Item	
+0 words	H_TYPE (Upper)	Header type	Upper: Header type: 0x4641 fixed
+1	H_TYPE (Lower)		Lower: Header type: 0x434E fixed
+2	TFL (Upper)	Total byte length of header and data	Upper: 0x00 fixed
+3	TFL (Lower)		Lower: Byte length
+4	SNA (Upper)	Source node address (node number)	
+5	SNA (Lower)		
+6	DNA (Upper)	Destination node address (node number)	Upper: 0x0001 fixed
+7	DNA (Lower)		Lower: source node number

Offset	Symbol		Item	
+8	V_SEQ (Upper)		Sequence version number	
+9	V_SEQ (Lower)			
+10	SEQ (Upper)		Sequence number	After 0xFFFFFFFF, returns to 0x00000001
+11	SEQ (Lower)			
+12	M_CTL (Upper)		Message control	
+13	M_CTL (Lower)			
+14	ULS		Upper layer status (RUN/STOP/ALARM/WARNING/NORMAL)	
+15	M_SZ		Message data size in virtual address space	
+16	M_ADD (Upper)		Offset address of virtual address space	
+17	M_ADD (Lower)			
+18	MFT	M_RLT	Minimum allowable frame interval/response message type	
+19	reserved			
+20	TCD		Transaction code	Set between 0 and 0xEA5F
+21	VER		Program version	
+22	C_AD1		Common Memory (Area 1) first word address	
+23	C_SZ1		Common Memory (Area 1) size	
+24	C_AD2		Common Memory (Area 2) first word address	
+25	C_SZ2		Common Memory (Area 2) size	
+26	MODE		Message mode (online/test)	
+27	PVER	PRI	Protocol version/message priority	
+28	CBN	TBN	Current fragment block number (CBN)	0x01 fixed
			Total number of fragment blocks (TBN)	0x01 fixed
+29	BSIZE		Current block length (byte) Note: Same value as TFL value	
+30	LKS	TW	Link status/token monitoring time	
+31	RCT		Allowable refresh cycle time	

Application Example This example shows a program with the TRANSPARENT FRAME READ command.

Sample configuration ✧ The FINS 2902 command executes at the point indicated by this mark and the PLC reads the transaction code that was received.



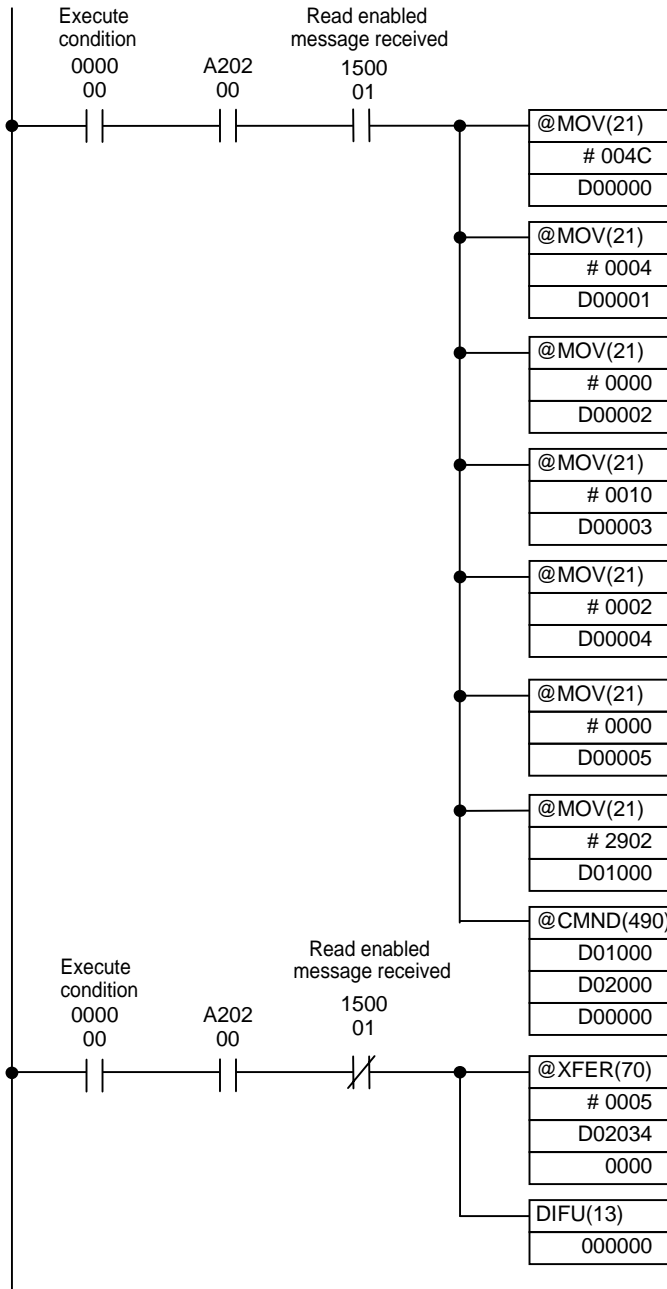
- Operation**
- Set the TRANSPARENT FRAME READ command starting at D01000 in the CPU Unit.
 - Read the transaction code (100) and 10-byte data that was sent by node address 2.
 - Store the results of the reading starting at D02002. (The command code is stored at D02000 and the response code is stored at D02001.)

Command

[CMND	S	D	C]	
S	D01000		+0	:2902 Hex
D	D02000			:First word of the stored responses
C	D00000		+0	:0002 Hex No. of command data bytes
			+1	:004E Hex No. of response data bytes (including command and response codes)
			+2	:0000 Hex Remote (destination) network address 0 (local network)
			+3	:0010 Hex Remote (destination) node number 0 (local node number) Remote (destination) unit address 10 Hex
				* Be sure to set the unit address of the FL-net (Ver. 2.00) Unit to the Unit number + 10 Hex.
			+4	:0000 Hex Response required, communication port no. 0, number of retries 0
			+5	:0000 Hex Response monitoring time (default: 2 s)

Response	D02000	+0	:2902 Hex	Response code (completed normally)
		+1	:0000 Hex	
		:		(Undecided)
		+4	:0001 Hex	(Fixed)
		+5	:004A Hex	=64+10=74 bytes
		+6	:0001 Hex	
		+7	:0002 Hex	Destination node number 2 (Undecided)
		:		
		+22	:0064 Hex	Transaction code 100 (Undecided)
		:		
		+34	:Data (10-bytes long)	
		:		
		+38		

Program Example



- When a read enabled message is received and 150001 turns ON: Sends a transparent frame just once when the Network Communications Port Enabled Flag for port 0 and the execute condition (CIO 000000) turn ON at port 0.
- Creates control data starting at D00000.

Word	Content	Meaning
D00000	00 4C	Command data length = 76 bytes
D00001	00 04	Response data length = 4 bytes
D00002	00 00	Target network address = 0
D00003	00 10	Target node address = 0 Target node number address = 10 Hex
D00004	00 02	Response required Communications port No. = 0 Retries = 2
D00005	00 00	Response monitoring time = 2 s

- Creates control data (command code) starting at D01000.
- Sends the transparent frame read command to the FL-net (Ver. 2.00) Unit using the CMND(490) instruction.
- Using the data that is received: Stores the 10-byte data (5 words) from D02034 (FA message data) starting at CIO 0000.
- Turns OFF the execute condition (CIO 000000).

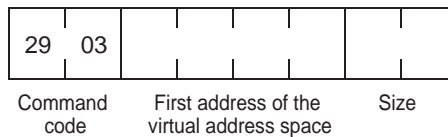
7-5-7 WORD BLOCK DATA READ (UNSPECIFIED NODE NUMBER)

Sends the request message Word Block Data Read (Unspecified Node Number).

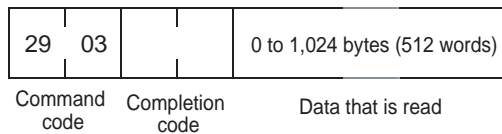
The remote node address specified in the control data of the CMND(490) instruction is used for the read destination node number. The FINS command can be executed from the CPU Unit in the FL-net (Ver. 2.00) Unit, but an error will occur if the command passes through a FINS network on another layer.

- Note**
1. This command is provided to ensure compatibility with applications created with the CS1W-FLN01.
 2. Use the WORD BLOCK DATA READ/WRITE (specified node number) commands to create new applications.

Command Block



Response Block



Parameters

First Address of the Virtual Address Space (Command)

Set the first address of data that will be read using hexadecimal format. Addresses spanning multiple areas cannot be set.

Refer to 7-4 CS-series Memory Areas and Virtual Addresses if the node that will be read is an OMRON FL-net (Ver. 2.00) Unit. If it is another manufacturer's FL-net (Ver. 2.00) node however, refer to the manual for that node.

Size (Command)

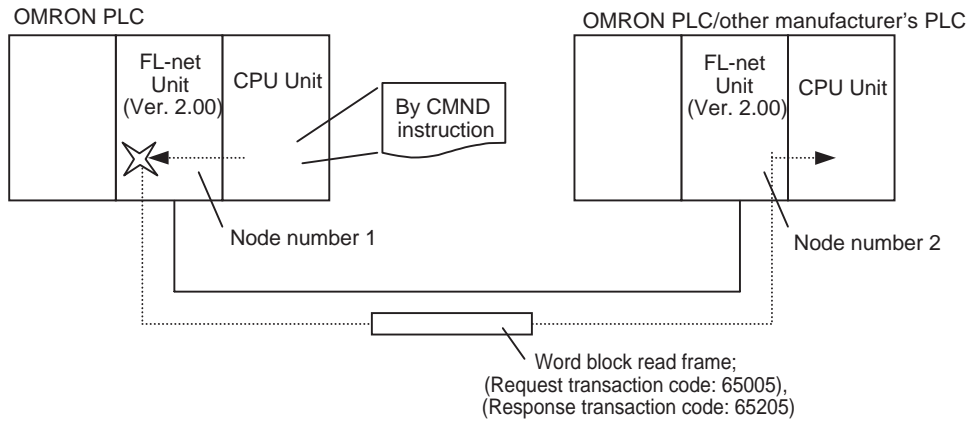
Specifies up to 512 words for the number of words in data that is received.

Response Codes

Response code	Description
0000	Normal completion
0101	Local node not part of network
0104	Reception buffer overflow, queuing not started (reception side)
0107	Unit's internal buffer full
0205	No response from remote node
1001	Command length too long
1002	Insufficient command length
1005	Sequence number error, sequence version error
110C	Source node is local node, requested number of words is greater than 512.
2605	Servicing in progress

Application Example This example shows a program with the WORD BLOCK DATA READ (unspecified node number) command.

Sample configuration ✧ The FINS 2903 command executes at the point indicated by this mark and the WORD BLOCK READ FRAME (transaction code: 65005) is sent.



Operation

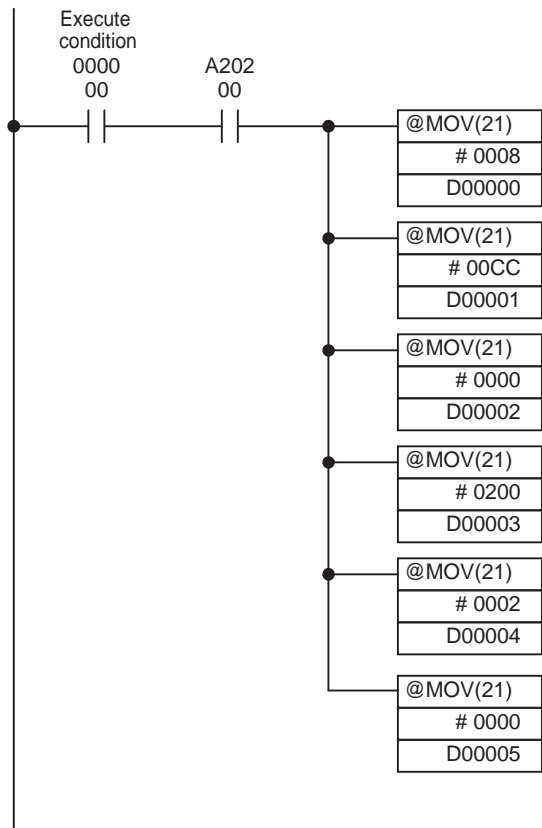
- Write the WORD BLOCK DATA READ (unspecified node number) command starting at D01000 and store the response data starting at D02000 in the CPU Unit.
- Read the 100-word data from EM0_00000 at node number 2 to a point after D02002 at node number 1 (D02000 stores the command code and D02001 stores the response code.).

Command

[CMND	S	D	C]	
S	D01000	+0:	2903 Hex	First address of the virtual address space (EM0_00000) * Refer to the manual for other manufacturer's FL-net (Ver. 2.00) nodes. Size of the data that is read (100)
		+1:	0020 Hex	
		+2:	0000 Hex	
		+3:	0064 Hex	
D	D02000		:First word of the stored responses	
C	D00000	+0:	0008 Hex	No. of command data bytes
		+1:	00CC Hex	No. of response data bytes (including command and response codes)
		+2:	0000 Hex	Remote (destination) network address = 0
		+3:	0200 Hex	Remote (destination) node number = 2
		+4:	0000 Hex	Remote (destination) unit address 00 Hex (ignore)
		+5:	0000 Hex	Response required, communications port no. = 0, number of retries = 0 Response monitoring time (default: 2 s)

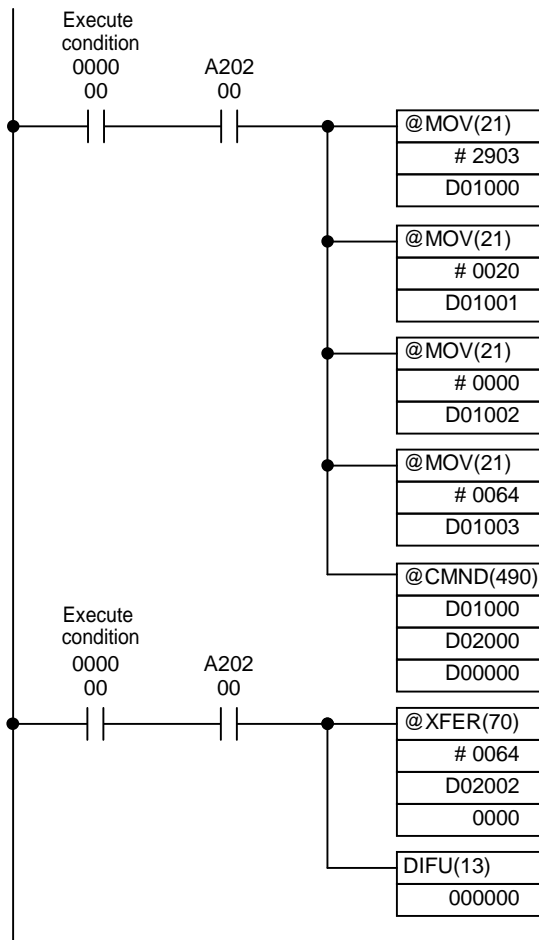
Response D01000 +0: 2903 Hex
+1: 0000 Hex Response code
(completed normally)
+2: Data that is read (100 words)
:
+102

Program Example



- Receives a transparent frame just once when the Network Communications Port Enabled Flag for port 1 and the execute condition (CIO 000000) turn ON.
- Creates control data starting at D00000.

Word	Content	Meaning
D00000	00 08	Command data length = 8 bytes
D00001	00 CC	Response data length = 204 bytes
D00002	00 00	Target network address = 0
D00003	02 00	Target node address = 2 Target node number address = 0
D00004	00 02	Response required Communications port No. = 0 Retries = 2
D00005	00 00	Response monitoring time = 2 s



- Creates control data starting at D01000.
- Sends the WORD BLOCK READ (unspecified node number) command to the FL-net (Ver. 2.00) Unit using the CMND(490) instruction.
- Using data that is read: Stores the 100-word long data from D02002 (read data) starting at word 0000.
- Turns OFF execute condition 000000.

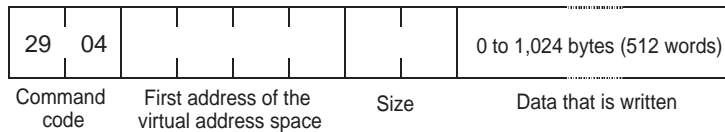
7-5-8 WORD BLOCK DATA WRITE (Unspecified Node Number)

Sends a request message Word Block Data Write.

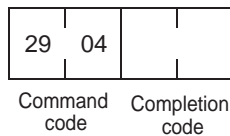
The remote node address specified in the control data of the CMND(490) instruction is used as the write destination node number. The FINS command can be executed from the CPU Unit of the FL-net (Ver. 2.00) Unit, but an error will occur if the command passes through a FINS network on another layer.

- Note**
1. This command is provided to ensure compatibility with applications created with the CS1W-FLN01.
 2. Use WORD BLOCK DATA READ/WRITE with specified node numbers to create new applications.

Command Block



Response Block



Parameters

First Address of the Virtual Address Space (Command)

Set the first address where data will be written using hexadecimal format. Addresses spanning multiple areas cannot be set.

Refer to 7-4 CS-series Memory Areas and Virtual Addresses if the node where data will be written is an OMRON FL-net (Ver. 2.00) Unit. If it is another manufacturer's FL-net (Ver. 2.00) node however, refer to the manual for that node.

Size (Command)

Specifies up to 512 words for the number of words in data that is sent.

Response Codes

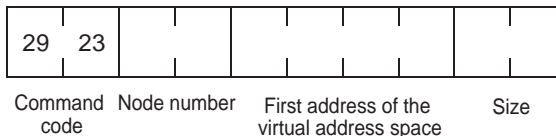
Response code	Description
0000	Normal completion
0101	Local node not part of network
0104	Reception buffer overflow, queuing not started (reception side)
0107	Unit's internal buffer full
0205	No response from remote node
1001	Command length too long
1002	Insufficient command length
1005	Sequence number error, sequence version error
110C	Source node is local node, requested number of words is greater than 512.
2605	Servicing in progress

7-5-9 WORD BLOCK DATA READ (Specified Node Number)

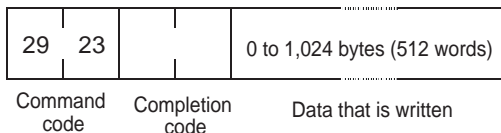
Sends the request message Word Block Data Read.

The node number specified in the FINS command block is used as the read source node number. Specify the FL-net (Ver. 2.00) Unit that will execute the FINS command in the control data (network address, node address, unit address) of the CMND(490) instruction. The FINS command can be executed from the CPU Unit of the FL-net (Ver. 2.00) Unit or through a FINS network on another layer.

Command Block



Response Block



Parameters

Node Number (Command)

Set the number of the FL-net (Ver. 2.00) node with data that will be read using hexadecimal format. Specify 00 (fixed value) for the upper end.

Example

Node number that will be read: 1

FINS command node number: 0001

Refer to 7-4 CS-series Memory Areas and Virtual Addresses if the node with data that will be read is an OMRON FL-net (Ver. 2.00) Unit. If it is another manufacturer's FL-net (Ver. 2.00) node however, refer to the manual for that node.

Size (Command)

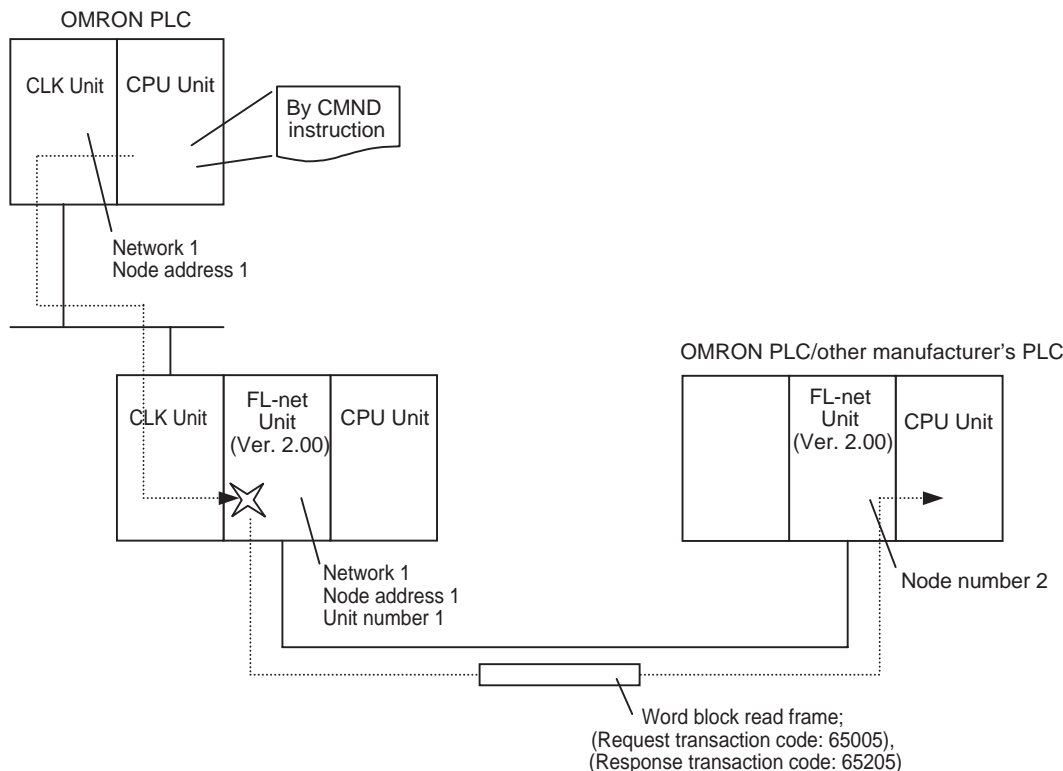
Specifies up to 512 words for the number words in data that is received.

Response Codes

Response code	Description
0000	Normal completion
0101	Local node not part of network
0104	Reception buffer overflow, queuing not started (reception side)
0107	Unit's internal buffer full
0205	No response from remote node
1001	Command length too long
1002	Insufficient command length
1005	Sequence number error, sequence version error
110C	Source node is local node, requested number of words is greater than 512.
2605	Servicing in progress

Application Example This example shows a program with the WORD BLOCK DATA READ (unspecified node number) command

Sample Configuration ✧ The FINS 2923 command executes at the point indicated by this mark and a WORD BLOCK DATA READ frame (transaction code: 65005) is sent.



Operation

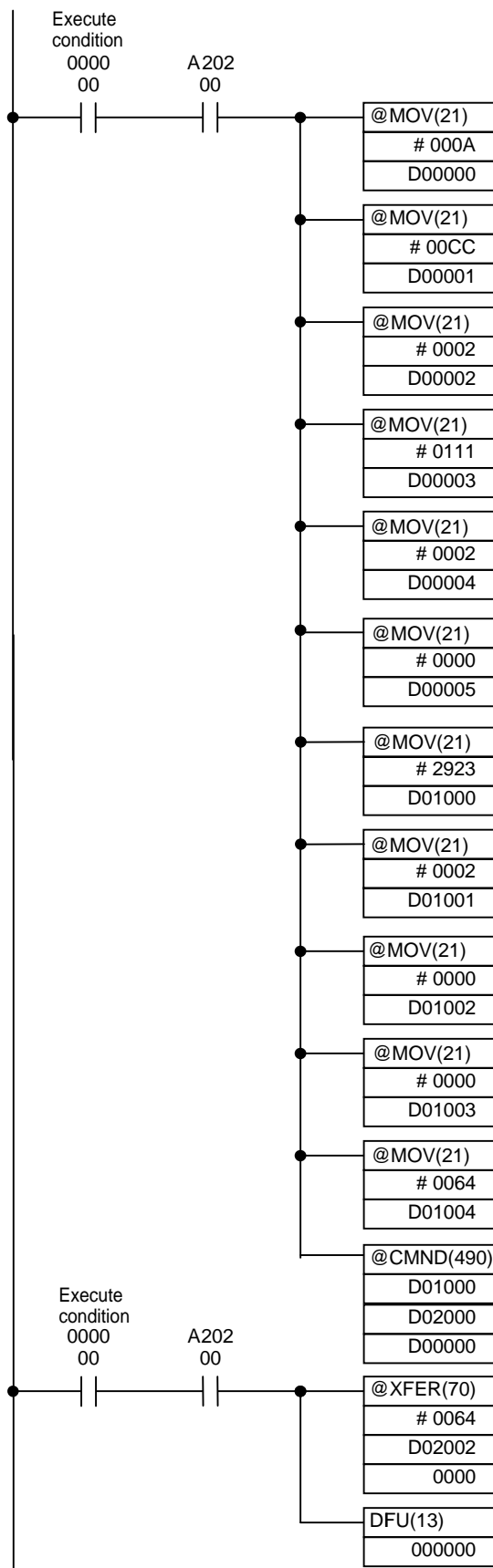
- Write the WORD BLOCK DATA READ (unspecified node number) command starting at D01000 and store the response data starting at D02000 in the CPU Unit.
- Read word data starting at D02002 of an OMRON PLC two levels away on the FINS network (The command code is stored at D02000 and the response code is stored at D02001.).

Command

[CMND	S	D	C]	
S	D01000	+0:	2923 Hex	
		+1:	0002 Hex	Read source node number
		+2:	0000 Hex	First address of the virtual address space
		+3:	0000 Hex	Refer to the manual for the other manufacturer's FL-net (Ver. 2.00) node.
		+4:	0064 Hex	Size of the data that is read (100)
D	D02000:			First word of the stored responses
C	D00000	+0:	000A Hex	No. of command data bytes
		+1:	00CC Hex	No. of response data bytes (including command and response codes)
		+2:	0002 Hex	Remote (destination) network address = 2
		+3:	0111 Hex	Remote (destination) node number = 1

			Remote (destination) unit address = 11 Hex * Be sure to set the unit address of the FL-net (Ver. 2.00) Unit to the unit number + 10 Hex.
		+4	:0000 Hex Response required, communication port no. 0, number of retries 0
		+5:	0000 Hex Response monitoring time (default: 2 s)
Response	D02000	+0:	2923 Hex
		+1:	0000 Hex Response code (completed normally)
		+2:	Data that is read (100-word long)
		:	
		+102	

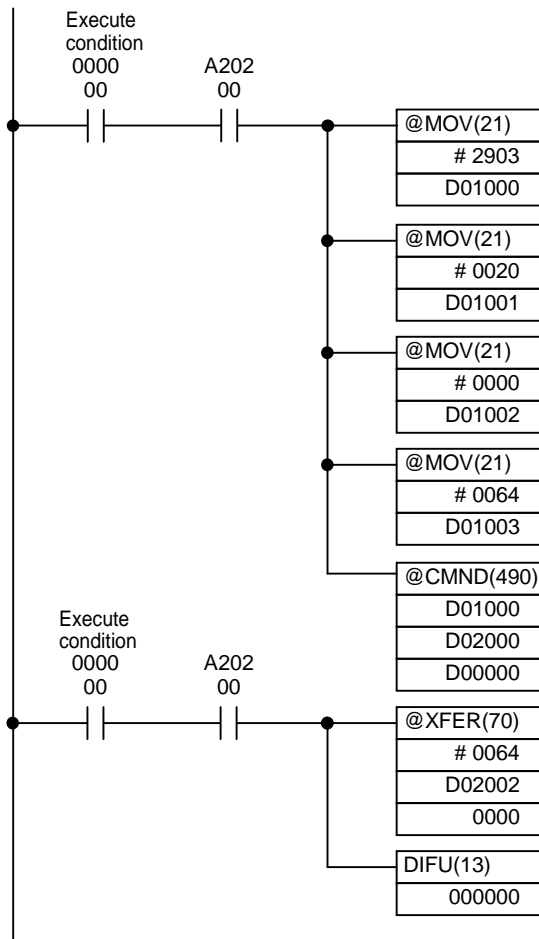
Program Example



- Sends a transparent frame just once when the Network Communications Port Enabled Flag for port 1 and the execute condition (CIO 000000) turn ON.
- Creates control data starting at D00000.

Word	Content	Meaning
D00000	00 0A	Command data length = 8 bytes
D00001	00 01	Response data length = 204 bytes
D00002	00 02	Target network address = 2
D00003	01 11	Target node address = 1 Target node number address = 11 Hex
D00004	00 02	Response required Communications port No. used = 0 Retries = 2
D00005	00 00	Response monitoring time = 2 s

- Creates control data starting at D01000.
- Sends the WORD BLOCK READ (unspecified node number) command to the FL-net (Ver. 2.00) Unit using the CMND(490) instruction.
- Using data that is read: Stores the 100-word data from D02002 (read data) starting at CIO 0000.
- Turns OFF the execute condition (CIO 000000).



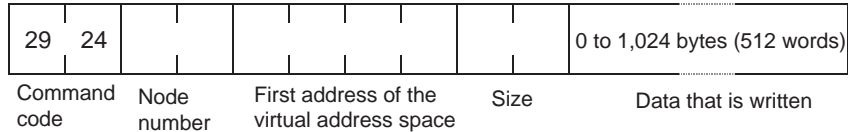
- Creates control data starting at D01000.
- Sends the WORD BLOCK READ (unspecified node number) command to the FL-net (Ver. 2.00) Unit using the CMND(490) instruction.
- Using data that is read: Stores the 100-word data from D02002 (read data) starting at CIO 0000.
- Turns OFF the execute condition (CIO 000000).

7-5-10 WORD BLOCK DATA WRITE (Specified Node Number)

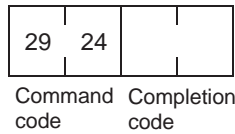
Sends the request message Word Block Data Write (specified node number). The node number specified in the FINS command block is used as the write destination node number.

The control data (network address, node address and unit address) of the CMND(490) instruction specifies the FL-net (Ver. 2.00) Unit that will execute the FINS command. The FINS command can be executed from the CPU Unit of the FL-net (Ver. 2.00) Unit, and it can pass through a FINS network on another layer.

Command Block



Response Block



Parameters

Node Number (Command)

Set the number of the FL-net (Ver. 2.00) node where data will be written using hexadecimal format. Specify 00 (fixed value) for the upper end.

Example

Node number that will be read: 1

FINS command node number: 0001

First Address of the Virtual Address Space (Command)

Set the first address where data will be written using hexadecimal format. Addresses spanning multiple areas cannot be set.

Refer to *7-4 CS-series Memory Areas and Virtual Addresses* if the node where data will be written is an OMRON FL-net (Ver. 2.00) Unit. If it is another manufacturer's FL-net (Ver. 2.00) node however, refer to the manual for that node.

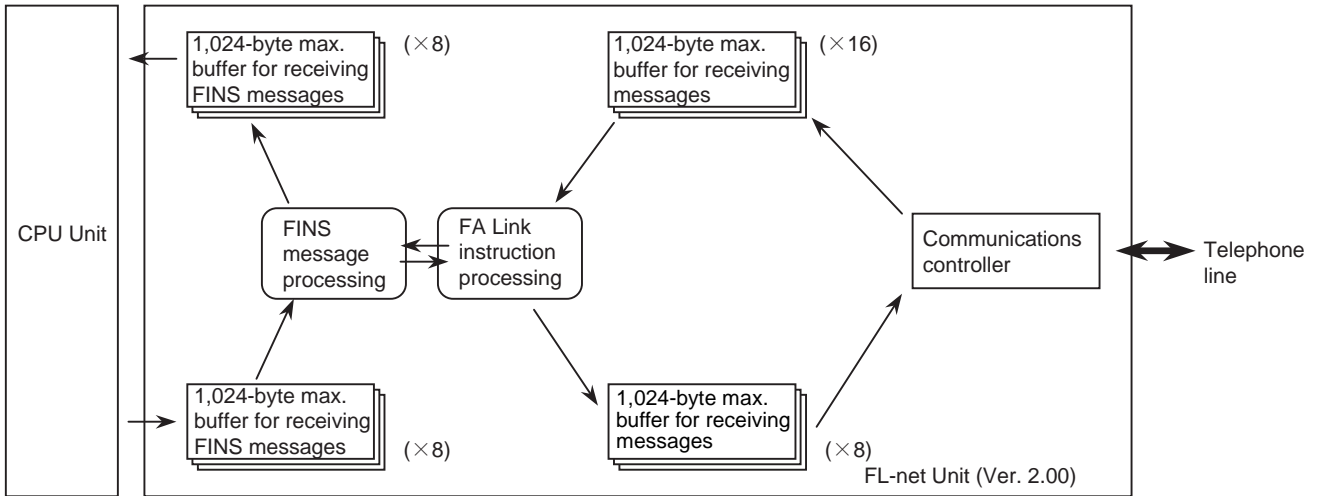
Size (Command)

Specifies up to 512 words for the number of data words that will be written.

Response Codes

Response code	Description
0000	Normal completion
0101	Local node not part of network
0104	Reception buffer overflow, queuing not started (reception side)
0107	Unit's internal buffer full
0205	No response from remote node
1001	Command length too long
1002	Insufficient command length
1005	Sequence number error, sequence version error
110C	Source node is local node, requested number of words is greater than 512.
2605	Servicing in progress

7-6 Message Buffer Configuration Chart



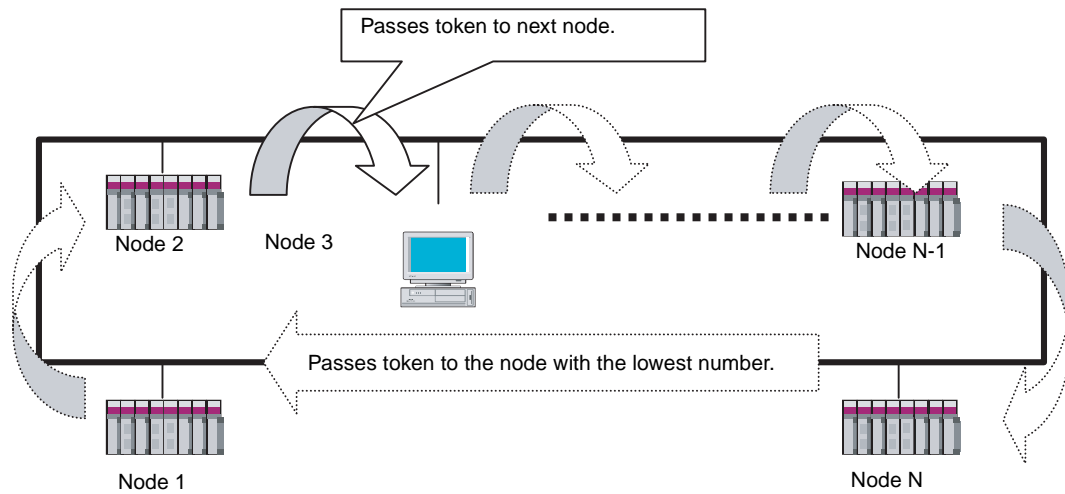
SECTION 8

Communications Timing

This section describes the communications system, communications cycle time, communications cycle time calculation, data link I/O response time, data link I/O response time calculation, and message service transmission delays.

8-1	Network Communications System	138
8-2	Communications Cycle Time	138
8-2-1	Calculating the Communications Cycle Time	138
8-2-2	Communications Cycle Time Calculation Example.	139
8-3	Calculating the Data Link I/O Response Time	140
8-4	Message Service Transmission Delays	140

8-1 Network Communications System



FL-net (Ver. 2.00) is a token-based network. The token, or right to transmit, circulates around the network and the node holding the token has the right to transmit. If that node has data to send, it attaches the data to the token. If it has no data to send, it simply passes the token along.

8-2 Communications Cycle Time

This section describes the method used to calculate the standard communications cycle time.

8-2-1 Calculating the Communications Cycle Time

The communications cycle time (time for one token rotation) in an FL-net (Ver. 2.00) system is determined by the capabilities of the devices in the network and the network operating parameters. The communications cycle time (T) is the sum total of the token holding time and the send frame transmission delay time for each node in the network.

$$T = \sum \{(\text{Token holding time}) + (\text{Send frame transmission delay time})\}$$

The communications cycle time for a network configured solely with these Units is found using the following formula. (The communications cycle time for networks configured with units by other manufacturers is calculated as the sum total of the token holding time and send frame transmission delay time of each unit. For details, refer to the user's manual for the relevant manufacturer.)

$$T = \sum \{(\text{Token holding time}) + (\text{Send frame transmission delay time})\}$$

$$= \sum \left\{ \left(1 + \frac{1}{S} \right) \times (0.004 \times L + 0.005 \times D + (0.085 + E) \times N + 1.1) \right\} \text{Unit : ms}$$

- L : Length of token frame directed to local node (unit: word)...1
- D : Data link transmission area size at local node (unit: word)...2
- E : Network's minimum allowable frame interval (unit: ms)...3

N: Number of frames without tokens ...4

S: PLC cycle time

1. If the data link transmission area size of the leading node (node with a node number one smaller than local node) is an integral multiple of 512 words, $L = 512$
If it is not an integral multiple, $L = \text{remainder of (data link transmission area size of leading node} \div 512$
2. The total size of the local node setting areas (Area 1 + Area 2) in the System Setup that was written using the FL-net Setting Tool.
3. Of the nodes in the network, the maximum value for the minimum allowable frame interval will be the network parameter. (The factory setting for the minimum allowable frame interval in OMRON FL-net (Ver. 2.00) Units is 0.1 ms)
4. If D (data link transmission area size of the local node) is less than 512 words, $N = 0$.
If D is an integral multiple of 512 words, $N = D \div 512 - 1$.
For other conditions, $N = D \div 512$ (round off to nearest integer)

8-2-2 Communications Cycle Time Calculation Example

The conditions are as follows:

Number of data link nodes:	10 nodes
Data link size of each node:	68 words
Minimum allowable frame interval:	0.1 ms
PLC cycle time:	20 m

1. Length of token frame directed to local node: L
The data link transmission area size of the leading node is 68 words, and the remainder of $68 \div 512$ is 68
Therefore, $L = 68$
2. Data link transmission area size at local node: D
 $D = 68$
3. Network's minimum allowable frame interval: E
From above, $E = 0.1$
4. Number of frames without tokens: N
The data link transmission area size is 68, which is less than 512 words, so $N = 0$

Subsequently, in a configuration of 10 nodes, the communications cycle time can be calculated by the following formula.

$$\begin{aligned}
 T &= \left\{ \left(1 + \frac{1}{S} \right) \times (0.004 \times L + 0.005 \times D + (0.085 + E) \times N + 1.1) \right\} \times 10 \\
 &= \left\{ \left(1 + \frac{1}{20} \right) \times (0.004 \times 68 + 0.005 \times 68 + (0.085 + 0.1) \times 0 + 1.1) \right\} \times 10 \\
 &= 17.262 \text{ (ms)}
 \end{aligned}$$

8-3 Calculating the Data Link I/O Response Time

The I/O response time in an FL-net (Ver. 2.00) system is expressed as the time delay for data from one node to be acknowledged by another node on the same network.

The formula for calculating the I/O response time differs depending on the quantity of data exchanged between the FL-net (Ver. 2.00) Unit and the PLC (sum of the local node areas and the remote node areas).

The equation for calculating the data link I/O response time R for OMRON FL-net (Ver. 2.00) Units is as follows:

A: Scan time of PLC on transmission side (unit: ms)

B: Scan time of PLC on reception side (unit: ms)

T: Communications cycle time (unit: ms)

- When the data link area size (transmission + reception sum total) of the PLC at the reception side is no more than 7,677 words, then

$$R = A + T + B \text{ (unit: ms)}$$

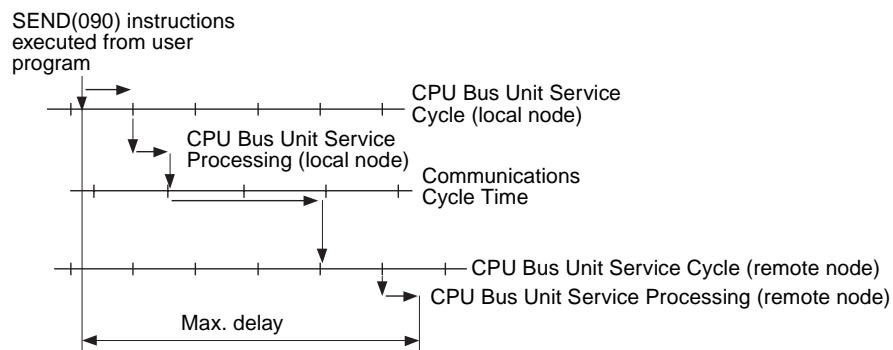
- When the data link area size (transmission + reception sum total) of the PLC at the reception side exceeds 7,677 words, then

$$R = A + T + 2 \times B \text{ (unit: ms)}$$

8-4 Message Service Transmission Delays

The conceivable criteria are provided here for determining the maximum transmission delay time from the time the SEND(090)/RECV(098) instructions are executed from the user program until execution is completed. Use the following equation to calculate the maximum transmission delay times. These times, however, do not take transmission delay times on the network into account, so they may be increased depending on the conditions under which the instructions are executed.

Send



The transmission delay for the SEND(090) instruction can be calculated using the following equation:

Max. delay = Local node service cycle + local node service processing time + communications cycle time x 2 + remote node service cycle + remote node service processing time

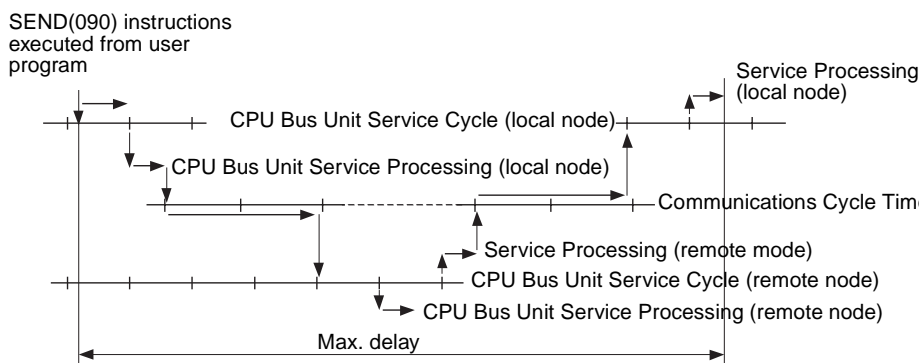
- CPU Bus Unit Service Cycle
One scan of CPU Unit.
- CPU Bus Unit Service Processing Time

CPU Unit peripheral processing: This is the time required to process CPU Bus Units and is approximately 1 ms for FL-net (Ver. 2.00) Units.

- Communications Cycle Time
Time taken by the token to do one rotation.

- Note**
1. The actual operating environment can cause transmission delays larger than those calculated with the methods given here. Among the causes of longer delays are the following: traffic on the network, traffic through the FL-net (Ver. 2.00) Unit, as well as the parameters and system configuration of the FL-net (Ver. 2.00) network.
 2. The CPU data set processing time is the standard when the peripheral service time is set in the CPU Unit System Setup to the default of 4%. As this value is increased, the processing time is shortened.

Receive



The transmission delay for the SEND(090) instruction can be calculated using the following equation:

$$\text{Max. delay} = \text{Local node service cycle} \times 2 + \text{local node service processing time} \times 2 + \text{communications cycle time} \times 4 + \text{remote node service cycle} \times 2 + \text{remote node service processing time} \times 2$$

- CPU Bus Unit Service Cycle
One scan of CPU Unit.
- CPU Bus Unit Service Processing Time
CPU Unit peripheral processing: This is the time required to process CPU Bus Units and is approximately 1 ms for FL-net (Ver. 2.00) Units.
- Communications Cycle Time
Time taken by the token to do one rotation.

- Note.**
1. The actual operating environment can cause transmission delays larger than those calculated with the methods given here. Among the causes of longer delays are the following: traffic on the network, traffic through the FL-net (Ver. 2.00) Unit, as well as the parameters and system configuration of the FL-net (Ver. 2.00) network.
 2. The CPU data set processing time is the standard when the peripheral service time is set in the CPU Unit System Setup to the default of 4%. As this value is increased, the processing time is shortened.

SECTION 9

Testing Communications

This section describes functions that allow you to test communications.

9-1	Communications Testing Functions	144
9-2	PING Command	144
9-2-1	FL-net (Ver. 2.00) Unit	144
9-2-2	Host Computer	144
9-3	Internode Test	145
9-3-1	Running the Test	145
9-3-2	Checking Results	147

9-1 Communications Testing Functions

The FL-net Unit (2.00) provides two functions that allow communications with other nodes to be tested.

PING Command

The PING command is a common way to perform echoback tests on Ethernet networks. The PING command can be executed to see if nodes are physically connected properly and to be sure that IP address are set for the correct Ethernet nodes.

Internode Testing

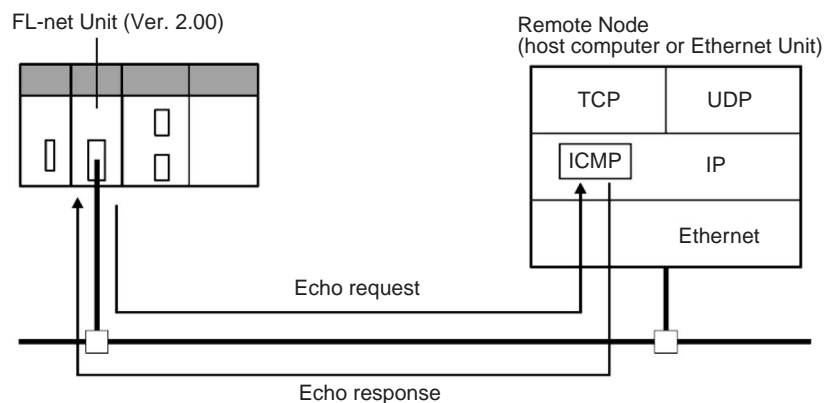
Echoback tests with specific nodes can also be performed by setting parameters in the PLC Interface Area and then manipulating specific bits in memory. This type of internode test can be performed only for nodes that support the FL-net (Ver. 2.00) message service.

9-2 PING Command

The PING command sends an echo request packet to a remote node and receives an echo response packet to confirm that the remote node is communicating correctly. The PING command uses the ICMP echo request and responses. The echo response packet is automatically returned by the ICMP.

The PING command is normally used to check the connections of remote nodes when configuring a network. The FL-net (Ver. 2.00) Unit supports both the ICMP echo request and reply functions.

If the remote node returns a normal response to the PING command, then the nodes are physically connected correctly and Ethernet node settings are correct.



9-2-1 FL-net (Ver. 2.00) Unit

The FL-net (Ver. 2.00) Unit automatically returns the echo response packet in response to an echo request packet sent by another node (host computer or other FL-net (Ver. 2.00) Unit). An FL-net (Ver. 2.00) Unit cannot send an echo request packet however.

9-2-2 Host Computer

The PING command can be executed from the host computer to send an echo request packet to an FL-net (Ver. 2.00) Unit. The method for using the PING command from a UNIX computer is given next.

Method

Input the following at the host computer prompt (\$):

```
$ ping IP_address(host_name)
```

The destination is specified by its IP address or host name. If the host name is used, the host name must be defined in file /etc/hosts.

Note The PING command is not supported by some host computers.

Application Examples

These examples show sending the PING command to the node at IP address 130.25.36.8. The "\$" on the example screen represents the host computer prompt. User inputs are underlined. Comments are placed after semicolons.

Normal Execution

```
$ ping 130.25.36.8 ; Executes PING command
PING 130.25.36.8: 56 data bytes
64 bytes from 130.25.36.8: icmp_seq=0. time=0.ms
64 bytes from 130.25.36.8: icmp_seq=0. time=0.ms
.
.
.
64 bytes from 130.25.36.8: icmp_seq=0. time=0.ms
←Enter Ctrl+C Key to cancel.
----130.25.36.8 PING Statistics----
9 packets transmitted, 9 packets received, 0% packets loss
round-trip (ms) min/avg/max = 0/1/16
$
```

Abnormal Execution

```
$ ping 130.25.36.8 ; Executes PING command
PING 130.25.36.8: 56 data bytes
←Enter Ctrl+C Key to cancel.
----130.25.36.8 PING Statistics----
9 packets transmitted, 0 packets received, 100% packets loss
$
```

Refer to operating system documentation for your host computer for details about using the host computer's PING command.

9-3 Internode Test

The internode test sends data to and from specified nodes and uses the responses to check the network.

If a normal response is returned for an internode test, it means that the settings for the FL-net (Ver. 2.00) Unit are correct.

9-3-1 Running the Test

The test parameters are set and the test is started and stopped by writing the required data to the CPU Bus Unit Area (in the CIO Area) of the PLC used to start the internode test. These settings are made using a Programming Device, such as a Programming Console.

Test Procedure

- 1,2,3...**
1. Write the test parameters into PLC memory. The test parameters are described following this procedure.
 2. Turn ON the Internode Test Start Bit allocated to the FL-net (Ver. 2.00) Unit in the CPU Bus Unit Area. The Internode Test Start Bit is described following the test parameters. This will begin the internode test.

3. If desired, the test parameters can be changed while the internode test is actually running. Use the same procedure as used in step 1.
4. Turn OFF the Internode Test Start Bit allocated to the FL-net (Ver. 2.00) Unit in the CPU Bus Unit Area to stop the test.

- Note**
1. The test parameters are effected as soon as they are set or changed. It is not necessary to reboot or restart. If the test parameters are changed during the test, however, the new parameters will not be used until the Internode Test Start Bit is turned OFF and then back ON.
 2. Line traffic on the Ethernet network will increase during the test, possibly affecting system performance.

Setting the Test Parameters

Before starting the test, set the following parameters in the CPU Bus Unit Area (in the CIO Area) of the PLC. The test parameters become effective immediately after they are set. It is not necessary to reboot or restart the PLC.

Configuration of the test parameters

The software switches are stored at offsets from the first word calculated with the formula: first word = 1500 + (25 x unit number + offset)

Setting Range

The parameter setting ranges are given in the following table.

Offset	Parameter	Settable range
+1	Remote network address	01 to F9 Hex (1 to 249 decimal)
+2	Response monitoring time (unit: 10 ms)	0000 Hex: 2 sec.s 0001 to FFFF Hex (1 to 65535 decimal)

- Note**
1. The test cannot run across a FINS network.
 2. Broadcast transmissions (target node address = FF) cannot be used for the internode test.
 3. A timeout error will occur if no response is received within the set response monitoring time.

Starting and Stopping the Internode Test

Bit 01 of the first word in the words allocated to the FL-net (Ver. 2.00) Unit in the CPU Bus Unit Area is used as the Internode Test Start Bit. Turn ON bit 01 to start the internode test and turn bit 01 OFF to stop the internode test. The address of the word containing the Internode Test Start Bit is calculated by the following formula:

$$\text{Word} = 1500 + (25 \times \text{unit number})$$



Internode Test Start Switch ———
 0: Stop internode test
 1: Start internode test

The internode test run status can be confirmed using the TS indicator on the Unit's front panel.

TS indicator	Run status
Lit	Internode test running
Not lit	Internode test stopped

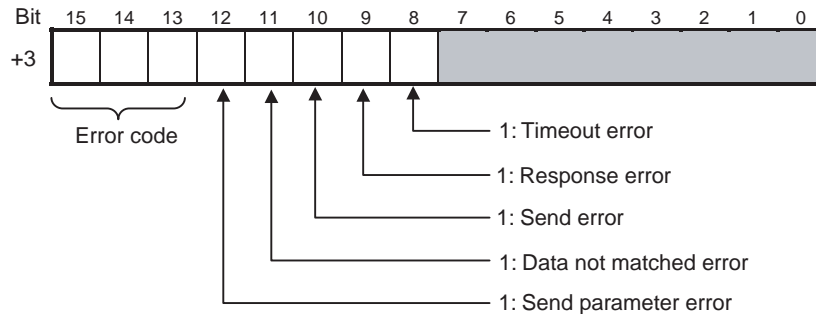
9-3-2 Checking Results

The results of the internode test are stored in the fourth through ninth words of the portion of the CPU Bus Unit Area allocated to the FL-net (Ver. 2.00) Unit. The status information area stores the test status and numbers of test runs and errors.

Test Status

The result of the test run and descriptions of errors are stored as the test status. The test status is stored at the word whose address is calculated by the following formula:

$$\text{Stored words} = 1,500 + (25 \times \text{unit number}) + 3$$



Error Code

If the test is run repeatedly, the code for the latest test results is stored.

Bit			Description
15	14	13	
0	0	0	Normal
1	1	1	Insufficient memory error

Error Flags

The bits corresponding to errors are turned ON if errors occur. The flag status is maintained until the internode test is run again.

Number of Test Runs and Errors

The number of test runs and total errors from the time the test is started until it is stopped is stored. The configuration of this area is shown in the following table. Each result is stored at a word relative to the first word the address of which can be calculated using the following formula:

$$\text{Stored words} = 1500 + (25 \times \text{unit number}) + 3 \text{ to } +5$$

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
+3	---												No. of test runs			
+4	Number of timeout errors												No. of response errors			
+5	Number of send errors												No. of times the data did not match			

- Note**
1. The contents of the test status area and test runs/errors area are maintained until the internode test is run again.
 2. When the number of tests counts to the maximum value (FF Hex), subsequent internode test runs are counted from 0. However, the maximum value is maintained and further errors are not counted when the number of errors reaches the maximum value.

SECTION 10

Troubleshooting

This section describes information and procedures that can be used to troubleshoot problems that sometimes occur with FL-net (Ver. 2.00) Unit and FL-net communications.

- 10-1 Troubleshooting with Indicators 150
- 10-2 Error Status 151
 - 10-2-1 Unit Status (Unit to CPU Unit). 151
 - 10-2-2 Network Status (Unit to CPU Unit) 152
- 10-3 Error Log. 152
 - 10-3-1 Error Log 152
 - 10-3-2 Error Log Error Codes 153
- 10-4 Troubleshooting Procedures 155
 - 10-4-1 Startup Problems. 155
 - 10-4-2 Network Connection Problems. 157
 - 10-4-3 FINS Communications Problems for SEND(090), RECV(098), and CMND(490). 159

10-1 Troubleshooting with Indicators

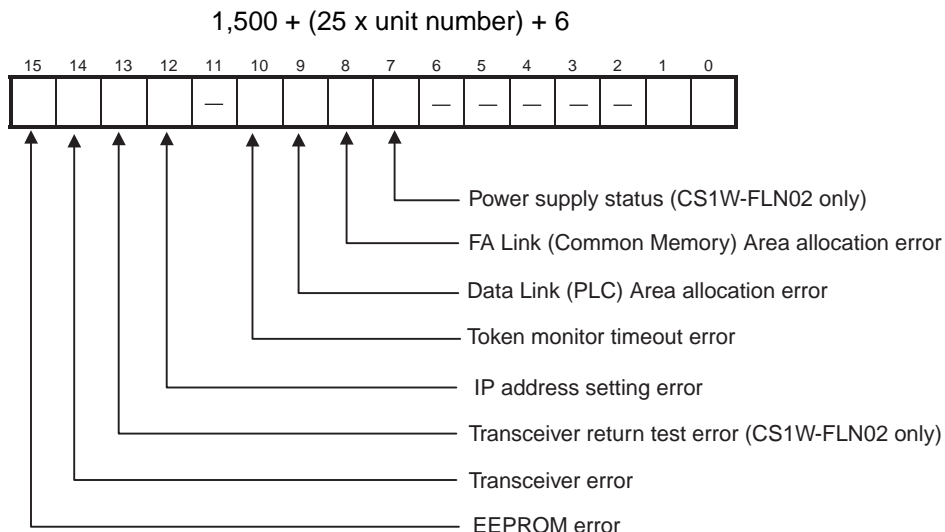
The indicators on the FL-net (Ver. 2.00) Unit can be used to troubleshoot some errors. The probable cause and correction for errors that can be determined from the RUN, HER, and PER LED indicators are listed in the following table.

RUN	HER	PER	Probable cause	Correction
Not lit	Not lit	Not lit	Power is not being supplied to the CPU Unit or the power supply voltage is too low.	Supply power. Make sure that the correct voltage is being supplied.
			The FL-net (Ver. 2.00) Unit is faulty.	Replace the FL-net (Ver. 2.00) Unit.
			The CPU Unit or Backplane is faulty.	Replace the CPU Unit or the Backplane.
			The mounting screws on the FL-net (Ver. 2.00) Unit are loose.	Tighten the mounting screws to the specified torque.
Not lit	Not lit	Lit	The unit number on the FL-net (Ver. 2.00) Unit is not set correctly on the rotary switch.	Correct the unit number setting.
			The I/O tables are not registered in the CPU Unit.	Register the I/O tables.
			The same unit number is being used on another Unit as well.	Correct the unit number.
			The CPU Unit is faulty.	Restart the CPU Unit. If the problem persists, replace the CPU Unit.
Lit	---	Lit	There is a mistake in the CPU Bus Unit Setup or routing tables.	Read the error history and correct the data that is causing the error. If the problem persists, replace the CPU Unit.
			Memory in the CPU Unit is faulty.	Restart the CPU Unit. If the problem persists, replace the CPU Unit.
			The CPU Unit is faulty.	Restart the CPU Unit. If the problem persists, replace the CPU Unit.
Not lit	Lit	Not lit	The node address is set outside the correct range on the rotary switches.	Set the node number to between 01 and F9 Hex.
			The FL-net (Ver. 2.00) Unit is faulty.	Restart the PLC. If the problem persists, replace the FL-net (Ver. 2.00) Unit.
Lit	Lit	---	An error occurred in EEPROM.	Restart the PLC. If the problem persists, replace the FL-net (Ver. 2.00) Unit.
Lit	Flashing	---	The IP address is set incorrectly on the rotary switches on the back of the Unit.	Correct the IP address. Do not set any of the following IP addresses. <ul style="list-style-type: none"> • Host IDs that are all 0 or all 1. • Network IDs that are all 0 or all 1. • Subnetwork IDs that are all 1. • Addresses beginning with 127 (7F Hex).
			The PLC was removed from the network because another node with the same node number was detected.	Another node with the same node number is already present on the network. Change the setting so no two nodes have the same number.
Lit	---	Flashing	The PLC was removed because it was connected to an FL-net (Ver. 1.00) network.	FL-net (Ver. 2.00) Units and FL-net Units (Ver. 1.00) cannot operate on the same network. Check the configuration of the network and make sure it consists solely of FL-net (Ver. 2.00) Units.
			A PLC area cannot be accessed (data allocation error).	Re-check the system settings on the Unit. Check to see if an area not in the PLC, an unusable area (i.e., the number of EM banks or where files are present), or an area where data cannot be written is being accessed.

10-2 Error Status

The FL-net (Ver. 2.00) Unit will output error status to the following word in the PLC Data Area Interface of the CPU Unit. This information can be used in troubleshooting errors.

10-2-1 Unit Status (Unit to CPU Unit)



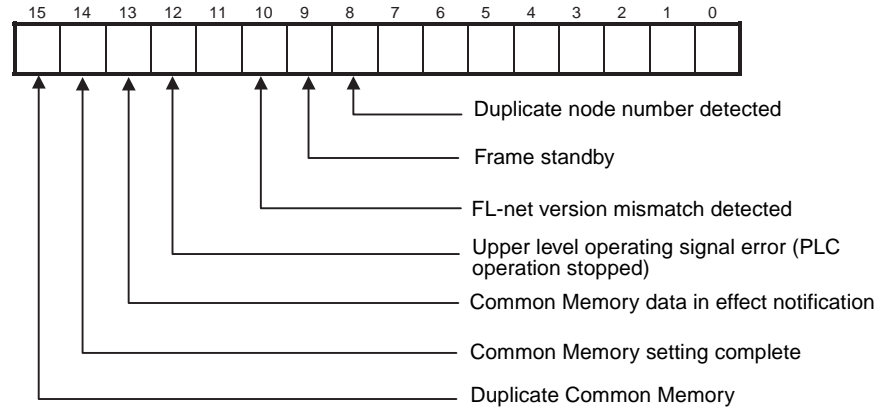
The corresponding bit will turn ON when an error occurs

Bit	Name	Correction
7	Power supply status (CS1W-FLN02 only) (See note.)	Turn ON the 24 VDC power supply. Check the power supply status if this bit is ON.
8	FA Link (Common Memory) Area allocation error	This bit turns ON if there is a Common Memory allocation error in the local node setting range of the FA Link (Data Link) settings. Use the FL-net Unit Support Tool to re-set the FA Link (Common Memory) allocation settings
9	Data Link (PLC) Area allocation error	This bit turns ON if there is a PLC Area allocation error in the local node setting range or another node setting range of the FA Link (Data Link) settings. Use the FL-net Unit Support Tool to re-set the FA Link (Common Memory) allocation settings.
10	Token monitoring timeout error	This bit turns ON if a token monitoring timeout occurs while the local node is holding the token. Processing may be delayed because of system traffic, so recheck the system configuration or extend the token monitoring timeout setting with the FL-net Unit Support Tool.
12	IP address setting error	The following cannot be used as IP address settings. <ul style="list-style-type: none"> • Host IDs that are all 0 or all 1. • Network IDs that are all 0 or all 1. • Subnetwork IDs that are all 1. • Addresses beginning with 127 (7F Hex). Reset the IP address.
13	Transceiver return test error (CS1W-FLN02 only) (See note.)	Check the transceiver or transceiver cable.
14	Transceiver error	The communications cable may be disconnected. Make sure the cable is mounted securely.
15	EEPROM error	Restart the PLC. If the problem persists, replace the FL-net (Ver. 2.00) Unit.

Note A transceiver is built into the CS1W-FLN12. If this bit turns ON, the FL-net (Ver. 2.00) Unit has malfunctioned.

10-2-2 Network Status (Unit to CPU Unit)

$$1,500 + (25 \times \text{unit number}) + 7$$



Bit	Name	Correction
8	Duplicate node number detected	This bit turns ON if two nodes have the same node number. All communications stop and the HER LED indicator flashes.
9	Frame standby	This bit turns ON if a receive frame cannot be detected. The power may not be ON at the other node or there is a problem on the communications path. Check the other node and the communications path.
10	FL-net version mismatch detected	This bit turns ON if you try to log on to an FL-net (Ver. 1.00) network. All communications stop and the HER LED indicator flashes. Make sure the network is configured entirely of FL-net (Ver. 2.00) nodes. Once this flag turns ON, it will remain ON until the power is turned OFF and back ON again or until the Unit is restarted.
12	Upper level operating signal error (PLC operation stopped)	A stop error or a persistent error has occurred in the CPU Unit. Use the CX-Programmer to clear the error on the CPU Unit.
13	Common Memory data in effect notification	This bit turns ON if the Common Memory of the FL-net (Ver. 2.00) Unit receives data from all the nodes and it starts to replace data in the CPU Unit.
14	Common Memory setting complete	This bit turns ON if the FL-net (Ver. 2.00) Unit can log on to the Data Link with no Common Memory allocation setting error in the Unit at the time it logs on to the network. If this flag is OFF when the local node logs on, the local node cannot access the Data Link and only has access to the message service and token.
15	Duplicate Common Memory	This bit turns ON if the same Common Memory is set for the local node that is attempting to log on to the network and another node that is already logged on to the network. In this case, the local node cannot access the Data Link and only has access to the message service and token.

10-3 Error Log

This section describes the error log that is used to record errors that have occurred during FL-net (Ver. 2.00) Unit operation.

10-3-1 Error Log

The error log records errors that have occurred during FL-net (Ver. 2.00) Unit operation. Errors recorded in the log can be read by FINS command. (Refer to *ERROR LOG READ* on page 113.)

Logged Errors

The following errors are recorded in the error log.

- Errors in network operation
- Errors in data transfers
- Error in the PLC

Error Log Table

Each error is recorded as one record in an error log table. Up to 64 records can be saved. If more than 64 errors occur, the oldest errors will be deleted from the error log and the most recent error will be recorded.

The following information is recorded in the error log table.

- Main error code (See table later in this section.)
- Detailed error code (See table later in this section.)
- Time stamp (from the clock in the CPU Unit)

Error Log Location

When an error is detected, the error codes and time stamp are recorded in the error log in RAM inside the FL-net (Ver. 2.00) Unit. Serious errors are also recorded in EEPROM. The maximum number of errors that can be saved to EEPROM is 64 for the CS Series and 32 for the CJ Series. The errors recorded in EEPROM will be saved even if the Unit is restarted or power is turned OFF. When the FL-net (Ver. 2.00) Unit is started, the contents of the error log in EEPROM are copied to RAM.

When a FINS command is used to read the error log, the log held in RAM is read. The error log cannot be cleared.

FINS Commands for Error Logs

The following FINS commands can be used to read or clear the error log. Refer to *7-5 Command/Response Reference*.

Command code		Function
MRC	SRC	
21	02	ERROR LOG READ

10-3-2 Error Log Error Codes

The error codes are described in the following table. The detailed error code will provide detailed information on an error.

Error code	Meaning	Detailed error code		Correction	EE-PROM
		1st byte	2nd byte		
0001	Watchdog timer error in CPU Unit	00	00	Replace the CPU Unit.	Saved
0002	CPU Unit service monitor error	monitoring time (ms)		Check the operating environment.	Saved
0006	Other CPU error	Bit 11: Unit not in Registered I/O Tables		Create the I/O tables.	Saved
000F	CPU Unit initialization error	00	00	Replace the CPU Unit.	Saved
0010	Insufficient System Setup Area	00	00	Reduce the number of CPU Bus Units.	Saved
0011	Event timed out	MRC	SRC	Replace the CPU Unit.	Saved
0012	CPU Unit memory error	01: Read error 02: Write error	03: Routing table 04: Setup error 05: CPU Bus Unit Words (CIO/DM)	01: Recreate the data specified by the 2nd byte of the detailed error code. 02: Clear memory using procedure in the PLC operation manual.	Saved
0013	CPU Unit protected	00	00	Remove protection from CPU Unit memory.	Saved

Error code	Meaning	Detailed error code		Correction	EE-PROM
		1st byte	2nd byte		
0103	Resend count exceeded (send failed)	Commands Bit 15: OFF Bits 08 to 14: SNA Bits 00 to 07: SA1 Responses Bit 15: ON Bits 08 to 14: DNA Bits 00 to 07: DA1		Check transceiver at remote node.	---
0105	Node address setting error (send failed)			Set the IP address correctly.	---
0107	Remote node not in network (send failed)			Check the connection to the remote node.	---
0108	No Unit with specified unit address (send failed)			Check the unit address at the remote node.	---
010B	CPU Unit error (send failed)			Troubleshoot the error in the CPU Unit using the PLC operation manual.	---
010D	Destination address not in routing tables (send failed)			Set the destination address in the routing tables.	---
010E	No routing table entry (send failed)			Set the local node, remote node, and relay nodes in the routing tables.	---
010F	Routing table error (send failed)			Create the routing tables correctly.	---
0110	Too many relay points (send failed)			Reconstruct the network or correct the routing tables so that commands are sent to within a 3-level network range.	---
0111	Command too long (send failed)			Check the command format and set the correct command data.	---
0112	Header error (send failed)			Check the command format and set the correct command data.	---
0117	Internal buffers full; packet discarded			Change the network so that traffic is not concentrated.	---
0118	Illegal packet discarded			Check for nodes sending illegal packets.	---
0119	Local node busy (send failed)			Change the network so that traffic is not concentrated.	---
0120	Unexpected routing error			Check the routing tables.	---
0121	No setting in IP address table; packet discarded			Set the remote node in the IP address table.	---
0122	Service not supported in current mode; packet discarded	Select the IP address table or both methods for the address conversion method.	---		
0123	Internal send buffer full; packet discarded	Change the network so that traffic is not concentrated.	---		
0124	Maximum frame size exceeded; routing failed	Reduce the size of the FINS message.	---		
021A	Logic error in setting table	00	01: Data link table 02: Network parameters 03: Routing tables 04: Setup 05: CPU Bus Unit Words (CIO/DM)	Recreate the data specified by the 2nd byte of the detailed error code.	Saved

Error code	Meaning	Detailed error code		Correction	EE-PROM
		1st byte	2nd byte		
0300	Parameter error; packet discarded	Commands Bit 15: OFF Bits 08 to 14: SNA Bits 00 to 07: SA1 Responses Bit 15: ON Bits 08 to 14: DNA Bits 00 to 07: DA1		Check the command format and set the correct command data.	---
0601	CPU Bus Unit error	Arbitrary		Restart the CPU Unit. If the problem persists, replace the FL-net (Ver. 2.00) Unit.	Saved
0602	CPU Bus Unit memory error	01: Read error 02: Write error	06: Error log	Restart the CPU Unit. If the problem persists, replace the FL-net (Ver. 2.00) Unit.	Saved (except for error log)

- Note**
1. The time information in the CPU Unit is used in the CPU Bus Units.
 2. If the time information cannot be read from the CPU Unit, the time stamp in the error log will be all zeros. This can occur due to CPU Unit startup error, unit number errors, CPU error, and model number errors. If the time is read out from a Programming Device, the time will be shown as all zeros in the year 2000.
 3. The battery must be installed in the CS-series CPU Unit, the power turned ON, and then the time set before the clock in the CPU Unit can be used. The time will not be set correctly in the error log unless the clock time is set correctly.
 4. An error record is not created in EEPROM when a CPU Bus Unit memory error occurs.

10-4 Troubleshooting Procedures

The following procedures can be used to troubleshoot various problems in system operation.

10-4-1 Startup Problems

RUN	HER	PER	P/S	Probable cause	Correction
Not lit	Not lit	Not lit	Not lit	Power is not being supplied to the CPU Unit or the power supply voltage is too low.	Supply power. Make sure that the correct voltage is being supplied.
				The mounting screws on the FL-net (Ver. 2.00) Unit are loose.	Tighten the screws on the FL-net (Ver. 2.00) Unit.
				An error occurred in the FL-net (Ver. 2.00) Unit.	Restart the PLC. If the problem persists, replace the FL-net (Ver. 2.00) Unit.
Not lit	---	Lit	---	The same unit number is being used on another Unit as well.	Correct the unit number setting and restart the PLC.
				The FL-net (Ver. 2.00) Unit is not registered in an I/O table.	Use a CX-Programmer or Programming Console to create a new I/O table.
Not lit	Lit	---	---	The node address is set outside the range.	Set the node number to between 01 and F9 Hex and restart the PLC.
				An error occurred in the FL-net (Ver. 2.00) Unit.	Restart the PLC. If the problem persists, replace the FL-net (Ver. 2.00) Unit.

RUN	HER	PER	P/S	Probable cause	Correction
Lit	---	Lit	---	The same unit number is being used on another CPU Bus Unit as well.	Correct the unit number setting.
				An error occurred in the CPU Unit.	Turn OFF and then restart the CPU Unit. If the problem persists, replace the CPU Unit.
				The routing table is not set correctly.	Use the CX-Programmer to create the correct routing table. Please note that all CPU Bus Units and INNER boards will restart automatically if the routing table is set using a CX-Programmer.
				The system setup is not correct.	Use the FL-net Unit Support Tool to correct the system setup and restart the PLC.
Lit	Lit	---	---	An error occurred in the FL-net (Ver. 2.00) Unit EEPROM.	Restart the PLC. If the problem persists, replace the FL-net (Ver. 2.00) Unit.
Lit	---	Flashing	---	An unavailable CPU Unit Area was set in the Data Link table settings.	Use the FL-net Unit Support Tool to correct the system setup and restart the PLC.
Lit	Flashing	---	---	The IP address is set incorrectly on the rotary switches at the back of the Unit.	Use the rotary switches or the FL-net Unit Support Tool to correct the IP address setting. If you use the rotary switches, you must turn OFF the PLC and remove it from the network before you change the settings. If you use the FL-net Unit Support Tool, restart the PLC after you change the settings.
				The PLC was removed from the network because another node with the same node number was detected.	Another node with the same node number is already present on the network. Change the setting so no two nodes have the same number.
				The FL-net (Ver. 2.00) Unit was removed because it was on an FL-net (Ver. 1.00) network.	FL-net (Ver. 2.00) Units and FL-net Units (Ver. 1.00) cannot operate on the same network. Check the configuration of the network and make sure it consists solely of FL-net (Ver. 2.00) Units.
---	---	---	Not lit	Power is not being supplied to the transceiver (AUI) terminal or the power supply voltage is too low. (CS1W-FLN02 only)	Supply power. Make sure that the correct voltage is being supplied.

10-4-2 Network Connection Problems

Failed communications	Power supply problems	Is the main power supply indicator lit?	Check the power supply, power cable connection and voltage.
		Is the power supply indicator lit on the Communications Unit?	Check the power supply, power cable connection and voltage.
		Is the power supply indicator lit on the AUI power supply unit?	Check the power supply, power cable connection and voltage.
		Is the output of the AUI power supply unit at the rated 12 V?	Check the power supply, power cable connection and voltage. Make sure the CS1W-FLN02 is converting 24 VDC to 12 V in the Unit.
		Is the HUB power supply indicator lit?	Check the power supply, power cable connection and voltage.
		Is the AUI power supply cable connected to the device correctly?	Check the power supply, power cable connection and voltage.
	Communications cable and transceiver connection	Is the transceiver securely mounted?	Re-install the transceiver.
		Were there any errors on the transceiver installation status checker?	Adjust the transceiver. If the errors persist, move the transceiver to another location.
		Is the transceiver properly insulated?	Re-install the transceiver.
		Is the transceiver properly aligned to the communications cable mark?	Re-position the transceiver.
	Transceiver cable and transceiver connection	Is the transceiver securely mounted?	Re-install the transceiver. Tighten more if needed.
		Were there any errors on the transceiver installation status checker?	Check the installation as outlined in the checker manual.
		Is the transceiver securely locked?	Lock the transceiver securely.
		Does the transceiver indicator remain lit?	Check the power supply, power cable connection and voltage.
	Transceiver cable and device connection	Is the transceiver securely mounted?	Re-install the transceiver. Tighten more if needed.
		Do the TX (send) and RX (receive) indicators remain lit on the FL-net (Ver. 2.00) Unit?	Check the error lists in 10-1 to 10-4.
		Is the media switch (i.e., SQE) set properly?	Re-set.

Unstable or failed communications		Is the outer conductor of the coaxial cable properly grounded?	Ground the cable correctly.
		Is the shielded wire of the AUI cable properly grounded?	Ground the cable as outlined in the User's Manual from the manufacturer.
		Does each node respond correctly to the Ping command?	Check the power supply and cables of nodes that fail to respond.
		Is the collision indicator lit frequently?	Check the contact between cables and connectors. Check the error with an analyzer.
		Are there a maximum of four repeater levels?	Reconfigure the repeaters.
		Are all segments within the specified length?	Reconfigure the segments.
		Are two terminal resistors installed at both ends?	Reconfigure the resistors.
		Is the number of devices connected in each segment within specified limits?	Reconfigure the segments.
		Is the FL-net (Ver. 2.00) Unit segment numbered 3 or less?	Reconfigure the segment.
		Are the repeaters turned ON?	Check the power supply, power cable connection and voltage.
Unstable or failed communications (continued)	Device setting check for participating nodes	Is the IP address of the network set properly?	Use a Programming Device or analyzer to re-check the IP address that was set.
		Is the unit number of the FL-net (Ver. 2.00) Unit set properly?	Use a Programming Device or analyzer to re-check the unit number that was set.
		Are the FL-net (Ver. 2.00) Unit parameters set properly?	Use a Programming Device to re-check the parameters that were set.
		Is the CD (carrier detection) indicator steadily or intermittently lit?	Check the communications cable and the AUI power supply.
		Is the TX (send) indicator steadily or intermittently lit?	Re-check the FL-net (Ver. 2.00) Unit settings.
		Does the LNK (link) indicator remain lit?	Re-check the parameter settings for the FL-net (Ver. 2.00) Unit.

10-4-3 FINS Communications Problems for SEND(090), RECV(098), and CMND(490)

<p>Did the completion code end normally?</p>	<p>Refer to <i>10-1 Troubleshooting with Indicators</i> as well as the <i>10-3 Error Log</i>.</p>
<p>Is the control data set properly?</p>	<p>Correct the network address, node address and unit address in the FINS address settings.</p>
<p>Is an IP address set that has the same HOST ID as a remote node?</p>	<p>Use the IP address setting switches (rotary switches at the back of the Unit) or the FL-net Unit Support Tool to correct the IP address setting.</p> <p>If you are using the IP address setting switches, you must turn the PLC OFF and disconnect it from the network to reset it.</p> <p>If you are using the FL-net Unit Support Tool, restart the PLC after you change the setting.</p>
<p>Are you communicating with nodes on another network in the FINS address system?</p>	<p>Check to see if the relay path (routing table) is defined for FINS messages.</p> <p>Use the CX-Programmer to create the correct routing table.</p> <p>Please note that all CPU Bus Units and INNER Boards will reset automatically if you use the CX-Programmer to define the routing table.</p>

SECTION 11

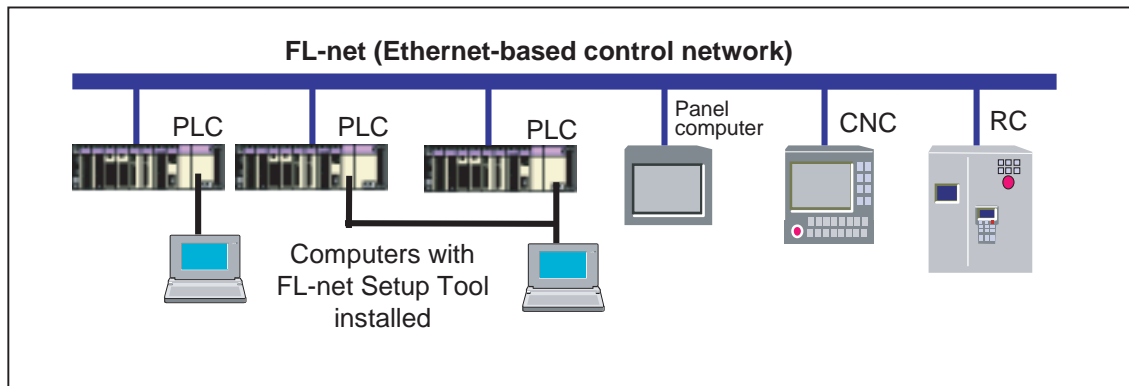
FL-net Unit Support Tool

This section describes the Support Tool used to make settings for the FL-net Units.

11-1	FL-net Unit Support Tool Overview	162
11-2	Installation.	164
11-3	Connecting the Computer to the PLC.	166
11-4	Using Support Tool Functions	168
11-4-1	Before System Settings: Data Link Concepts.	172

11-1 FL-net Unit Support Tool Overview

The FL-net Unit Support Tool is used to make settings for OMRON FL-net (Ver. 2.00) Units mounted to Programmable Controllers (PLCs). The FL-net Unit Support Tool is installed on a computer running Windows 95, 98, 98SE, Me, NT Ver 4.0, or 2000. This computer is connected to a PLC to which an FL-net Unit is mounted.



Checking Components

The FL-net Unit Support Tool is configured from the following components. Check to be sure they are included.

■ FL-net Unit Support Tool Components

- Setup Disk 1 (one 3.5-inch, 1.44-MB floppy disk)
- Setup Disk 2 (one 3.5-inch, 1.44-MB floppy disk)

- Note**
1. The FL-net Unit Support Tool is designed especially for OMRON FL-net (Ver. 2.00) Units.
 2. For information on node settings for FL-net (Ver. 2.00) devices from other companies, contact the particular companies.
 3. The Window operating system is not provided with the Support Tool and must be purchased separately.

Operating Environment

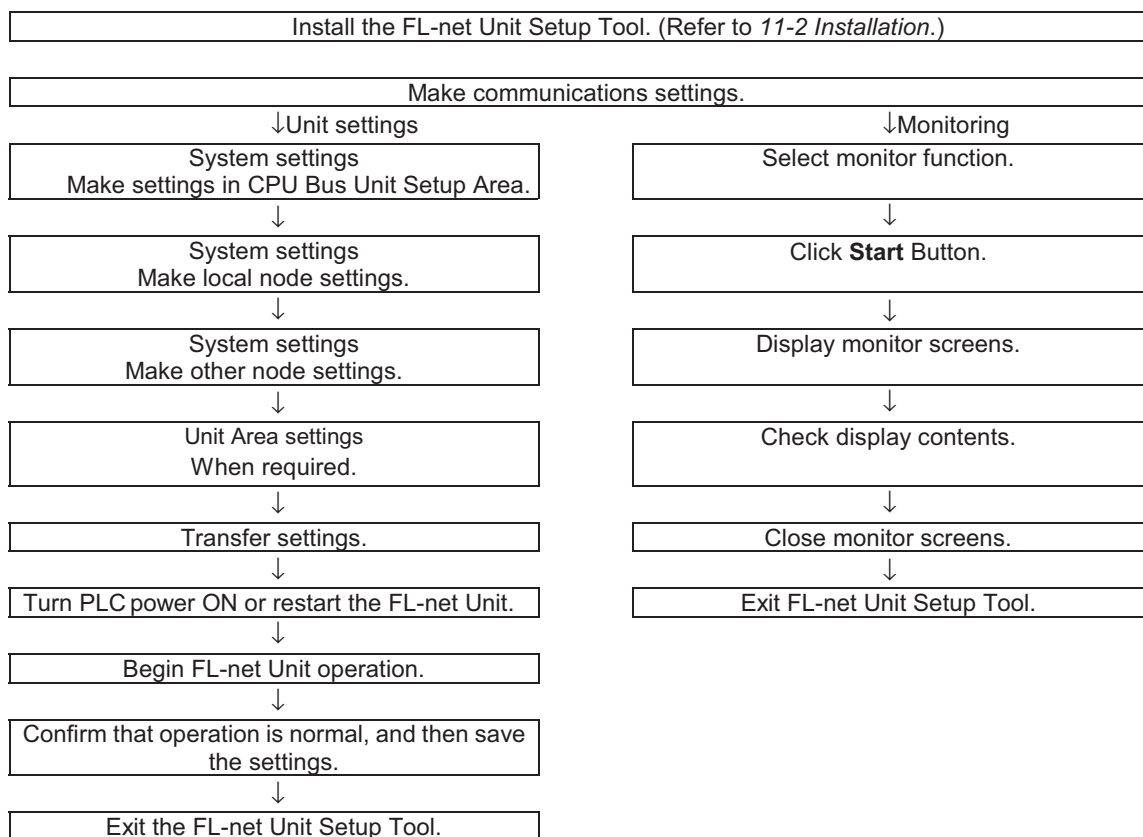
Item	Conditions
Operating systems	Microsoft Windows 95, 98, 98SE, or ME Microsoft Windows NT, Ver. 4.0 Microsoft Windows 2000
Hard disk	1 Mbyte or more of free space
Floppy disk drives	1 or more
Display	Resolution: 640 x 480 pixels min.
Other CPU and memory requirements	Must meet at least the recommended standards for the operating system.

Functions

Name	Function
File Initialize	Returns system and communications settings to their defaults.
File Open	Reads saved setup data. (CSV format only.)
Save to file	Saves edited setup data in CSV format.
Communications settings	Makes communications settings for connecting the computer to the PLC, and the settings for Unit designation.

Name	Function
System setting (CPU Bus Unit setup area)	Sets the basic FL-net (Ver. 2.00) Unit data stored in the CPU Bus Unit Setup Area.
System setting (Local node setup)	Makes settings related to cyclic data for the FL-net (Ver. 2.00) Unit at the local node.
System setting (Other node setup)	Makes settings related to cyclic data for the FL-net (Ver. 2.00) Units at remote nodes.
Unit area setting	Makes settings related to the settings and information in the Unit Area for the FL-net (Ver. 2.00) Unit.
Monitor (Unit status)	Shows the Unit status.
Monitor (Network status)	Shows the network status.
Monitor (Node status)	Shows the node status.
Monitor (Data link status)	Shows the data link status.
Monitor (Participating node status)	Shows the participating node status.
Monitor (Message sequential status)	Shows the message sequential status.
Monitor (FA Link network status)	Shows the FA Link network status.

Operating Procedure



- Note**
1. The new settings go into effect when the PLC's power is turned ON again or when the FL-net Unit is restarted.
 2. Confirm that the communications settings are correct for the environment in which they are to be used.

11-2 Installation

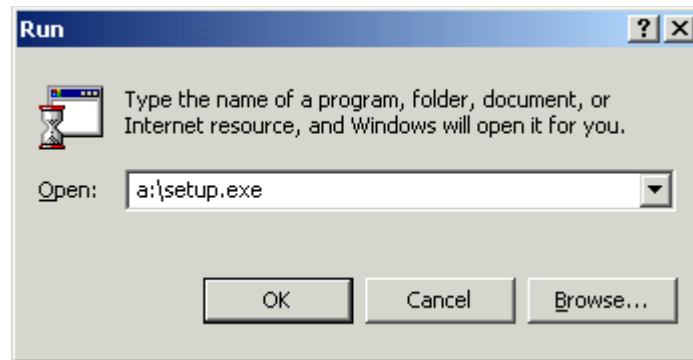
This section explains how to install the software for setting the FL-net Unit's operating parameters.

Installation Procedure

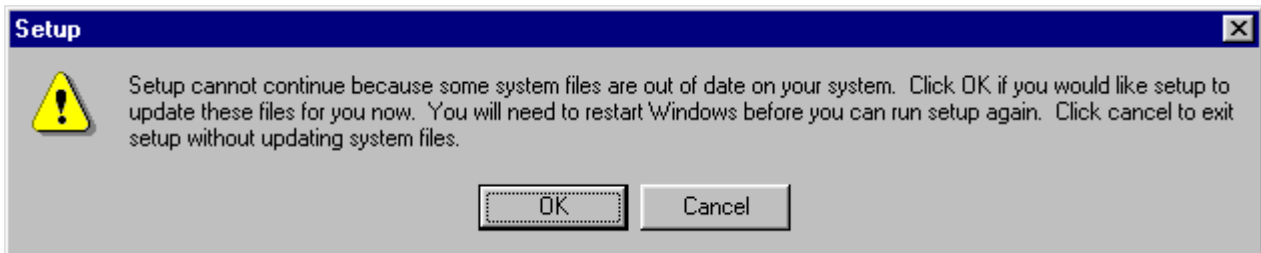
The procedure for installing the FL-net Unit Support Tool is given below. Use the special-purpose Support Tool Installer to install the software.

Note Operations and screen displays will vary slightly according to the Windows system which is used. The procedure shown here uses Windows NT as an example.

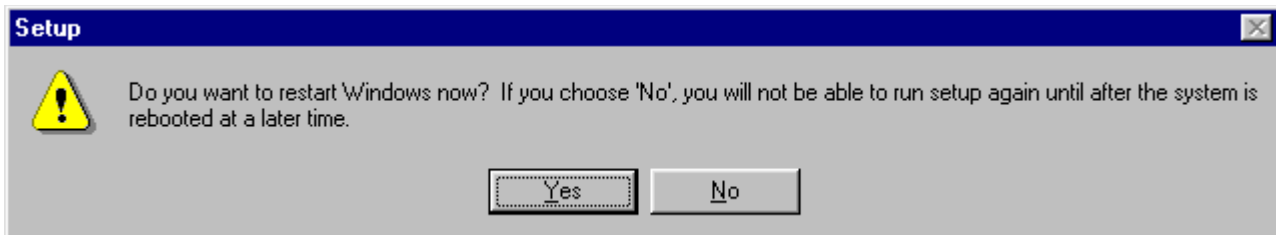
- 1,2,3...
1. Close all applications that are running.
 2. Insert the Support Tool's Setup Disk 1 into the drive.
 3. Click the Start Button, and select "Run."
 4. As shown in the following diagram, specify \Setup.exe at the drive where the disk is set, and then click the OK Button. \Setup.exe can be selected at the appropriate drive by clicking the Browse Button.



5. Depending on the Windows system being used, some of the system files may be modified for the setup, and it may be necessary to restart Windows. If the following message is displayed, click the OK Button. If it is not displayed, proceed to Step 7.

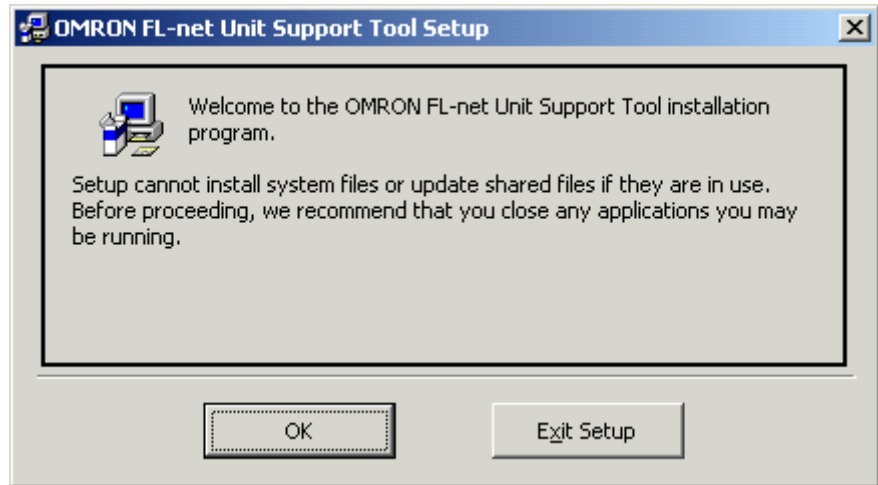


6. Click the **Yes** Button. After the computer has been restarted, the setup will be started when setup.exe is again executed.

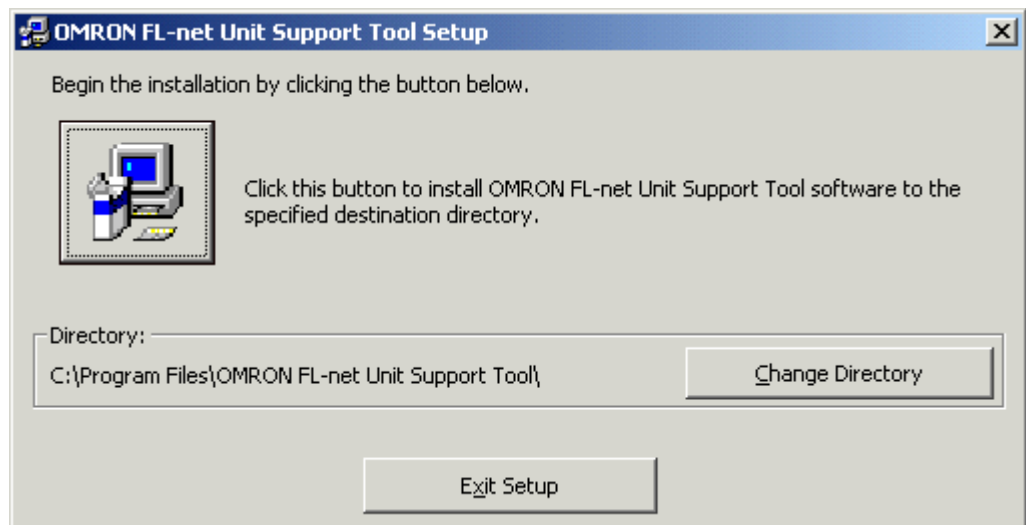


7. The installation will be started, and the Installer will begin preparations. When the next disk is required, a message will be displayed requesting that Setup Disk 2 be inserted into the drive.

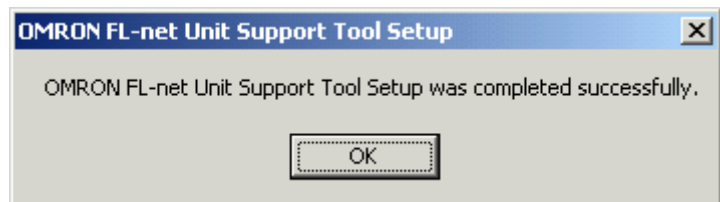
- 8. The following window will be displayed. Click the OK Button.



- 9. Specify the directory where the Support Tool software is to be installed. If the directory displayed is correct, then click the Icon Button. To install the software in another directory, click the Change Directory Button and specify the storage location. Then click the Icon Button. If a directory that does not exist is specified, it will be automatically created.



- 10. The software will be installed. When the installation is finished, the following window will be displayed. Click the OK Button to complete the setup.



- 11. This completes the software installation.

11-3 Connecting the Computer to the PLC

This section explains how to connect to the PLC the computer in which the FL-net Unit Support Tool is installed. The cables used depend on the type of connection to the PLC. When connecting the computer to the PLC, refer to the connection examples provided in this section.

Communications Settings

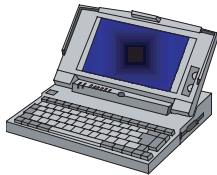
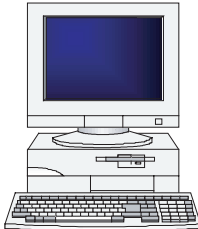
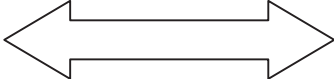

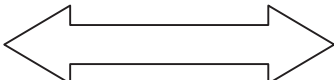

The following table provides the settings for the communications port used for the FL-net Unit Support Tool (i.e., the set values used during operation).

Specifications		Remarks
Communications protocol	Tool bus	---
Port No.	1 to 4	Default: 1
Baud rate	9600, 19,200, or 38,400 bps	Default: 9,600
Communications method	Start-stop synchronization, bit serial transfer	---
Frame configuration	Data: 8 bits, 1 stop, no parity	---
Transfer code	Binary	---
Response method	Full duplex	---
Xon/Xoff	No	---
RS/CS control	Yes	---

Note

1. The above specifications are automatically set and used internally by the FL-net Unit Support Tool when it connects through the serial port of the computer.
2. By setting the CS CPU Unit's DIP switch to "Auto-detect Programming Device," the connection can be made easily and with no need to pay attention to the details of the above communications settings. For details, refer to the *CS Series PLC Operation Manual*.
3. These settings do not depend on the serial port settings in the operating system, and there is no need to change the Windows settings.
4. If the communications settings are all set manually, the settings must be made in the PLC Setup. For details, refer to the *CS Series PLC Operation Manual*.

Examples: Connecting the Computer and PLC

Computer	Connecting Cable	PLC
 	CQM1-CIF01 ←RS-232C Peripheral port→ 	CS  Auto-detect Programming Device connection enabled by setting DIP switch pin No. 4 to OFF.
	RS-232C Cable CQM1-CIF01 ←RS-232C RS-232C port→ 	CS  Auto-detect Programming Device connection enabled by setting DIP switch pin No. 5 to ON.

- If the RS-232C connector at the computer is a half-pitch 14-pin connector, use a D-Sub 25-pin to Half-pitch Conversion Cable (XW2Z-S001).

- RS-232C cable can be connected only for models with a built-in RS-232C port or when a Host Link Unit is mounted.
- If the RS-232C port at the PLC is D-Sub 9-pin connector, use a XW2Z-200S cable.
- If the RS-232C port at the PLC is D-Sub 25-pin connector, use a XW2Z-200P cable.
- For details on PLC DIP switch settings, refer to the *CS Series PLC Operation Manual*.

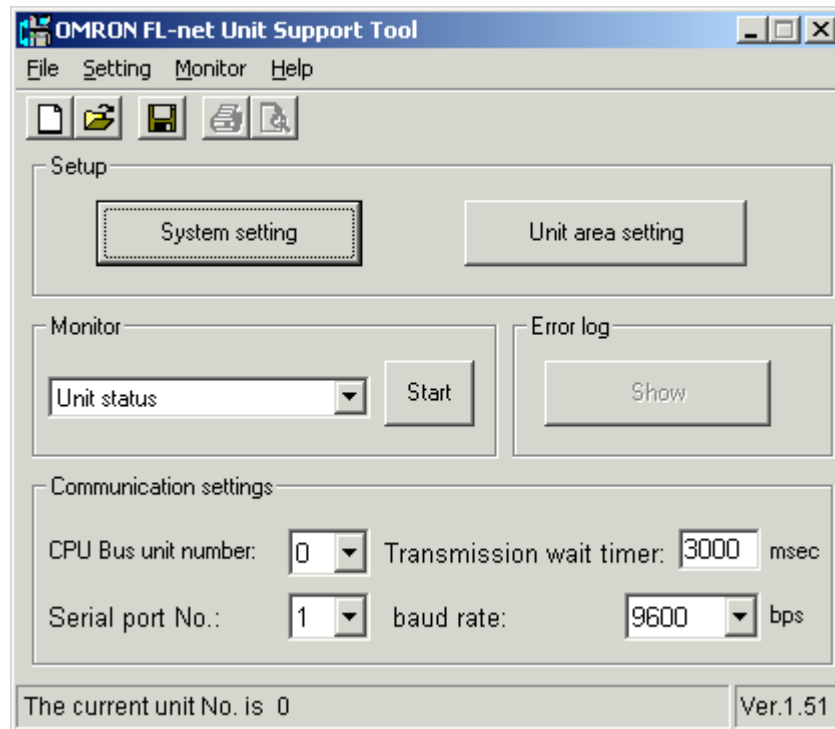
11-4 Using Support Tool Functions

Basic Operations

■ Starting

- 1,2,3...
1. Click the **Start** Button.
 2. Display the menu by moving the cursor from Program to OMRON.
 3. Select **FL-net Unit Support Tool** to start the program. The following screen will be displayed.

Main Screen



■ Initializing

- 1,2,3...
1. Select **Initialize** from the File Menu.
 2. The system and communications settings will be initialized to their default values.

■ Opening

- 1,2,3...
1. Select **File Open** from the File Menu.
 2. When any file is selected, the previously-set contents of that file can be read.

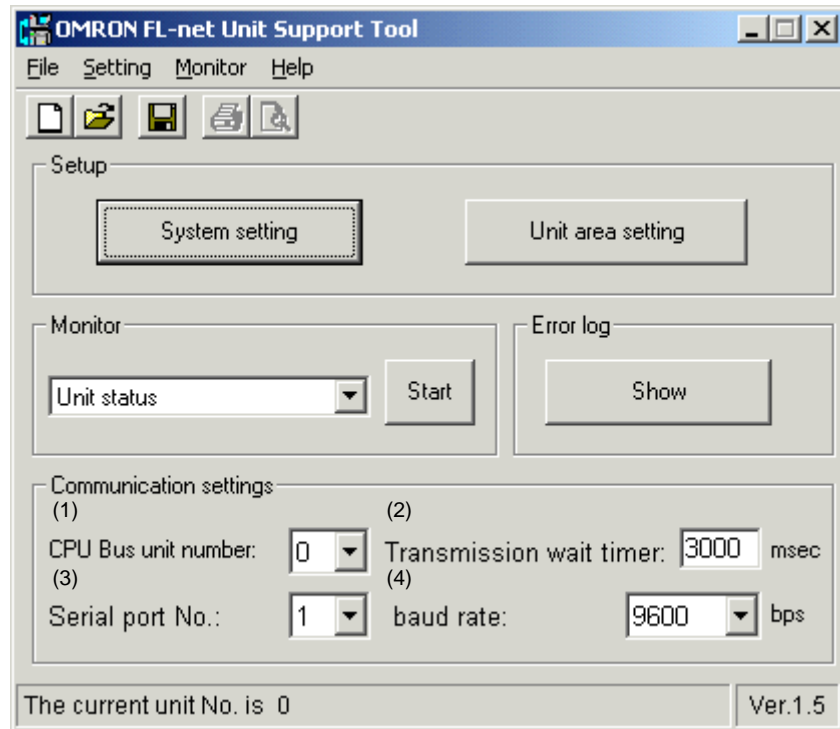
■ Saving

- 1,2,3...
1. Select **Save to file** from the File Menu.
 2. The contents of a file can be saved by specifying the filename.

■ Exiting

- 1,2,3...
1. Select **Exit** from the File Menu.
 2. The FL-net Unit Support Tool will be exited.

Communications Settings

**(1) CPU Bus Unit Number (Default: 0)**

Specify the unit number (0 to F).

Use the same setting as the number set on the rotary switch on the front panel of the FL-net Unit.

(2) Transmission Wait Timer (Default: 3,000 ms)

Specify the period of time to wait for the response to be returned (1 to 65,535 ms). If the value is too small, communications may not be possible.

The baud rate must be taken into account, but there is normally no need to change this setting.

(3) Serial Port Number (Default: 1)

Specify the number of the serial port (1 to 4) to be used at the computer (for cable connection).

(4) Baud Rate (Default: 9,600 bps)

Specify the baud rate (9,600, 19,200, or 38,400 bps) for connecting to the PLC. Match the baud rate that is set for the PLC port.

When the PLC communications port setting is for "Auto-detect Programming Device," the connection can be made at any of the baud rate settings. The PLC automatically detects the baud rate and makes the connection.

System Setting - CPU Bus Unit Setup Area

Any of several different operating parameters can be selected depending on the system, but the explanation is provided here in terms of simple operating conditions.

The screenshot shows the 'Setting.Edit' dialog box with the 'CPU Bus Unit setup area' tab selected. The dialog contains the following items:

- (1) FA Link mapping table method: PLC build-in method (dropdown)
- (2) FA Link startup method: Auto participating (dropdown)
- (3) Confirm message protocol: Confirmed (dropdown)
- (4) Broadcast type: ***.***.***.255 (dropdown)
- (5) IP address set method: 192.168.250+ node No. (dropdown)
- (6) Sub-net Mask: 255 . 255 . 255 . 0 (text boxes)
- (7) IP address: 0 . 0 . 0 . 0 (text boxes)
- (8) No. of the other nodes in FA link: 0 (text box)
- (9) Show data: Decimal Hex (radio buttons)
- (10) Send (button)
- (11) Receive (button)
- (12) OK (button)
- (13) Cancel (button)

(1) FA Link mapping table method (Default: PLC built-in method)

Selects the method (PLC built-in method or FA Link Unit built-in method) for storing the FA Link mapping table. Normally the default should be selected.

(2) FA Link startup method (Default: Auto-participating method)

Selects the method (auto-participating or manual-participating) for starting the FA Link. Normally the default should be selected.

(3) Confirm message protocol (Default: Confirmed)

Selects the protocol (confirmed or unconfirmed) for when messages are used. Select "Confirmed" for a network with OMRON FL-net Units only. Select "Unconfirmed" for a network in which units from other manufacturers are connected.

(4) Broadcast type (Default: *.***.***.255)**

Selects the broadcast type (***.***.***.255, C255.255.255.255). Normally the default should be selected.

(5) IP address set method (Default: 192.168.250 + node number)

Selects the IP address setting method (192.168.250 + node number, rotary switch on back panel of Unit, rotary switch on back panel of Unit + node num-

ber, or System Setup Area).
Normally the default should be selected.

(6) Sub-net mask (Default: 255.255.255.0)

Sets the sub-net mask (user setting).
Normally the default should be selected.

(7) IP address (Default: None)

Sets the IP address (user setting).
The IP address does not need to be set except when the IP address set method is "System Setup Area."

(8) No. of the other nodes in FA Link (Default: None)

The number of remote nodes (user setting) in the FA Link configuration is displayed.
This does not normally need to be set.

(9) Show data

Selects whether data is to be given in decimal or hexadecimal.

(10) Send

Writes to the System Setup Area of the specified Unit.

(11) Receive

Reads the contents of the System Setup Area of the specified Unit to the FL-net Unit Support Tool.

(12) OK

Validates the changed settings and closes the window.
When the System Setup Window is next opened, the changed settings will be displayed.

(13) Cancel

Cancels the changes to the settings and closes the window.
When the System Setup Window is next opened, the settings prior to the changes will be displayed.

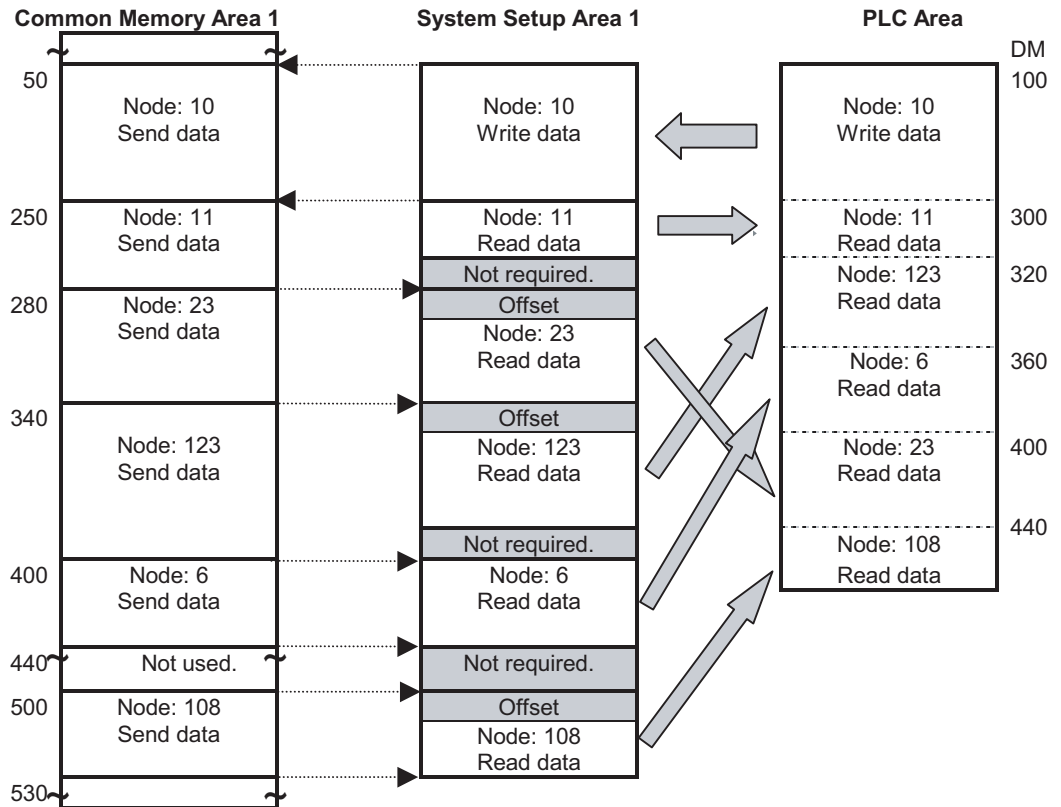
Note In order to circulate a token among nodes connected to the network, match the uppermost three digits of the IP address, the sub-net mask, and the broadcast type to those of the other connected nodes.

11-4-1 Before System Settings: Data Link Concepts

Before making the system settings in the Local and Other Node Setup Areas, it is necessary to clearly understand the data link concept.

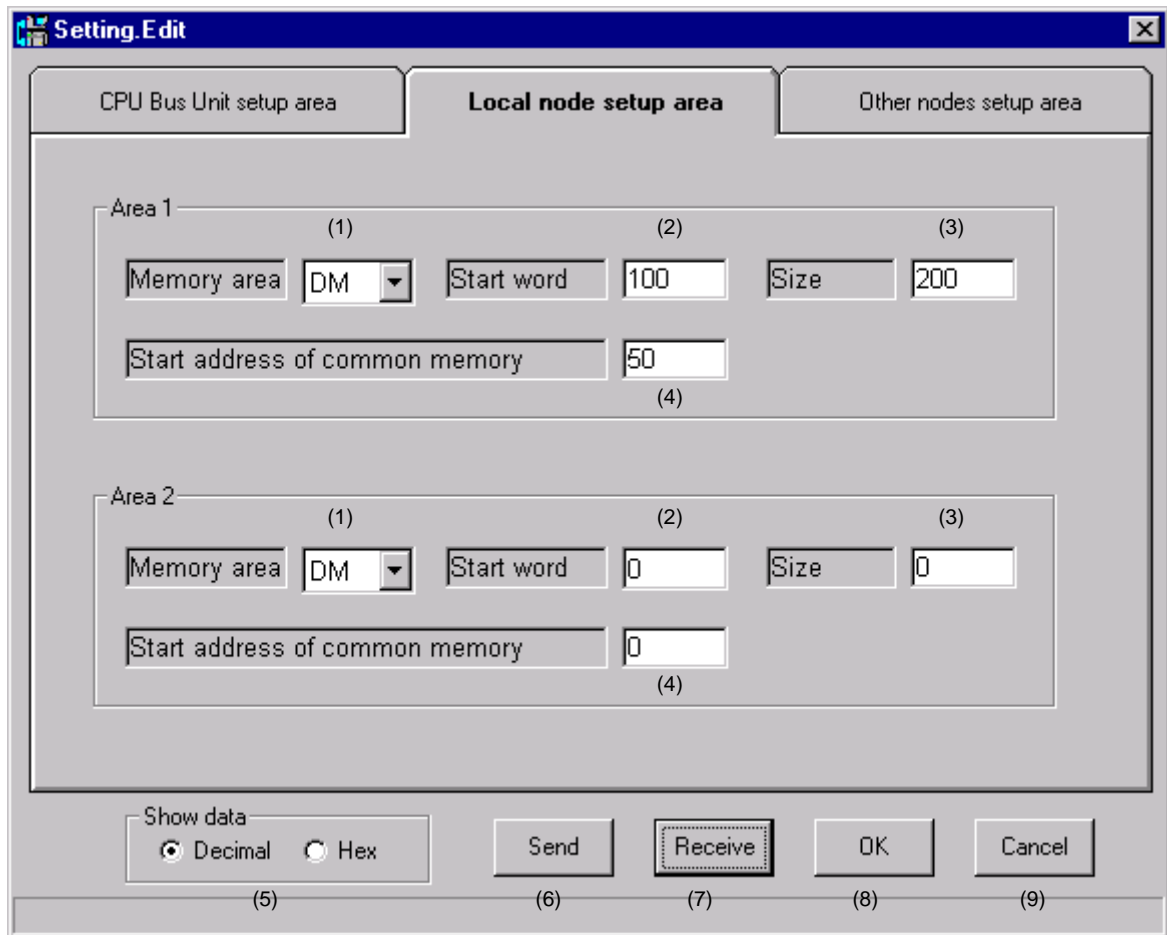
Example

On the example on the following pages, the local node shown below is 10.



System Setting (Local Node Setup Area)

The Local Node Setup Area can be set so that data from any PLC area can be used as the send data from the local node

**(1) Area 1 (Area 2) Memory Area (Default: DM)**

Sets the PLC area in which Cyclic Data Areas 1 and 2 for the local node are stored.

The following areas are set: CIO, WR, HR, DM, and EM0 to EMC.

(2) Area 1 (Area 2) start word (Default: 0)

Sets the beginning word of the PLC area in which Cyclic Data Areas 1 and 2 for the local node are stored.

(3) Area 1 (Area 2) size (Default: 0)

Sets the size of the PLC area in which Cyclic Data Areas 1 and 2 for the local node are stored. This setting also determines the size allocated to this node in common memory.

(4) Area 1 (Area 2) Start address of common memory (Default: 0)

Sets the beginning address of the Common Memory allocated to Area 1 (or Area 2).

(5) Show data

Selects whether data is to be given in decimal or hexadecimal.

(6) Send

Writes set data to the System Setup Area of the specified Unit.

(7) Receive

Reads the contents of the System Setup Area of the specified Unit to the FL-net Unit Support Tool.

(8) OK

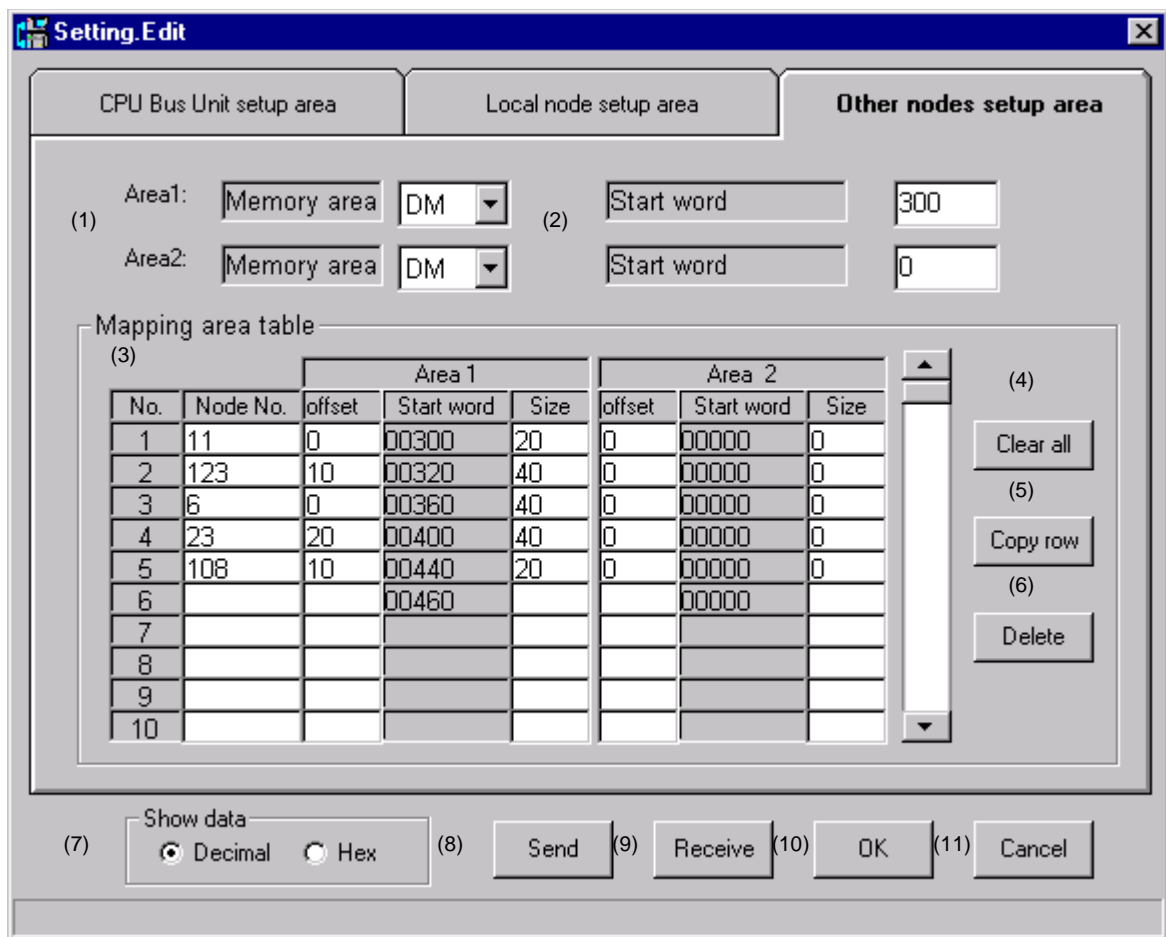
Validates the changed settings and closes the window. When the System Setup Window is next opened, the changed settings will be displayed.

(9) Cancel

Cancels the changes to the settings and closes the window. When the System Setup Window is next opened, the settings prior to the changes will be displayed.

System Setting (Other Node Setup Area)

The Other Node Setup Area are be set so that Common Memory data for remote nodes can be read to the local PLC areas.



(1) Area 1 (Area 2) Memory Area (Default: DM)

Sets the PLC area in which Cyclic Data Areas 1 and 2 for the remote nodes are stored.

The following areas are set: CIO, WR, HR, DM, and EM0 to EMC.

(2) Area 1 (Area 2) start word (Default: 0)

Sets the beginning word of the PLC area in which Cyclic Data Areas 1 and 2 for the remote nodes are stored.

(3) Mapping area table

Sets the offset, size and mapped node numbers of the PLC area in which Cyclic Data Areas 1 and 2 for the remote nodes are stored.

- Note**
1. Do not assign the local node to this area.
 2. If the settings are made for only Area 1 (or Area 2), set the offset and size for the other area to 0.

(4) Clear all

Clears all entries in the mapped area table.

(5) Copy row

Copies the contents of the row in which the cursor is placed, and adds it as a new row.

(6) Delete

Deletes the contents of the row in which the cursor is placed. Any settings after the deleted row are moved forward in the table.

(7) Show data

Selects whether data is to be displayed in decimal or hexadecimal.

(8) Send

Writes set data to the System Setup Area of the specified Unit.

(9) Receive

Reads the contents of the System Setup Area of the specified Unit to the FL-net Unit Support Tool.

(10) OK

Validates the changed settings and closes the window.

When the System Setup Window is next opened, the changed settings will be displayed.

(11) Cancel

Cancel the changes to the settings and closes the window.

When the System Setup Window is next opened, the settings prior to the changes will be displayed.

- Note** The "offset" designation is the designation of how much data to receive of the data sent from a given node (i.e., which word to begin receiving from, and how many words to receive). The number of words from the beginning of the sent data until the beginning of the received data is called the "offset." The offset function can be used to receive only a portion of the data sent from a given node to enable using the Data Link Memory Areas efficiently.

Unit Area Setup

Sets the Unit's data display and node name.

The screenshot shows a dialog box titled "Unit area" with the following fields and controls:

- Protocol version: 128
- Vendor: OMRON Co.
- Maker model: FLnet Unit
- IP address: 192.168.250.1
- Allowed min. frame interval: 1 x 100u sec, with radio buttons for Valid and Invalid (Invalid is selected).
- Node name: OMRON, with radio buttons for Valid and Invalid (Valid is selected).
- Buttons: Send, Receive, OK, Cancel.
- Status bar: Receive completed. (3) (4) (5) (6)

(1) Allowed min. frame interval

Sets the present minimum allowable frame interval. "Valid" must be selected to enable this setting.

(2) Node name

Sets the node name. "Valid" must be selected to enable this setting.

(3) Send

Writes set data to the Unit Area Setup Area of the specified Unit.

(4) Receive

Reads the contents of the Unit Area Setup Area of the specified Unit to the FL-net Unit Support Tool.

(5) OK

Validates the changed settings and closes the window.

When the Unit Area Setup Window is next opened, the changed settings will be displayed.

(6) Cancel

Cancels the changes to the settings and closes the window.

When the Unit Area Setup Window is next opened, the settings prior to the changes will be displayed.

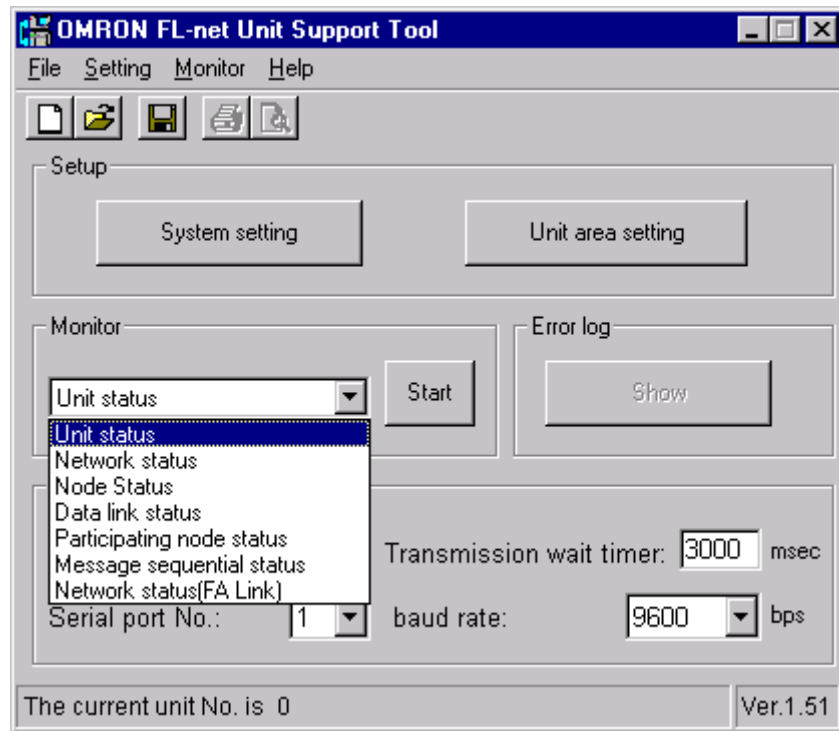
Monitoring Function

The FL-net Unit Support Tool can be used to monitor conditions such as the network status, settings, etc.

Several types of status can be displayed simultaneously, providing an accurate picture of network status.

Selecting the Monitoring Function

Select the data to be monitored, and then click the Start Button.



Note The monitoring function periodically reads data from the FL-net (Ver. 2.00) Unit or the PLC, so they may have an effect on data link operations and message communications.

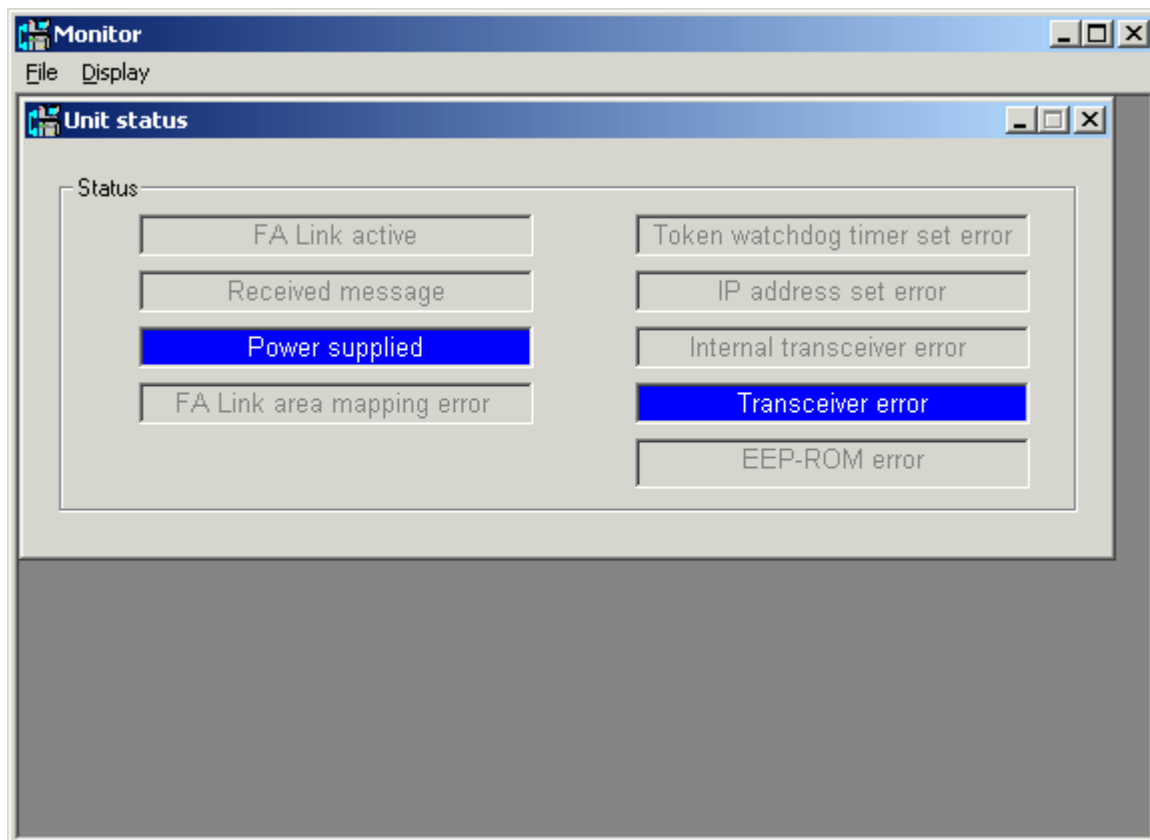
Use the monitoring function only when required. In particular, be careful about simultaneously displaying several types of status, because this can have an especially noticeable effect on operations.

While executing the monitoring function, do not disconnect the communications cable between the computer and the PLC, or turn OFF the power to the computer or the PLC.

Monitor (Unit Status)

Shows the status of the FL-net (Ver. 2.00) Unit.

The status shown here is the same as the Unit status which is reflected in the CIO Area.

**FA Link active**

Lit when FA Link operation is normal.

Received message

Lit when a transparent message is received.

Power supplied

Lit when transceiver power supply is normal.

FA Link Area mapping error

Lit when FA Link Area mapping is incorrect. Recheck the settings.

Token watchdog timer set error

Lit when time for monitoring token in network is incorrect.

This error occurs for reasons such as faulty network configuration.

Restore by resetting the Unit.

IP address set error

Lit when IP address setting is incorrect. Recheck the setting.

Internal transceiver error

Lit when an error occurs during a transceiver test. Restore by resetting the Unit.

If this is a recurring error, replace the Unit.

Transceiver error

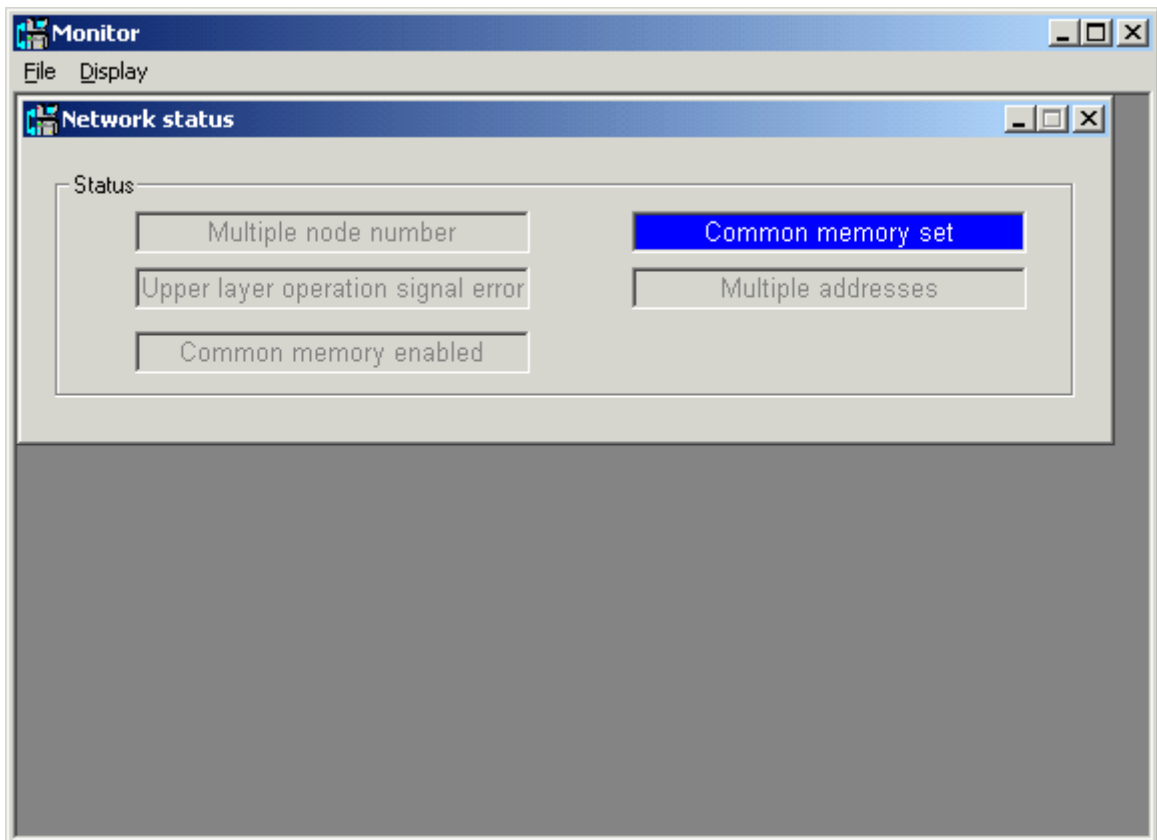
Lit when an error occurs at the transceiver.
Restore by resetting the Unit.
If this is a recurring error, replace the Unit.

EEPROM error

Lit when an error occurs at the EEPROM.
There are cases in which an error recurs in a Unit in a faulty network configuration.
Recheck the settings.
If the error recurs after rechecking the settings, replace the Unit.

Monitor (Network Status)

Shows the network status of the FL-net (Ver. 2.00) Unit.
The status shown here is the same as the network status which is reflected in the CIO Area.

**Multiple node number**

Lit when a node number is used more than once. Recheck the Unit and the settings.

Upper layer operation signal error

Lit when an error occurs between the Unit and the PLC. Reset the Unit.

Common Memory enabled

Lit when Common Memory data is enabled.
Lit after Unit restart if the settings are normal.

Common Memory set

Lit when Common Memory settings are completed.
Lit after Unit restart if the settings are normal.

Multiple addresses

Lit when a local node Common Memory address is used more than once.
Recheck the Unit and the settings.

Monitor (Node Status)

Shows the status of remote nodes participating in the FL-net network.

The status shown here is the same as the network status which is reflected in the DM Area.

Node No	Mapping error	Participating in network	Error(upper layer)	Run(upper layer)
242	No error	Not Participating	No Error	Not active
243	No error	Not Participating	No Error	Not active
244	No error	Not Participating	No Error	Not active
245	No error	Not Participating	No Error	Not active
246	No error	Not Participating	No Error	Not active
247	No error	Not Participating	No Error	Not active
248	No error	Not Participating	No Error	Not active
249	No error	Not Participating	No Error	Not active
250	No error	Not Participating	No Error	Not active
251	No error	Not Participating	No Error	Not active
252	No error	Not Participating	No Error	Not active
253	No error	Not Participating	No Error	Not active

Mapping error

Notifies that the settings do not correctly reflect the network data in the PLC areas. Recheck the settings.

Participation in network

Network participation status is stored.

The operating status and error status data when not participating is invalid.
(The upper layer status when changing from participating to not participating is retained.)

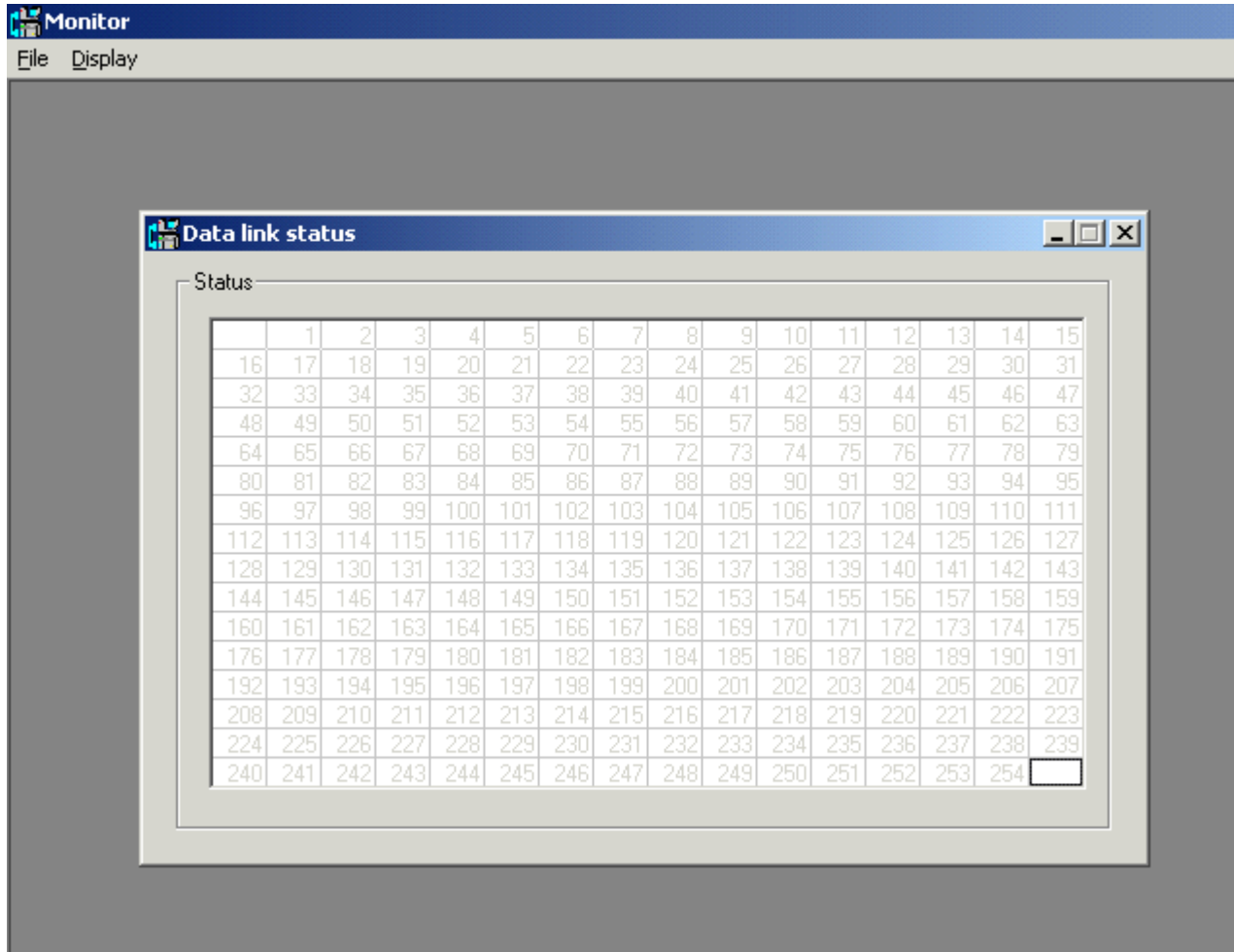
Error (Upper Layer)

The error status (Error/No error) of applications installed at the node is stored.

Run (Upper Layer)

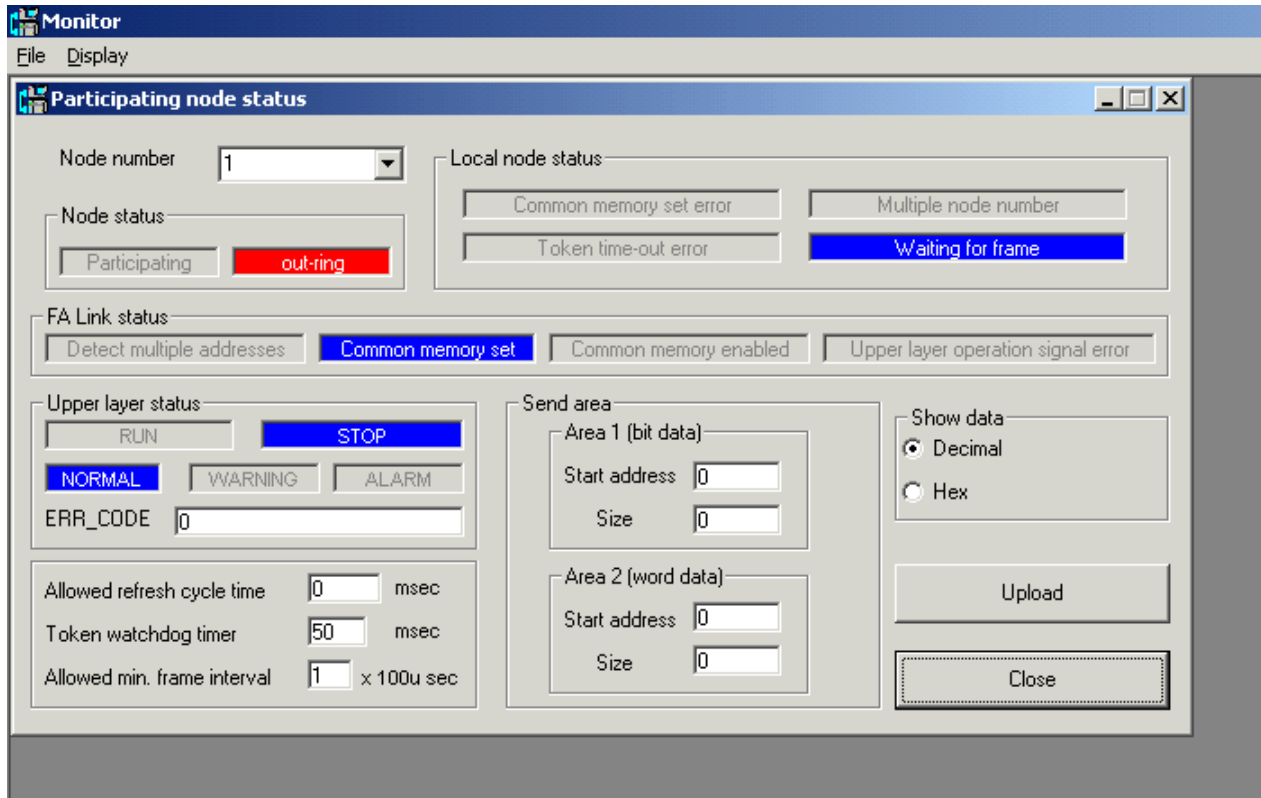
The operating status (Active/Not active) of applications installed at the node is stored.

Monitor (Data Link Status) Shows the data link status of remote nodes participating in the FL-net network.
The status shown here is the same as the connected node data which is reflected in the CIO Area.



Monitor (Participating Node Status)

Shows the status of remote nodes participating in the FL-net network. Data from unmapped remote nodes can also be displayed.



Node number

Sets the node number of the node for which the status is to be read.

Local node status (only when local node is specified)

Shows the status of the local node when the node set by the node number is the local node. In this case, the same data is displayed as for the network status.

Node status

Shows the participation status of the node.

FA Link status

Shows the network status of the node set by the node number.

Upper layer status

Shows the upper layer status.

ERR_CODE	Meaning
0	Normal
1	CPU Unit servicing stopped.

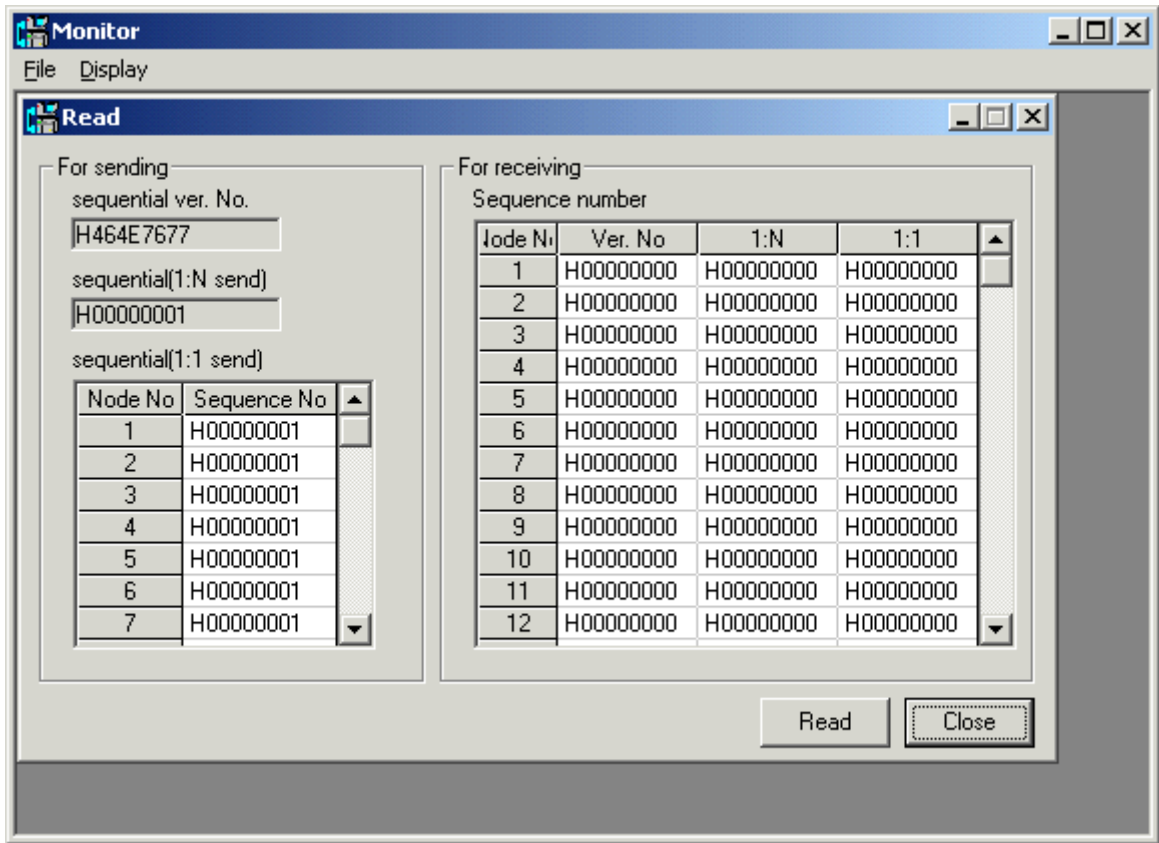
Note For information on FL-net node error codes in systems by other companies, refer to the relevant manuals.

Allowed refresh cycle time, token watchdog timer, allowed min. frame interval

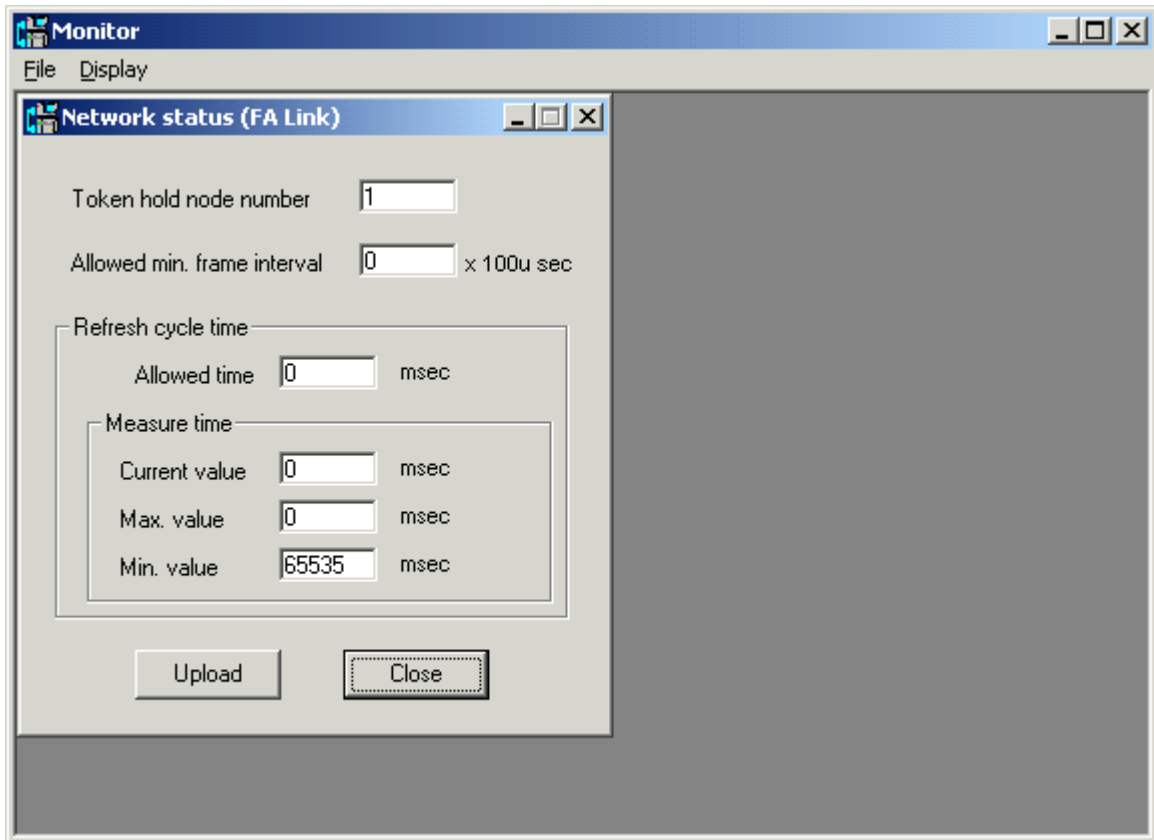
Displays the allowed refresh cycle time, the token watchdog timer, and the allowed minimum frame interval for the node set by the node number.

Monitor (Message Sequential Status)

Shows the message sequential status.



Monitor (FA Link Network Status) Shows the network status.



Token hold node number

Displays the node number of the node where the token is held when the Upload Button is clicked.

Allowed min. frame interval

Displays the minimum allowable frame interval for the network in which the specified Unit is participating.

Refresh cycle time

Displays the allowable refresh cycle time for the specified Unit.

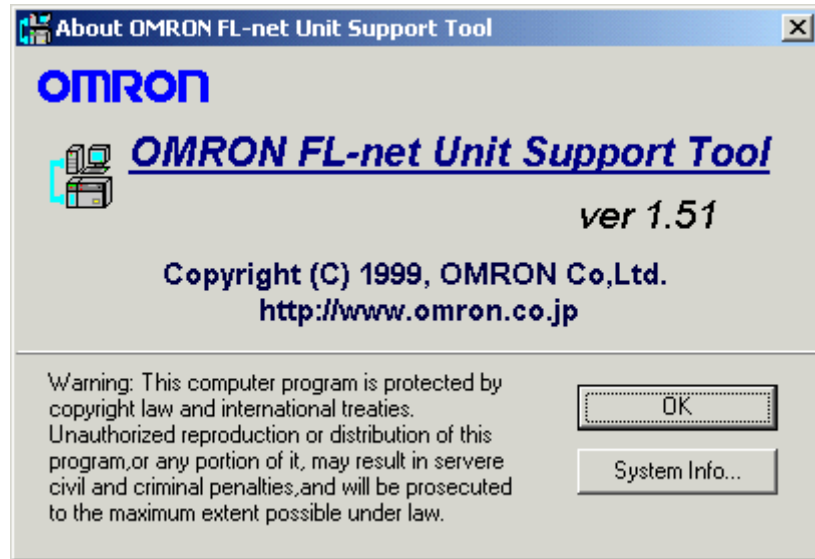
Measure time

Displays the current value, maximum value, and minimum value of the measured refresh cycle time for the specified Unit.

Version Information

The FL-net Unit Support Tool version number can be displayed by selecting Help from the menu, and then selecting **About OMRON FL-net Unit Support Tool**.

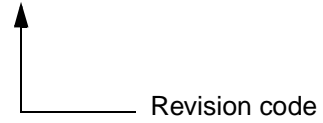
Check the version number when making inquiries about the Support Tool.



Revision History

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

Cat. No. W432-E1-01



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

Revision code	Date	Revised content
01	November 2003	Original production

OMRON CORPORATION

FA Systems Division H.Q.
66 Matsumoto
Mishima-city, Shizuoka 411-8511
Japan
Tel: (81)55-977-9181/Fax: (81)55-977-9045

Regional Headquarters

OMRON EUROPE B.V.

Wegalaan 67-69, NL-2132 JD Hoofddorp
The Netherlands
Tel: (31)2356-81-300/Fax: (31)2356-81-388

OMRON ELECTRONICS LLC

1 East Commerce Drive, Schaumburg, IL 60173
U.S.A.
Tel: (1)847-843-7900/Fax: (1)847-843-8568

OMRON ASIA PACIFIC PTE. LTD.

83 Clemenceau Avenue,
#11-01, UE Square,
Singapore 239920
Tel: (65)6835-3011/Fax: (65)6835-2711

OMRON

Authorized Distributor:

Cat. No. W432-E1-01

CS Series CS1W-FLN02/CS1W-FLN12 FL-net (Ver. 2.00) Units

OPERATION MANUAL

OMRON