Cat. No. W440-E1-03

SYSMAC
CS/CJ Series
CS1W-FLN22 (100Base-TX)
CJ1W-FLN22 (100Base-TX)
FL-net Units

OPERATION MANUAL

OMRON

CS1W-FLN22 (100Base-TX)
CJ1W-FLN22 (100Base-TX)
FL-net Units

Operation Manual

Revised October 2010

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. Additionally, there may be severe property damage.

⚠WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.

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

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About this Manual:

This manual describes the installation and operation of the CS1W-FLN22 (100Base-TX) and CJ1W-FLN22 (100Base-TX) FL-net Units.

FL-net Units are used to connect to FL-net 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/CJ Series CS1W-FLN22 (100Base-TX) and CJ1W-FLN22 (100Base-TX) FL-net Units Operation Manual (this manual)	W440	Describes the installation and operation of the CS1W-FLN22 and CJ1W-FLN22 FL-net Units. Refer to the *Communications Commands Reference Manual* (W342) for information on FINS commands that can be addressed to CS/CJ-series CPU Units.
SYSMAC CS/CJ Series CS1W-ETN21, CJ1W-ETN21 100Base-TX Ethernet Units Operation Manual, Construction of Network	W420	Provides information on operating and installing 100Base-TX Ethernet Units, including details on basic settings and FINS communications.
CXONE-AL□□C-E CX-One FA Integrated Tool Package Setup Manual	W444	Provides an overview of the CX-One FA Integrated Tool and installation procedures.
WS02-CXPC1-E-V61 SYSMAC CX-Programmer Ver. 6.1 Operation Manual	W446	Provides information on installing and operating the CX-Programmer for all functions except for function blocks.
WS02-CXPC1-E-V61 SYSMAC CX-Programmer Ver. 6.1 Operation Manual Function Blocks	W447	Provides specifications and operating procedures for function blocks. When programming, refer to the *CJ Series (W339)* or *CJ Series (W393) Programmable Controllers Operation Manual, CS/CJ Series Programmable Controllers Programming Manual (W394),* and *CS/CJ Series Programmable Controllers Instructions Reference Manual* (W340).
CXONE-AL□□C-E CX-Integrator Operation Manual	W445	Describes CX-Integrator operating procedures and provides information on network configuration (data links, routing tables, Communications Units setup, etc.
SYSMAC CS Series CS1G/H-CPU□□-EV1, CS1G/H-CPU□□H Programmable Controllers Operation Manual	W339	Provides an outline of and describes the features, system configuration, installation, wiring, I/O memory allocations, and troubleshooting for the CS-series PLCs. Use this manual together with the *CS/CJ Series Programmable Controllers Programming Manual (W394).*
SYSMAC CJ Series CJ1G-CPU□□, CJ1M-CPU□□, CJ1G-CPU□□P, CJ1G/H-CPU□□H Programmable Controllers Operation Manual	W393	Provides an outline of and describes the features, system configuration, installation, wiring, I/O memory allocations, and troubleshooting for the CJ-series PLCs. Use this manual together with the *CS/CJ Series Programmable Controllers Programming Manual (W394).*
SYSMAC CS/CJ Series CS1G/H-CPU□□-EV1, CS1G/H-CPU□□H, CS1D-CPU□□H, CS1D-CPU□□S, CJ1G-CPU□□, CJ1M-CPU□□, CJ1G-CPU□□P, CJ1G/H-CPU□□H Programmable Controllers Programming Manual	W394	This manual describes programming, tasks, file memory function, and other functions of the CS/CJ-series PLCs. Use this manual together with the CJ *Series (W339)* or *CJ Series (W393) Programmable Controllers Operation Manual.*

Name	Cat. No.	Contents
SYSMAC CS/CJ Series CS1G/H-CPU□□-EV1, CS1G/H-CPU□□H, CS1D-CPU□□H, CS1D-CPU□□S, CJ1G-CPU□□, CJ1M-CPU□□, CJ1G-CPU□□P, CJ1G/H-CPU□□H Programmable Controllers Instructions Reference Manual	W340	Describes the ladder diagram programming instructions supported by CS/CJ-series PLCs. Use this manual together with the CJ *Series (W339)* or *CJ Series (W393) Programmable Controllers Operation Manual* and the *CS/CJ Series Programmable Controllers Programming Manual (W394).*
SYSMAC CS/CJ Series CS1G/H-CPU□□-EV1, CS1G/H-CPU□□H, CS1D-CPU□□H, CS1D-CPU□□S, CJ1M-CPU□□, CJ1G-CPU□□, CJ1G-CPU□□P, CJ1G/H-CPU□□H, CS1W-SCB21-V1/41-V1, CS1W-SCU21-V1, CJ1W-SCU21-V1/41-V1 Communications Commands Reference Manual	W342	Describes the C-series (Host Link) and FINS communications commands used with CS/CJ-series PLCs. This manual describes communications commands addressed to the CPU Unit. The communications path is not relevant, i.e., communications can be performed via a serial port on the CPU Unit, Serial Communications Unit/Board, or a Communications Unit.

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 Software 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.

Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Application Considerations

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PROGRAMMABLE PRODUCTS

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

Disclaimers

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA

Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS

The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

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

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.

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

- Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.

⚠ **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.

4 Operating Environment Precautions

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

- 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.

5 Application Precautions

Observe the following precautions when using the FL-net Unit.

⚠ **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 of 100 Ω or less may result in electric shock.

- Always turn OFF the power supply to the CPU Unit, Slaves, and Communications Units 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, Memory Packs, or Master 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 Ethernet Unit or the system, or could damage the Ethernet Unit. 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.
- Make sure that all the Backplane mounting screws, terminal block 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 to prevent wire clippings from entering the Unit. 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.
- Double-check all wiring and switch settings before turning ON the power supply. Incorrect wiring may result in burning.
- Wire all connections correctly.
- Mount Units only after checking terminal blocks and connectors completely.
- Make sure that the terminal blocks, expansion cables, and other items with locking devices are locked in place.
- When transporting the Unit, use special packing boxes and protect it from being exposed to excessive vibration or impacts during transportation.

- Check the user program and set parameters for proper execution before actually running it on the Unit. Not checking the program may result in unexpected operation.
- Observe the following precautions when wiring the communications cable.
  - Separate the communications cables from the power lines or high-tension lines.
  - Do not bend the communications cables past their natural bending radius.
  - Do not pull on the communications cables.
  - Do not place heavy objects on top of the communications cables.
  - Always lay communications cable inside ducts.
  - Use appropriate communications cables.
- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static build-up. Not doing so may result in malfunction or damage.
- 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 (including changing the Startup Mode setting).
  - Force-setting/force-resetting any bit in memory.
  - Changing the present value of any word or any set value in memory.
- Check that data link tables and parameters are properly set before starting operation. Not doing so may result in unexpected operation. Even if the tables and parameters are properly set, confirm that no adverse effects will occur in the system before running or stopping data links.
- Install the FL-net Units separated sufficiently from devices that generate high-frequency noise.
- Do not drop the FL-net Unit or subject it to excessive shocks or vibrations.

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 Applicable EMS (Electromagnetic Susceptibility) and EMI (Electromagnetic Interference) Standards in the EMC (Electromagnetic Compatibility) standards are as follows:

Unit/Board	EMS	EMI
CS1W-FLN22 CJ1W-FLN22	EN61000-6-2	EN61000-6-4

Common Emission Standard EN61000-6-4, radiated emission standard (10 m)

Low Voltage Directive

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

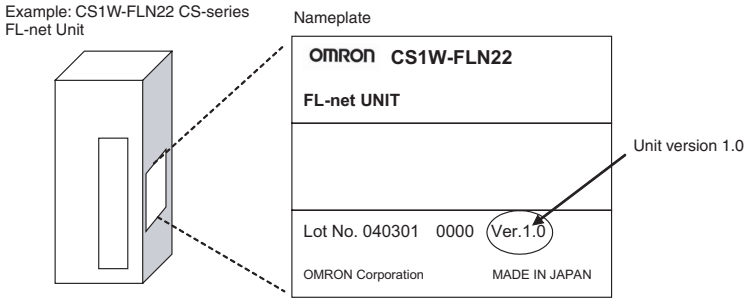
7 Unit Versions of CS/CJ-series FL-net Units

Unit Versions

A “unit version” has been introduced to manage CS/CJ-series FL-net Units according to differences in functionality accompanying upgrades.

1. Unit Version Notation on Products

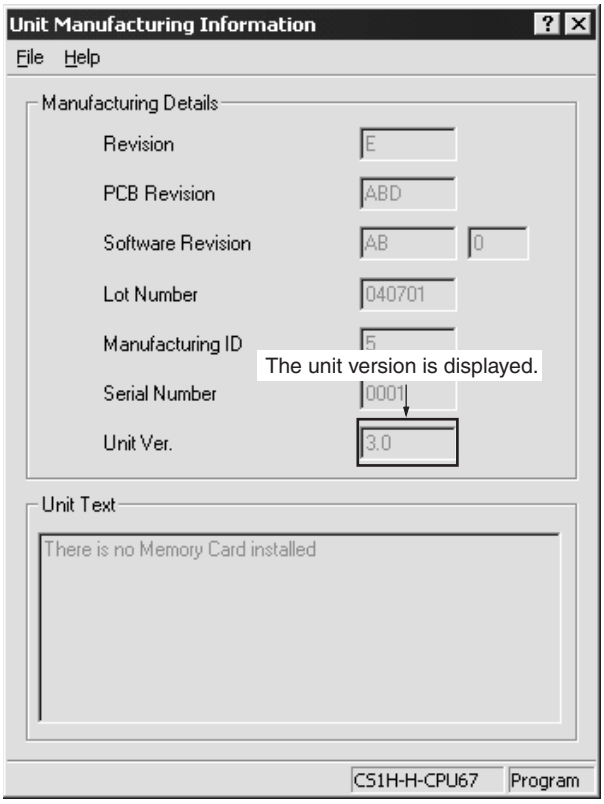
The unit version code is provided on the nameplate of the CS-series FL-net Units for which unit versions are being managed, as shown below. This system applies to FL-net Units with unit version 1.0 or later.



2. Confirming Unit Versions with Support Software

CX-Programmer version 5.0 can be used to confirm the unit version in the *Unit Manufacturing Information*.

1. In the I/O Table Window, right-click on the FL-net Unit, and then select ***Unit Manufacturing Information***.
2. The following Unit Manufacturing Information Dialog Box will be displayed.



Example: In this Unit Manufacturing Information Dialog Box, unit version 1.0 is displayed. Use this dialog box to confirm the unit version of the FL-net Unit that is connected online.

3. Using the Unit Version Labels

Unit version labels are provided with the FL-net Unit. These labels can be attached to the front of FL-net Units to differentiate from previous FL-net Units.

Unit Version Notation

The unit versions are indicated in this manual as follows:

Notation in product nameplate	Notation in this manual	Remarks
Ver.1.0 or later after the lot number	CS/CJ-series FL-net Units with unit version 1.0 or later	Information for which no particular version is specified applies to all unit versions.

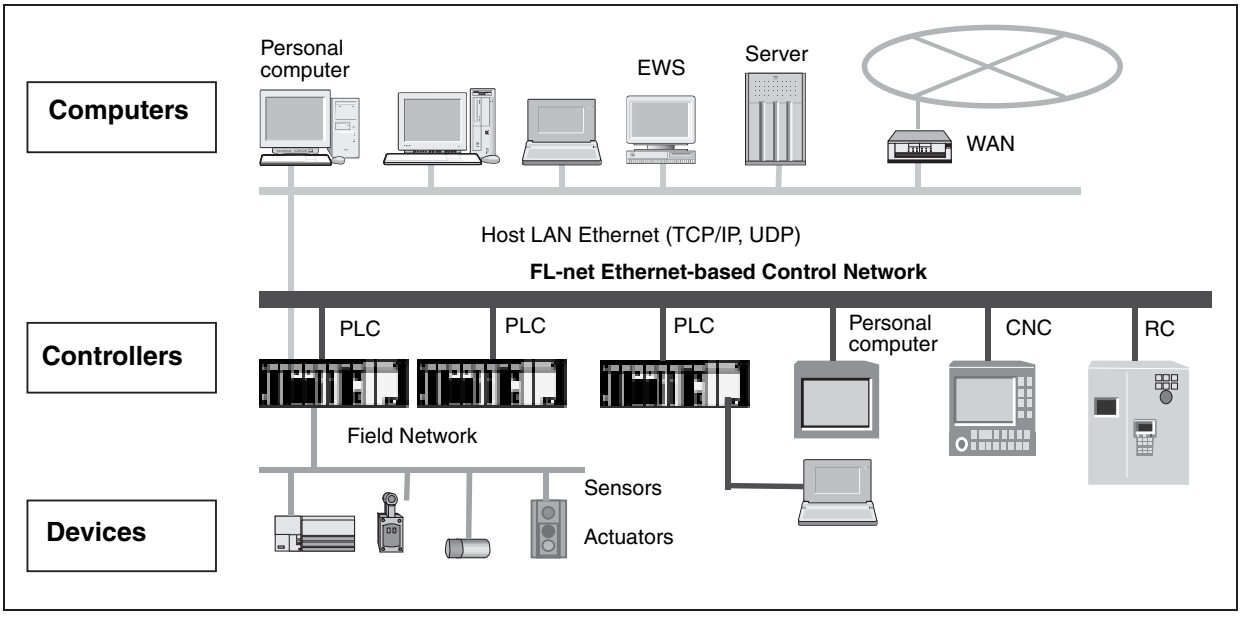
SECTION 1
Features and System Configuration

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

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 Positioning

FL-net 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/English/).

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, 100Base-TX	CJ1W-FLN22 CJ1W-FLN22 (See note 2.)	JEM1479: 2002	With FL-net Ver. 2.0 specifications (OPCN-2).
FL-net (Ver. 2.00) Unit, 10Base-5	CS1W-FLN02 (See note 2.)	JEM 1479: 2001	
FL-net (Ver. 2.00) Unit, 10Base-T	CS1W-FLN12 (See note 2.)	JEM 1479: 2001	
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.

Note

1. The CS1W-FLN01 FL-net Unit cannot be connected to a network based on CS1W-FLN02, CS1W-FLN12, CS1W-FLN22, or CJ1W-FLN22 FL-net Units.
2. CS1W-FLN02, CS1W-FLN12, CS1W-FLN22, or CJ1W-FLN22 FL-net Units cannot be connected to a network based on the CS1W-FLN01 FL-net Unit.

FL-net Features

FL-net System Concept

FL-net was designed to provide realtime communications between controllers in manufacturing systems, such as programmable controllers (PLCs), robot controllers (RCs), and computerized numeric controllers (CNCs). FL-net is configured to broadcast tokens using the Ethernet UDP/IP protocols to enable cyclic and message communications.

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.

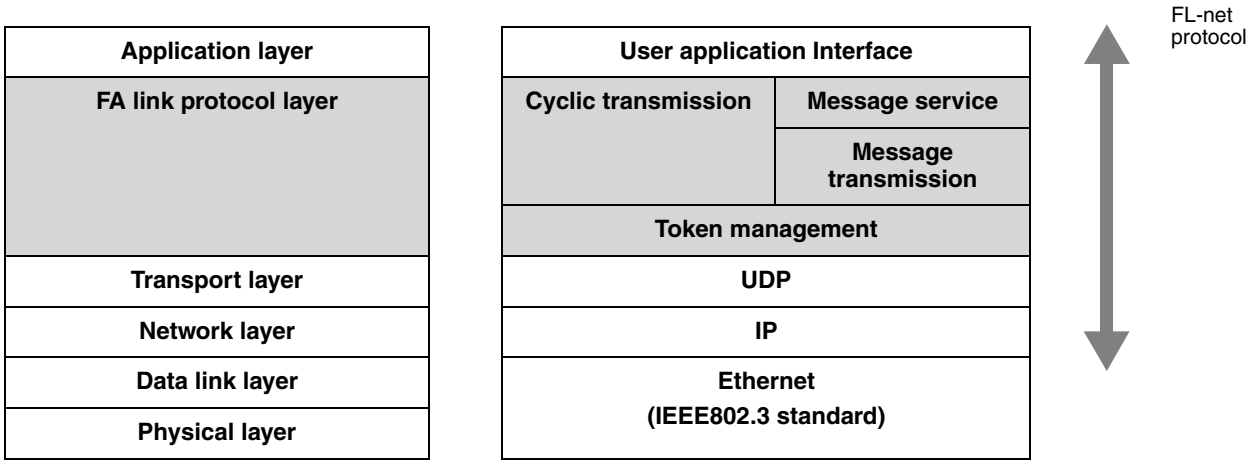


Figure 1 Basic Configuration of FL-net Protocol

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 to100 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.

General Differences between Ethernet and FL-net

1. FL-net is a network designed for FA environments and is not compatible with all general-purpose Ethernet devices. Some devices are not suitable due to noise resistance and environment resistance requirements.
2. Only FL-net-compatible controllers and control devices can be connected to FL-net to meet the demands of control applications requiring responsiveness in realtime communications.
3. FL-net is a cyclic communications method using the broadcasting supported by UDP/IP protocols based on the 10Base-5 and 10Base-T standards. The following restrictions currently apply.
   - Compatible devices mainly use 10 Mbps Ethernet LAN.
   - Connection to other general-purpose Ethernet systems is not supported.
   - TCP/IP are not supported.
   - Switching hubs cannot be used effectively.
   - Routers and similar devices may not be compatible.

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.

	Question	Answer
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.)
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. • 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. • 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 Unit (100Base-TX) Features

High-speed Communications at 100 Mbps

A baud rate of 100 Mbps is supported. The baud rate can be automatically selected or a fixed baud rate of 10 Mbps can be set.

Specify the Order of Data Link Data

The order of upper/lower bytes in data link data (word data) can be specified for each node before sending or receiving the data, according to the specifications of the device connected in the data link.

FINS Message Communications

The FL-net 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 network but also on other networks such as Ethernet or Controller Link.

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 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 network.

Abundant Troubleshooting Functions

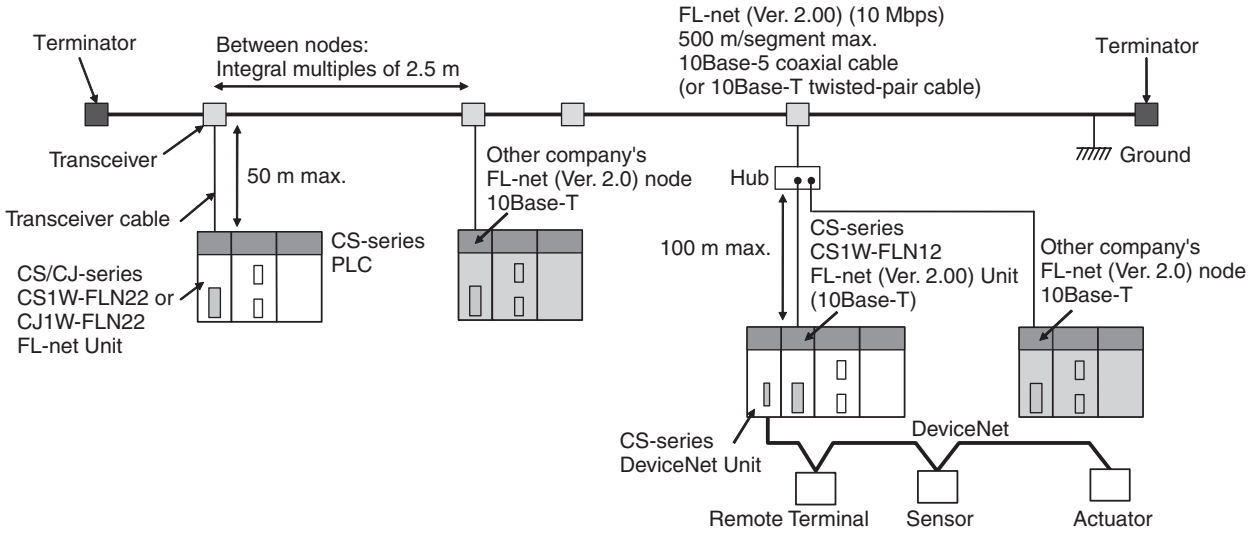
The Ethernet Unit is provided with a variety of troubleshooting functions for prompt recovery in case of errors.

- 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

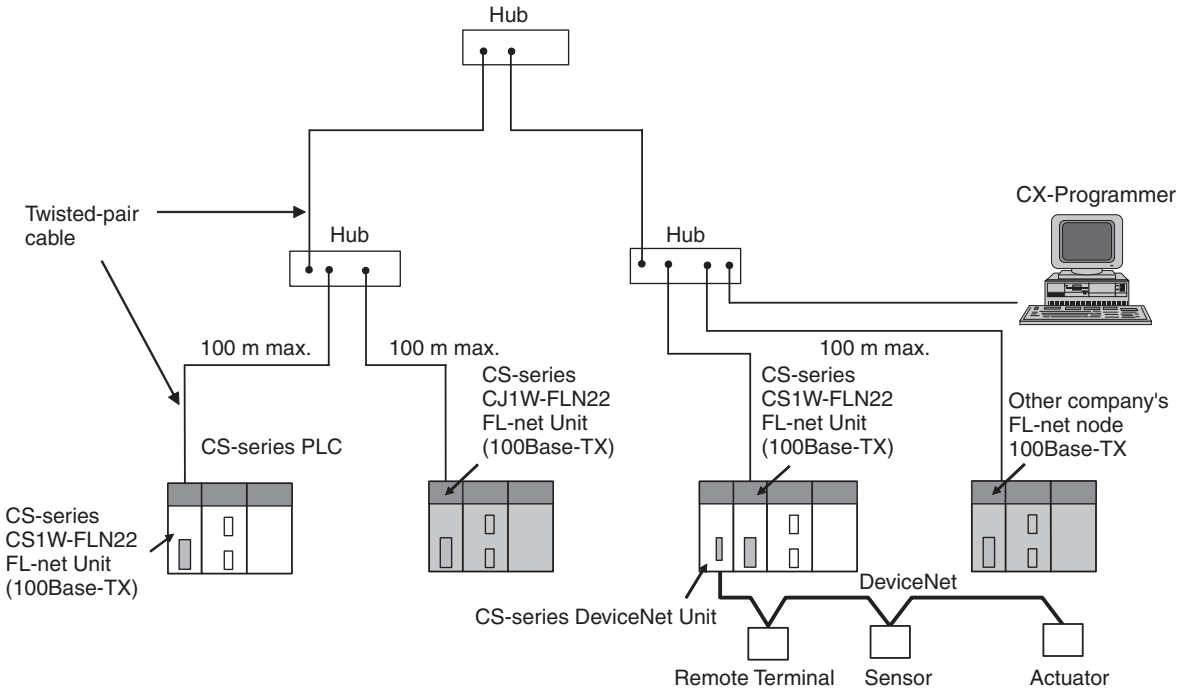
1-2 System Configuration

1-2-1 Device Configuration

10Base-T



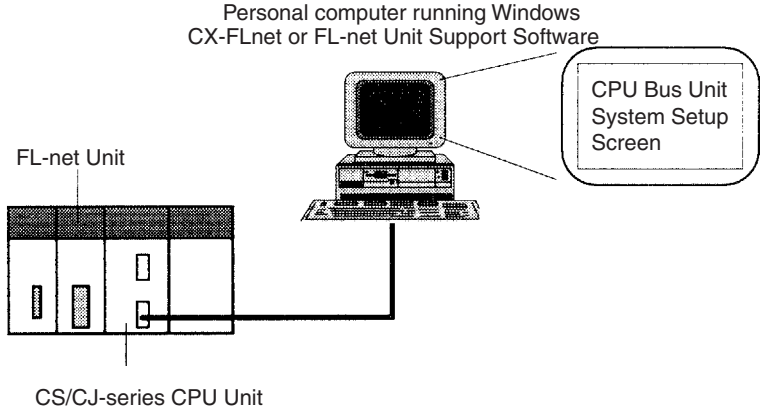
100Base-TX



Note Do not combine nodes using a baud rate of 10 Mbps with nodes using a baud rate of 100 Mbps in the same configuration, where possible. If nodes with a baud rate of 10 Mbps are used, use a baud rate of 10 Mbps for all the connected devices in the configuration.

1-3 Related Programming Devices

The FL-net Unit functions as a node on the FL-net network. The basic settings for operation are made in the CPU Bus Unit System Setup in the CS/CJ-series CPU Unit. Use the CX-FLnet or FL-net Unit Support Software to make the settings.



The following items are included in the Setup Area.

Screen	Item	Default	Page
Setup Screen	FA Link mapping table method	PLC built-in method	50
	FA Link startup method	Automatic participation	50
	Message protocol confirmation	Yes	50
	Broadcast type	***.***.***.255	50
	IP address setting method	192.168.250.node number	50
	Subnet mask	255.255.255.0	50
	Baud rate	10 Mbps	50
	Local node setup area	Not set.	50
	Other node setup area	Not set.	50
	Data order setting	No swapping (sequential order)	79

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

1-4 Introducing the CX-FLnet Support Software

The FL-net Unit Support Software can be installed from the CX-One FA Integrated Tool Package (version 1.1 or higher) as the CX-FLnet. The following table compares the FL-net and CX-FLnet. Other aspects are the same.

Item	Previous Support Software: FL-net version 1.6	New Support Software: CX-FLnet
Obtaining the software	Downloaded from the OMRON Industrial Website.	Provided with CX-One version 1.1 or higher (CXONE-AL□□C-E)
Simultaneously being online with other Programming Device software that uses the CX-Server, such as the CX-Programmer	Not possible.	Possible.
Starting the software	From the Windows Start Menu	From the Windows Start Menu or from the I/O Table Window of the CX-Programmer installed from CX-One. (Right-click the FL-net Unit and use the pop-up menu.)

1-5 Specifications

CS-series FL-net Units

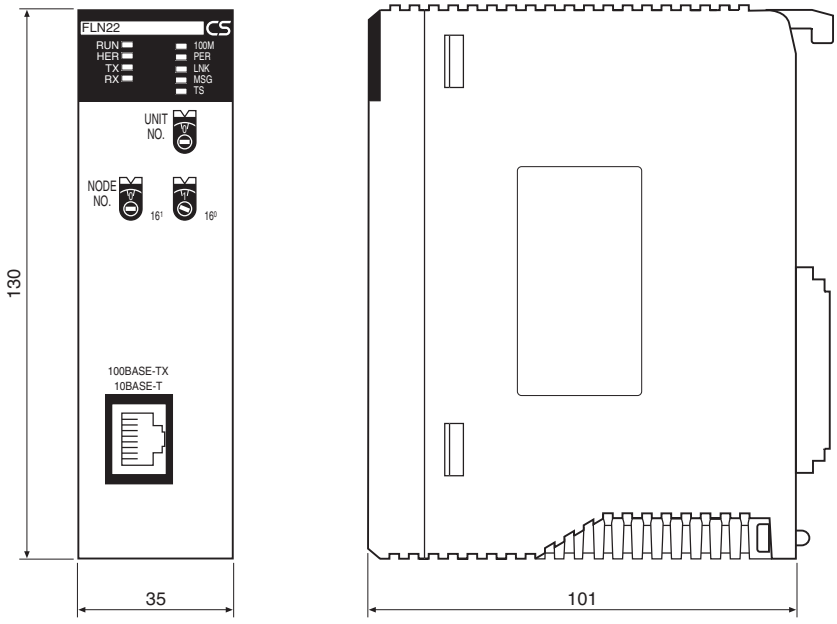
Item		Specifications	
Model number		CS1W-FLN22	
Type		100Base-TX (10Base-T is also possible)	
Applicable PLCs		CS-series PLCs	
Unit classification		CS-series CPU Bus Unit	
Mounting location		CPU Rack or Expansion Rack	
Number of Units that can be mounted		4 max. (including Expansion Racks)	
Transfer specifications	Media access method	CSMA/CD	
	Modulation	Baseband	
	Transmission paths	Star	
	Baud rate	100 Mbps (100Base-TX)	10 Mbps (10Base-T)
	Transmission media	Unshielded twisted-pair (UTP) cable Categories: 5, 5e Shielded twisted-pair (STP) cable Categories: 100 Ω at 5, 5e	Unshielded twisted-pair (UTP) cable Categories: 3, 4, 5, 5e Shielded twisted-pair (STP) cable Categories: 100 Ω at 3, 4, 5, 5e
	Transmission distance	100 m max. (distance between hub and node)	
	Number of cascade connections with repeater hub	2	4
Current consumption (Unit)		380 mA max. at 5 VDC	
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		200 g max.	
Dimensions		35 × 130 ×101 mm (W × H × D)	

CJ-series FL-net Units

Item		Specifications	
Model number		CJ1W-FLN22	
Type		100Base-TX (10Base-T is also possible)	
Applicable PLCs		CJ-series PLCs	
Unit classification		CJ-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	Star	
	Baud rate	100 Mbps (100Base-TX)	10 Mbps (10Base-T)
	Transmission media	Unshielded twisted-pair (UTP) cable Categories: 5, 5e Shielded twisted-pair (STP) cable Categories: 100 Ω at 5, 5e	Unshielded twisted-pair (UTP) cable Categories: 3, 4, 5, 5e Shielded twisted-pair (STP) cable Categories: 100 Ω at 3, 4, 5, 5e
	Transmission distance	100 m max. (distance between hub and node)	
	Number of cascade connections with repeater hub	2	4
Current consumption (Unit)		370 mA max. at 5 VDC	
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		100 g max.	
Dimensions		31 × 90 × 65 mm (W × H × D)	

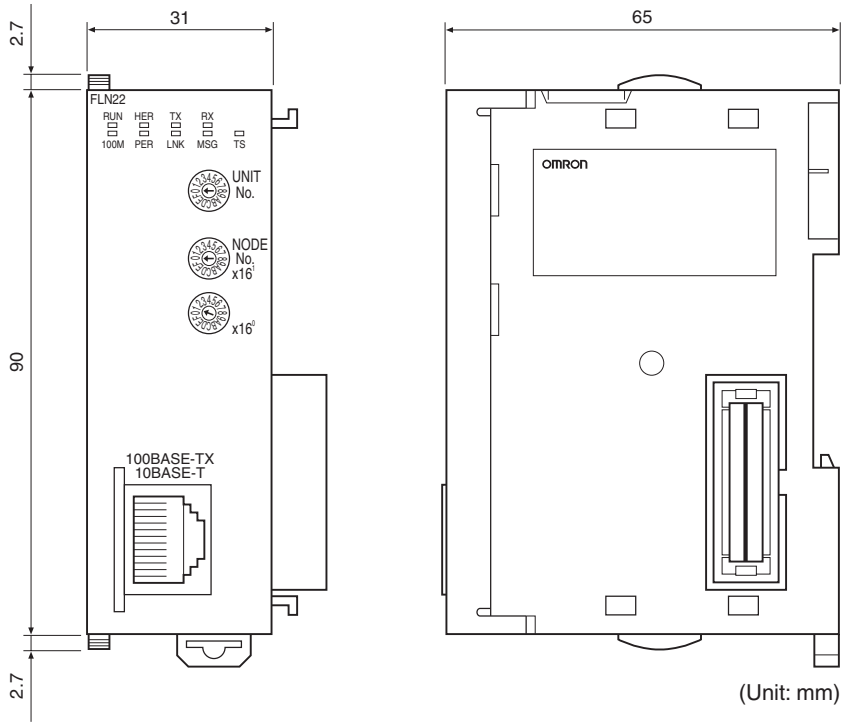
Dimensions

CS1W-FLN22



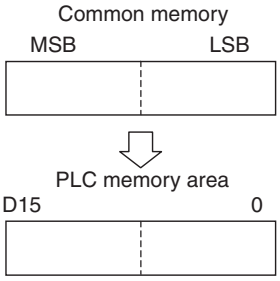
(Unit: mm)

CJ1W-FLN22



(Unit: mm)

Comparison with Previous Models (CS1W-FLN02, CS1W-FLN12)

Model	CS1W-FLN22 CJ1W-FLN22	CS1W-FLN02/12
Type	100Base-TX (10Base-T is also possible)	10Base-5 (CS1W-FLN02) 10Base-T (CS1W-FLN12)
Switches/indicators	100M indicator provided This indicator indicates when baud rate of 100 Mbps is being used.	No 100M indicator
	No rotary switch for setting the IP address. The IP address is set using the CX-FLnet or FL-net Unit Support Software. Either of the following two methods can be used to set the IP address. 1. 192.168.250 + node number 2. Setup area	Rotary switch provided on rear of Unit for setting the IP address. Either of the following four methods can be used to set the IP address 1. 192.168.250 + node number 2. Rotary switch on rear of Unit. 3. Rotary switch on rear of Unit + node number 4. Setup area
Data link functions	Total capacity: 8,704 words (Area 1: 512 words, Area 2: 8,192 words) If the total number of words in Area 1 and Area 2 for a single node exceeds 7,677 words, the data for the corresponding node will be refreshed over two scans of the CPU Unit. The data will be split from the 7,678th word counted from the beginning of the combined Area 1 and Area 2.	Total capacity: 8,704 words (Area 1: 512 words, Area 2: 8,192 words) Data link tables that exceed the following conditions, however, cannot be set. Number of words in local node setup area (Area 1 and Area 2) ≤ 7,677 words. Number of words in local node setup area (Area 1 and Area 2) + the number of words in setup area (Area 1 and Area 2) for node with the largest setup area size (except local node) ≤ 7,677 words
	The order of the upper and lower byte in the word data can be swapped for each node when exchanging data between the data link area in the PLC and the FL-net.	The data order cannot be changed and is fixed as shown in the following diagram. 
Simple backup function	Supported.	Not supported.
Support Software	CX-FLnet or FL-net Unit Support Software version 1.60 or higher (CS1W-FLN22 and CJ1W-FLN22 settings cannot be made using Ver. 1.51 or lower)	FL-net Unit Support Software Ver. 1.51 or higher (CS1W-FLN02 and CS1W-FLN12 settings can also be made using Ver. 1.60 or higher)

Comparison between FL-net Unit Support Software

Version	CX-FLnet or FL-net Unit Support Software Ver. 1.60	Ver. 1.51
New setting function	Set the baud rate. Set the data link data order.	None (these settings are not available)
Connection with PLC	Set/monitor other nodes via the FL-net network.	Only the local node can be set or monitored.
Setting file	Setting files saved from Japanese version and English version are compatible.	No compatibility between setting files saved in the English version and Japanese version.

1-6 Precautions

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

1-6-1 Installation

Observe the following precautions when installing an FL-net 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 Unit is mounted. The current consumption is 380 mA maximum for the CS-series FL-net Unit and 370 mA for the CJ-series FL-net Unit. 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 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 Unit. In particular, the transceiver cable for the IEEE802.3 standards provides superior noise resistance and should be used for the FL-net 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

FL-net Concept

FL-net is an Ethernet-based FA control network.

FL-net supports both cyclic transmission and message transmission functions.

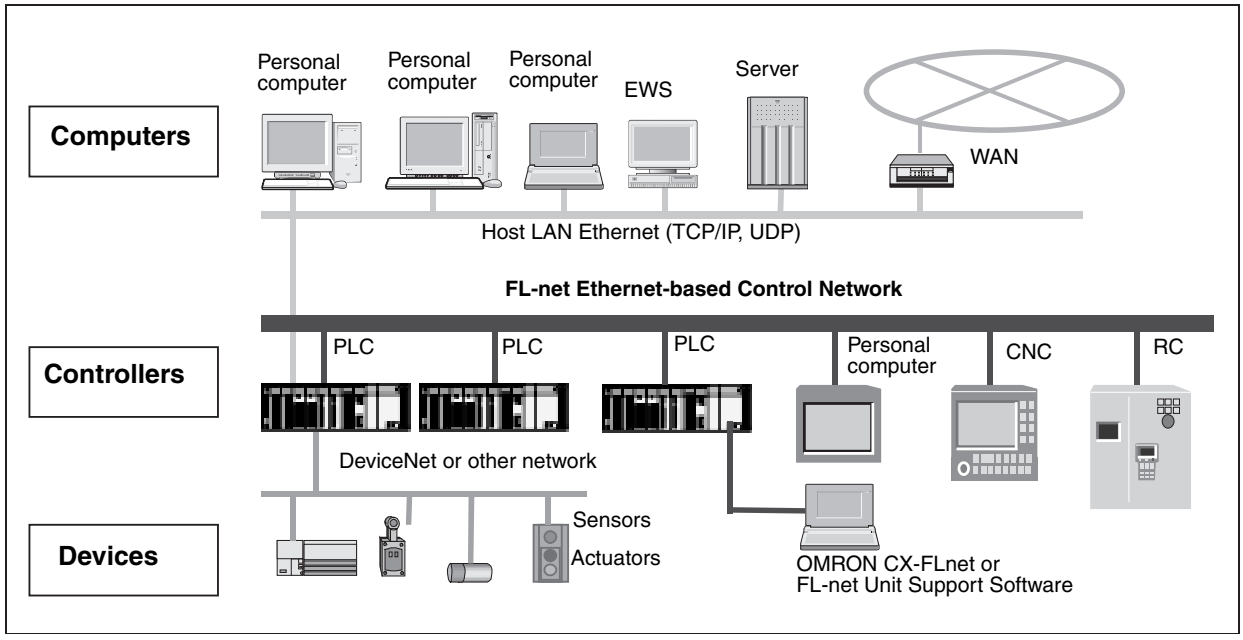
The basic concepts of FL-net are as follows:

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.

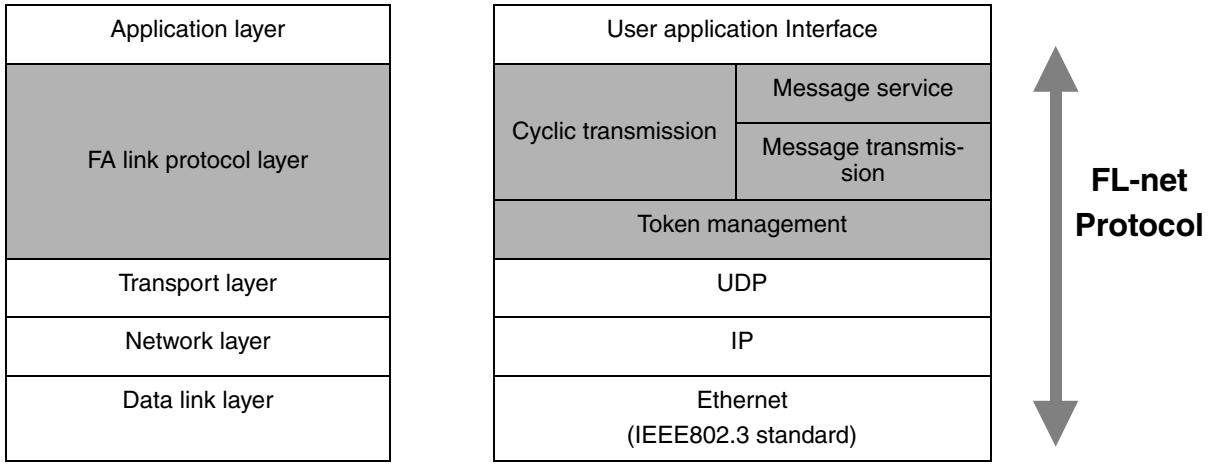
FL-net is an FA control network enabling the exchange of data between control devices in manufacturing systems, such as programmable controllers (PLCs), robot controllers (RCs), and computerized numeric controllers (CNCs), and personal computers used for controlling them.

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



FL-net Protocol

FL-net 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 Transmission Features

FL-net'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 IP Addresses

Unique class-C IP addresses must be assigned to each node in the FL-net 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 uses Class-C IP addresses. The default IP address for FL-net 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)

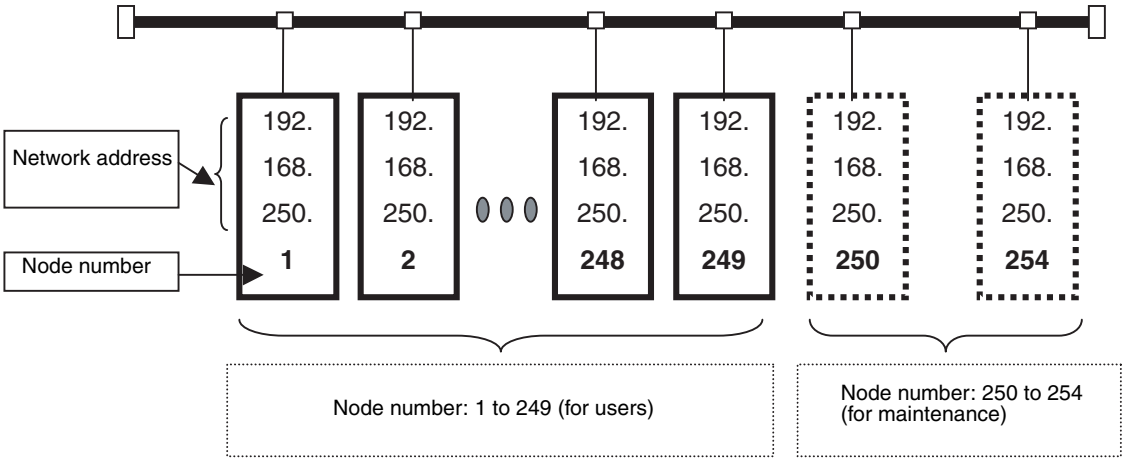
Number of Connectable Nodes and Node Numbers

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 devices.
250 to 254	Used for FL-net maintenance purposes.
255	Reserved for the internal system use. (See notes 1 and 2.)
0	Reserved for internal system use. (See note 1.)

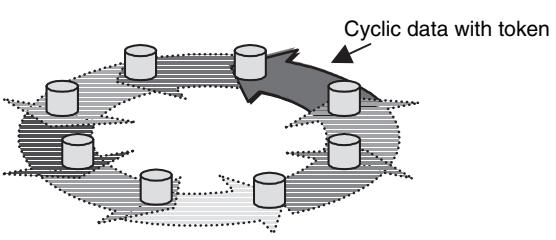
Note
1. Not available to users.
2. Used for broadcasting.

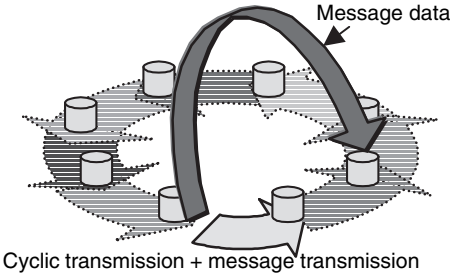
FL-net



Data Communications

FL-net supports data communications by cyclic transmission and message transmission.



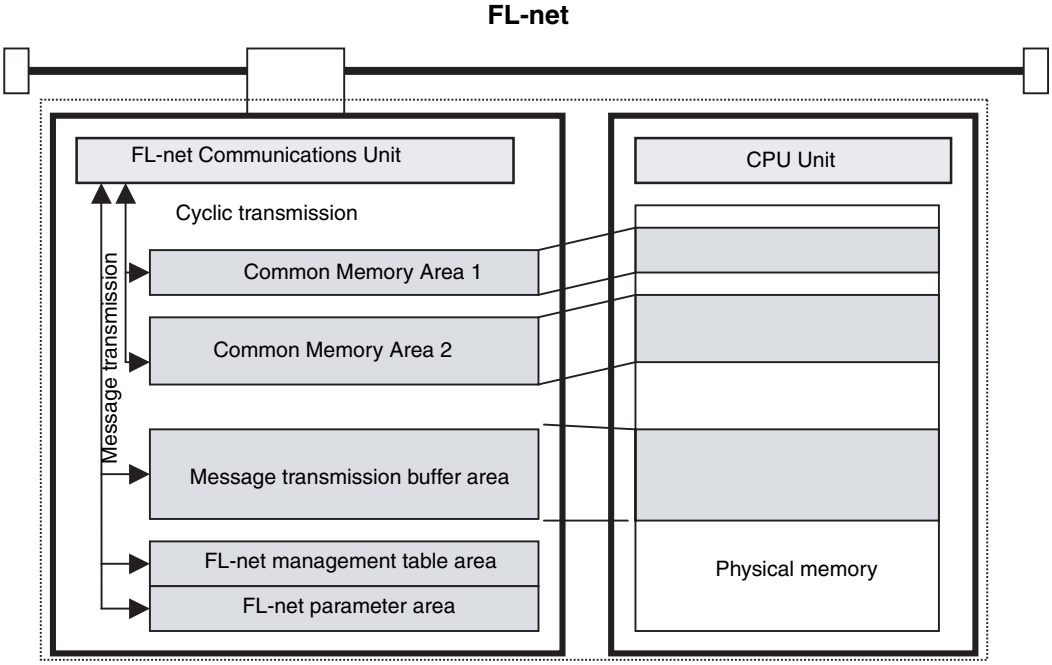


Transmission Cycle

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 0x1fff)
Common Memory Area 2 data size	2 bytes	Size (0 to 0x2000)
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.

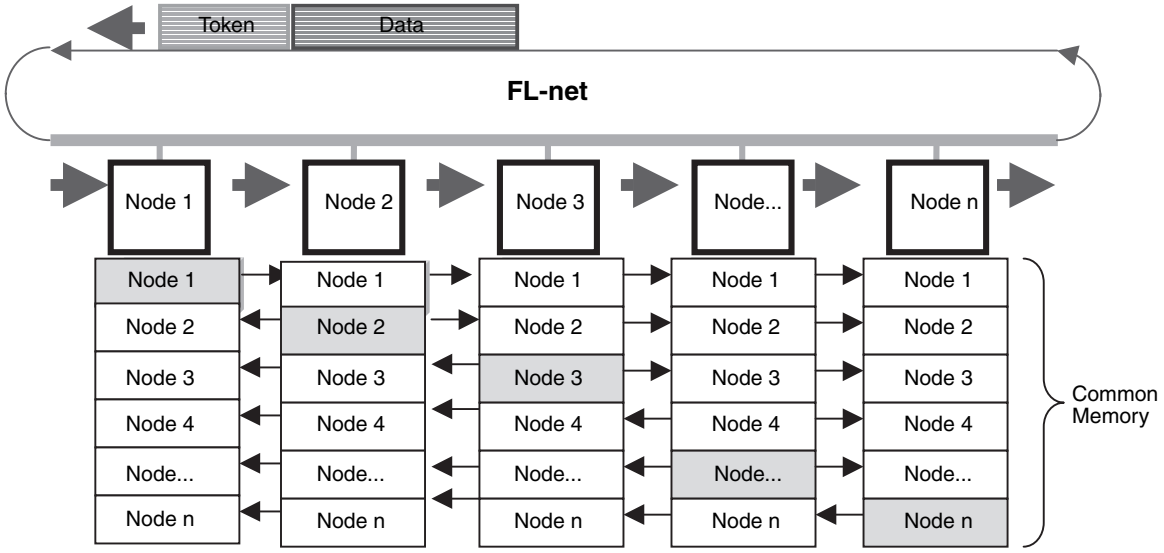
Network Management Table

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.

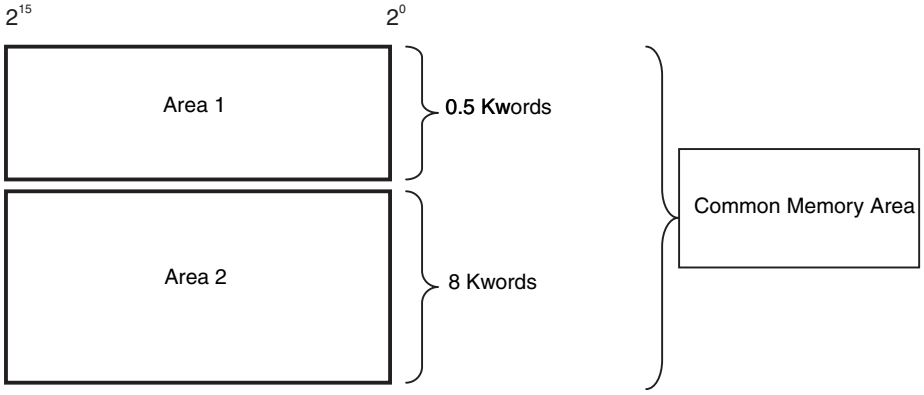


Note Cyclic transmission allows PLCs made by OMRON to communicate with PLCs made by other companies.

Volume of Transmission Data

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

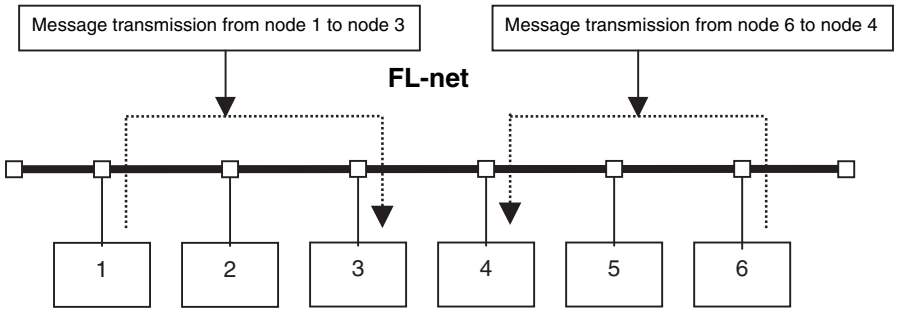
The maximum quantity of data that can be transmitted by a single node is 8.5 Kwords. One word is equal to two bytes.



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.

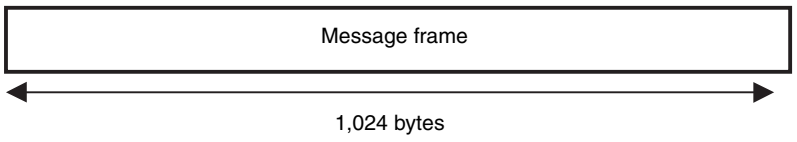


Note

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

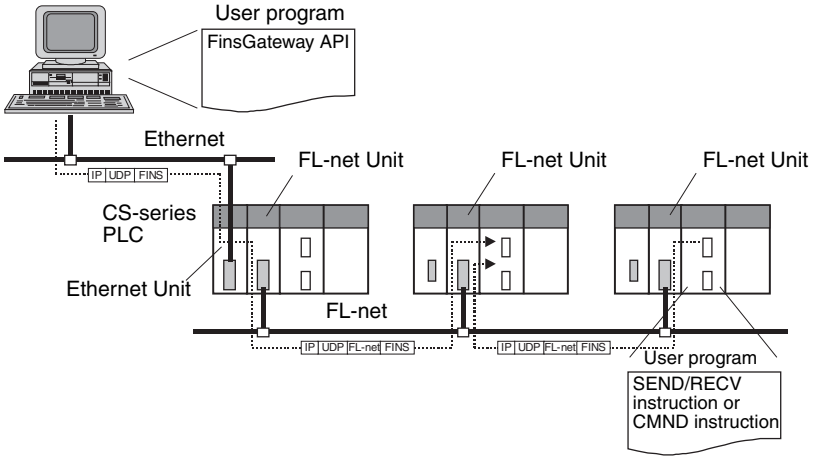
The maximum size of one message frame is 1,024 bytes (not including the header).



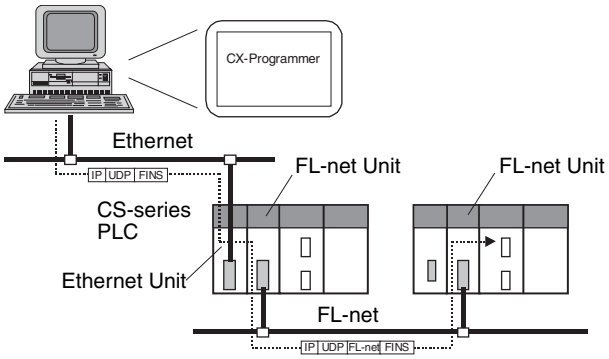
2-4 FINS Communications Service

FINS commands or data can be sent to or received from other manufacturer's PLCs on the same FL-net 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 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.

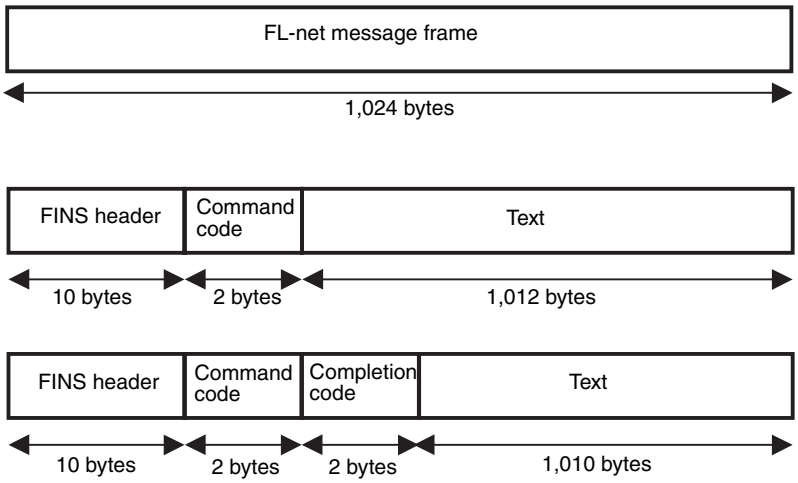


Note

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 Unit creates FINS communications messages through FL-net 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

Precautions

Observe the following precautions when installing and using an FL-net Unit.

Installation Precautions

Observe the following precautions when installing an FL-net Unit.

- Make sure that all of the nodes in the network are CS1W-FLN22, CJ1W-FLN22, CS1W-FLN02, or CS1W-FLN12. CS1W-FLN01 FL-net Units cannot be connected.

FL-net network version	Supported FL-net Units
V2.00	CS1W-FLN22 CJ1W-FLN22 CS1W-FLN02 CS1W-FLN12
V.100	CS1W-FLN01

- 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 Unit is 96 when links are stored in the CPU Unit, and 128 when links are stored in the FL-net Unit.

Restrictions on Data Link Capacity for Each Node

In the Data Link Area for each FL-net Unit node up to 512 words can be allocated in Area 1 and up to 8,192 words can be allocated in Area 2. The total number of words that can be allocated in Areas 1 and 2 combined is 8,704 words.

Restrictions on Data Link Data Concurrency

Concurrency of data within each node is assured (concurrency of data between all nodes is not assured).

If the data size of Area 1 and Area 2 for a single node exceeds 7,677 words, however, the data for the corresponding node will be refreshed over two CPU Unit cycles. Therefore, concurrency will be lost. The data will be split for refreshing at 7,677 words counted from the beginning of Area 1. 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 corresponding node in the Status Area will leave the network and then rejoin it, but the PLC data will be held in its previous state.

The data for Area 1 and Area 2 from the same node will be refreshed in the same CPU Unit cycle or Area 2 will be refreshed first. If concurrency is required between the data in Area 1 and Area 2, use refreshing of the data in Area 1 as a trigger before accessing data from Area 2.

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 Units

- Up to four FL-net Units can be mounted to a single PLC.
- The current consumption of the FL-net Unit is 380 mA maximum for CS1W-FLN22 and 370 mA maximum for CJ1W-FLN22. (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 Unit is mounted does not exceed the capacity of the Power Supply Unit.

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

Size = 32 + 10 × 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 Unit, the CPU Unit System Setup size is 32 bytes per Unit regardless of the number of remote nodes set.

3-2 Initial Setup

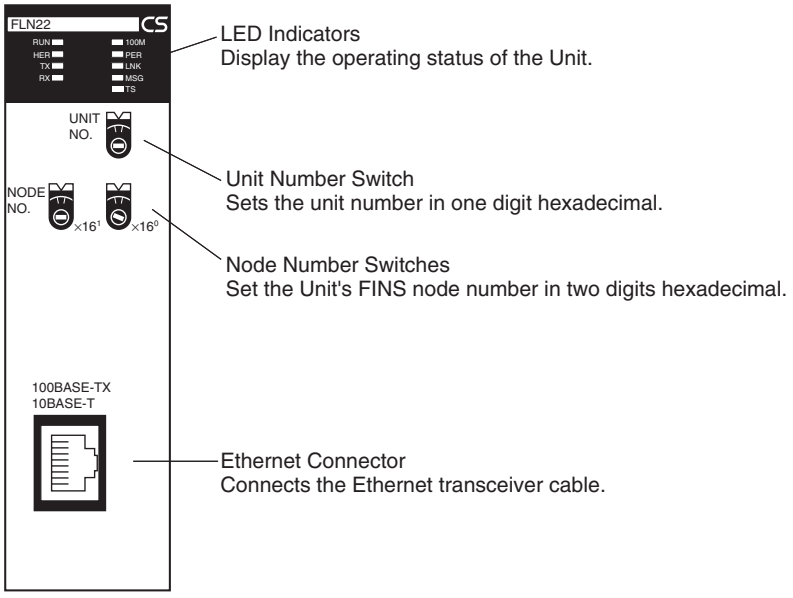
Item	Procedure	References
Set the hardware switch.	Set a unique number for the Unit so it can operate as a CPU Bus Unit.	*3-4 Hardware Setup*
Mount the Unit to the Backplane.	Mount the Unit to the Backplane.	*3-5 Mounting to the PLC*
Connect to the network.	Connect the Unit to the network using the transceiver cable.	*3-7 Connecting to the Network*
Turn ON the CPU Unit.	Turn ON the power supply to the CPU Unit.	---
Create I/O tables.	Register the FL-net (Ver. 2.00) Unit in the CPU Unit using the CX-Programmer.	*3-8 Creating an I/O Table*
Create routing tables.	Always create routing tables for using message communications when multiple CPU Bus Units are mounted to the same PLC.	*3-9 Creating Routing Tables*
System Setup	Set the operating parameters for the FL-net (Ver. 2.00) Unit using the CX-FLnet or FL-net Unit Support Software.	*SECTION 11 CX-FLnet Support Software Operations*
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

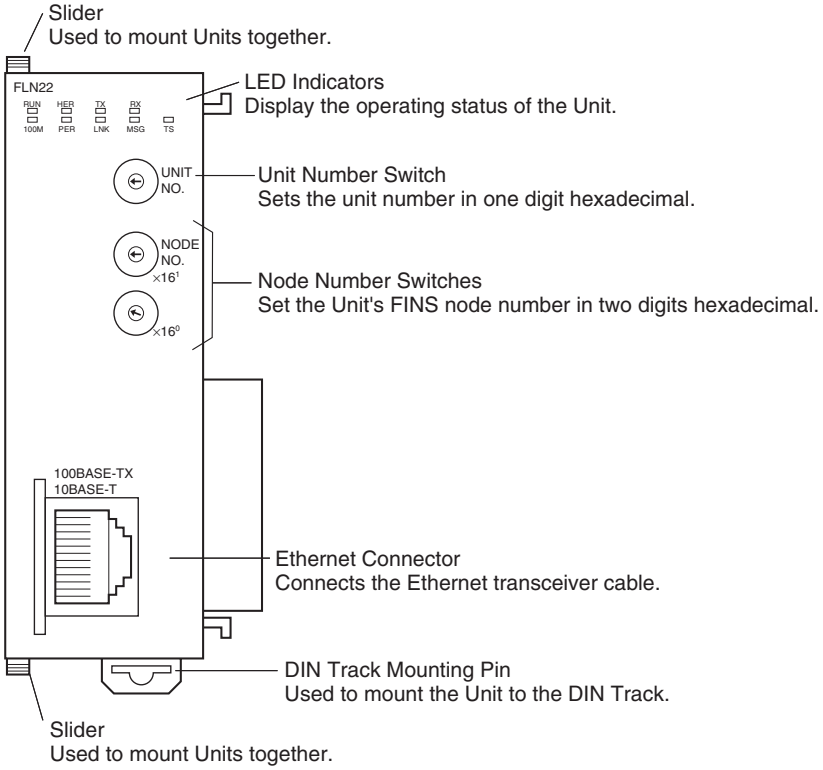
This section explains FL-net Unit part names, settings, and LED indicators.

Part Names

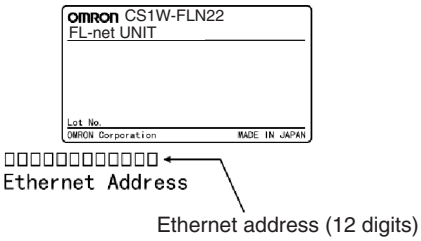
CS1W-FLN22, 100Base-TX



CJ1W-FLN22, 100Base-TX



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

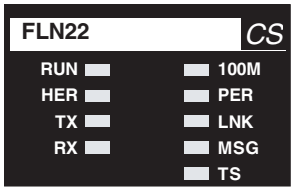


Note The Ethernet address can also be checked by means of the FINS command CONTROLLER DATA READ (page 107).

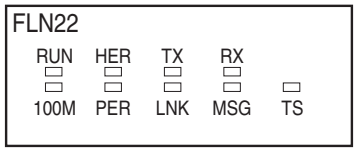
LED Indicators

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

CS1W-FLN22 (100Base-TX)



CJ1W-FLN22 (100Base-TX)



Indicator	Name	Color	Display	Operating status
RUN	RUN	Green	Not lit.	The Unit has not completed initialization. Unit hardware error.
			Lit.	Normal operation.
HER	Unit Error	Red	Not lit.	Unit normal.
			Lit.	Hardware error in Unit, FROM error, EEPROM error, or node address setting error (node address is FF).
			Flashing.	IP address setting error. Node address setting error (node address is 0).
PER	CPU Unit Error	Red	Not lit.	CPU Unit normal.
			Lit.	CPU Unit error. CPU Unit interface error. I/O table error. Routing table setting error. System setup data error. Unit number setting error (unit number duplication) Failure to read internal parameters from Memory Card.
			Flashing.	Data link area allocation 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.

Indicator	Name	Color	Display	Operating status
MSG	Transferring Messages	Yellow	Not lit.	Not transferring messages (including remote access from CX-Programmer or other Programming Device).
			Lit.	Transferring messages (including remote access from CX-Programmer or other Programming Device).
100M	100 Mbps Baud Rate	Green	Not lit.	Communicating at 10 Mbps
			Lit.	Communicating at 100 Mbps
TS	Internode Testing	Yellow	Not lit.	Not running internode test.
			Lit.	Running internode test.

3-4 Hardware Setup

This section explains how to set the various switches on the FL-net 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.

CS-series

CJ-series

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/CJ-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 Unit uses these words for receiving control data from the CPU Unit and for notifying the CPU Unit of FL-net Unit and communications status. The word addresses in the allocated areas for the CPU Bus Unit are important in creating the user program for using the FL-net 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

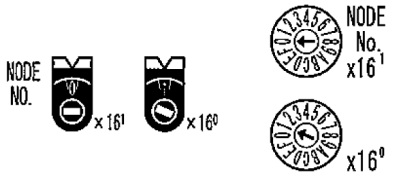
Unit No. (decimal)	Allocated words	Unit No. (decimal)	Allocated words
0 (0)	CIO 1500 to CIO 1524	8 (8)	CIO 1700 to CIO 1724
1 (1)	CIO 1525 to CIO 1549	9 (9)	CIO 1725 to CIO 1749
2 (2)	CIO 1550 to CIO 1574	A (10)	CIO 1750 to CIO 1774
3 (3)	CIO 1575 to CIO 1599	B (11)	CIO 1775 to CIO 1799
4 (4)	CIO 1600 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 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 Unit on the same network.



CS-series CJ-series

Setting range
01 to F9 (1 to 249 decimal)

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.

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

■ **Relationship between Node Numbers and IP Addresses**

OMRON FL-net Units are provided with two 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. For details on FL-net IP addresses, refer to *FL-net IP Address* under *Appendix C Network System Definitions*.

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.
Setup area	Fourth octet of IP address (rightmost eight bits of the IP address)	The IP address can be set when writing the Setup data using the CX-FLnet or FL-net Unit Support Software. The CX-FLnet or FL-net Unit Support Software is required to change the IP addresses.

Note

1. After changing IP addresses or other settings with any of these setting methods, restart the FL-net Unit.
2. If the IP address of an earlier FL-net Unit (CS1W-FLN02 and CS1W-FLN12) was set using the rotary switch on the rear of the Unit, reset the IP address using the CX-FLnet or FL-net Unit Support Software with either of the above two methods.

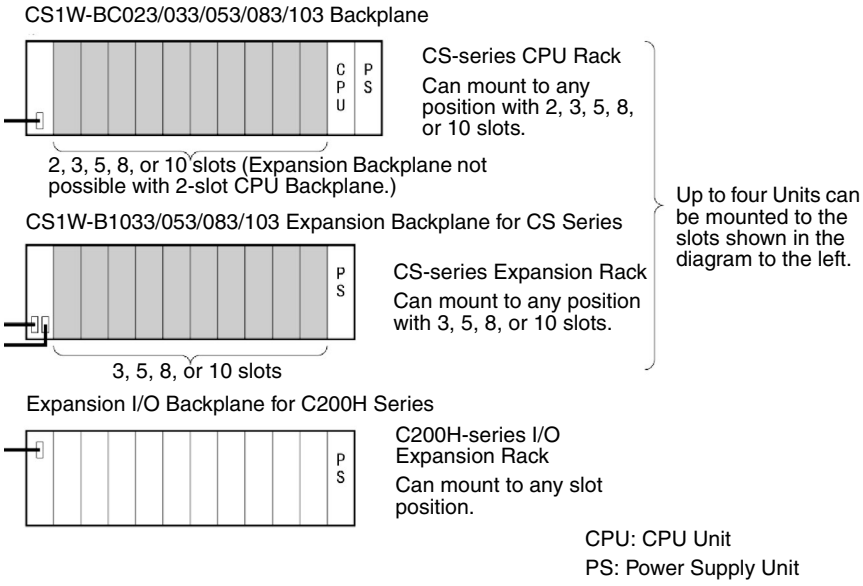
Note If a subnet mask is to be set, use the Support Software to set it in the CPU Bus Unit Setup Area. For details, refer to *SECTION 11 CX-FLnet Support Software Operations*.

3-5 Mounting to the PLC

CS-series PLCs

FL-net 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 Units can be mounted to a single PLC. If an FL-net 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.

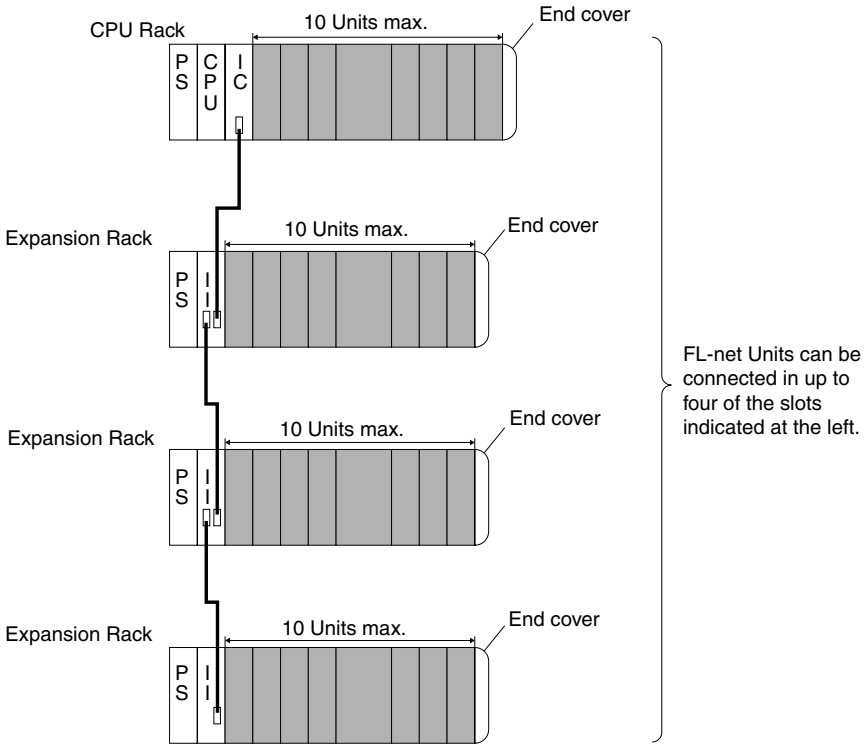
Note PLC Backplane mounting screws to a torque of 0.9 N·m, and the Unit's mounting screws to a torque of 0.4 N·m.



Note The current consumption of the CS1W-FLN22 FL-net Unit is 380 mA maximum. Make sure that the total current consumption of all Units mounted to the CPU Rack or Expansion Rack to which the FL-net Unit is mounted does not exceed the capacity of the Power Supply Unit.

CJ-series PLCs

CJ-series FL-net Units can be mounted to either a CJ-series CPU Rack or a CJ-series Expansion Rack. Mount the Units to any of the positions shown in the following diagram, and secure with the slider on the top and bottom of the Unit. Up to four FL-net Units can be mounted to a single PLC. If an FL-net 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 PS: Power Supply Unit
CPU: CPU Unit
IC: I/O Control Unit
II: I/O Interface Unit

Note The current consumption of the CJ1W-FLN22 FL-net Unit is 370 mA maximum. Make sure that the total current consumption of all Units mounted to the CPU Rack or Expansion Rack to which the FL-net Unit is mounted does not exceed the capacity of the Power Supply Unit.

3-6 Network Installation

3-6-1 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.

3-6-2 Recommended Products

The following products are recommended for use with the CS1W-ETN21 Ethernet Unit.

Part	Maker	Model number	Specifications	Inquires
Hub	10Base-T			
	Allied Telesis	RH509E	9-port hub	Allied Telesis (0120) 86-0442 (in Japan only)
		MR820TLX	9-port hub with 10Base-5 backbone port	
Twisted-pair cable	100Base-TX			
	Fujikura	F-LINK-E 0.5mm x 4P	STP (shielded twisted-pair) cable: Category 5, 5e **Note:** Impedance is limited to 100 Ω.	---
	Fujikura	CTP-LAN5 0.5mm x 4P	UTP (unshielded twisted-pair) cable: Category 5, 5e	
	10Base-T			
	Fujikura	F-LINK-E 0.5mm x 4P	STP (shielded twisted-pair) cable: Category 3, 4, 5, 5e **Note:** Impedance is limited to 100 Ω.	
	Fujikura	CTP-LAN5 0.5mm x 4P	UTP (unshielded twisted-pair) cable: Category 3, 4, 5, 5e	
Connectors (Modular plug)	STP Plug			
	Panduit Corp	MPS588	---	
	UTP Plug			
	Panduit Corp	MP588-C	---	

3-6-3 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 Ethernet Unit.
- After laying the twisted-pair cable, check the connection with a 10Base-T cable tester.

Environment Precautions

- The UTP cable is not shielded, and the hub is designed for use in OA environments. In environments subject to noise, construct a system with shielded twisted-pair (STP) cable and hubs suitable for an FA environment.
- 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 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

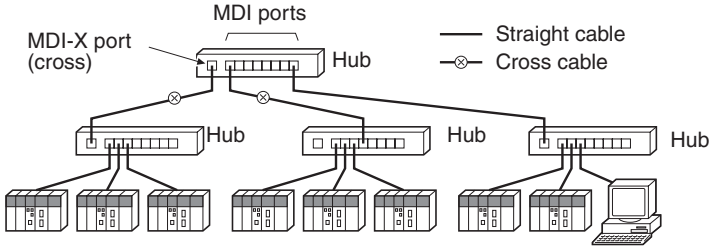
If more hub ports are required, they can be added by connecting more than one hub. There are two possible connection methods for hubs: Cascade and stacked.

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.

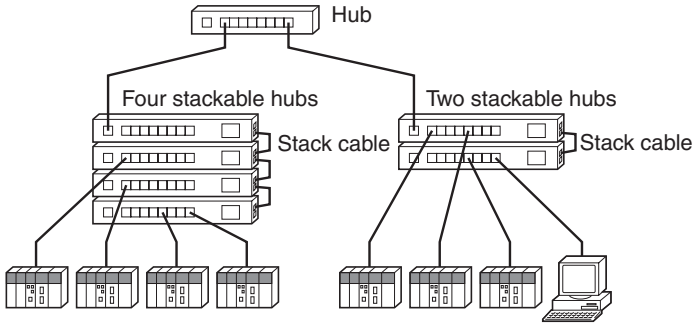
Note It is very difficult to distinguish cross cables and straight cables by appearance. Incorrect cables will cause communications to fail. We recommend using cascade connections with straight cables whenever possible.

- 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.

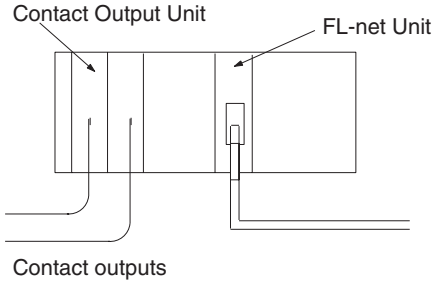


3-6-4 Noise Reduction when Using Contact Outputs

Communications errors can occur when Contact Output Units are mounted to the same Rack or connected to the same PLC as an FL-net Unit due to noise generated by the contact outputs. Use one or more of the following measures when installing Contact Output Units and Ethernet Units on the same Rack.

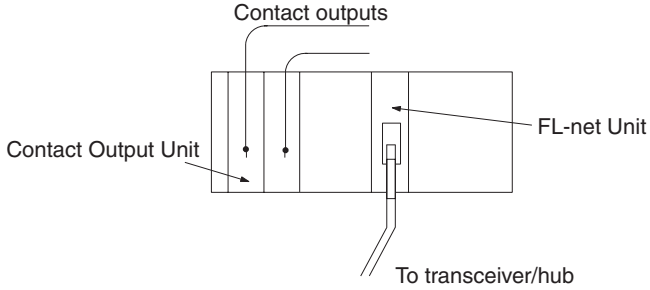
Mounting Location

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



Cable Location

Separate the transceiver cable or twisted-pair cable connecting the FL-net 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.

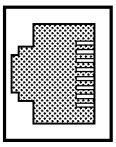


3-7 Connecting to the Network

3-7-1 Ethernet Connectors

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)

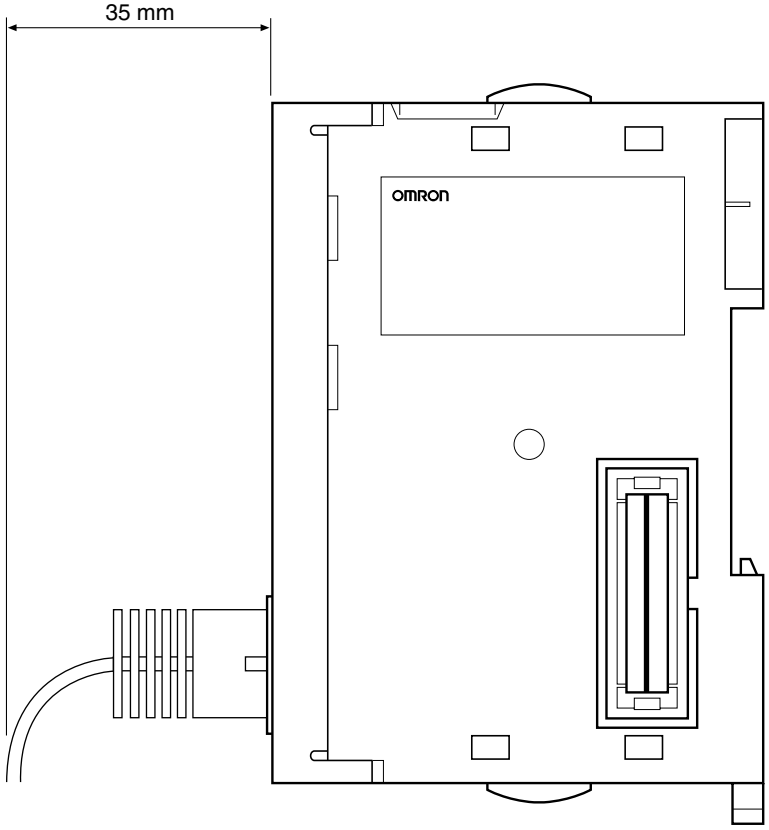


Connector pin	Signal name	Abbr.	Signal direction
1	Transmission data +	TD+	Output
2	Transmission data –	TD–	Output
3	Reception data +	RD+	Input
4	Not used.	---	---
5	Not used.	---	---
6	Reception data –	RD–	Input
7	Not used.	---	---
8	Not used.	---	---
Hood	Frame ground	FG	---

3-7-2 Connecting the Cable

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

⚠ **Caution** Allow enough space for the bending radius of the twisted-pair cable as shown in below.

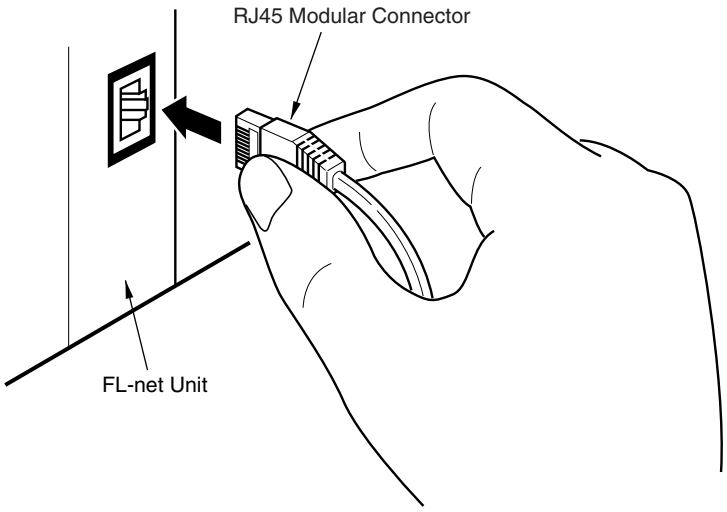


1,2,3...

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.

   Request cable installation from a qualified professional.
3. Connect the cable to the connector on the Ethernet Unit. Be sure to press in the cable until it locks into place.

Example: CS1W-FLN22



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-Integrator

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

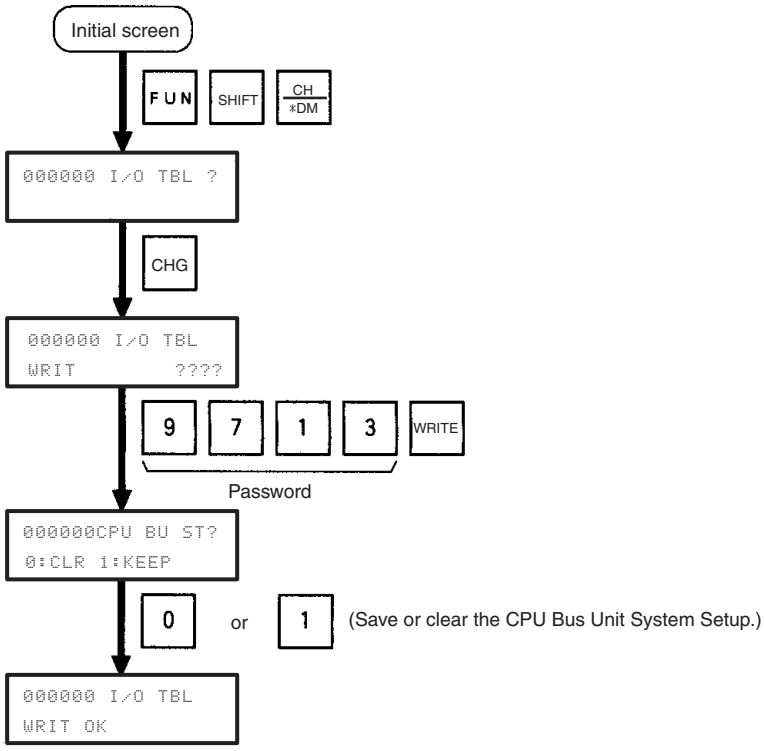
Connecting Programming Devices

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 network (including when communications are only carried out between FA networks via an FL-net 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*.

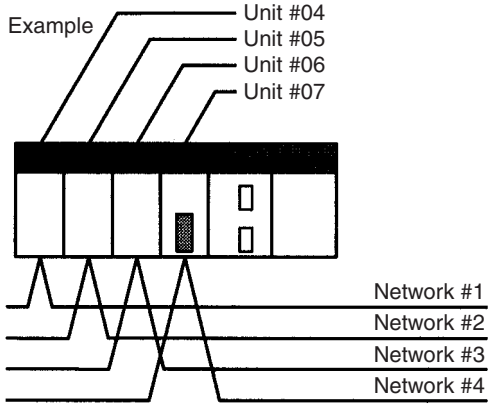
The routing table is required not only for nodes communicating via the FINS communications service but for all relay nodes on the network.

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 Table

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

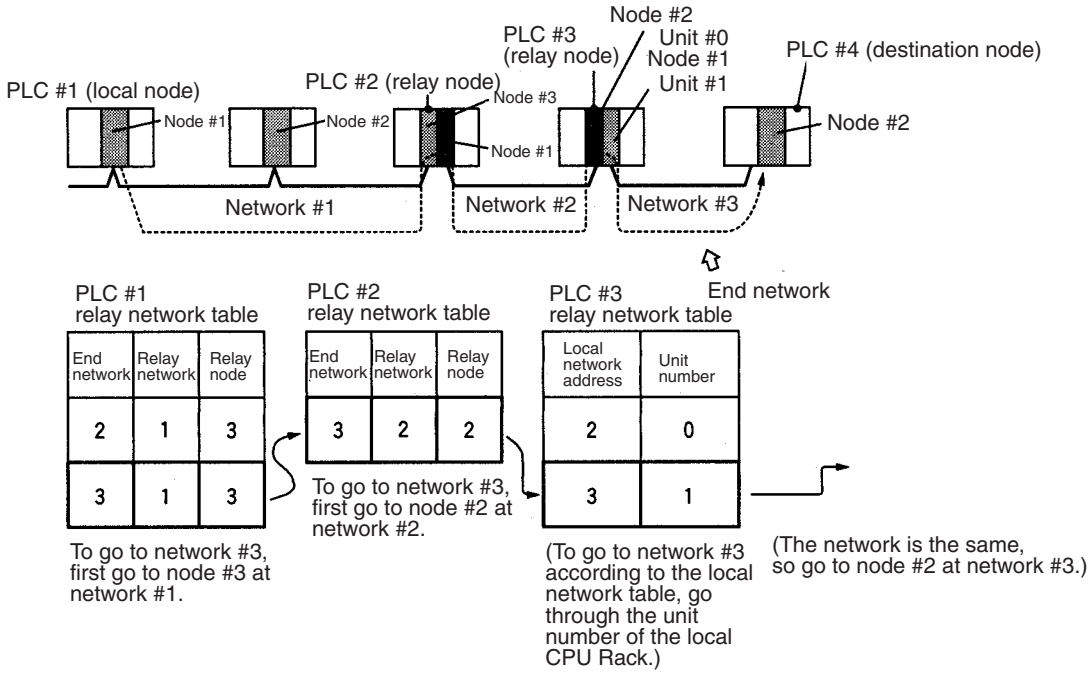
Note

1. The unit number is set (from 0 to F: 1 to 15) by the rotary switch on the front of the FL-net 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).



Note In the above example, the routing tables required to send a message in one direction from PLC #1 to PLC #4 are shown. Similar settings would need to be added to the routing tables to enable sending a message the other direction, i.e., from PLC #1 to PLC #4.

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

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

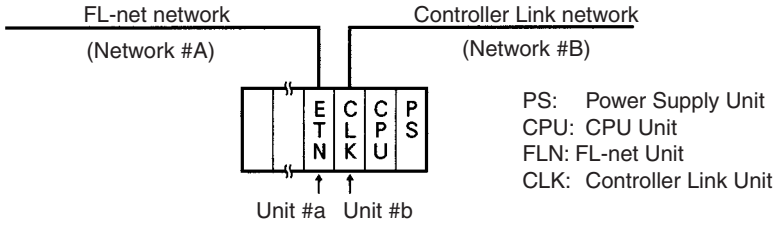
Note

1. When routing tables are transferred from the CX-Integrator to a PLC, the CPU Bus Unit will be reset so that the set routing tables can be read and enabled. Make sure that the equipment will not be adversely affected when the CPU Bus Unit is reset before transferring the routing tables.
2. To transfer routing tables for multiple nodes to a PLC in one batch, connect the CX-Integrator 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.
3. Routing tables can only be transferred as a batch to multiple nodes within the same network as the PLC to which the CX-Integrator 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.

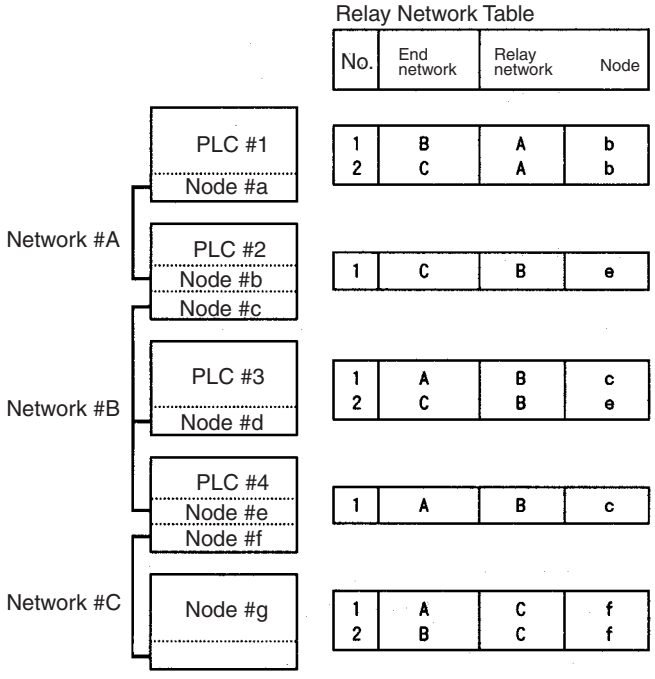


Local Network Table

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

Example 2: Three Interconnected Networks

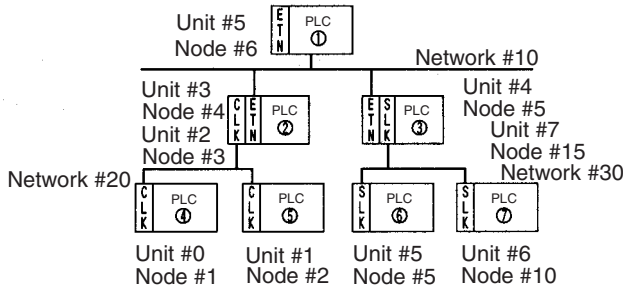
This example shows the relay network table settings for three different interconnected networks.



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.



PLC #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			

PLC #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			

PLC #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			

PLC #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			

PLC #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			

PLC #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			

PLC #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 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	Page
FA Link mapping table method	When the number of nodes assigned to the table exceeds 96.	50
FA Link startup method	When using a ladder program to control communications participation after turning on the power.	50
Confirm message protocol	When executing message communications with an FL-net node by another manufacturer.	50
Broadcast type	When changing the broadcast address for any reason.	50
IP address set method	When making settings, for any reason, outside of the range of the default IP address setting method.	50
Sub-net mask	When changing the sub-net mask for any reason.	50
Baud rate	When changing the baud rate to 100 Mbps.	50
Local node setup	When using the Data Link function.	50
Other node setup	When using the Data Link function.	50
Minimum allowable frame interval	When using a baud rate of 100 Mbps.	181

3-10-2 Using the CX-FLnet or FL-net Unit Support Software

The settings for the CPU Bus Unit System Setup are made using an CX-FLnet or FL-net Unit Support Software connected to the PLC. The settings cannot be made using a Programming Console or a CX-Programmer. The CX-FLnet and FL-net Unit Support Software can be used only for OMRON FL-net Units.

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
Baud rate	10 Mbps
Local node setup	None
Other node setup	None

3-11 Checking Communications

The FL-net 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 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 node.
Test objects	FL-net Units and Ethernet devices that support PING.	FL-net Units and devices supporting FL-net.
Network classification	Within Ethernet networks (including between segments).	Within FL-net networks.
Address system used	IP addresses	Node numbers
Transmission from FL-net 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 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 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 Unit. For details, refer to *9-3 Internode Test*.

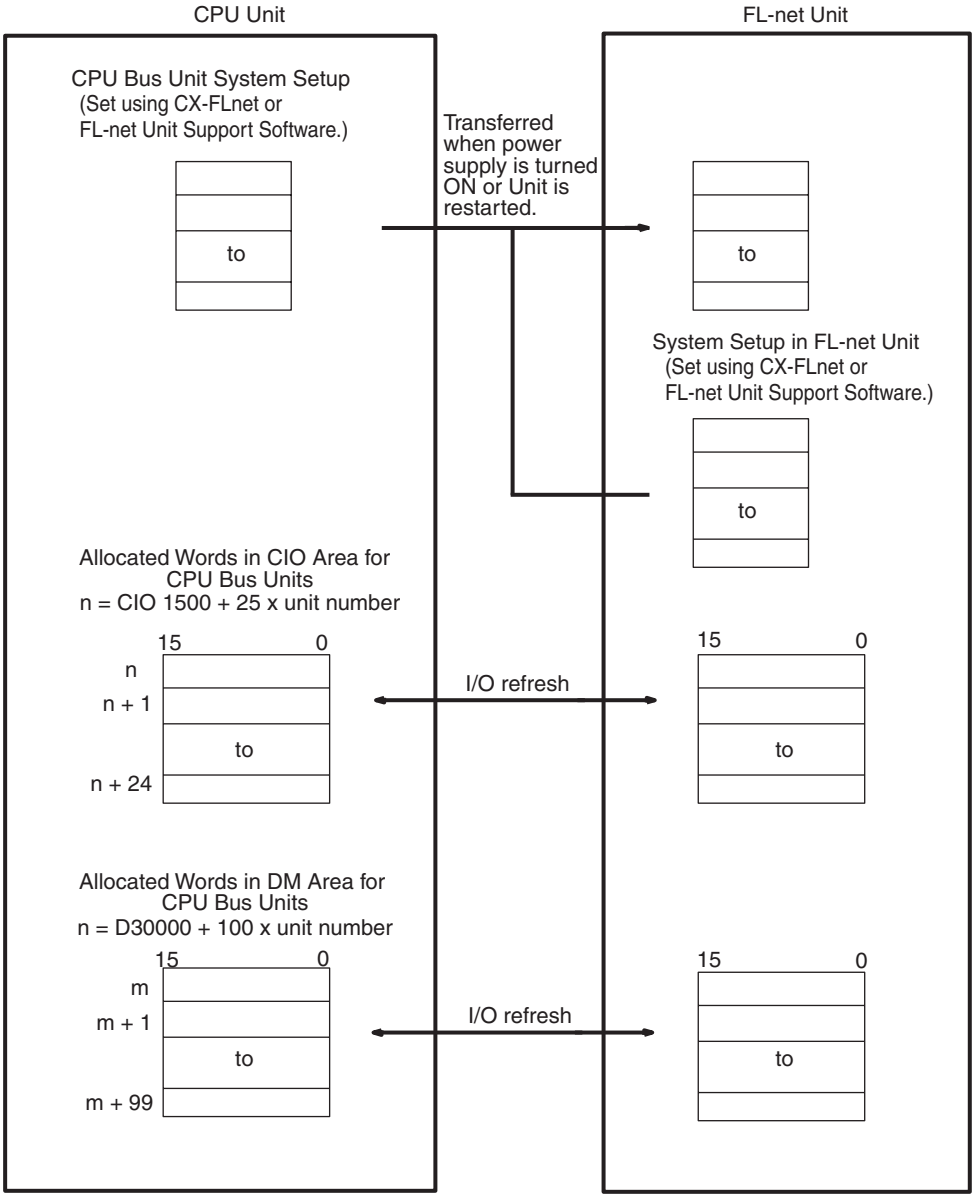
SECTION 4
System Setup and Memory Allocations

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

The FL-net 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 node.
- System Setup in FL-net Unit
  Stores Data Link data when the FL-net 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 Unit as a node on FL-net 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.

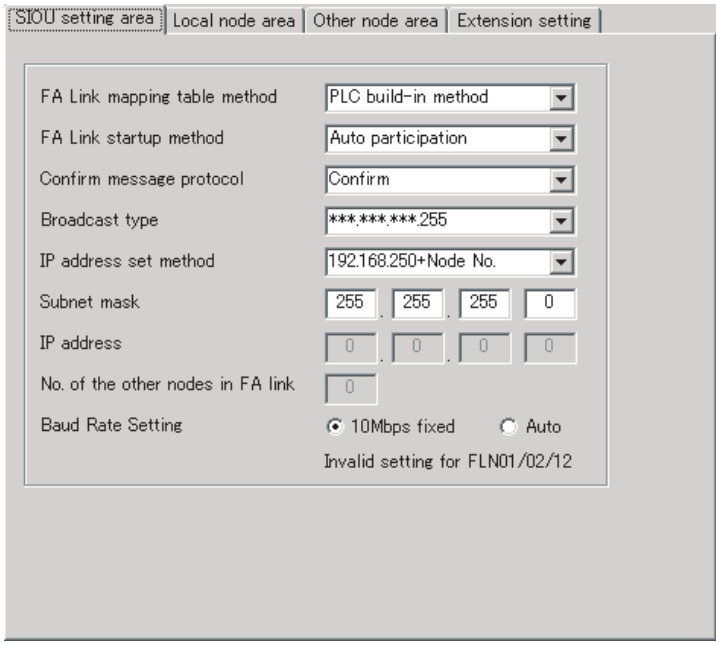
- The Data Link function is used. The Data Link table is stored in either the CPU Bus Unit System Setup (PLC built-in method) or the FL-net Unit System Setup (Unit built-in method). (Default: PLC built-in method)
- The startup method is changed. (Default: Automatic participation method)
- Message protocol confirmation is changed. (Default: Confirm)
- The broadcast method is changed. (Default: ***.***.***.255)
- The IP address is set. (Default: 192.168.250 + node number)
- The subnet mask is changed. (Default: 255.255.255.0)
- The baud rate is changed to 100 Mbps. (Default: 10 Mbps)

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

The settings are made in the CPU Bus Unit System Setup using the CX-FLnet or FL-net Unit Support Software.

Note The CPU Bus Unit System Setup 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 CX-FLnet or FL-net Unit Support Software.

4-2-1 System Setting - CPU Bus Unit Setup Area



Note Refer to *SECTION 11 CX-FLnet Support Software Operations* for CX-FLnet procedures.

Item	Content
FA Link mapping table method (default: PLC build-in method)	Selects the method (PLC build-in method or FA Link Unit build-in method) for storing the FA Link mapping table. Normally the default should be selected.
FA Link startup method (default: Auto-participating)	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 or C255.255.255.255). Normally the default should be selected.
IP address set method (default: 192.168.250 + Node No.)	Selects the IP address setting method (*192.168.250* + *Node No.*, *Unit rear rotary SW*, *Unit rear rotary SW* + Node No., or *Setup Area*). Normally the default should be selected. When using CS1W-FLN22 or CJ1W-FLN22, select either *192.168.250* +Node No or Setup Area.
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 se to *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 parameter cannot be set.
Baud Rate Setting (default: 10 Mbps (not variable))	Sets the baud rate for FL-net communications. To communicate at 100 Mbps, select *Auto*. The baud rate is determined by the auto-negotiation function of the connected hub.

Note

1. To circulate a token among the 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.
2. If either *Unit rear rotary SW + node No.* or *Unit rear rotary SW* is set as the IP address setting method for the CS1W-FLN22 or CJ1W-FLN22, a setting error will occur (HER indicator will light). Set the IP address setting method to either *192.168.250 + node No.* (default) or *Setup Area*.
3. The baud rate setting is supported by the CS1W-FLN22 and CJ1W-FLN22 only. The setting cannot be made for the CS1W-FLN02 or CS1W-FLN12, which always communicate at 10 Mbps.
4. Select ***Option - Switch Settings - Hex*** from the Main Menu. The IP address and subnet mask will be displayed in hexadecimal, and hexadecimal input will be possible.
5. If communications are set to connect via the network and storage in the PLC is set to use the FA link allocation table storage method, the maximum number of nodes that can be registered in other node areas is 50.

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.

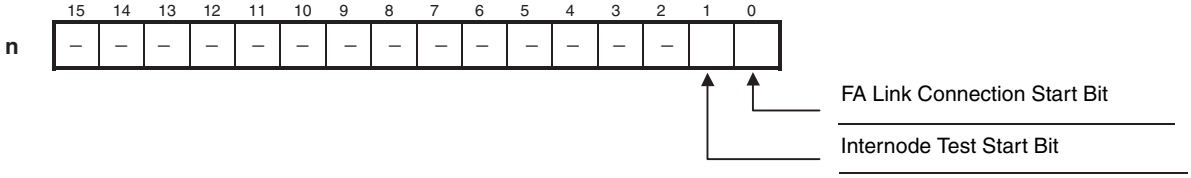
Beginning word n can be calculated by means of the following equation.

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			

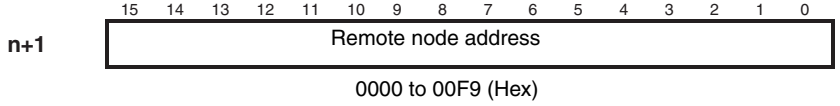
4-3-1 Unit Control Bits (CPU Unit to FL-net Unit)

FL-net Unit operation is started by turn control bits ON and OFF.



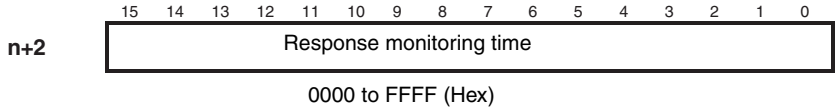
Bit	Bit name	Status	Manipulated by	Unit operation
0	FA Link Connection Start Bit	ON	User	Connects to network when turned from OFF to ON.
		OFF	User	Disconnects from network when turned from ON to OFF.
1	Internode Test Start Bit	ON	User	Executes internode test while ON.
		OFF	User Unit	Stops internode 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)

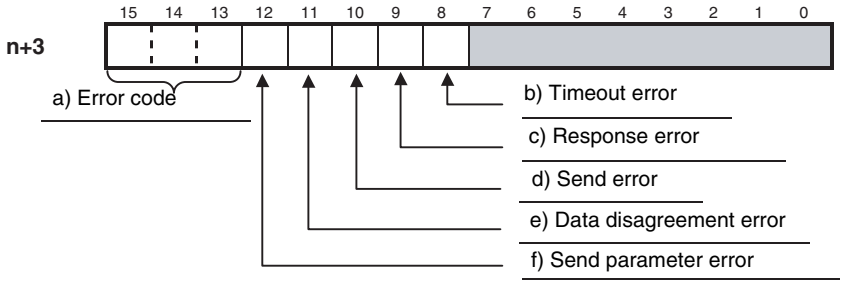


Set the time period, in the ranges shown below (in units of 10 ms, hexadecimal), to wait for a response in the internode test.

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.

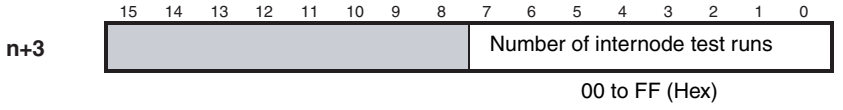
c) Response error
Turns ON if the response frame is abnormal.

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.

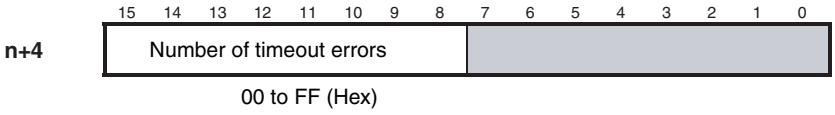
4-3-5 No. of Internode Test Runs (FL-net Unit to CPU Unit)



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)

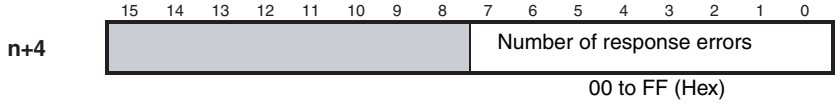


The number of timeout errors that have occurred in the internode test is stored in this word in hexadecimal.

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)

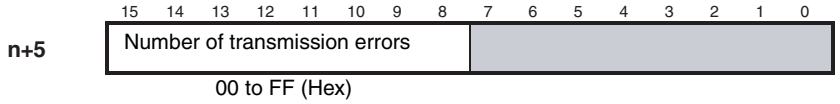


The number of response errors that have occurred in the internode test is stored in this word in hexadecimal.

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)

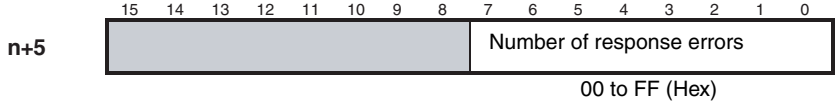


The number of transmission errors that have occurred in the internode test is stored in this word in hexadecimal.

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)

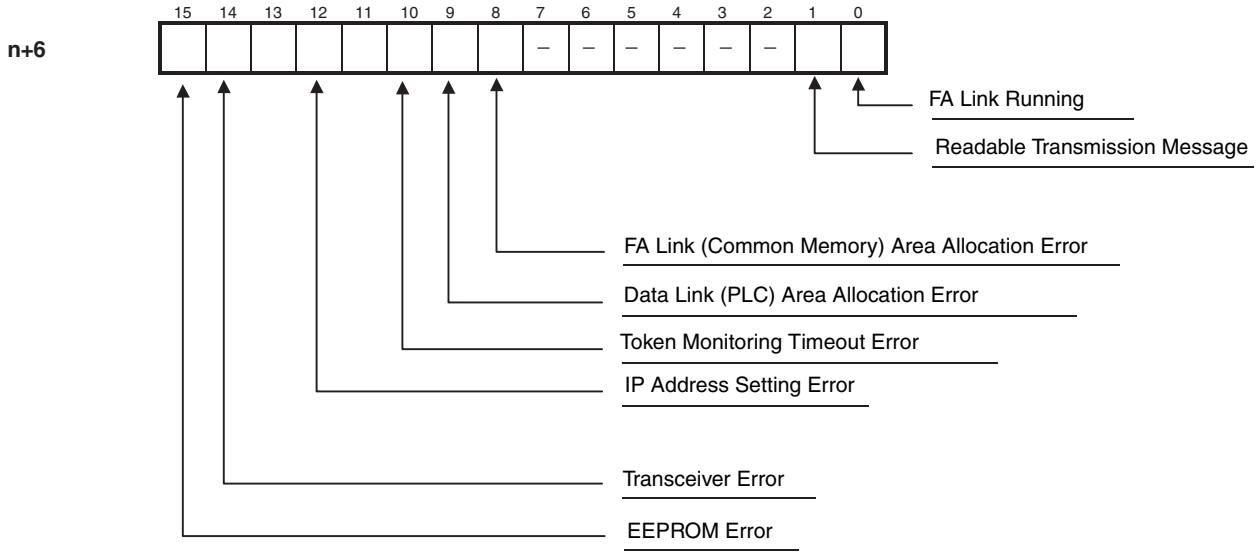


The number of data disagreement errors that have occurred in the internode test is stored in this word in hexadecimal.

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.

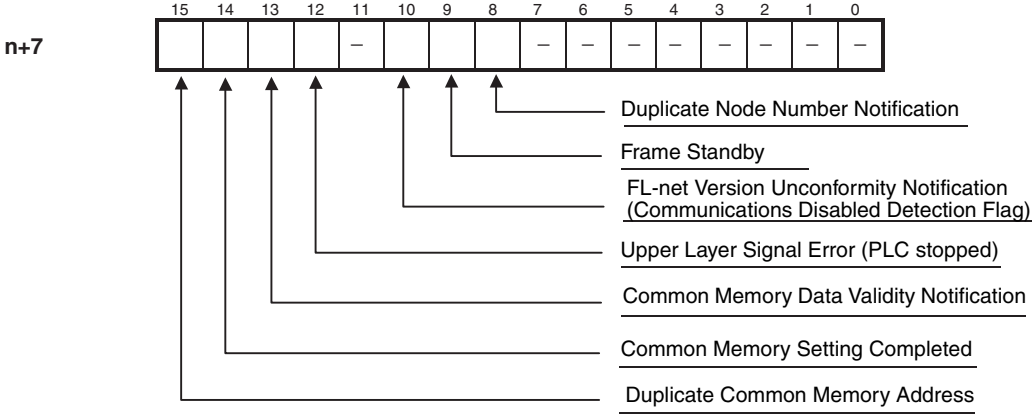
4-3-10 Unit Status (FL-net Unit to CPU Unit)



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.
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 7	(Not used.)	---	---	
8	FA Link (Common Memory) Area Allocation Error	ON	Error	ON when an error occurs in FA Link (Common Memory) Area allocations. The Common Memory allocations for the local node setup area are incorrect. Correct the settings from the CX-FLnet or FL-net Unit Support Software.
		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. The PLC Area allocations for the local node setup area and other node setup area are incorrect. Correct the settings from the CX-FLnet or FL-net Unit Support Software.
		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. A processing delay has occurred due to high system load. Correct the system configuration or extend the token monitoring timeout time (token watchdog timer) using the CX-FLnet or FL-net Unit Support Software.
		OFF	Normal	OFF when a token monitoring timeout does not occur while the local node is holding the token.
11	LAN Controller Error	ON	Error	ON when communications are not possible due to an error.
		OFF	Normal	OFF when communications are normal.

Bits	Name	Status		Unit operation
12	IP Address Setting Error	ON	Error	ON when an error occurs in the IP address setting. The following IP addresses cannot be set. • Host ID containing all 0s or 1s. • Net ID containing all 0s or 1s. • Sub-net ID containing all 1s. • Address beginning with 127 (7F hex).
		OFF	Normal	ON when the IP address setting is normal.
13	(Not used.)	---	---	
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.

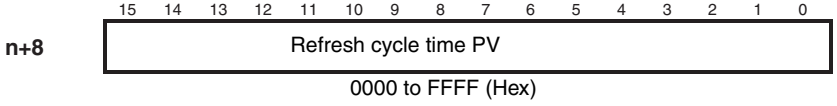
4-3-11 Network Status (FL-net Unit to CPU Unit)



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. Indicates that a frame from a remote node cannot be received.
		OFF	Off standby	OFF when a reception frame can be detected.
10	FL-net Version Unconformity Notification (Communications Disabled Detection Flag)	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 FL-net Unit and the PLC. A fatal or non-fatal error has occurred in the CPU Unit. The routing table settings are incorrect.
		OFF	Not stopped	OFF when communications between the FL-net Unit and the PLC are normal.

Bits	Name	Status		Unit operation
13	Common Memory Data Validity Notification	ON	Valid	ON when Common Memory data is valid. Indicates that data from each node has started being refreshed in the PLC.
		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. Correct the settings from the CX-FLnet or FL-net Unit Support Software.
15	Duplicate Common Memory Address	ON	Error	ON when local node has same Common Memory address as a remote node. The Common Memory address is the same as that for a remote node that has already joined the network. Correct the setting from the CX-FLnet or FL-net Unit Support Software.
		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 1 ms.

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

4-3-13 Node Information (FL-net Unit to CPU Unit)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
n+9	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
n+10	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
n+23	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224
n+24	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241	240

Note Nodes 250 to 255 are reserved for FL-net (Ver. 2.00) maintenance purposes.

- Indicates the network participation status between the local node and nodes in the data link table settings that are registered in the other node setup area (set using the CX-FLnet or FL-net Unit Support Software).
- When nodes registered in the data link table join the network normally and the data link data from the nodes can be refreshed in the CPU Unit, the corresponding bit turns ON.
- When communications from a participating node stop for three consecutive communications cycles, the node is detected as not participating in the network and the corresponding bit turns OFF.
- When the local node leaves the network, the corresponding bit for the local node turns OFF, at which all bits including those for the local node will turn OFF.

- Bits corresponding to nodes that are not registered in the data link table are always OFF.
- When a corresponding node is not connected, or an area allocation error occurs, the corresponding bit is always OFF.

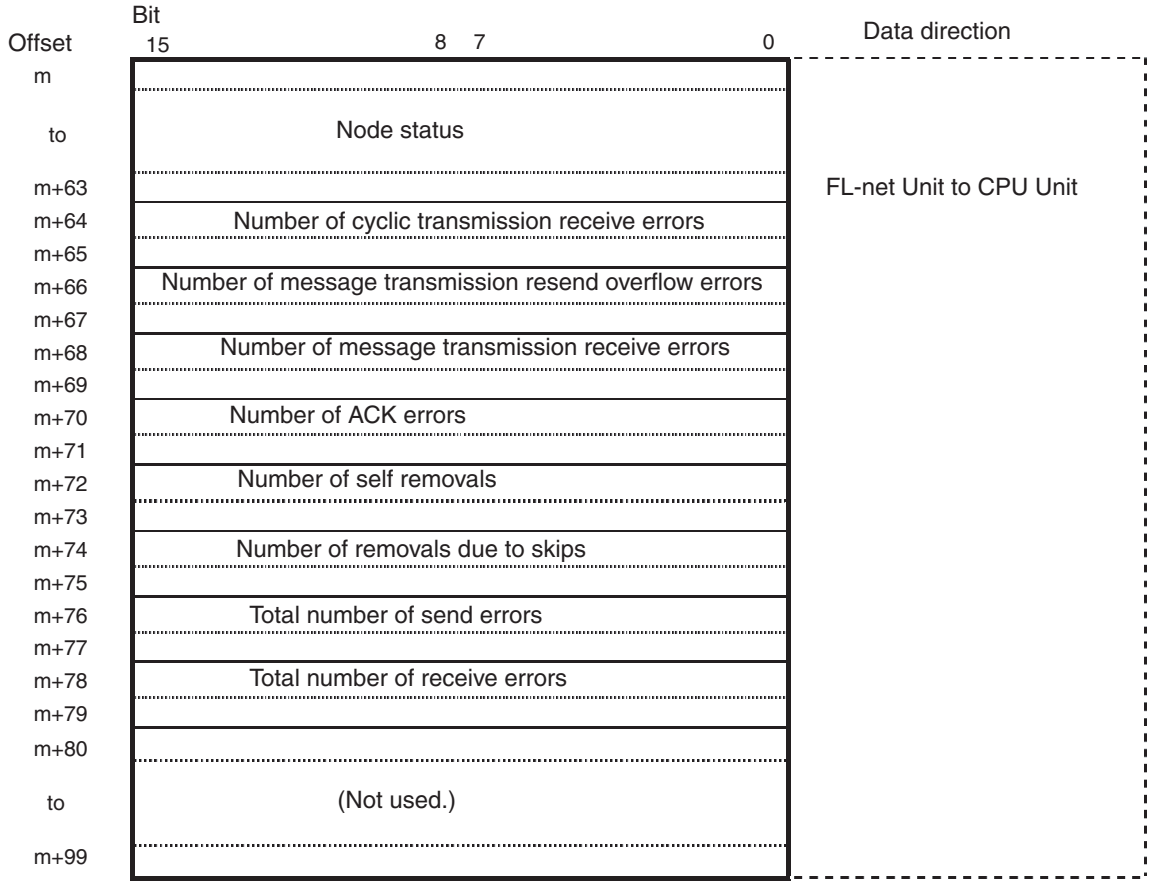
4-4 Allocated Words in the DM Area

The allocated DM Area words contain the status of the network to which the FL-net Unit is connected and information on connected nodes. All area information is cleared to 0 when the power is turned ON or the FL-net Unit is restarted.

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 m can be calculated by means of the following equation.

Beginning word m = D30000 + (100 x unit number)



4-4-1 Node Status (FL-net Unit to CPU Unit)

	15 14 13 12	11 10 9 8	7 6 5 4	3 2 1 0
m	Node 3	Node 2	Node 1	(Always 0)
m+1	Node 7	Node 6	Node 5	Node 4
m+62	Node 251	Node 250	Node 249	Node 248
m+63	Node 255	Node 254	Node 253	Node 252

Note Nodes 250 to 255 are reserved for maintenance purposes for FL-net Ver. 2.00 specifications.

The network connection status of remote nodes is stored in the following bits.

Bits				Meaning	
15	11	07	03	1. Operation (upper layer)	ON: Operating; OFF: Stopped
14	10	06	02	2. Error (upper layer)	ON: Error; OFF: No error
13	09	05	01	3. Participation in network	ON: Participating; OFF: Not participating
12	08	04	00	4. Mapping error	ON: Error; OFF: No error

1. Operation (Upper Layer)
   The operating status (active/not active) of applications installed at the node is stored.
2. Error (Upper Layer)
   The error status (error/no error) of applications installed at the node is stored. These bits turn ON when a fatal or non-fatal error occurs in each PLC, or when the routing tables are incorrect.
3. 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.)
4. Mapping Error
   Notifies that the settings do not correctly reflect the network data in the PLC areas.

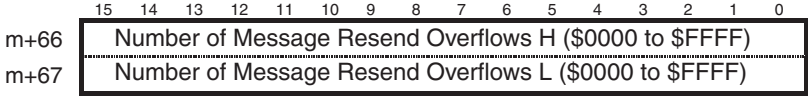
4-4-2 Number of Cyclic Transmission Receive Errors (FL-net Unit to CPU Unit)

The number of times ($0 to $FFFFFFFF) inconsistencies occur in parameters in communications frames (CBN, TBN, and BSIZE) during cyclic transmission reception is stored.
These errors may occur due to the network configuration. If this error occurs frequently, either extend the minimum allowable frame interval using the CX-FLnet or FL-net Unit Support Software or reduce the number of Units using cascade connections from the hub.

	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
m+64	Number of cyclic transmission errors H ($0000 to $FFFF)
m+65	Number of cyclic transmission errors L ($0000 to $FFFF)

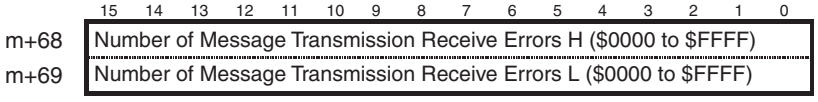
4-4-3 Number of Message Resend Overflows (FL-net Unit to CPU Unit)

The number of times ($0 to $FFFFFFFF) a message is resent three times or more during message transmission is stored. This error may occur due to the network configuration or line load.



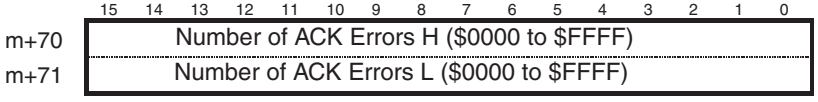
4-4-4 Number of Message Transmission Receive Errors (FL-net Unit to CPU Unit)

The number of occurrences ($0 to $FFFFFFFF) of sequence errors, illegal source node numbers, illegal transaction codes, and illegal sequence versions during message reception is stored.



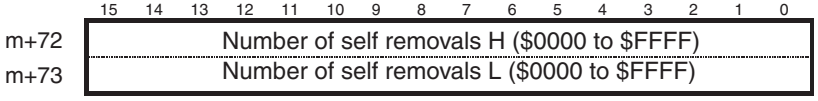
4-4-5 Number of ACK Errors (FL-net Unit to CPU Unit)

The number of occurrences ($0 to $FFFFFFFF) of ACK errors during message reception is stored. This error may occur due to the network configuration or line load.



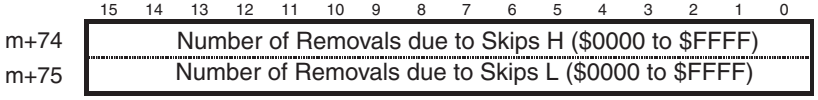
4-4-6 Number of Self Removals (FL-net Unit to CPU Unit)

The number of times ($0 to $FFFFFFFF) a node removes itself from the network during communications is stored. Self removal occurs when a token holding timeout occurs at least four times This error may occur due to the network configuration, line load, or line settings.



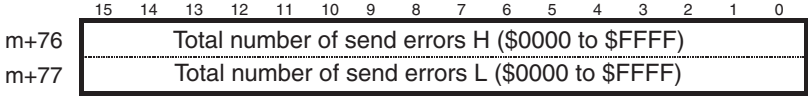
4-4-7 Number of Removals Due to Skips (FL-net Unit to CPU Unit)

The number of times ($0 to $FFFFFFFF) a node is removed due to a local node skip during communications is stored.



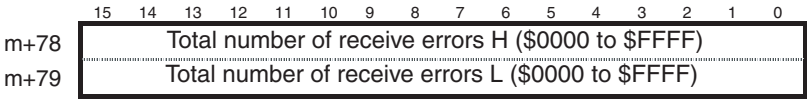
4-4-8 Total Number of Send Errors (FL-net Unit to CPU Unit)

The number of collisions ($0 to $FFFFFFFF) from 16 or more that occurred during packet transmission is stored. This error may occur during normal operation due to the network configuration or line load.



4-4-9 Total Number of Receive Errors (FL-net Unit to CPU Unit)

The total number of errors ($0 to $FFFFFFFF), including overflow errors, CRC errors, alignment errors, and short packet errors, that occur during packet reception is stored. This error may occur due to the network configuration. If this error occurs frequently, either extend the minimum allowable frame interval using the CX-FLnet or FL-net Unit Support Software or reduce the number of Units using cascade connections from the hub.



Note When the baud rate is set to 100 Mbps, adjust the minimum allowable frame interval. The set value depends on the number of nodes, number of data link words, and hub performance capacity. The following table provides a guide for set values.

Total data link words	Minimum allowable frame interval
0 to 2,000 words	0.8 ms
2,000 to 4,000 words	1.0 ms
4,000 to 6,000 words	1.2 ms
6,000 to 8,000 words	1.5 ms

The minimum allowable frame interval is set in the Unit area settings from the FL-net Unit Support Software. If the minimum allowable frame interval is too short, the total number of receive errors will be incremented.

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

The data link function uses FL-net 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-FLN22/CJ1W-FLN22 can also be used for exchanging data between CS/CJ-series PLCs or between FL-net nodes by other manufacturers.

5-1-1 FL-net Cyclic Transmission and Common Memory

1. Cyclic Transmission Overview

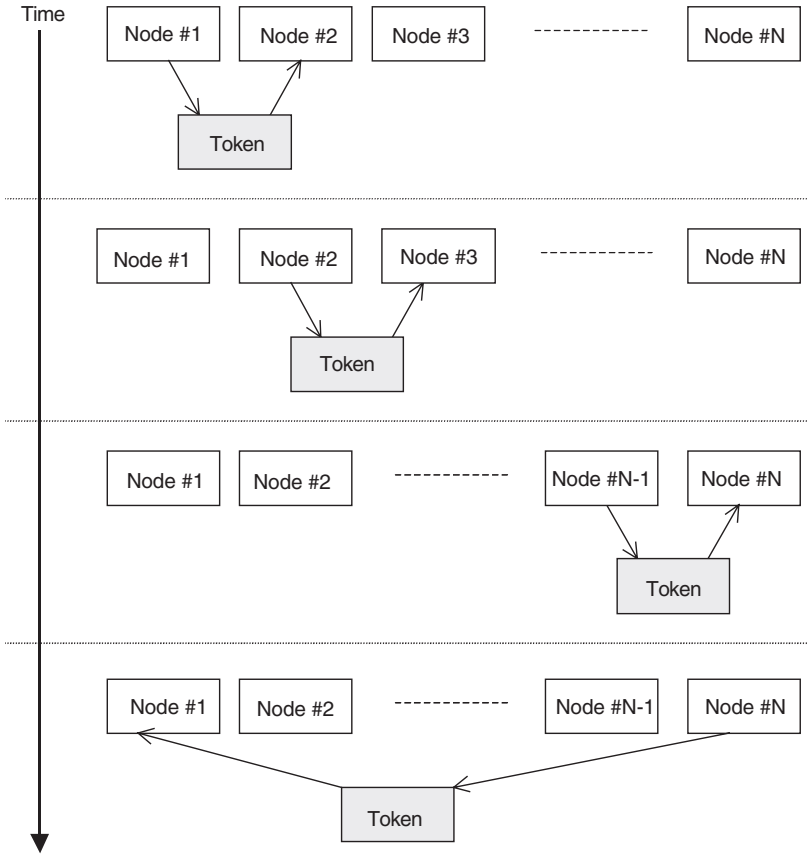
   Cyclic transmission supports the exchange of cyclic data between nodes.

   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.

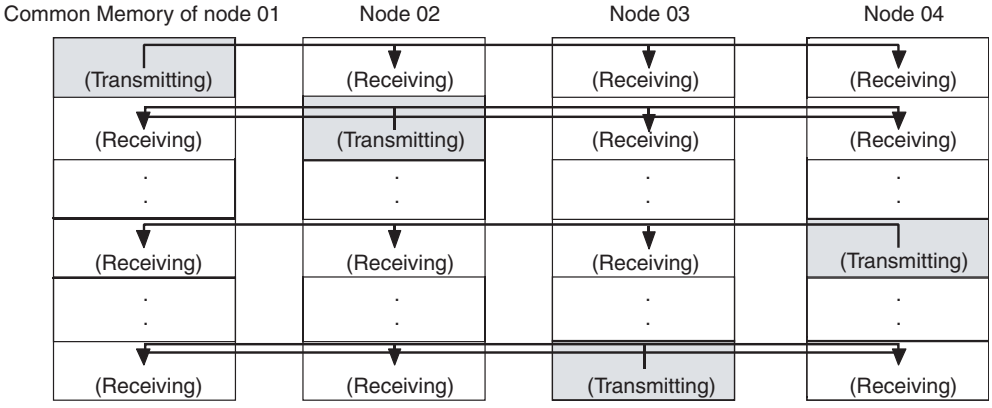
   c) When the area transmitted by a node exceeds the transmission size limit for a single frame, which is 1,024 bytes, the data is fragmented into multiple frames and then transmitted.

   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.

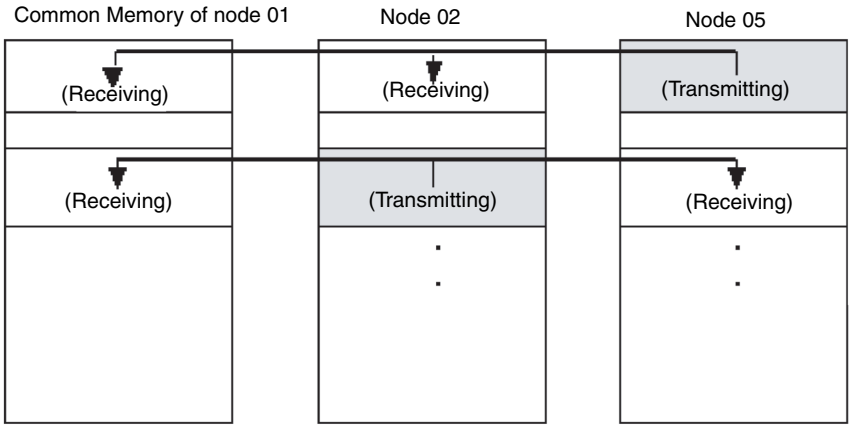
   e) The capacity reserved as Common Memory for communications in a single node is a fixed size of 8 Kbits + 8 Kwords = 8.5 Kwords.

   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.



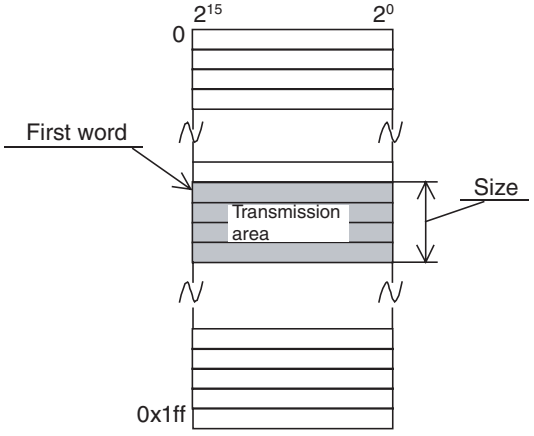
A node can also use the whole Common Memory as a receiving area only.



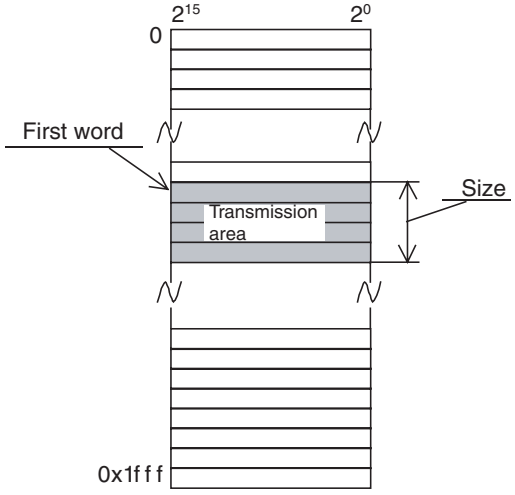
3. Areas 1 and 2

   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.

Area 1



Area 2



4. Data Concurrency

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

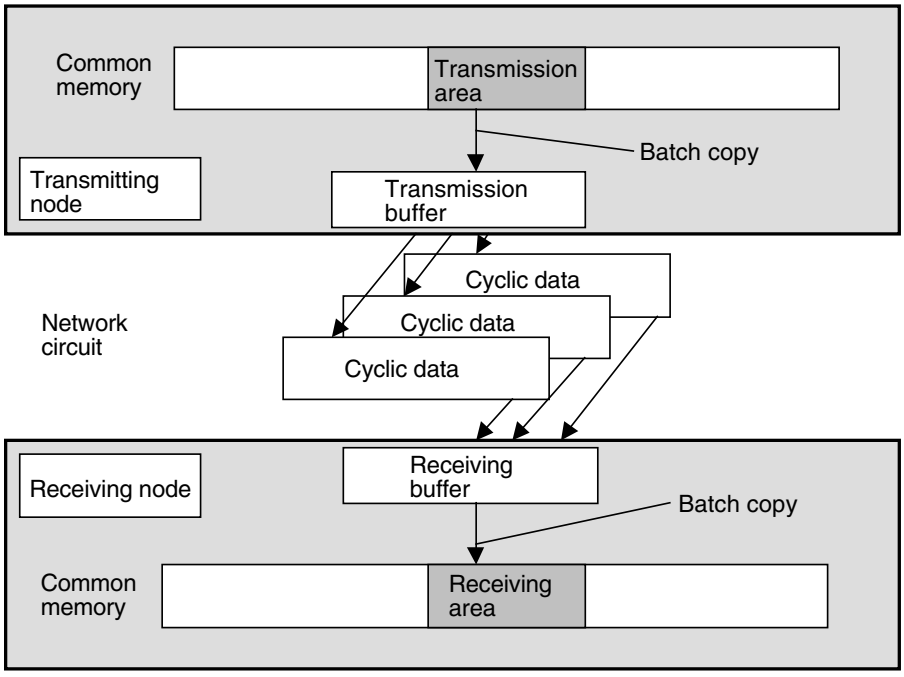
5. Transmission Timing

   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 Unit has 8,704 words of Common Memory (including Area 1 and Area 2).

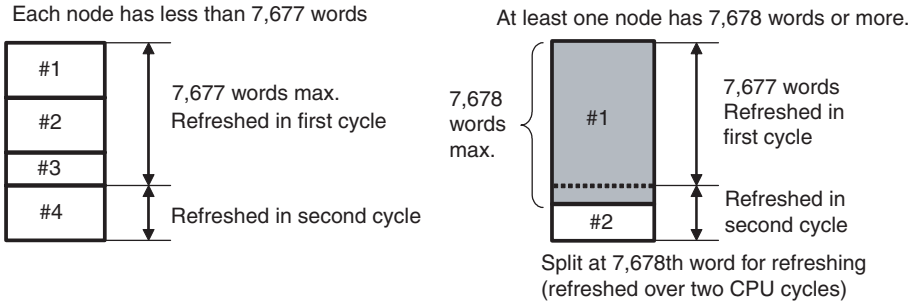
Item	Specifications
Number of nodes	128 nodes max.
Number of data blocks	Two areas max. per node (Area 1 and Area 2)
Total Data Link capacity	8,704 words max. • Area 1 (bit area): 512 words • Area 2 (word area): 8,192 words
Areas that can be allocated	• CIO (I/O bits, etc.): CIO 0 to CIO 6143 • Work 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. MSB LSB Word D15 D0

Note 1. The data for Area 1 and Area 2 from the same node will be refreshed in the same CPU Unit cycle or Area 2 will be refreshed first. If concurrency is re-

quired between the data in Area 1 and Area 2, use refreshing of the data in Area 1 as a trigger before accessing data from Area 2.

2. Make sure that the data link tables are correct and confirm that the equipment will not be adversely affected by the data link table settings before starting the data links. Incorrect data link tables may result in unexpected operation.
3. If the total number of words in Area 1 and Area 2 for setting a single node exceeds 7,677 words, the data for the corresponding node will be refreshed over two scans of the CPU Unit. If the setup area of at least one node in the network exceeds 7,677 words, the data for that node is split and refreshed over two cycles. The data for the corresponding node will be split from the 7,678th word counted from the beginning of Area 1.

Data Refresh when a Single Node's Setup Area Is More than 7,677 Words



5-2 Setting Data Link Tables

5-2-1 Setting Data Link

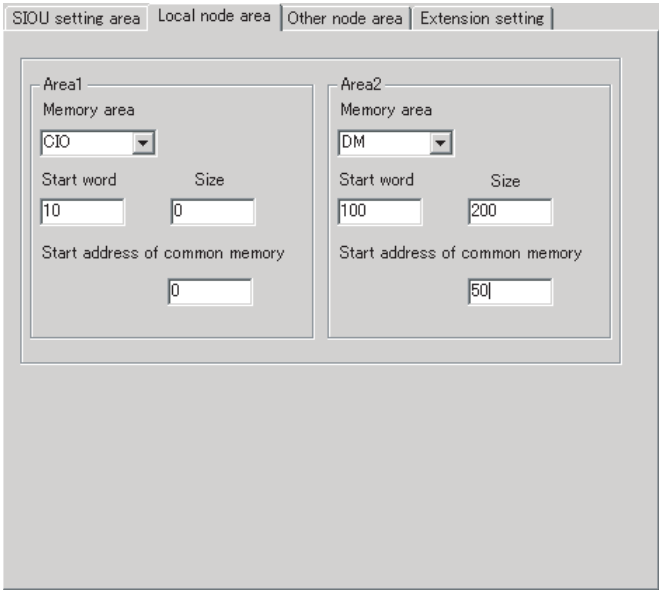
The method for setting Data Link is explained by means of the CX-FLnet or FL-net Unit Support Software.

Note

1. The CX-FLnet or FL-net Unit Support Software, Support Software designed especially for OMRON FL-net Units, is used to set Data Link tables.
2. To enable the Data Link table settings once they have been made from the CX-FLnet or FL-net Unit Support Software, it is necessary to either turn the PLC power OFF and back ON again or restart the FL-net Unit.

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.

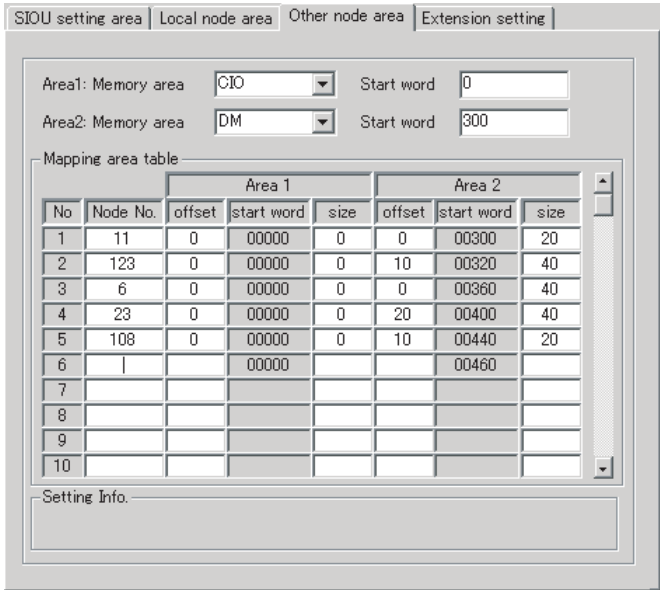


Item	Content
Area 1 (Area 2) Memory Area (default: Area 1 CIO, Area 2 DM)	Sets the PLC area in which Cyclic Data Areas 1 and 2 for the local node are stored. The following areas can be set: CIO, WR, HR, DM, and EM0 to EMC.
Area 1 (Area 2) start word (default: 0)	Sets the beginning word of the PLC area 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 for 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).

Note Select ***Option - Switch display - Hex***. It will be possible to display and input words, sizes, and addresses in hexadecimal.

System Setting - Other Node Setup Area

The other node setup area are set so that Common Memory data for remote nodes can be read to the local PLC areas.



Item	Content
Area 1 (Area 2) Memory Area (default: Area 1 CIO, Area 2 DM)	Sets the PLC area in which Cyclic Data Areas 1 and 2 for the remote nodes are stored. The following areas can be 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.

When setting Other Node Setup Area, the following functions can be used.

Menu	Function
Edit - Clear all	Clear all data in the FA link table.
Edit - Copy row	Copy a single data row data and add as a new row.
Edit - Delete	Delete a single data row.

Note

1. Do not assign the local node to the mapping area table.
2. Enter 0 in the *Node No.* Field and enter the size of the local node setup area in the *Size* Field for the area corresponding to that for the local node.
3. If the settings are made for only Area 1 (or Area 2), set the offset and size for the other area to 0.
4. Select ***Option - Switch display - Hex***. It will be possible to display and input words, sizes, and addresses in hexadecimal.
5. The “offset” designation tells 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.
6. Select ***Option - Switch Settings - Hex*** from the Main Menu. It will be possible to display and input words, sizes, and addresses in hexadecimal.

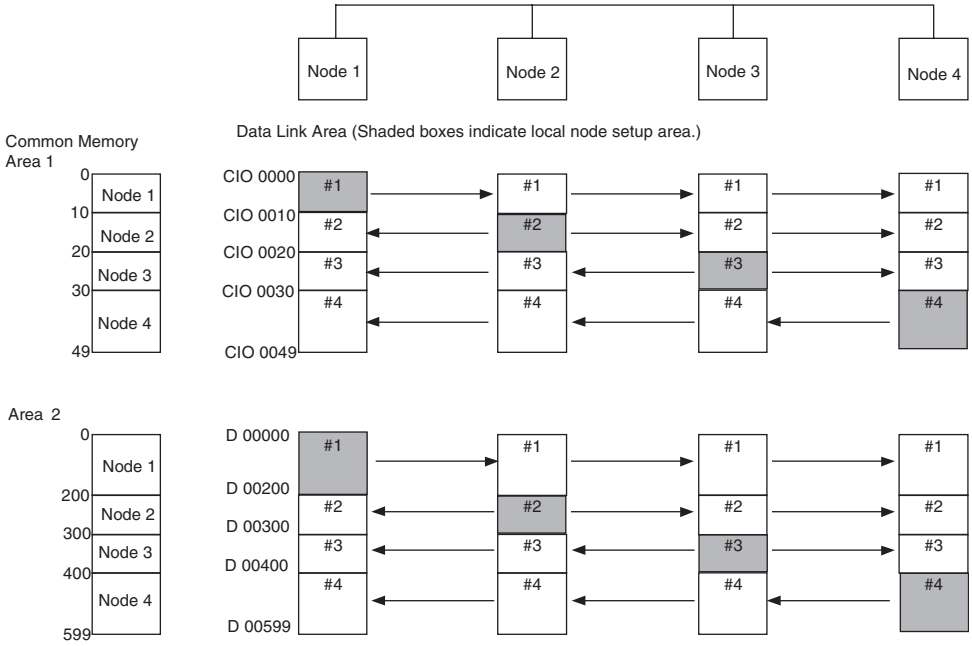
5-2-2 Settings Examples

This section provides examples of Data Link tables set by the CX-FLnet or FL-net Unit Support Software, 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

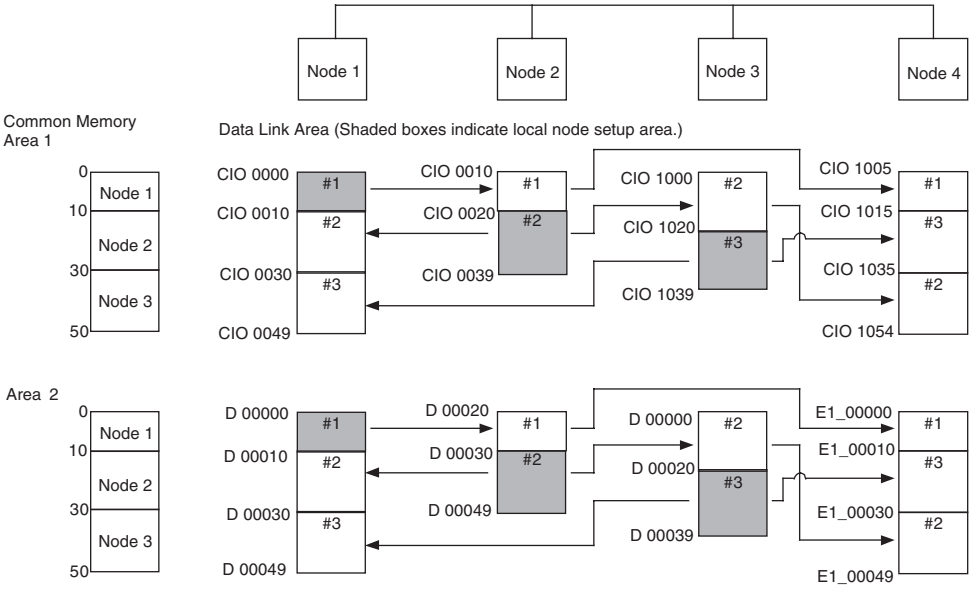
Node number	Area 1		Area 2	
	Offset	Size	Offset	Size
1	0	10	0	200
2	0	10	0	100
3	0	10	0	100

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	0

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

Node 4

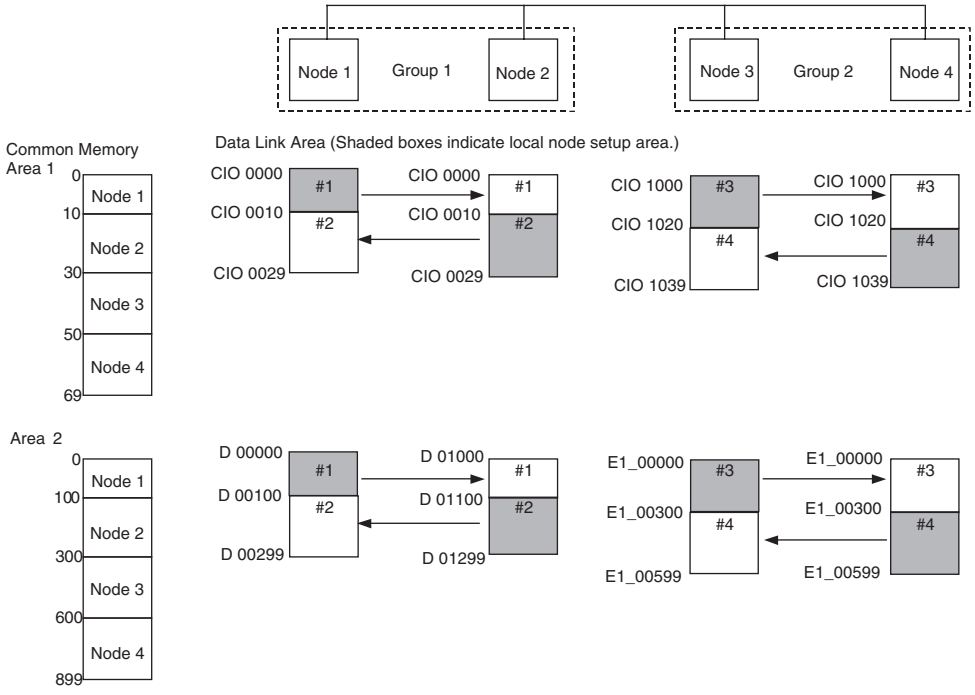
Area	Classification	Beginning word
1	CIO	1005
2	E1	0

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	10
2	DM	100

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	1020
2	EM0	300

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

Node 4

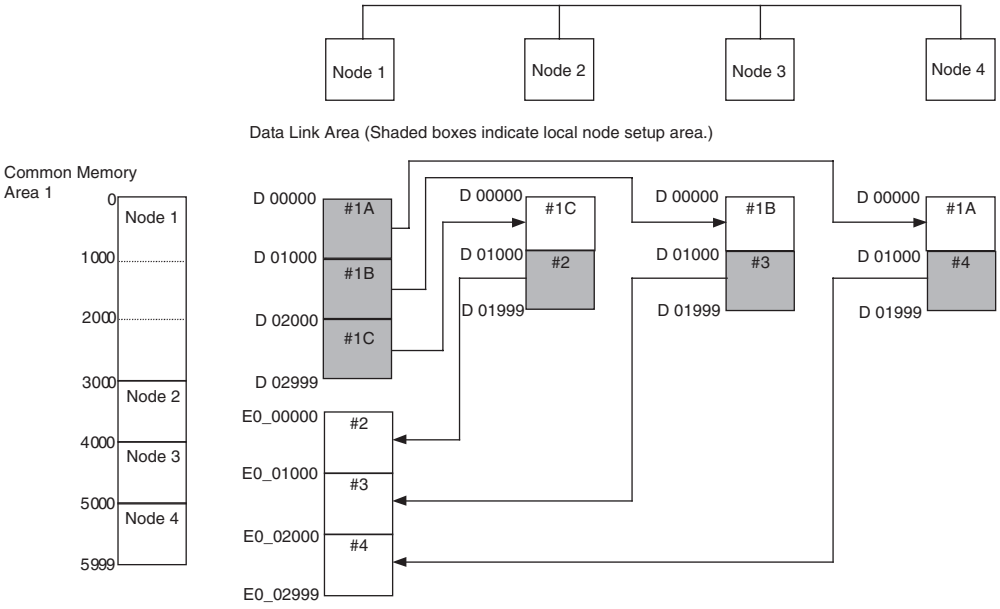
Area	Classification	Beginning word
1	DM	1000
2	EM1	0

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	2000	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	0	1000

5-2-3 Advanced Data Link Settings

The order of link data bytes can be specified for each node according to the needs of the connected device, eliminating the need for upper/lower byte conversion (SWAP) processing in the ladder program or user application.

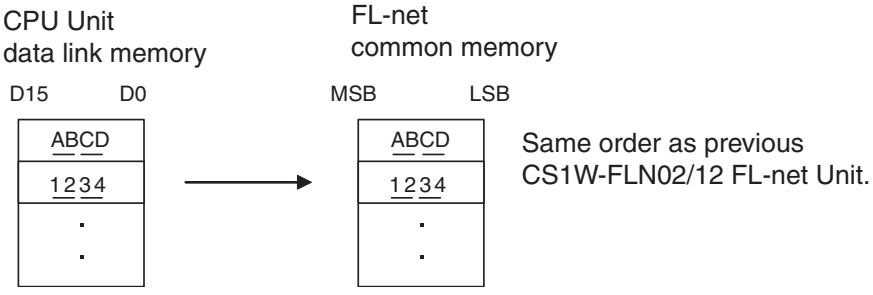
Setting	Details	Operation
Local node setup area	Sequential direction (default)	Sends data in the order the same as the earlier CS1W-FLN02/12 FL-net Units.
	Reverse direction	Sends data from the local node setup area after swapping the upper and lower bytes. The upper/lower byte data of CS/CJ-series CPU Unit's data link area is swapped and changed in the Common Memory.
Other node setup area	Sequential direction (default)	Sends data in the order the same as the earlier CS1W-FLN02/12 FL-net Units.
	Reverse direction	Sends data from the other node setup area after swapping the upper and lower bytes. The upper/lower byte data of the Common Memory is swapped and changed in the CS/CJ-series CPU Unit's data link area.

Note

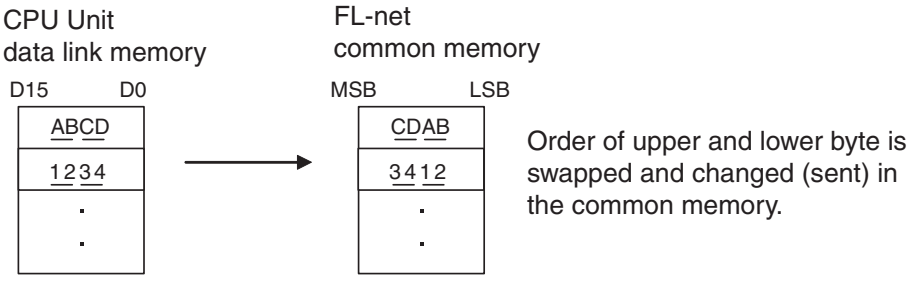
1. The default status is sequential data ("sequential direction") both for the local node setup area and other node setup area. This is the same data order used for the earlier CS1W-FLN02 and CS1W-FLN12 FL-net Units. Use the default settings for normal use. When changing the data order, be sure to consider the data order of the sending nodes and receiving nodes before changing the settings.
2. The data link data order can be set using the CX-FLnet or FL-net Unit Support Software Ver. 1.60.
3. The data link data order settings are enabled only for CS1W-FLN22 and CJ1W-FLN22 FL-net Units. Settings are disabled for earlier CS1W-FLN02 and CS1W-FLN12 FL-net Units (always operate in sequential direction).

Local Node Setup Area Settings

Sequential Direction

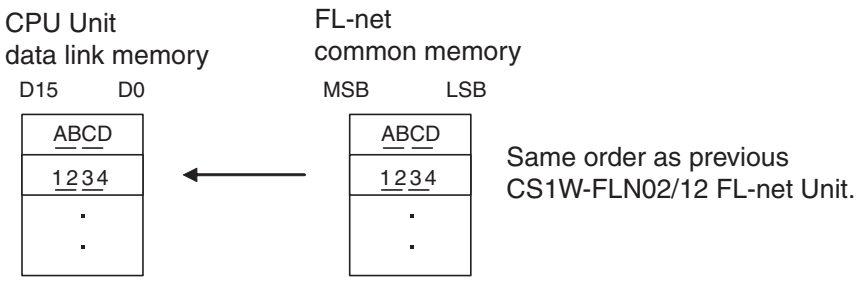


Reverse Direction

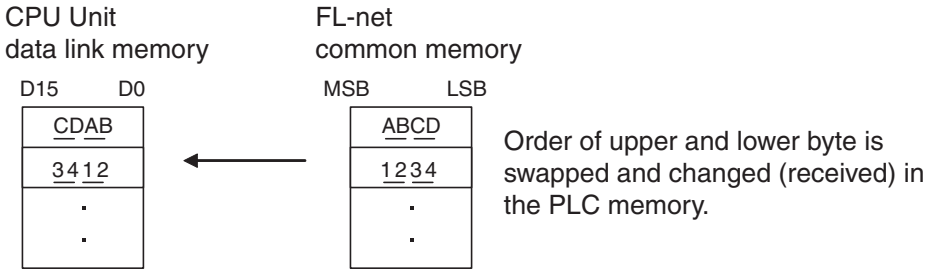


Other Node Setup Area Settings

Sequential Direction



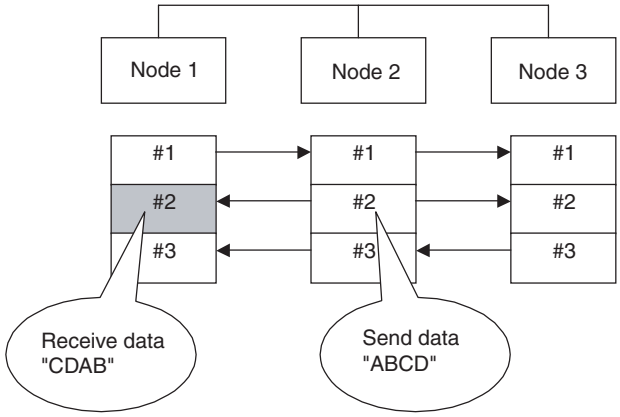
Reverse Direction



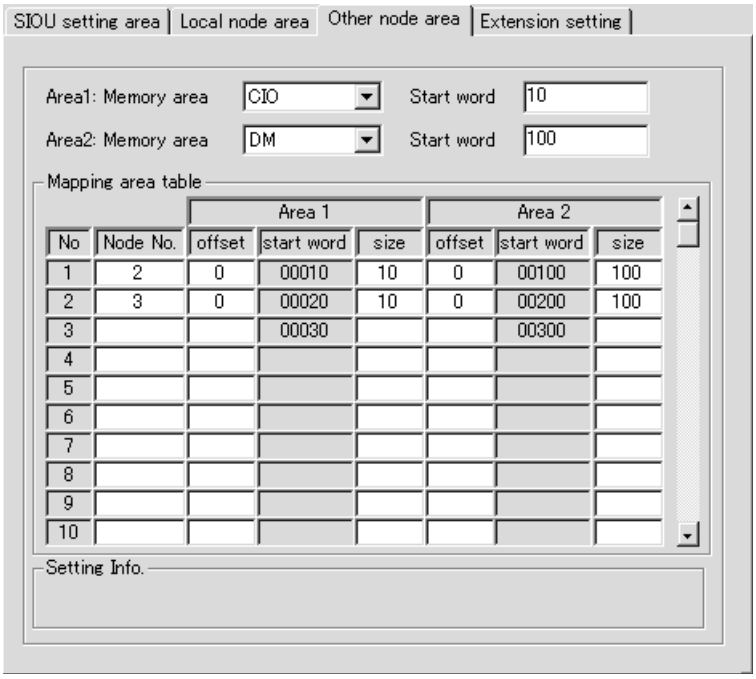
Using the CX-FLnet or FL-net Unit Support Software

This setting method is shown using the following configuration example.

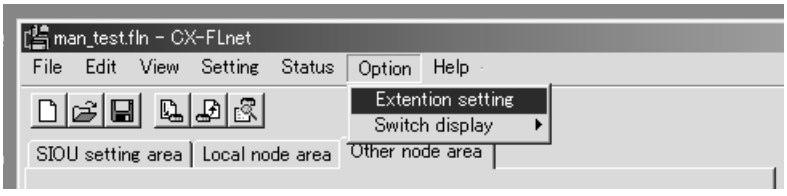
The order of data link data received from node 2 is swapped in node 1. Data swapping (reverse direction) is specified in the settings of the other node setup area for node 1. The data received by node 3 from node 2 is refreshed in the original order (sequential direction).



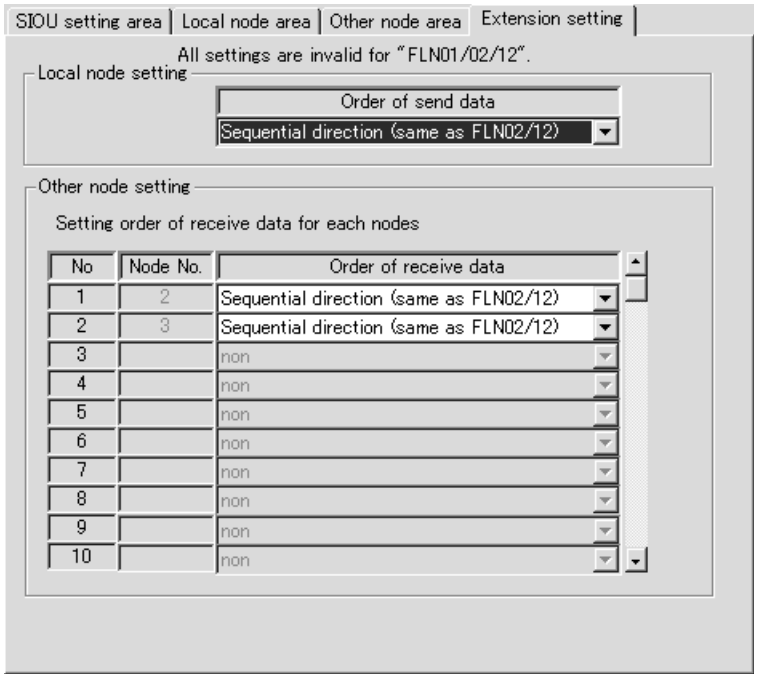
1,2,3... 1. Create the data link table using the CX-FLnet or FL-net Unit Support Software.



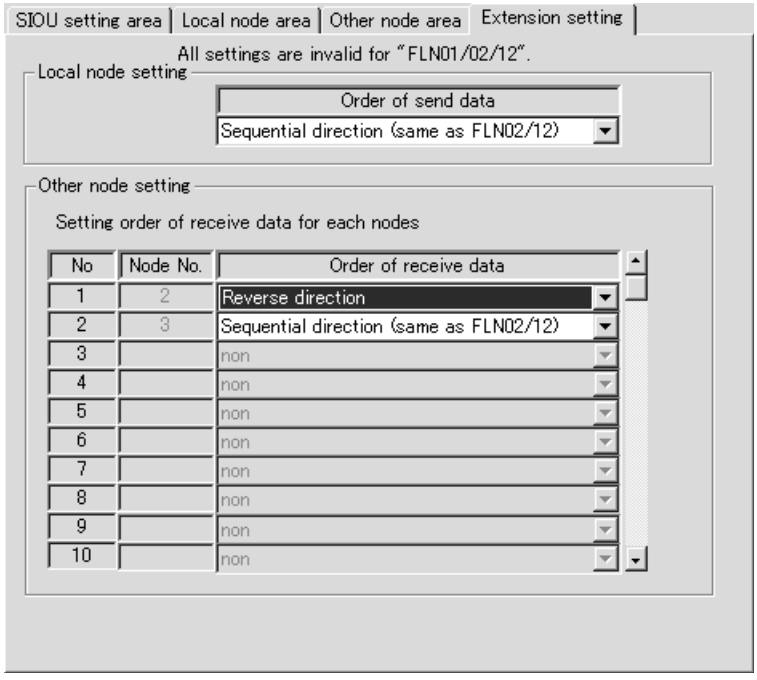
2. Click the **OK** Button to return to the Main Menu. Select ***Extension setting*** from the Option Menu.



3. Click the **System Setting** Button and open the data link table editing screen to display the Extension Setting Tab Page.



4. Set the order of receive data to the reverse direction for node number 2 under *Other node setup.*



5. Click the **Send** Button and transfer the settings to the FL-net Unit (CS/CJ-series CPU Unit). To enable the settings, restart the FL-net Unit or cycle the power to the CS/CJ-series CPU Unit.

SECTION 6
Message Transmission

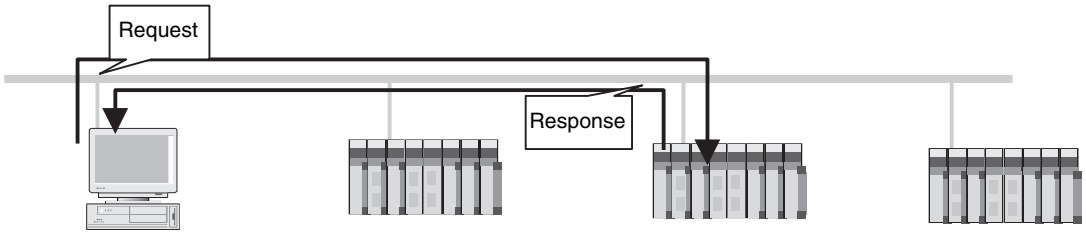
This section describes the message transmission used by an FL-net (Ver. 2.00) network.

6-1 Message Transmission

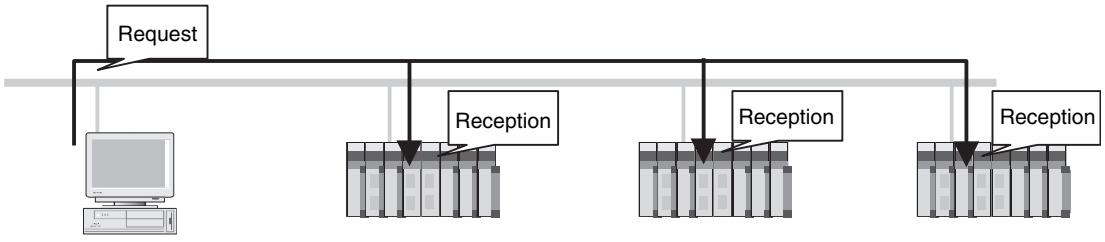
Message transmission is a function that supports the asynchronous exchange of data between nodes. The basic functions of message transmissions are explained here.

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

Message	1:1 transmission		1:N transmission	
	Client function	Server function	Client function	Server function
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 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 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 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*

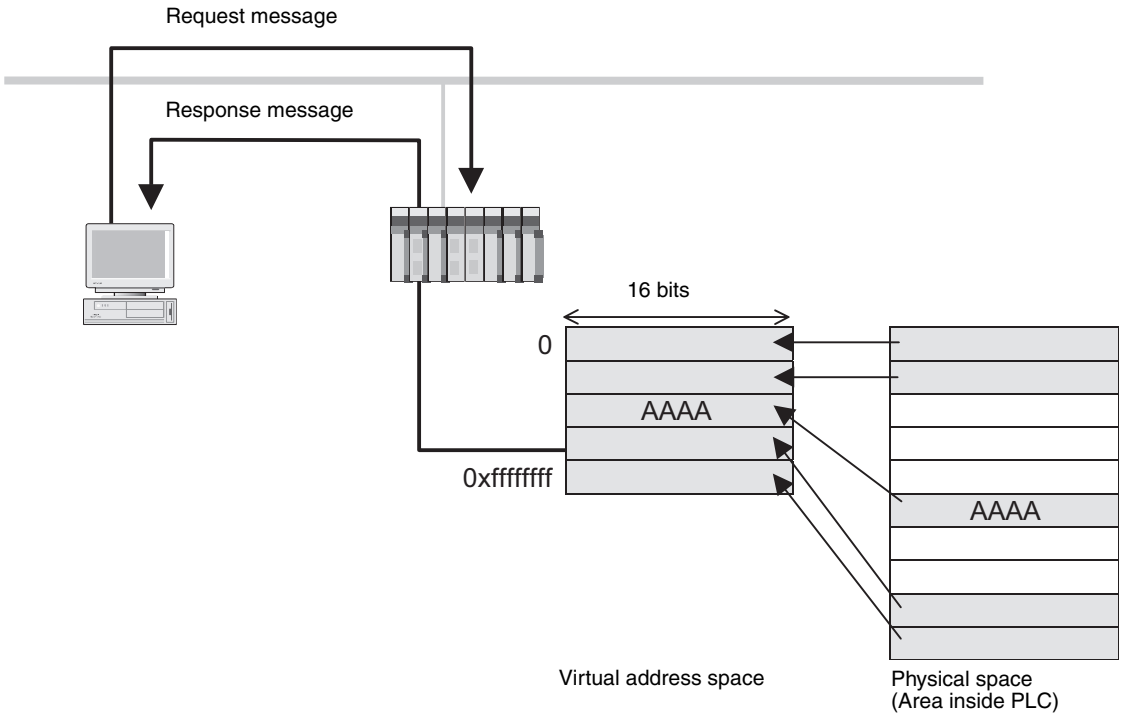
Note
1. Messages sent only between OMRON PLCs.
2. Messages sent between OMRON PLCs or between an OMRON PLC and a node for another manufacturer's unit.

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.

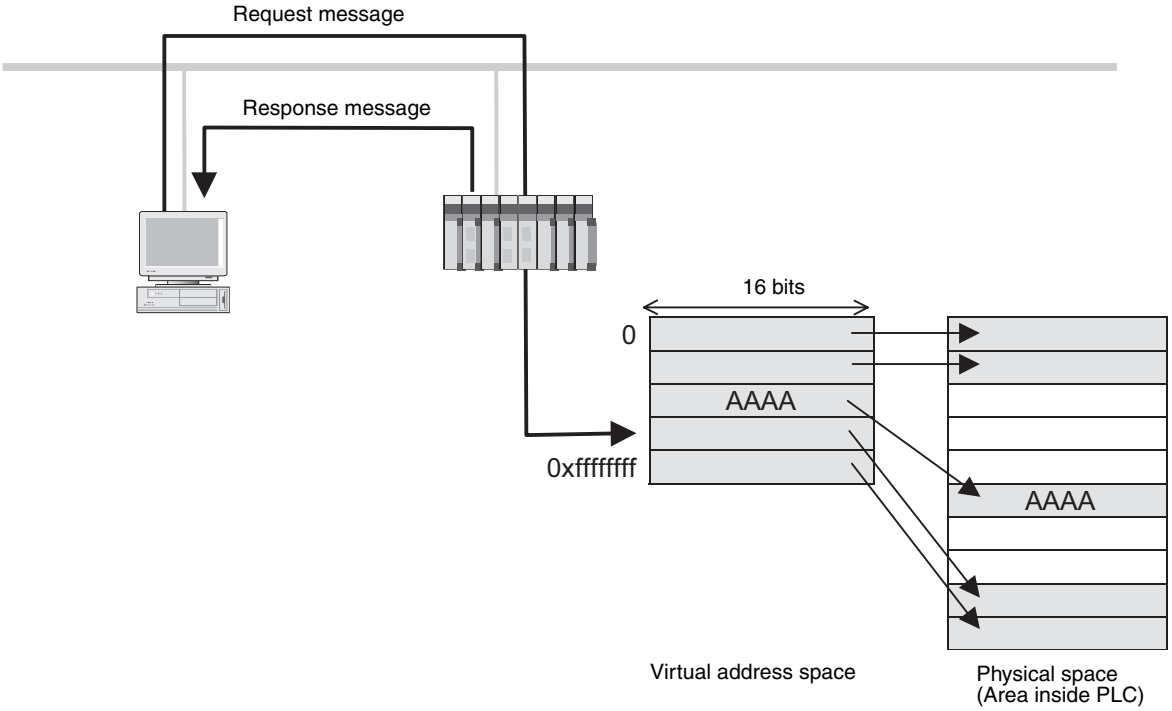
For more information on the FL-net Unit's virtual address space, refer to *7-4 CS/CJ-series Memory Areas and Virtual Addresses*.



*: “Oxffffffff” 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.



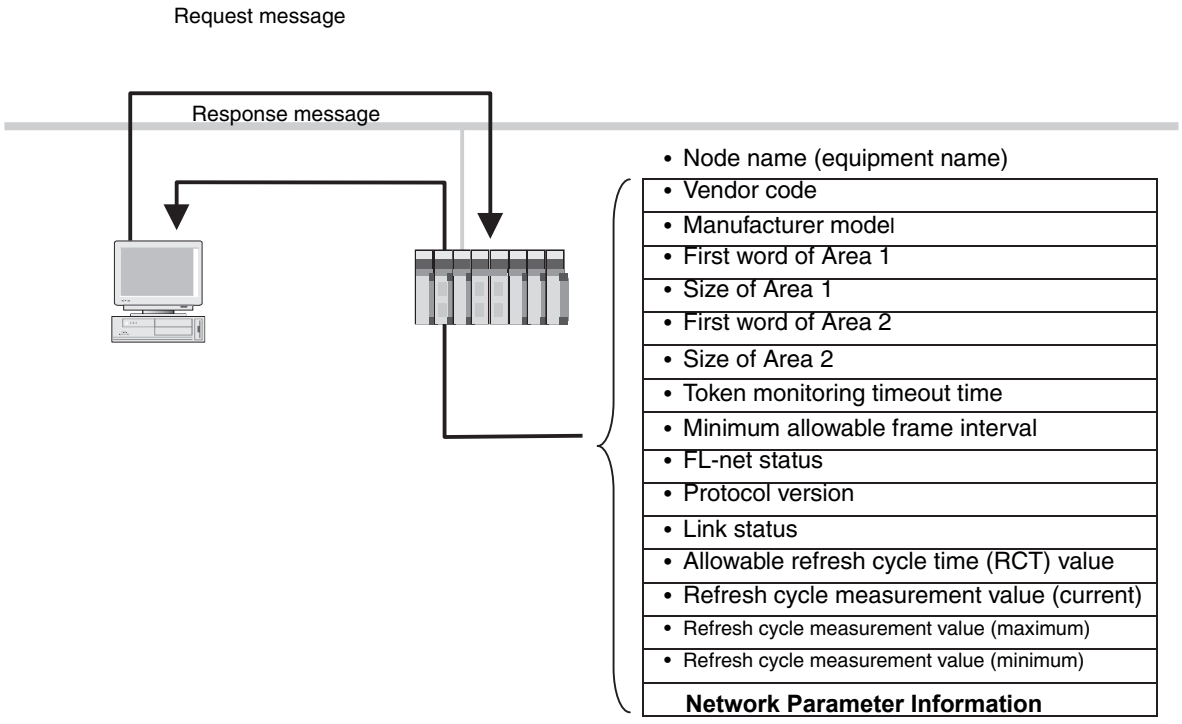
*: "Oxffffffff" refers to FFFFFFFF Hex.

Read Network Parameter

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

Network Parameter Information

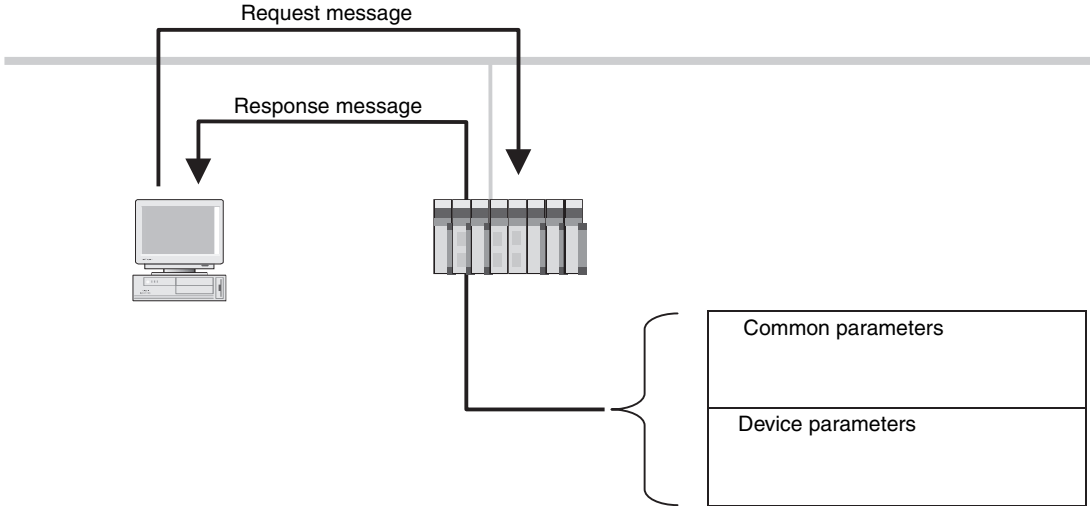
• Node name (equipment name)
• Vendor code
• Manufacturer model
• First word of Area 1
• Size of Area 1
• First word of Area 2
• Size of Area 2
• Token monitoring timeout time
• Minimum allowable frame interval
• FL-net status
• Protocol version
• Link status
• Allowable refresh cycle time (RCT) value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

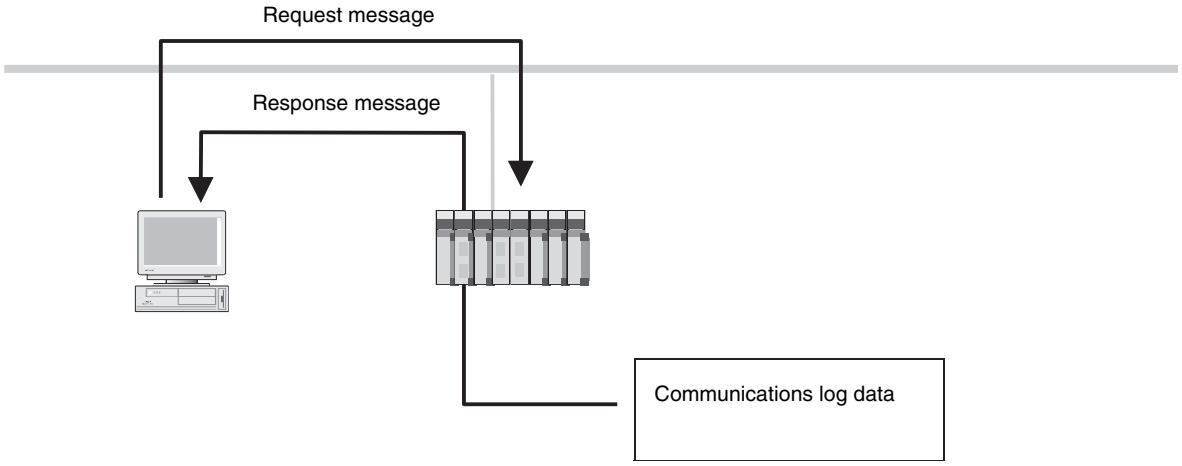
- Common parameters (mandatory)
- Device parameters (optional)



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

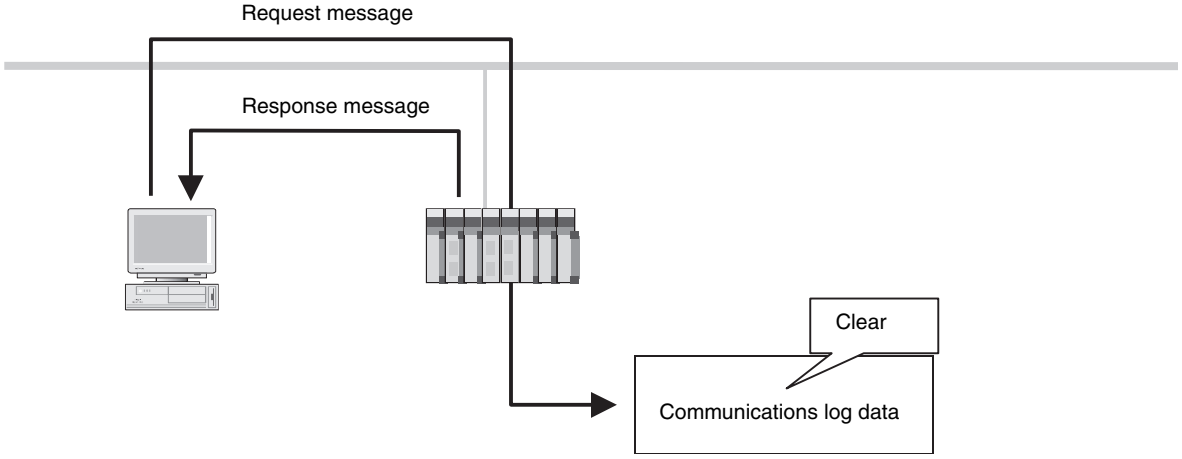
Read Communications Log Data

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



Clear Communications Log Data

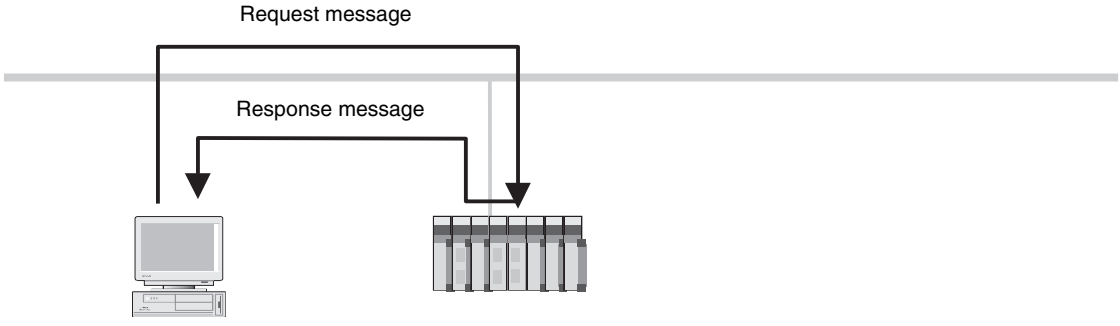
This message clears the communications log data of the remote node.



Echoback Message

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

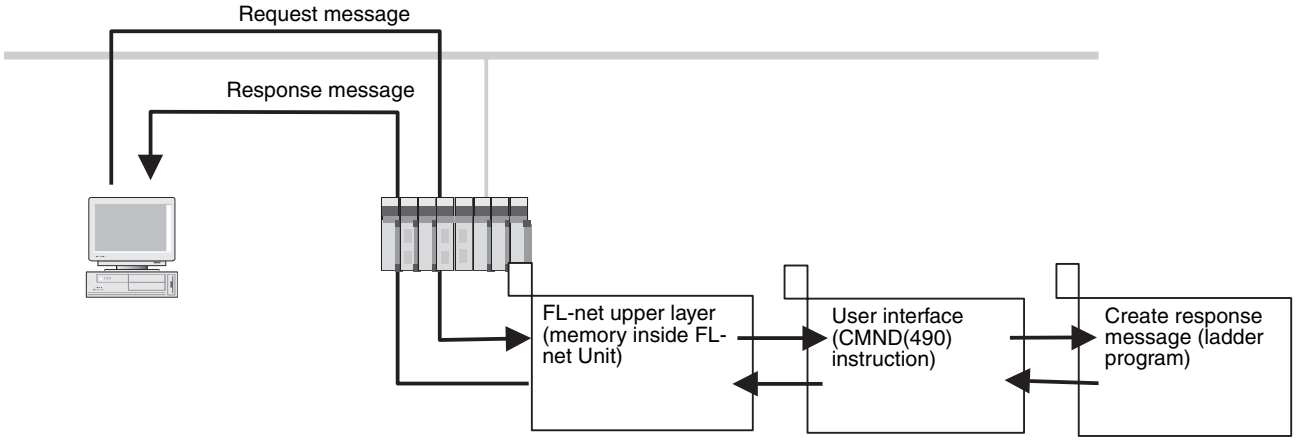
The echoback response occurs automatically in the FL-net Unit.



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

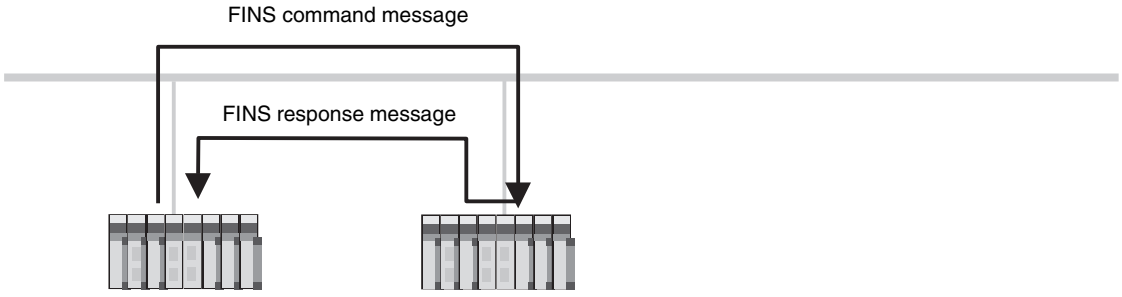
Transparent messages provide a message service in the FL-net's upper layer. The service notifies the FL-net's upper layer of received messages. The FL-net's upper layer notifies the user interface layer. When the user interface layer is notified, a response to the notification must be created and returned.



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 112 and *TRANSPARENT MESSAGE RECEIVE FRAME READ* on page 117.

Vendor Message (FINS Message)

Vendors can implement their own message service in FL-net. In an OMRON FL-net 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.

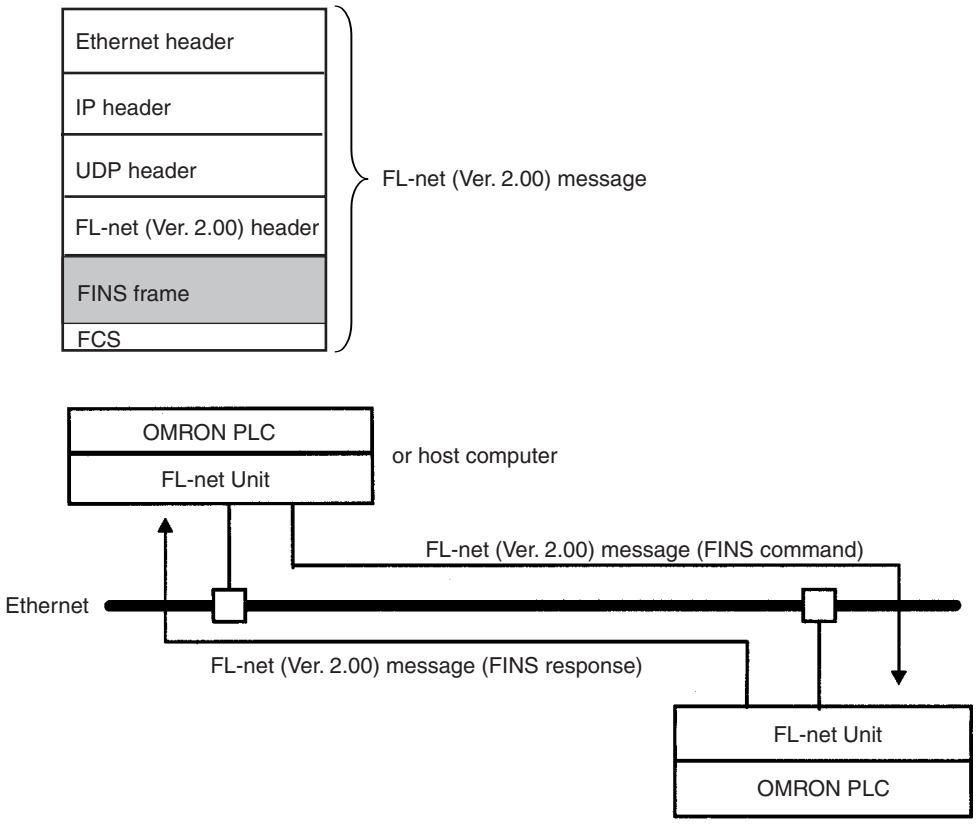
FINS commands from a PLC are sent using the SEND(090), RECV(098), and CMND(490) instructions programmed into the user ladder-diagram program. Although an outline of these instructions is provided in this section, refer to the *CS/CJ Series Programmable Controllers Programming Manual* (W340) for further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

7-1 Overview of FINS Communications

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 Unit uses FL-net message transmissions to execute the FINS communications service. (Refer to *Vendor Message (FINS Message)* on page 90.)

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:

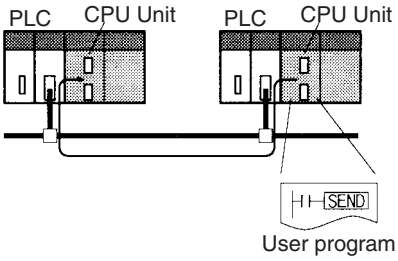
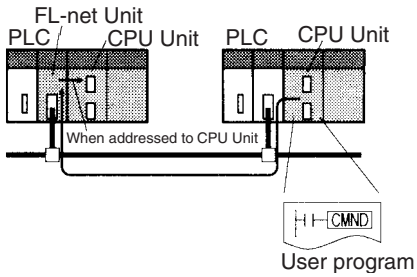
- **SEND(090)/RECV(098)**

  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 Units, refer to *7-5 Command/Response Reference*. For details regarding FINS commands addressed to CS/CJ-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	• When the PLC executes SEND(090) or RECV(098), a program is not required for receiving a response. • When the PLC receives a SEND(090) or RECV(098) instruction, a program is not required for processing the instruction. 	• When the PLC executes CMND(490), a program is not required for receiving a response. • When the PLC 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.
	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.
	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.) The CPU Unit has eight communications ports. Use one communications port to execute communications instructions for the FL-net Unit.	
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.
3. Broadcasting cannot be used with the SEND(090)/RECV(098) instructions.
4. If multiple communications ports are used to execute multiple communications instructions (SEND(090), RECV(098), and CMND(490)), an error response will be received by the FL-net Unit (error code 0x2605: Servicing in progress). Execute communications instructions for FL-net one at a time from a single communications port.

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

Area	Range
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.)

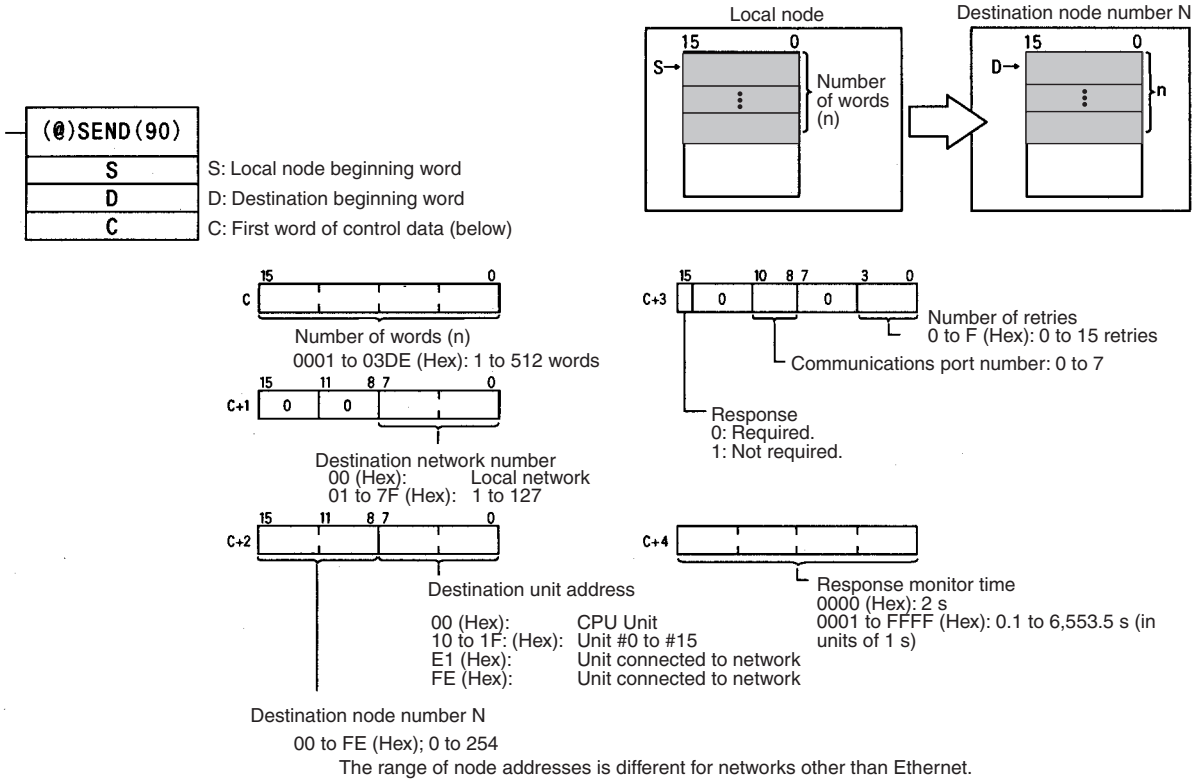
Note
1. Data cannot be written to words A000 to A447 in the Auxiliary Area.
2. A maximum of 13 banks in the EM Area can be used. For details regarding the EM Area, refer to the operation manual for the PLC that is used.

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)

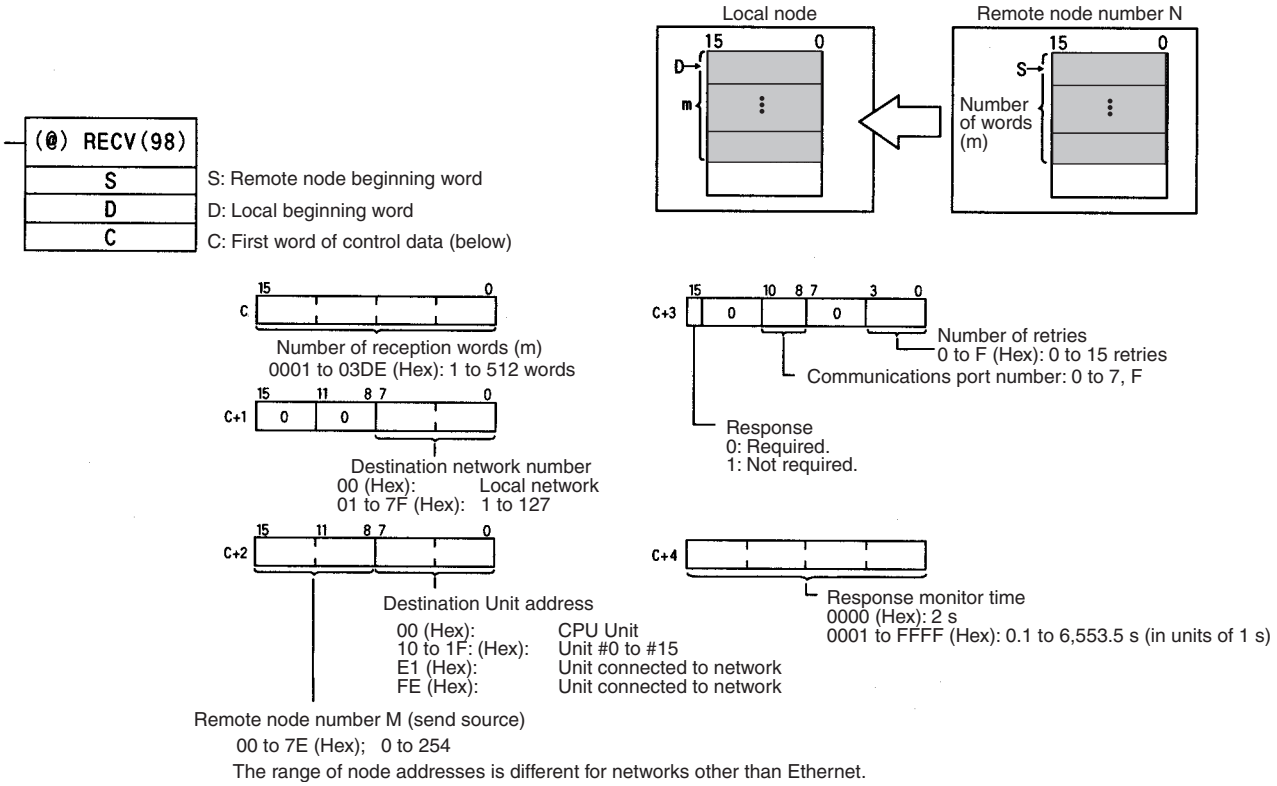
The SEND(090) instruction sends the data in n number of words, starting from the beginning word S at the local node, to the words starting from the beginning word D at the remote destination node (node number N).



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)

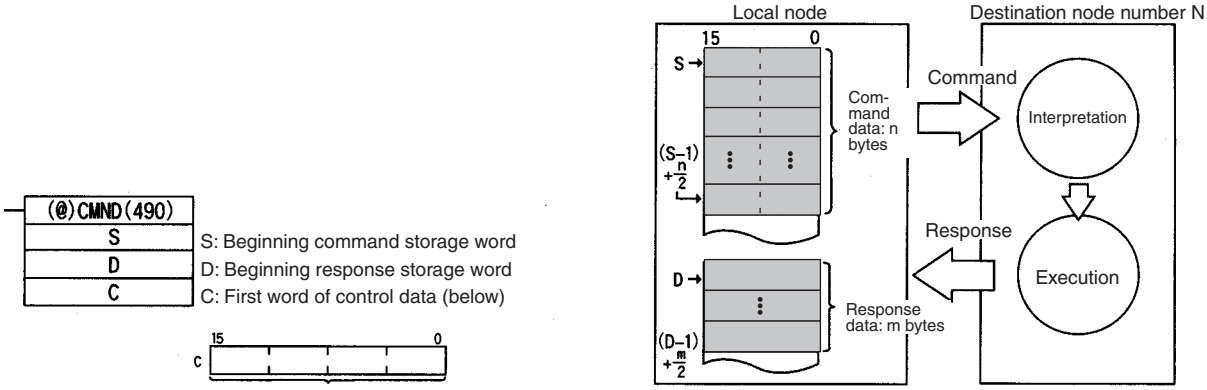
With the RECV(098) instruction, the data in m number of words, starting from the beginning word S at the remote node (node number M), is received at the words starting from the beginning word D at the local node.



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.



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/CJ-series CPU Units

The following table provides a list of FINS commands that can be processed by a CS/CJ-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 Unit, refer to *7-5 Command/Response Reference*.

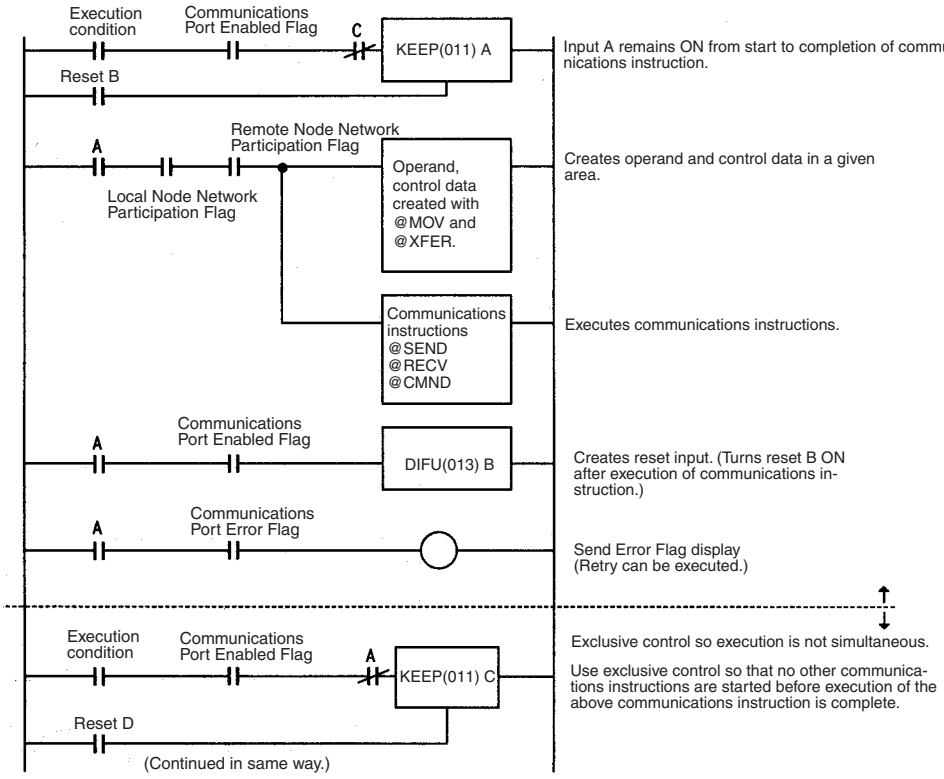
Usage	Command code		Name	Function
	MR	SR		
I/O memory area access	01	01	MEMORY AREA READ	Reads the contents of consecutive I/O memory area words.
	01	02	MEMORY AREA WRITE	Writes the contents of consecutive I/O memory area words.
	01	03	MEMORY AREA FILL	Writes the same data to the specified range of I/O 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/CJ-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.

Note CS1-H, CJ1-H CJ1M, or CS1D CPU Units (for independent CPU systems) with lot numbers 020601 (manufactured on June 1, 2002 or later) can automatically detect an available communications port. For details, refer to the automatic communications port allocations for network communications instructions in the *SYSMAC CS/CJ Series Communications Commands Reference Manual* (W342).



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/CJ-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 101.

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:

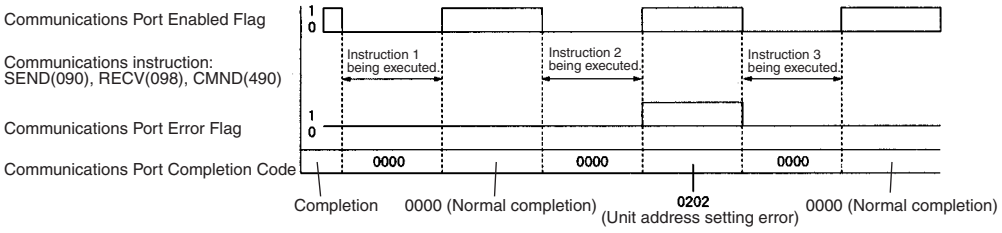
- When a response timeout error has occurred.
- When the number of communications data bytes exceeds the maximum value for the Unit (i.e., more than 1,014 bytes) after the FINS command code for the FL-net Unit.
- When the actual number of response bytes is greater than the number of reception bytes that 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.

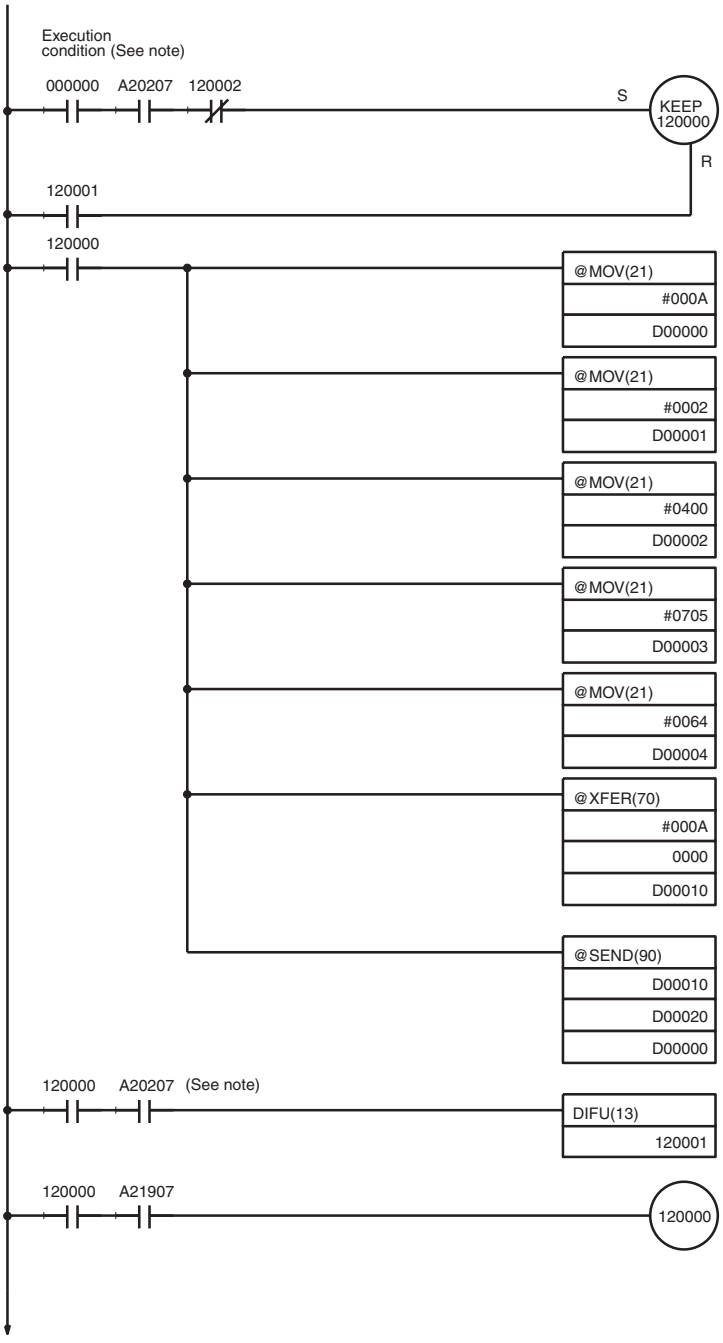
Timing of Communications Flag Changes

- 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



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.

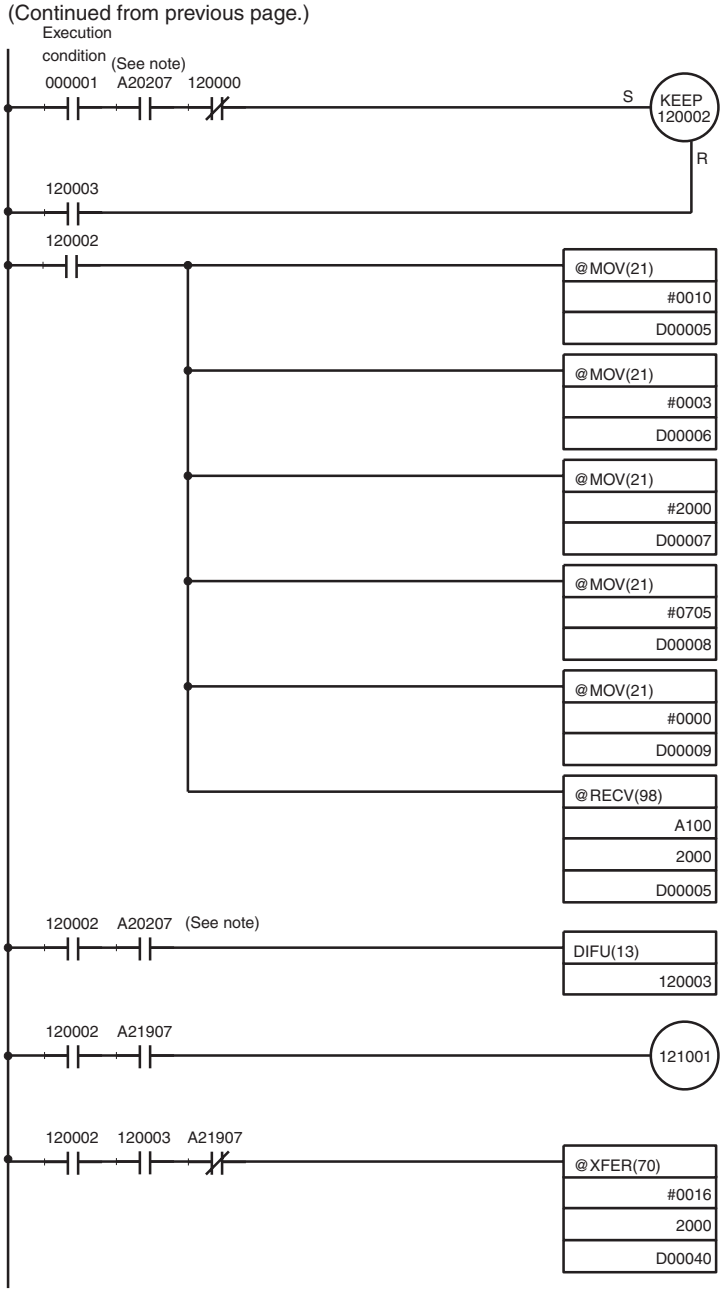
Ten words of data from D00010 at the local node is sent to D00020 onwards at network number 2, node number 4, unit address 0 (the PC).

Reset Input Creation

Send Error Display

(Continued on next page.)

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

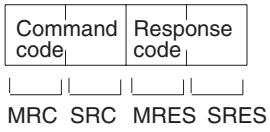
Note The WORD BLOCK DATA READ/WRITE commands with an unspecified node numbers are provided to ensure compatibility with applications created with the CS1W-FLN01. Use the WORD BLOCK DATA READ/WRITE commands with specified node numbers to create new applications.

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: 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/CJ-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 CS/CJ-series 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 Units and the responses to each command.

Reading Reference Pages

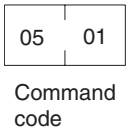
The reference pages for FINS commands are configured as follows:

- 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.

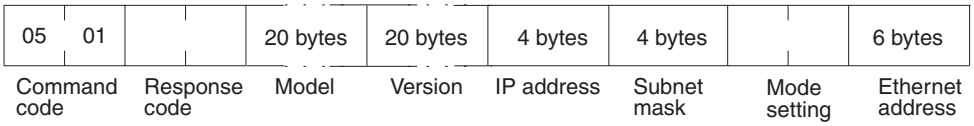
7-5-1 CONTROLLER DATA READ

Reads the controller data.

Command Block



Response Block



Parameters

Model, Version (Response)

The FL-net 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

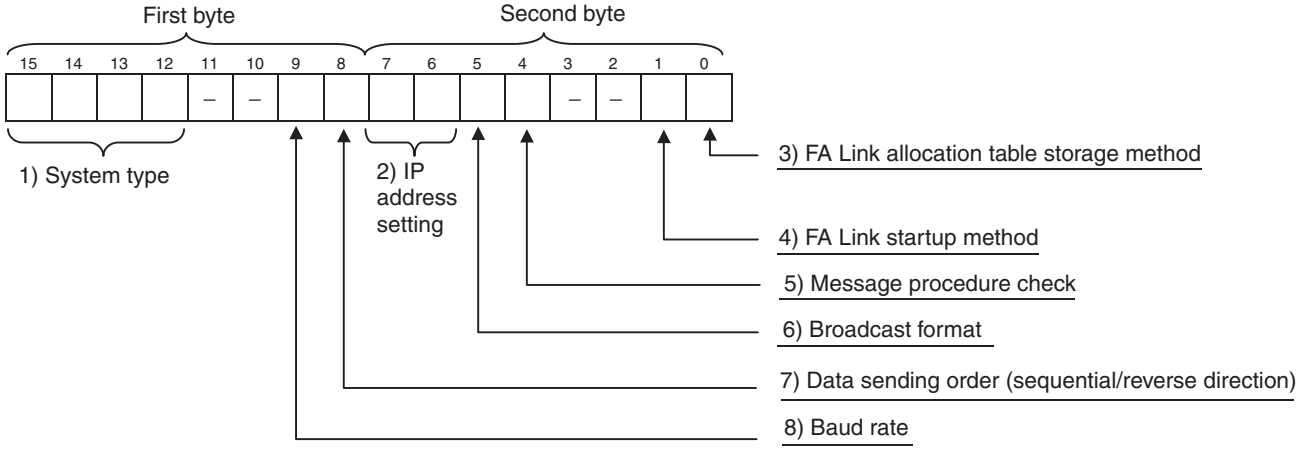
Model: CS1W-FLN22, CJ1W-FLN22

Version:V1.00

IP Address, Subnet Mask (Response)

The FL-net 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 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 CX-FLnet or FL-net Unit Support Software.
1	1	Operates with the default setting (192.168.250.*node_address_switch_setting*).

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	
0	Store in CPU Unit Stores the data link tables (FA link allocations) in the System Bus Unit setup area of the CPU Unit.
1	Store in FL-net Unit 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	Automatic Log In Communications are enabled automatically by turning ON PLC power.
1	Manual Log In 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 *Unit Control Bits (CPU Unit to FL-net Unit)* on page 52.)

5. Message Procedure Check

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

Bit	Description
1	
0	Checked Select only when sending messages between OMRON FL-net (Ver. 2.00) Units.
1	Not checked 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

7. Data Sending Order (Sequential/Reverse Direction)

Bit	Description
1	
0	Sequential order Same order as earlier FL-net Unit (CS1W-FLN02 and CS1W-FLN12).
1	Reverse order Swaps the upper/lower byte order of word data before sending data link data.

8. Baud Rate

This bit is used to set the baud rate.

Bit	Description
1	
0	10 Mbps fixed Communications are performed at 10 Mbps.
1	Automatic detection The baud rate between hubs is automatically detected. Communications are performed at 100 Mbps depending on the hub.

Ethernet Address (Response)

The Ethernet address of the FL-net Unit is returned.

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

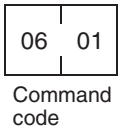
Response Codes

Response code	Description
0000	Normal
1001	Command too large

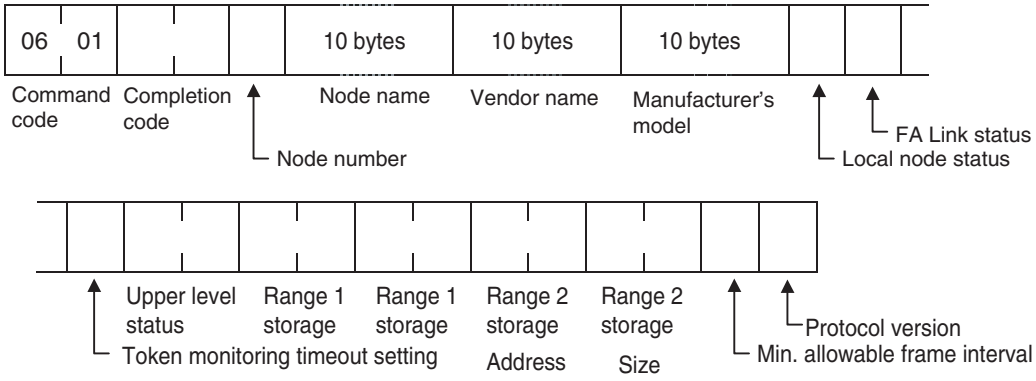
7-5-2 CONTROLLER STATUS READ

Reads the controller status.

Command Block



Response Block



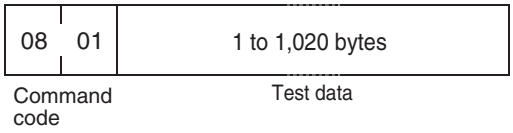
Response Codes

Response code	Description
0000	Normal
1001	Command too large

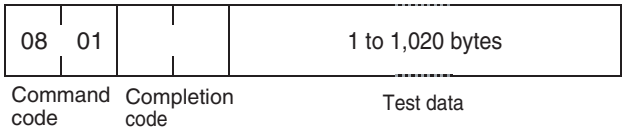
7-5-3 INTERNODE ECHO TEST

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 Unit.

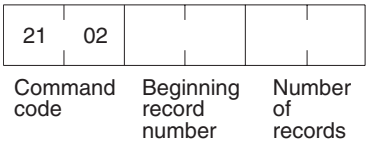
Response Codes

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

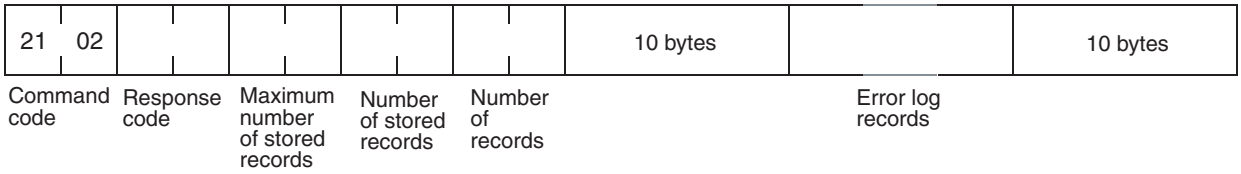
7-5-4 ERROR LOG READ

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)

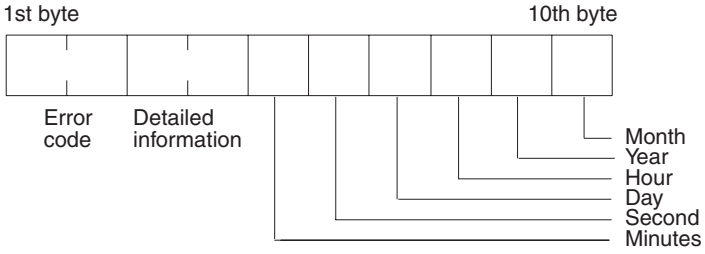
The maximum number of records that can be stored in the error log. Care is required as the error log differs according to the type of PLC or CPU Bus Unit. In an FL-net Unit, the maximum number of stored records is fixed at 40 (64 decimal).

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.

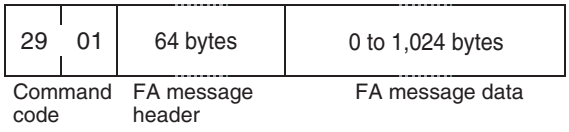
Response Codes

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.

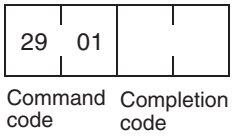
7-5-5 TRANSPARENT MESSAGE SEND

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.

Precautions

If this command is executed for a receiving node before the transparent message previously received by the corresponding node has been read by the TRANSPARENT MESSAGE RECEIVE FRAME READ (29 02) command, an error will occur (response code 0x0104: Reception buffer overflow).

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

Response code	Description
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 Unit.

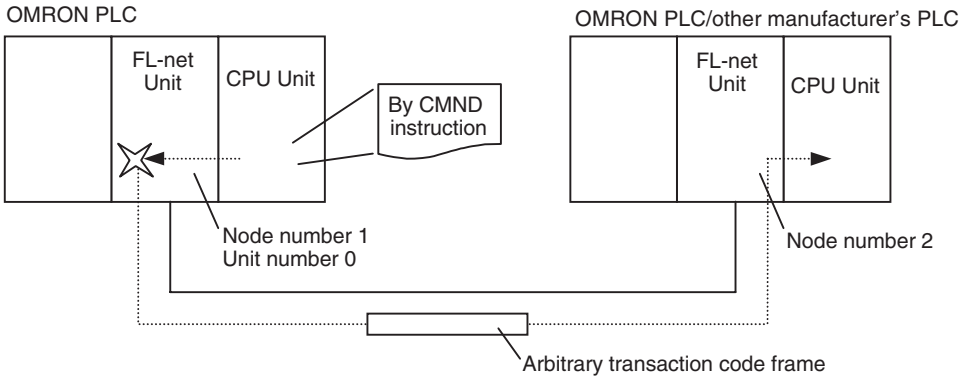
Word offset	Symbol		Item	
+0	H_TYPE (Upper)		Header type	Upper: 0x4641 fixed
1	H_TYPE (Lower)			Lower: 0x434E fixed
2	TFL (Upper)		Total byte length of header and data	Upper: 0x0000 fixed
3	TFL (Lower)			Lower: Byte length
4	SNA (Upper)		Source node address (node number)	
5	SNA (Lower)			
6	DNA (Upper)		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/WARNING/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	
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

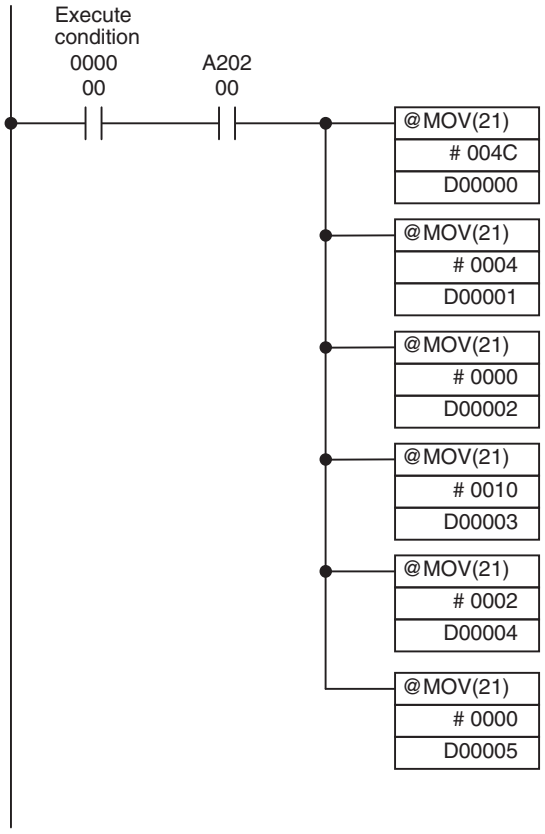
- Set the TRANSPARENT FRAME SEND command starting at D01000 in the CPU Unit.
- Send the transaction code (100) and 10-byte data to node number 2.
- Store the results of the transmission starting at D02000.

Command

[CMND S D C]

S	D01000	+0:	2901 Hex	
		+1:	4641 Hex	(Fixed)
		+2:	434E Hex	(Fixed)
		+3:	0000 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
		:		
		+32:	Data (10 bytes long)	
		:		
		+36		
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
				* Be sure to set the unit address of the FL-net Unit

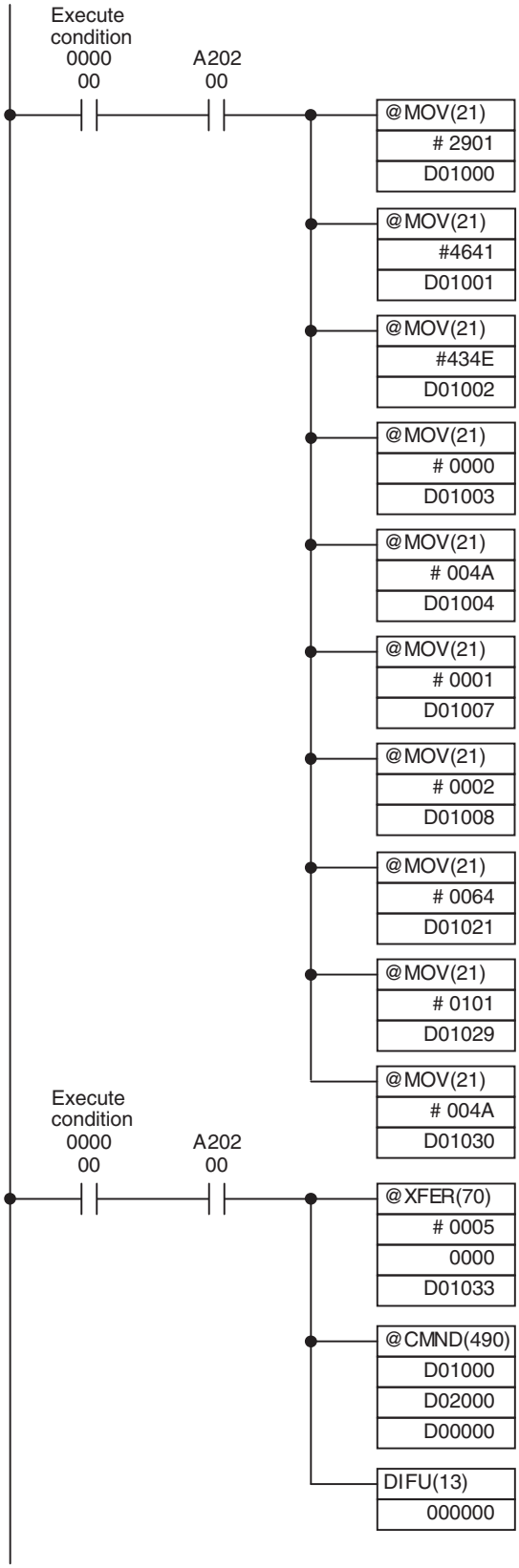
				to the unit number + 10 Hex.
			+4:	0000 Hex	Response required, communication port no. = 0, number of retries = 0
			+5:	0000 Hex	Response monitoring time (default: 2 s)
Response		D02000	+0	:2901 Hex	
			+1	:0000 Hex	Response code (completed normally)



(Continued next page.)

- 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



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

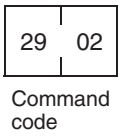
Word	Content		Meaning
D01000	29	01	Command code
D01001	46	41	H_TYPE Upper = (Fixed value)
D01002	43	4E	H_TYPE Lower = (Fixed value)
D01003	00	00	TFL Upper = (Fixed value)
D01004	00	4A	TFL Lower = 74 bytes
D01007	00	01	DNA Upper = (Fixed value)
D01008	00	02	DNA Lower = 2
D01021	00	64	TCD = 100
D01029	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 Unit using the CMND(490) instruction.
- Turns OFF execute condition 000000.

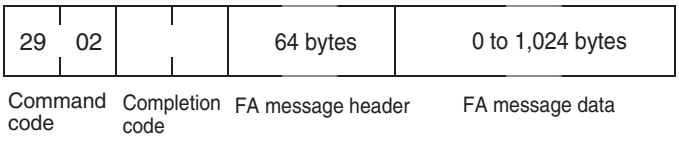
7-5-6 TRANSPARENT MESSAGE RECEIVE FRAME READ

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 (CIO 1500 + unit number × 25 + 6 words) is ON. An error response (response code 0x0001) will be returned if this command is executed when bit 1 is OFF.

Command Block



Response Block



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: 0x0000 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
+8	V_SEQ (Upper)	Sequence version number	
+9	V_SEQ (Lower)		
+10	SEQ (Upper)	Sequence number	After 0xFFFFFFFF, returns to 0x00000001
+11	SEQ (Lower)		

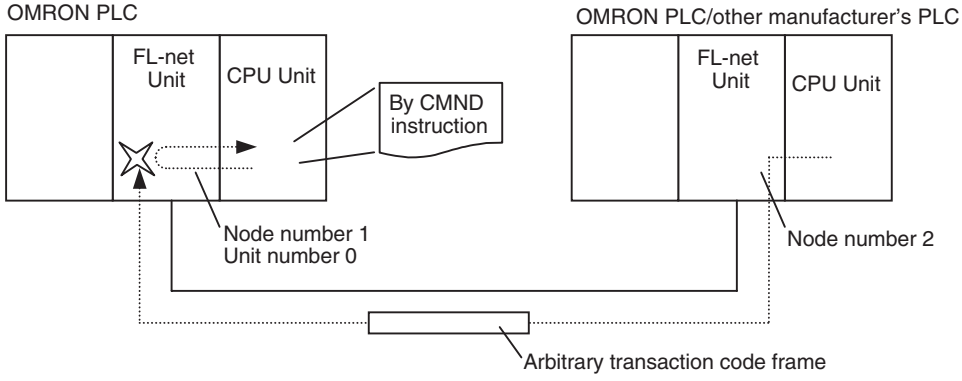
Offset	Symbol		Item	
+12	M_CTL (Upper)		Message control	
+13	M_CTL (Lower)			
+14	ULS		Upper layer status (RUN/STOP/ALARM/WARNING/NORMAL)	
+15	M_SZ		Message data size in virtual address space	
+16	M_ADD (Upper)		Offset address of virtual address space	
+17	M_ADD (Lower)			
+18	MFT	M_RLT	Minimum allowable 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.

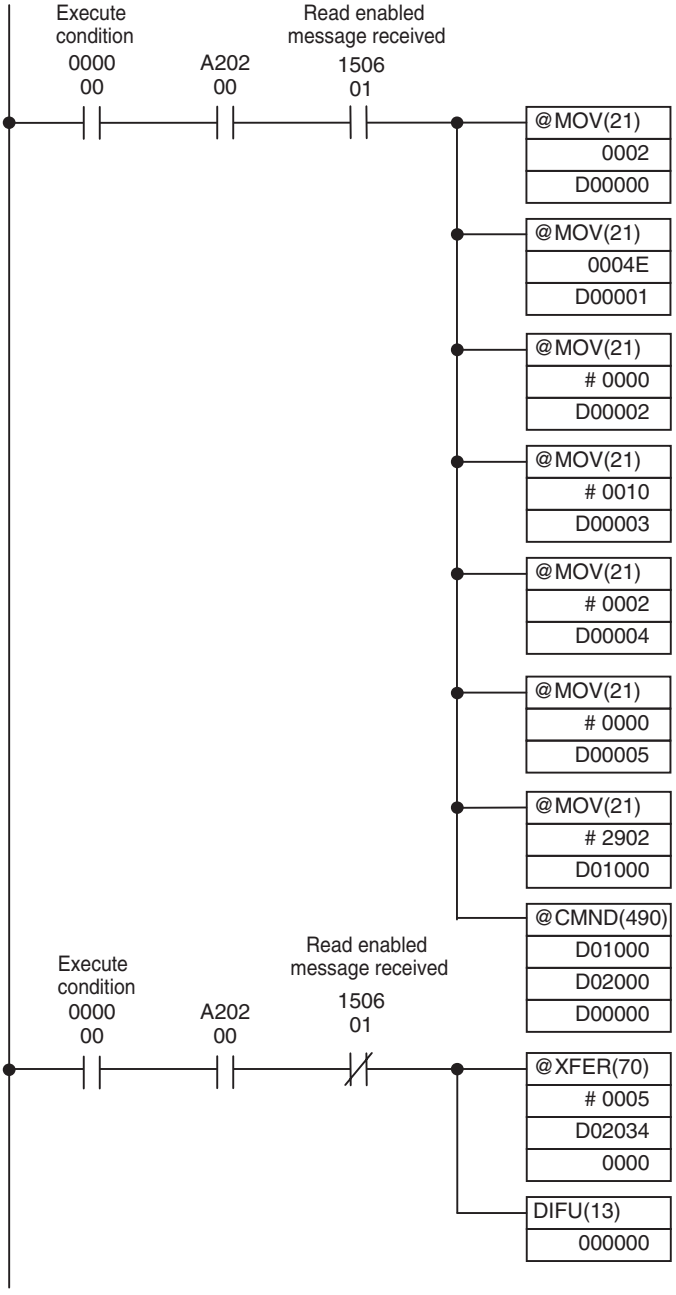


Operation

- 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	02	Command data length = 2 bytes
D00001	00	4E	Response data length = 78 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 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)

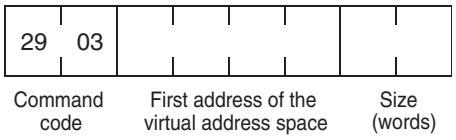
Sends the request message Word Block Data Read (Unspecified Node Number).

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 Unit, but an error will occur if the command passes through a FINS network on another layer.

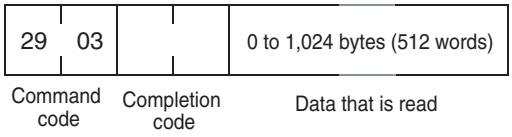
Note

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/CJ-series Memory Areas and Virtual Addresses* if the node that will be read is an OMRON FL-net Unit. If it is another manufacturer's FL-net 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

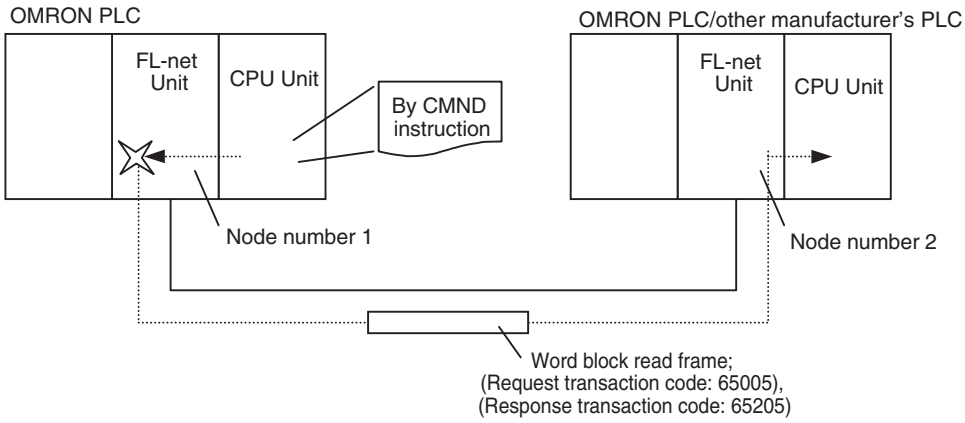
Response code	Description
0000	Normal completion
0101	Local node not part of network
0104	Reception buffer overflow, queuing not started (reception side)
0107	Unit's internal buffer full
0205	No response from remote node
1001	Command length too long
1002	Insufficient command length
1005	Sequence number 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

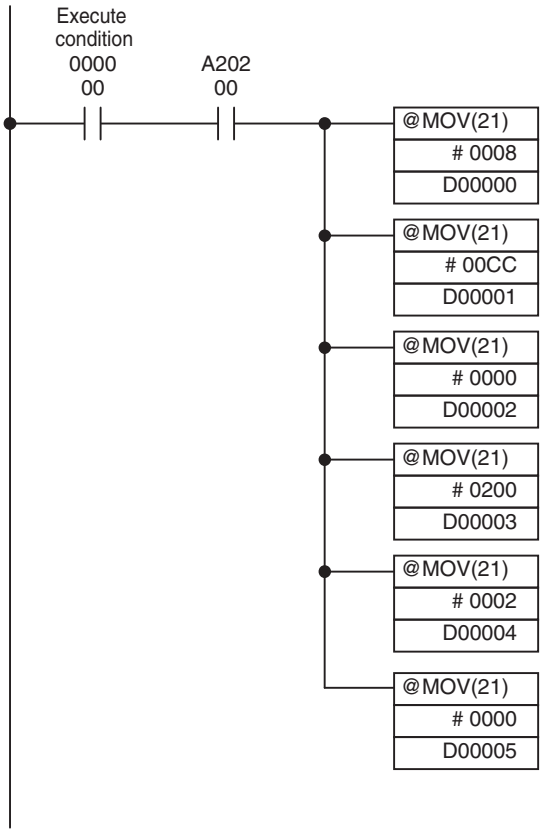
[CMND S D C]

S	D01000	+0:	2903 Hex	
		+1:	0020 Hex	First address of the virtual address space (EM0_00000)
		+2:	0000 Hex	* Refer to the manual for other manufacturer's FL-net nodes.
		+3:	0064 Hex	Size of the data that is read (100)
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 Remote (destination) unit address 00 Hex (ignore)
		+4:	0000 Hex	Response required, communications port no. = 0, number of retries = 0
		+5:	0000 Hex	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		

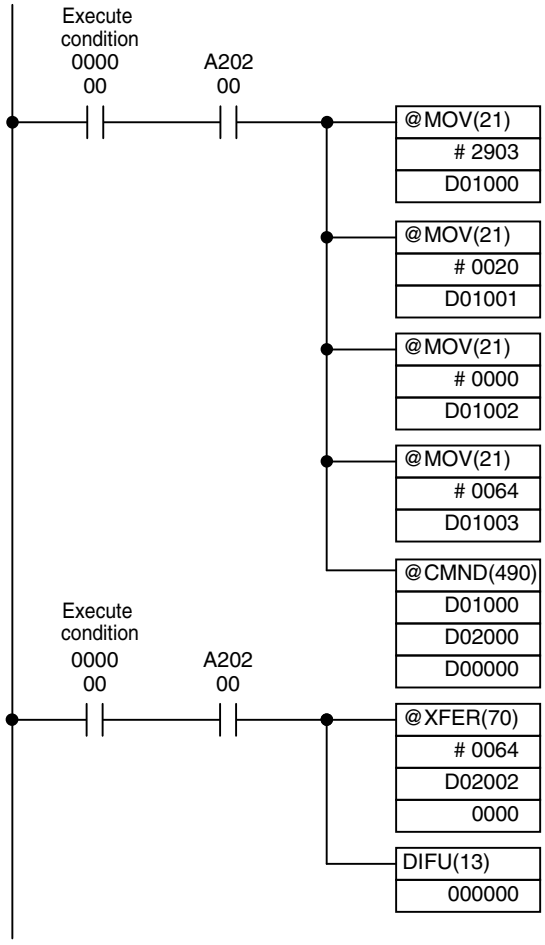
Program Example



- 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

(Continued next page)



- Creates control data starting at D01000.

- Sends the WORD BLOCK READ (unspecified node number) command to the FL-net 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)

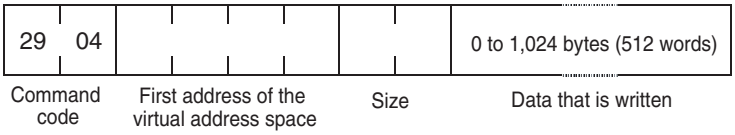
Sends a request message Word Block Data Write.

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 Unit, but an error will occur if the command passes through a FINS network on another layer.

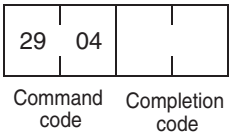
Note

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/CJ-series Memory Areas and Virtual Addresses* if the node where data will be written is an OMRON FL-net Unit. If it is another manufacturer's FL-net 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

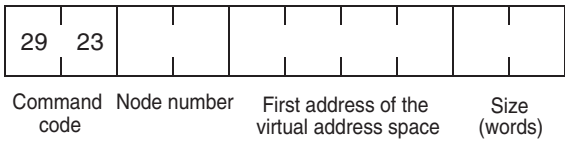
Response code	Description
0000	Normal completion
0101	Local node not part of network
0104	Reception buffer overflow, queuing not started (reception side)
0107	Unit's internal buffer full
0205	No response from remote node
1001	Command length too long
1002	Insufficient command length
1005	Sequence number 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)

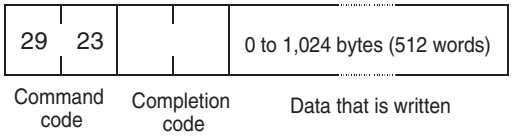
Sends the request message Word Block Data Read.

The node number specified in the FINS command block is used as the read source node number. Specify the FL-net 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 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/CJ-series Memory Areas and Virtual Addresses* if the node with data that will be read is an OMRON FL-net Unit. If it is another manufacturer's FL-net 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

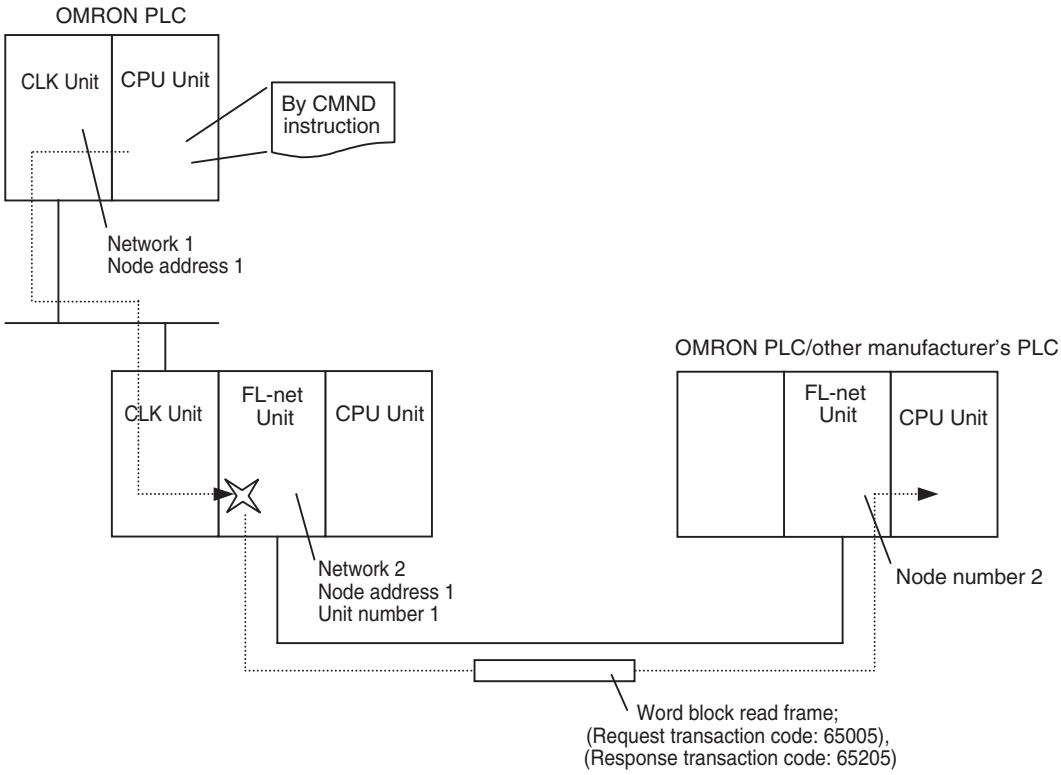
Response code	Description
0000	Normal completion
0101	Local node not part of network
0104	Reception buffer overflow, queuing not started (reception side)
0107	Unit's internal buffer full
0205	No response from remote node
1001	Command length too long
1002	Insufficient command length
1005	Sequence number 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 (specified node number) command starting at D01000 and store the response data starting at D02000 in the CPU Unit.
- Read 100 words of data from the virtual address (00020000 hex) of a non-OMRON FL-net (Ver. 2.00) node number 2 to addresses starting from 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.).

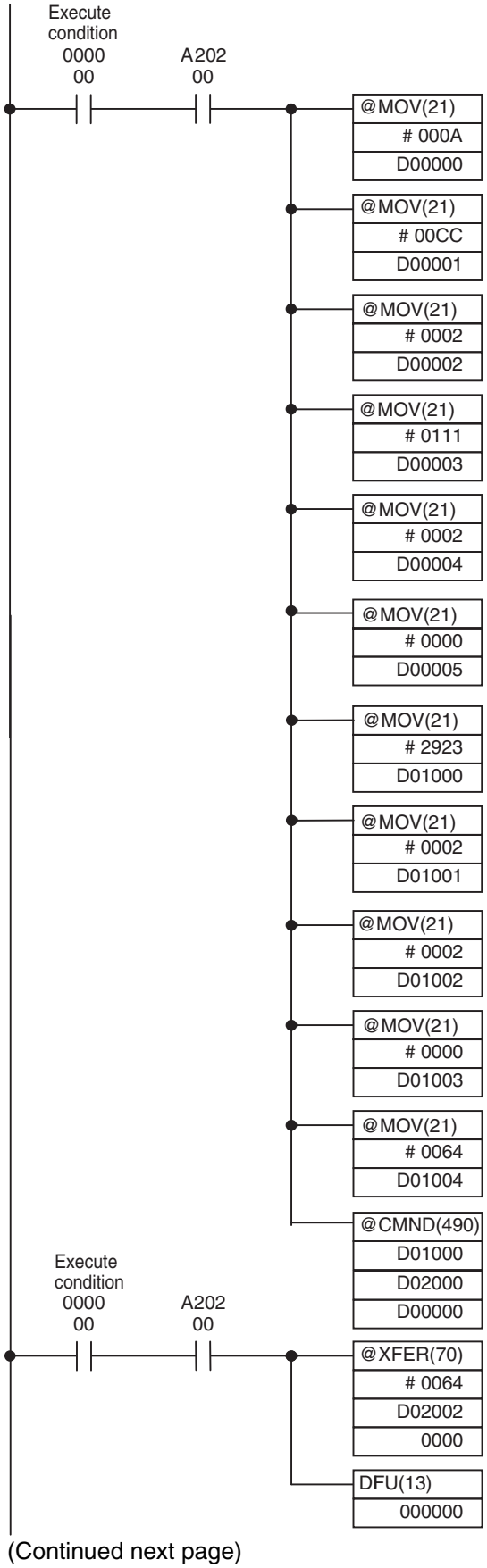
Command

[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 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 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: : +102	Data that is read (100-word long)	

Program Example



(Continued next page)

- 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.

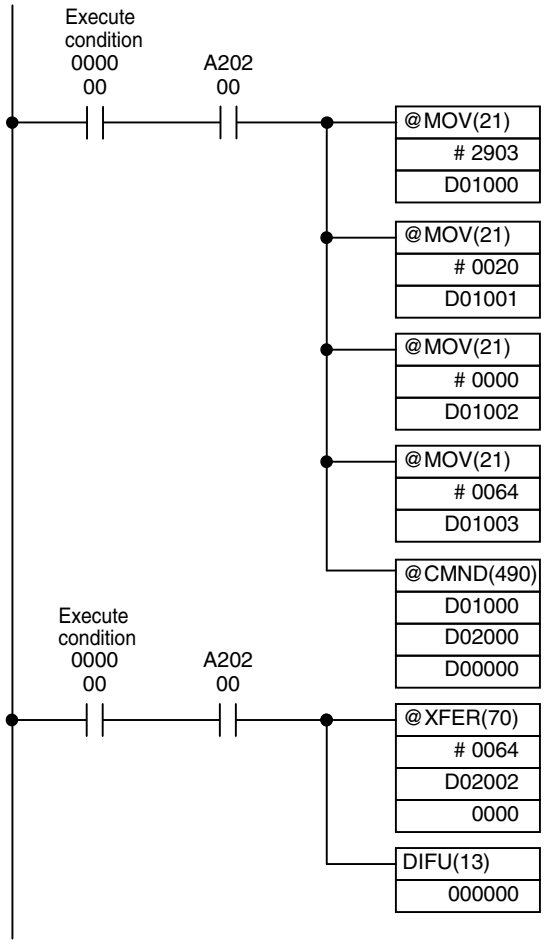
Word	Content		Meaning
D00000	00	0A	Command data length = 10 bytes
D00001	00	01	Response data length = 204 bytes
D00002	00	02	Target network address = 2
D00003	01	11	Target node address = 1 Target node number address = 11 Hex
D00004	00	02	Response required Communications port No. used = 0 Retries = 2
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 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 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).

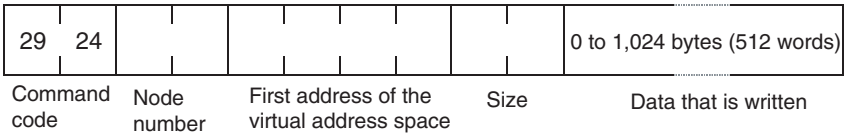
7-5-10 WORD BLOCK DATA WRITE (Specified Node Number)

Sends the request message Word Block Data Write (specified node number).

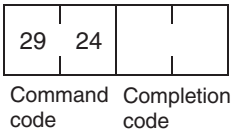
The node number specified in the FINS command block is used as the write destination node number.

The control data (network address, node address and unit address) of the CMND(490) instruction specifies the FL-net Unit that will execute the FINS command. The FINS command can be executed from the CPU Unit of the FL-net 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/CJ-series Memory Areas and Virtual Addresses* if the node where data will be written is an OMRON FL-net Unit. If it is another manufacturer's FL-net 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.

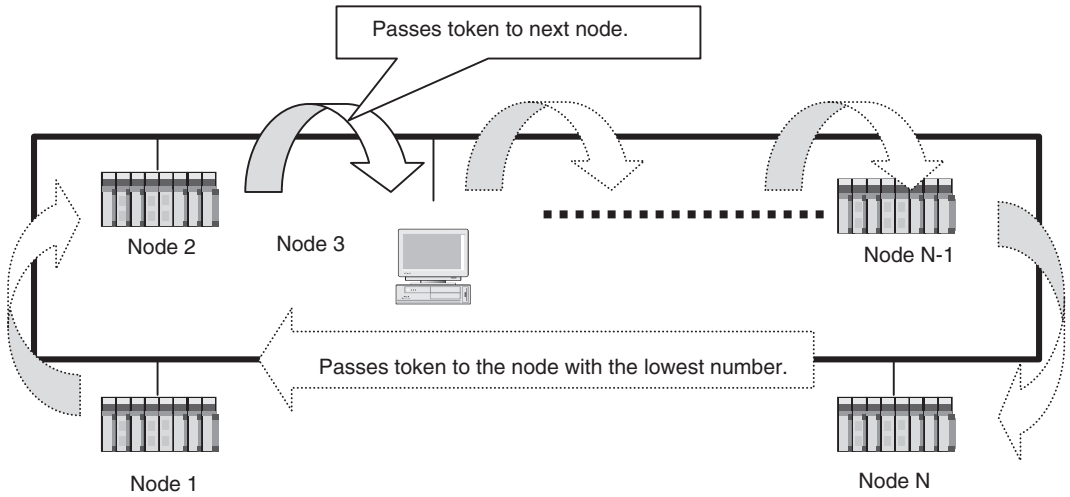
Response Codes

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

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



FL-net 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.

Calculating the Communications Cycle Time

The communications cycle time (T) is the sum total of the token holding time for each node in the network. Use the following methods to calculate the token holding time for each node and obtain the total value.

Calculating the Token Holding Time

The token holding time is the time from when the token is received at the local node until the token is sent to the next node. The communications cycle time is the sum total of the token holding time for each node in the network configuration.

Token holding time (μs) at 10 Mbps
= Number of local node data link send words × 5.1
+ Number of local node data link send frames × Minimum allowable frame interval (See note 1.) + 700

Token holding time (μs) at 100 Mbps
= Number of local node data link send words × 3.16
+ Number of local node data link send frames × Minimum allowable frame interval (See note 1.) + 400

Set a minimum allowable frame interval of at least 1 ms when using a baud rate of 100 Mbps. Use at least 1 ms when calculating the cycle time.For details on standard set values, refer to *4-4-9 Total Number of Receive Errors (FL-net Unit to CPU Unit)*.

Note

1. Number of local node data link send frames:
   When the local node data link send words (total of Area 1 and Area 2) exceeds 512 words, the data will be split into several frames.
   Number of local node data link send frames = Number of local node data link send words ÷ 512 (rounded up to nearest integer)
   Any decimal places are rounded up to the nearest integer. Therefore, if the

number of local node data link send words is 768 words, 768 ÷ 512 = 1.5, which is rounded up to 2 (frames).

2. Of the nodes in the network, the node with the highest value for the minimum allowable frame interval is used as the network's minimum allowable frame interval.
3. The token holding time when using message communications is calculated as follows:
   10 Mbps: Number of send message words × 1.6 + minimum frame interval
   100 Mbps: Number of send message words × 0.16 + minimum frame interval
4. Obtain the communications cycle time for networks that include units by other manufacturers by calculating the total sum of holding time. For information on non-OMRON units, refer to the relevant manuals for the unit.
5. The equation for calculating the communications cycle provides a rough guide only. The actual communications cycle is affected by delays at the hubs and other factors.

Token Holding Time Calculation Example

This example is calculated using the following conditions.
Example 1:

Baud rate: 10 Mbps
Number of participating nodes: 10 nodes
Total number of data link words: 680 words (68 words per node)
Minimum allowable frame interval: 100 μs
Message communications: None

Token holding time (μs)
= 68 × 5.1
+ 1 × 100
+ 700
= 1146.8 (μs)

= 1.2 ms

The number of participating nodes is 10 nodes, so the communications cycle time is calculated as 12 ms (1.2 × 10).

Example 2:

Baud rate: 100 Mbps
Number of participating nodes: 10 nodes
Total number of data link words: 6,000 words (600 words per node)
Minimum allowable frame interval: 1 ms
Message communications: None

Token holding time (μs)
= 600 × 3.16
+ 2 × 1000
+ 400
= 4296 (μs)
= 4.3 ms
The number of participating nodes is 10 nodes, so the communications cycle time is calculated as 43 ms (4.3 × 10).

Note This calculation example is for a network configuration in which each node is allocated a uniform number of data link send words. WHen the number of data link send words is different for each node, obtain the sum total of the token holding time for each node (= communications cycle time).

8-3 Influence on Cycle Time

The time required by the FL-net Unit to exchange data with the CPU Unit is shown below. Use the value obtained from this equation to calculate the approximate cycle time of the CPU Unit.

Approximate data processing time =

0.3 + Number of data link words × 0.0011 (ms)

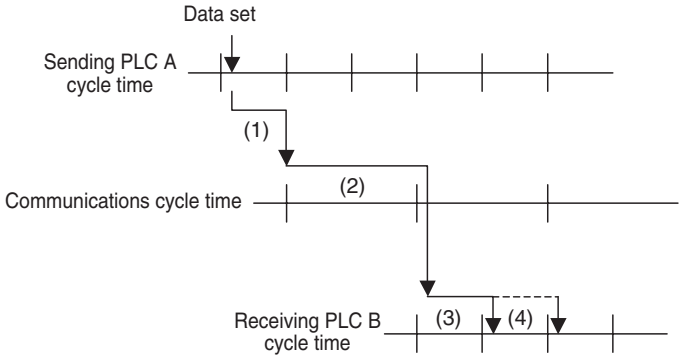
(The number of data link words: The number of data link words sent and received by the corresponding node).

Note

1. The value obtained from this equation is for a single FL-net Unit.
2. Add the event execution time when executing message services.

8-4 Calculating the Data Link I/O Response Time

The FL-net Unit I/O response time indicates the delay until data from a specified node is detected by another node on the same network. The method used to calculate I/O response time depends on the amount of data being exchanged between the FL-net Unit and the PLC (sum of the local node setup area and other node setup area).



1. After setting data in the data link area (local node setup area), the FL-net Unit requires up to one cycle until it can read the data.
2. Up to one communications cycle and the token holding time is required until the data from the local node setup area is sent on the FL-net communications line (i.e., until the token from the local node is held).
3. Up to one communications cycle is required until the data link data received from the remote node is reflected in the PLC's data link area (for up to 7,677 words of data link data (local data setup area + other node setup area)).
4. Up to two cycles are required to refresh data sent across two CPU Unit cycles when the data link data (local data setup area + other node setup area) exceeds 7,677 words.

Receiving PLC B Data Link Area (Sum of Local Node Setup Area and Other Node Setup Area): 7,677 Words Max.

Data link I/O response time =
Sending PLC A cycle time + Communications cycle time
+ Token holding time + Receiving PLC B cycle time

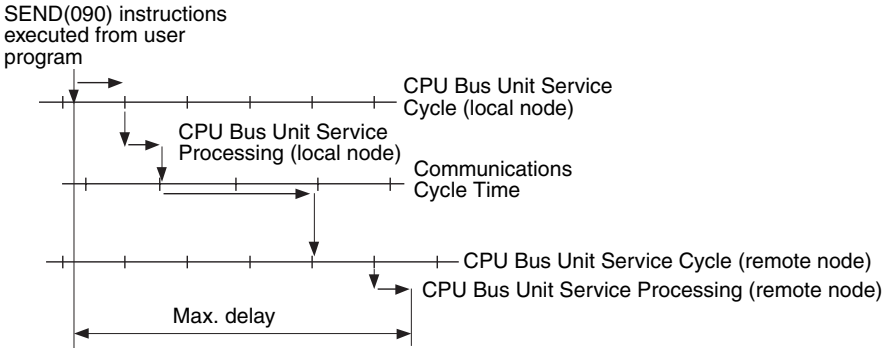
Receiving PLC B Data Link Area (Sum of Local Node Setup Area and Other Node Setup Area): More than 7,677 Words

Data link I/O response time =
Sending PLC A cycle time + Communications cycle time
+ Token holding time + Receiving PLC B cycle time × 2

8-5 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:

Transmission delay = Local node service cycle + local node service processing time + communications cycle time + token holding time + 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 Units.

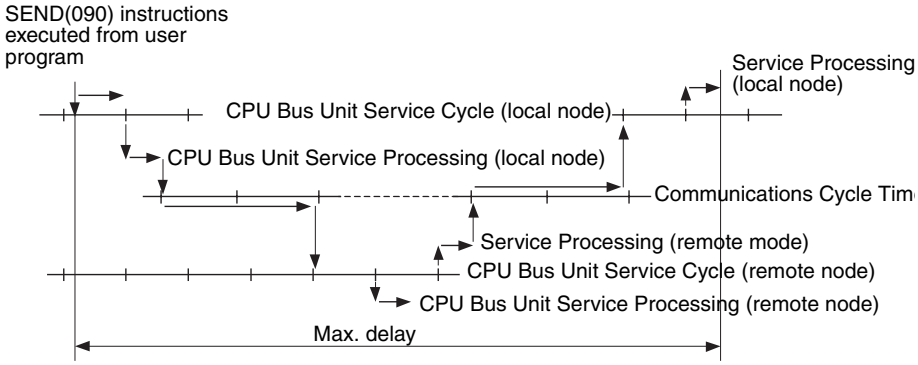
- Communications Cycle Time

  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 Unit, as well as the parameters and system configuration of the FL-net 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:

Transmission delay = Local node service cycle × 2 + local node service processing time × 2 + communications cycle time × 2 + token holding time × 2 + remote node service cycle × 2 + remote node service processing time × 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 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 Unit, as well as the parameters and system configuration of the FL-net 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

The FL-net Unit 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

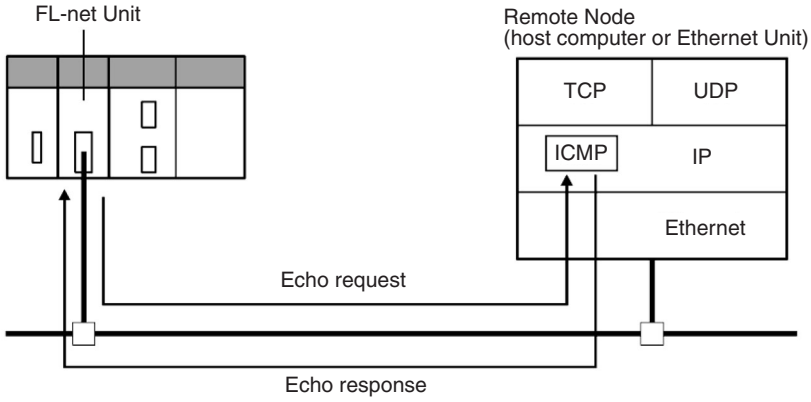
Echoback tests with specific nodes can also be performed by setting parameters in the PLC Interface Area and then manipulating specific bits in memory. This type of internode test can be performed only for nodes that support the FL-net message service.

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 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 Unit

The FL-net Unit automatically returns the echo response packet in response to an echo request packet sent by another node (host computer or other FL-net Unit. An FL-net 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 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.
ñññññ130.25.36.8 PING Statisticsñññññ
9 packets transmitted, 9 packets received, 0% packets loss
roundñtrip (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.
ñññññ130.25.36.8 PING Statisticsñññññ
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 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 setting 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 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 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 × unit number + offset)

Setting Range

The parameter setting ranges are given in the following table.

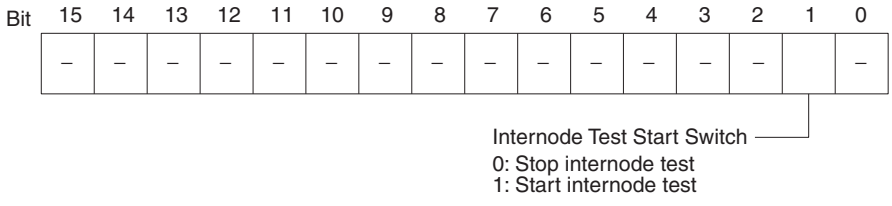
Offset	Parameter	Settable range
+1	Remote network address	01 to F9 Hex (1 to 249 decimal)
+2	Response monitoring time (unit: 10 ms)	0000 Hex: 2 sec.s 0001 to FFFF Hex (1 to 65535 decimal)

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 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:

Word = 1500 + (25 × unit number)



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

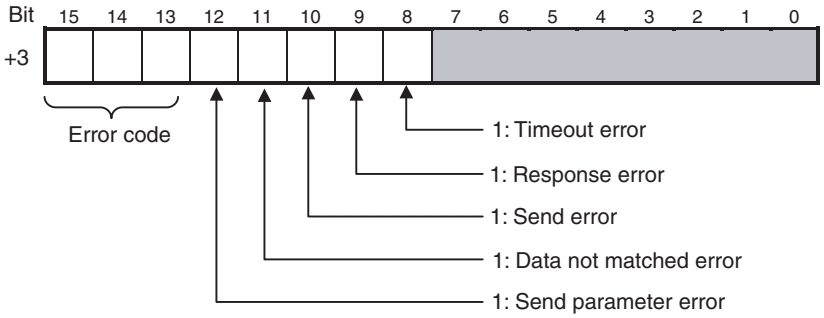
9-3-2 Checking Results

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 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:

Stored words = 1,500 + (25 × 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:

Stored words = 1500 + (25 × unit number) + 3 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

The indicators on the FL-net 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 Unit is faulty.	Replace the FL-net Unit.
			The CPU Unit or Backplane is faulty.	Replace the CPU Unit or the Backplane.
			The mounting screws on the FL-net Unit are loose.	Tighten the mounting screws to the specified torque.
Not lit	Not lit	Lit	The unit number on the FL-net 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.
			Failed to read files in Memory Card for the simple backup function.	Check that the Memory Card is installed and that the correct backup file is saved in the Memory Card.
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 Unit is faulty.	Restart the PLC. If the problem persists, replace the FL-net Unit.
Lit	Lit	---	The communications cable is disconnected. (Transceiver Error Flag: ON)	The communications cable may be disconnected. Check that the communications cable is connected securely.
			An error occurred in EEPROM.	Restart the PLC. If the problem persists, replace the FL-net Unit.
Lit	Flashing	---	The IP address is set incorrectly.	Correct the IP address. Do not set any of the following IP addresses. • 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.

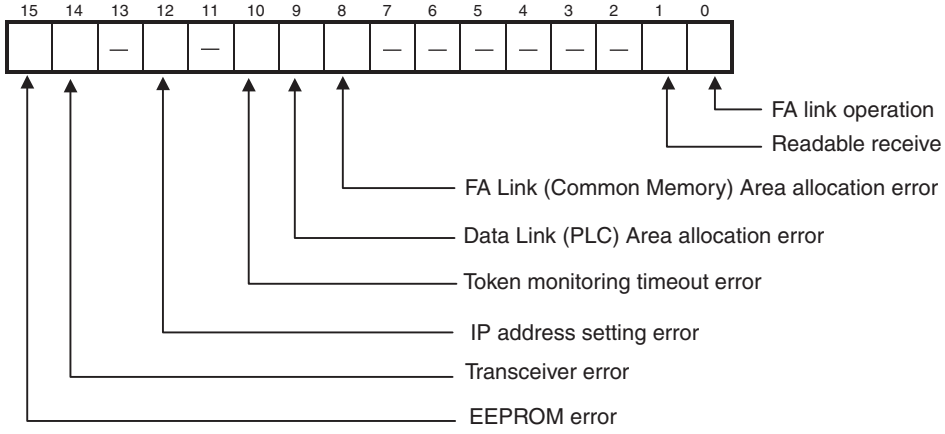
RUN	HER	PER	Probable cause	Correction
Lit	---	Flashing	The Unit was removed because it was connected to an FL-net (Ver. 1.00) network.	FL-net Units (Ver. 1.00) cannot operate on the same network as other FL-net Units. Check the configuration of the network and make sure it consists solely of compatible FL-net Units.
			Communications have stopped due to a LAN controller error (LAN Controller Error Flag: ON)	Noise or other factor may be affecting network communications. Check the grounding of the network equipment and devices. Restart the CPU Unit if this error occurs.
			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. Check that local node addresses are not allocated in an other node setup area.

10-2 Error Status

The FL-net 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)

1,500 + (25 × unit number) + 6

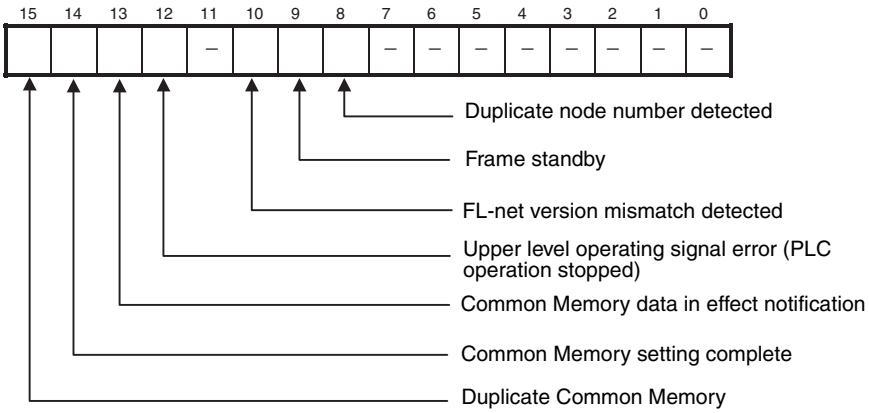


The corresponding bit will turn ON when an error occurs

Bit	Name	Correction
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 CX-FLnet or FL-net Unit Support Software 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 CX-FLnet or FL-net Unit Support Software 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 CX-FLnet or FL-net Unit Support Software.
12	IP address setting error	The following cannot be used as IP address settings. • 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.
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 Unit.

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

1,500 + (25 × 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. The routing table settings are incorrect. Correct the routing tables using CX-Integrator.
13	Common Memory data in effect notification	This bit turns ON if the Common Memory of the FL-net 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 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 Unit operation.

10-3-1 Error Log

The error log records errors that have occurred during FL-net Unit operation. Errors recorded in the log can be read by FINS command. (Refer to *ERROR LOG READ* on page 111.)

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 Unit. Serious errors are also recorded in EEPROM. The maximum number of errors that can be saved to EEPROM is 32. The errors recorded in EEPROM will be saved even if the Unit is restarted or power is turned OFF. When the FL-net 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 FL-net Unit's error log can be read using the CX-FLnet or FL-net Unit Support Software. The following FINS commands can also be used to read or clear the error log. For details on each command, 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	01: Read error 02: Write error	03: Routing table 04: Setup error 05: CPU Bus Unit Words (CIO/DM)	Replace the CPU Unit.	Saved
0012	CPU Unit memory error			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
0040	Self-removal	Undefined		Check the communications cable hub connection. Use the CX-FLnet or FL-net Unit Support Software to increase the value for the minimum allowable frame interval.	---

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 Unit are loose.	Tighten the screws on the FL-net Unit.
				An error occurred in the FL-net Unit.	Restart the PLC. If the problem persists, replace the FL-net 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 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 Unit.	Restart the PLC. If the problem persists, replace the FL-net 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-Integrator 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-Integrator.
				The System Setup is not correct.	Use the CX-FLnet or FL-net Unit Support Software to correct the System Setup and restart the PLC.
				The simple backup function is being used without the Memory Card installed, or the backup file does not exist in the Memory Card.	Install the Memory Card and check that the the Memory Card contains the correct backup file.
Lit	Lit	---	---	An error occurred in the FL-net Unit EEPROM.	Restart the PLC. If the problem persists, replace the FL-net Unit.
Lit	---	Flashing	---	An unavailable CPU Unit Area was set in the Data Link table settings.	Use the CX-FLnet or FL-net Unit Support Software to correct the System Setup and restart the PLC.
Lit	Flashing	---	---	The IP address is set incorrectly.	Use the CX-FLnet or FL-net Unit Support Software to correct the IP address setting. Restart the PLC after changing 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 Unit was removed because it was on an FL-net (Ver. 1.00) network.	FL-net 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 Units.

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 HUB power supply indicator lit?	Check the power supply, power cable connection and voltage.
Unstable or failed communications		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 network using four repeaters max.
		Is the distance between the hub and nodes (cable length) within 100 m?	Reconfigure the network with a distance between the hub and nodes of 100 m max.
		Are the hubs turned ON?	Check the hub power supply and power cable connection.
		Is the correct communications cable connected?	Use the correct communications cable, referring to *1-5 Specifications*. For a baud rate of 100 Mbps, the cable must be category 5 or 5e.
		Is the communications cable connector correctly attached?	Check that the communications cable connector is securely attached.
		Is the communications cable wired correctly (straight/crossed)?	Check the hub specifications and use the correct wiring for the cable. Check the hub settings.
		Are the hub settings correct?	Correct the settings if the hub uses SCADA ports or individual settings for each port. For details, refer to the hub's operation manual.
		Are there too many cascade connections from the switching hub?	Switching hubs are subject to transmission delays. Therefore, the cycle time will be affected if multiple switching hubs are connected using cascade connections. Either increase the minimum allowable frame interval or reconfigure the network.
		Are Ethernet communications other than FL-net being performed on the same network?	Communications will not be performed correctly if another network is combined with the FL-net network. Make sure that only FL-net communications are performed on the FL-net network.
		Is the network load too high?	If a high network load (data link capacity, number of nodes) is high, increase the value of the minimum allowable frame interval. The minimum allowable frame interval can be changed using the CX-FLnet or FL-net Unit Support Software. After changing the setting, restart the FL-net Unit or cycle the PLC power.

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 Unit set properly?	Use a Programming Device or analyzer to re-check the unit number that was set.
		Are the FL-net 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 Unit settings.
		Does the LNK (link) indicator remain lit?	Re-check the parameter settings for the FL-net Unit.

10-4-3 FINS Communications Problems for SEND(090), RECV(098), and CMND(490)

Did the completion code end normally?	Refer to *10-1 Troubleshooting with Indicators* as well as the *10-3 Error Log*.
Is the control data set properly?	Correct the network address, node address and unit address in the FINS address settings.
Is an IP address set that has the same HOST ID as a remote node?	Use the IP address setting switches (rotary switches at the back of the Unit) or the CX-FLnet or FL-net Unit Support Software to correct the IP address setting. If you are using the IP address setting switches, you must turn the PLC OFF and disconnect it from the network to reset it. If you are using the CX-FLnet or FL-net Unit Support Software, restart the PLC after you change the setting.
Are you communicating with nodes on another network in the FINS address system?	Check to see if the relay path (routing table) is defined for FINS messages. Use the CX-Integrator to create the correct routing table. Please note that all CPU Bus Units and INNER Boards will reset automatically if you use the CX-Integrator to define the routing table.

10-4-4 Checking IP Address Using PING Command

The PING command can be used from a Windows computer to check the FL-net device connections and IP address settings, without requiring the FL-net Network Analyzer or other special Programming Device. An overview of operation using the PING function are provided in the following table.

Checking IP connection using PING	Use the PING command to check that IP connections are correct.
	1) From Windows, Select ***Start - Programs - MS-DOS Prompt*** to display the MS-DOS window, as follows
	Microsoft (R) Windows (C) Copyright Microsoft Corp xxxx.xxxx C:\WINDOWS>
	2) Enter the PING command, and execute the basic internode test between the Link Unit and personal computer. Enter the PING command as either Ping[IP address] or Ping[Host name]. IP Address Example: Ping 192.168.250. 13 The following message will be displayed if the corresponding FL-net device setting is correct.
	Pinging 192.168.250. 13. with 32 bytes of data Reply from 192.168.250. 13. 13 bytes=32 time=2ms TTL=32 Reply from 192.168.250. 13. 13 bytes=32 time=1ms TTL=32 Reply from 192.168.250. 13. 13 bytes=32 time=1ms TTL=32 C:WINDOWS>
	3) The following message will be displayed for a timeout due to a failed (NG) connection.
	Pinging 192.168.250. 13. with 32 bytes of data Request timed out. Request timed out. Request timed out. Request timed out. C:WINDOWS>

10-4-5 Basic Troubleshooting Check List

If you think there is a problem with the system, check the following general points first.

No.	Item
1	Is the FL-net Unit installed correctly?
2	Are the FL-net Unit switches set correctly?
3	Is the FL-net Unit's IP address set correctly?
4	Is the Common Memory Area set correctly?
5	Are any of the FL-net Unit connectors or other connections loose?
6	Are the communications cables connected correctly?
7	Is cross cable being used for a 10Base-T/100Base-TX system?
8	Does the 10Base-T/100Base-TX cable have category 5 specifications?
9	Is power being supplied to the Ethernet Hubs and Repeaters?

10-4-6 General Precautions for FL-net (Ver. 2.00)

Refer to the FL-net transmission path standards earlier in this manual or to IEEE802.3. The following restrictions and precautions also apply specifically to FL-net Ver. 2.00.

No.	Details
1	Communications data from other Ethernet networks cannot be transmitted on FL-net (Ver.2.00) communications cables.
2	Do not connect the FL-net (Ver.2.00) to a router.
3	Switching hubs are not effective on FL-net (Ver. 2.00) networks.
4	Infrared and wireless media will greatly reduce the realtime communications performance.
5	The realtime communications performance will be greatly affected by the personal computer capacity and the OS and applications being used.
6	Use the specified IP addresses. Network addresses must be in order (the standard network address is 192.168.250). IP address node numbers (station numbers) within the input range are recommended. Network address: 192.168.250 Node number: 1 to 249 Duplication of node numbers cannot be checked in the initial settings. Duplication will not be detected until communications are started and a node number duplication error occurs.
7	Make sure that the ground line is connected properly and is sufficiently thick.
8	Install the FL-net cables sufficiently far away from noise sources and avoid laying cables beside power lines.
9	Realtime performance will deteriorate by the data capacity and other factors when cyclic data communications and message data communications are performed simultaneously.
10	The area used for cyclic data communications (Common Memory Area) does not need to be allocated sequentially.
11	Set the SQE switch on the transceiver correctly according to the instruction manual.

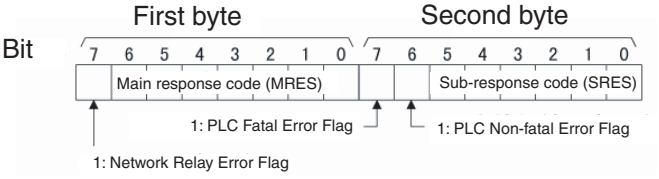
No.	Details
12	The regular communications of the entire system are affected by the processing capacity of connected devices. Perform communications using the communications processing speed for all devices connected to the network that matches the communications processing capacity (minimum allowable frame interval) of the slowest device. Therefore, the realtime performance for the entire system may be greatly reduced by adding devices to the network.
13	The header section of message data is big endian, but the data is little endian. The system parameters in the data of transparent messages and profile read data, however, is big endian. (Big endian data indicates a transmission method that sends the MSB first).

10-4-7 Troubleshooting According to Response Codes

You can troubleshoot the errors in FL-net communications from the response codes when the SEND(090), RECV(098), or CMND(490) instructions have been used. For the storage areas of response codes for SEND(090), RECV(098), and CMND(490) instructions, refer to *Communications Port Completion Codes* on page 101 in *7-2 Sending Commands from a PLC*.

The table below lists response codes (main and sub-codes) returned for the FL-net Unit. Refer to the relevant operation manuals for information on response codes for the CPU Unit, other CPU Bus Units, or FA computers using FINS communications.

The 6th, 7th, and 15th bits of the response codes have specific functions. The 15th bit will be ON when a network relay error has occurred. Refer to information given after the following table for more information on relay errors. The 6th bit or 7th bit will be ON when an error has occurred in the destination CPU Unit. Remove the cause of the error at the destination CPU Unit, referring to the operation manual for the CPU Unit. The meaning of the response codes are shown below.



Main response code		Sub-response code		Check point	Probable cause	Remedy
Value	Meaning	Value	Meaning			
00	Normal completion	00	---	---	---	---
01	Local node error	01	Local node not in network	Local IP address, node number	Message cannot be sent because the node is not participating in the network.	Correct the local IP address and node number.
		04	Reception buffer overflow (receiving node)	System load	No available space n internal buffer of receiving node.	Correct the user application to reduce the load (traffic) at the FL-net Unit.
		07	Local node busy, cannot send	System load	The internal buffers are full because there is too much traffic at the local node, preventing data from being sent.	Correct the user application to reduce the load (traffic) at the FL-net Unit.

Main response code		Sub-response code		Check point	Probable cause	Remedy
Value	**Meaning**	**Value**	**Meaning**			
02	Remote node error	00	Command data error	Command data	An error response was returned for the command executed at the remote node.	Check the command data and status of the remote node.
		01	Remote node not in network	IP address table, IP router table	IP address of remote node not set correctly in IP address table or IP router table.	Set IP address of remote node into IP address table and, if internetwork transmission is required, into the IP router table.
		05	Response timeout	Response to CONTROLLER STATUS READ FINS command	Message packet was corrupted by transmission error.	Increase the number of transmit retry attempts.
				Control data in instruction	Response monitor time interval too short.	Increase the value for the response monitor time parameter.
				Read error log	The transmission frame may be corrupted or the internal reception buffer is full.	Check the error log and correct as required.
04	04: Not executable (Service not supported.)	01	Unsupported command	Command code	An undefined command has been used.	Check the command code.
				FINS header frame length	A short frame (4 bytes) is being used for the FINS header frame.	Check the FINS header frame length. The FL-net Unit does not support short headers.
05		01	Routing table setting error	Routing tables	Remote node address is not set in the routing tables.	Set the destination address in the routing tables.
		02	Routing tables not registered	Routing tables	Cannot determine destination because routing tables have not been created.	Set routing tables at the local node, remote node, and any relay nodes.
		03	Routing table error	Routing tables	Routing table error	Set the routing tables correctly.
		04	Too many relays	Network configuration	The maximum number of network levels (3) was exceeded in the command.	Redesign the network or reconsider the routing table to reduce the number of relay nodes in the command. Communications are possible on three network levels, including the local network.

Main response code		Sub-response code		Check point	Probable cause	Remedy
Value	**Meaning**	**Value**	**Meaning**			
10	Command format error	01	01: Command too long	Command data	The command is longer than the max. permissible length.	Check the command format and set the command data correctly.
					Broadcast transmissions exceeded 1,473 bytes.	
		02	Command too short	Command data	The command is shorter than min. permissible length.	
		03	Element-data mismatch	Command data	The designated number of data items differs from the actual number in the command data.	Check the number of items and the data, and make sure that they agree.
		05	Header parameter error	Command data	Data for another node on the same network was received from the network.	Check the command format and set the command data correctly.
					An attempt was made to send response data for a broadcast address.	
			Sequential error	---	An error response was returned for the instruction executed at the remote node.	Check the status of the remote node.
11	Parameter error	03	Address specification out of range	First word address in command data	The first word in the command is in an inaccessible area.	Set a first word that is in an accessible area.
					The bit number is not 00.	Check the variable area specified in the results storage area and set the bit number to 00.
		04	Address range exceeded	Command data	The address set in the command is not correct.	Correct the address in the command data, being sure that the beginning address plus the number of elements does not exceed the accessible memory.
		0B	Response too long	Command data	The response frame is too long.	Correct the number of data elements or other parameters in the command data for which the response is being returned.
		0C	0C: Parameter error	Parameters in command data	Parameters are set incorrectly in the command data.	Check the command data and correct any parameters that are incorrect.
26	Command error	05	Servicing in progress	System load	Execution of the previous command has not been completed.	Correct the user application to reduce the load (traffic) at the FL-net Unit.
30	Access control error	00	EEPROM access error	---	The EEPROM device has deteriorated.	Restart the CPU Unit. If the error recurs, replace the FL-net Unit.

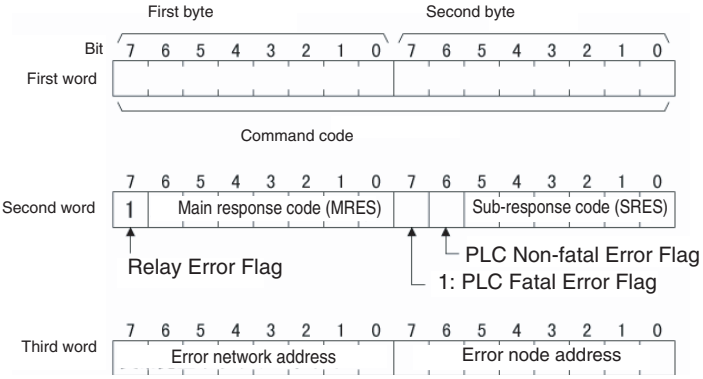
Network Relay Errors

SEND(090) or RECV(098)

For network relay errors using SEND(090) or RECV(098), check the path of the command using the routing tables and the nature of the error using the response code to eliminate the cause of the error.

CMND(490)

For network relay errors using CMND(490), the location of the relay error is recorded in the second through third words of the response, as shown below.



Check the node in which the error occurred, and remove the cause of the error in that node.

10-5 Maintenance

The FL-net Unit makes up part of a network. Repair a defective FL-net Unit as soon as possible as it can have a negative effect on the entire network. We recommend that customers keep one or more spare FL-net Units to allow immediate recovery of the network.

Replacing an FL-net Unit

Observe the following precautions when replacing the FL-net Unit.

- Always turn OFF the power supply before replacing the FL-net Unit.
- Check that the spare FL-net Unit is operating normally before replacing a defective Unit with it.
- When returning a defective Unit for repairs, provide as much written information as possible on the symptoms of the problem.
- If a problem occurs with poor contacts, wipe the contacts with a clean cloth soaked with industrial alcohol. Carefully remove any lint remaining on the contacts before replacing the Unit.

Settings after Replacing an FL-net Unit

After replacing an FL-net Unit, set the following to the same settings as were used on the previous Unit.

- Unit number
- Node address
- Local IP address
- System Setup (only when using the Unit built-in method)

Settings after Replacing a CPU Unit

The EEPROM in the CPU Unit holds the information listed below. This information must be stored in any new CPU Unit used to replace a defective one.

- Routing tables
- System Setup

10-6 Inspections

Perform regular inspections to ensure that the FL-net Unit is functioning to its optimum capacity.

Items

Most of the parts that make up an FL-net Unit are semiconductor components. None of the parts in the Unit will wear out after a specific lifetime, but some parts may deteriorate due to extreme operating conditions. Therefore, it is important to inspect the Unit regularly.

Inspection Interval

Normally inspect once or twice per year. Choose the inspection period according to the severity of the operating conditions. New installation should be inspected more frequently until they are judged to be stable.

Inspection Items

Correct any of the items in the table below not conforming to the specified standard

Item	Details	Standard
Environment	Temperature around Unit	0 to 55°C
	Humidity around Unit	10% to 90% (with no condensation)
	Accumulated dust	No accumulated dust
Mounting	FL-net Unit firmly attached	No looseness
	Transceiver cable connector fully pushed in	No looseness
	Condition of transceiver cable	No visible abnormality
	Twisted-pair cable connector fully pushed in	No looseness
	Condition of twisted-pair cable	No visible abnormality

Tools Required for Inspection

The following tools are needed to inspect the FL-net Unit:

Standard Tools

- Flat-blade and Phillips screwdrivers
- Tester or digital voltmeter
- Industrial alcohol and a clean cloth

Tools Required Under Special Circumstances

- Synchroscope
- Pen oscilloscope
- Thermometer and hygrometer

Replacing CS1W-FLN12 with CS1W-FLN22

Use the following procedure to replace CS1W-FLN12 with CS1W-FLN22.

1,2,3...

1. Read the CS1W-FLN12 settings using the CX-FLnet or FL-net Unit Support Software.

Note The IP address setting method must be changed in the system settings if it is set to use either the rotary switch on the rear of the Unit or the rotary switch on the rear of the Unit + the node number. Refer to the following information under *Changing the IP Address Setting Method*.

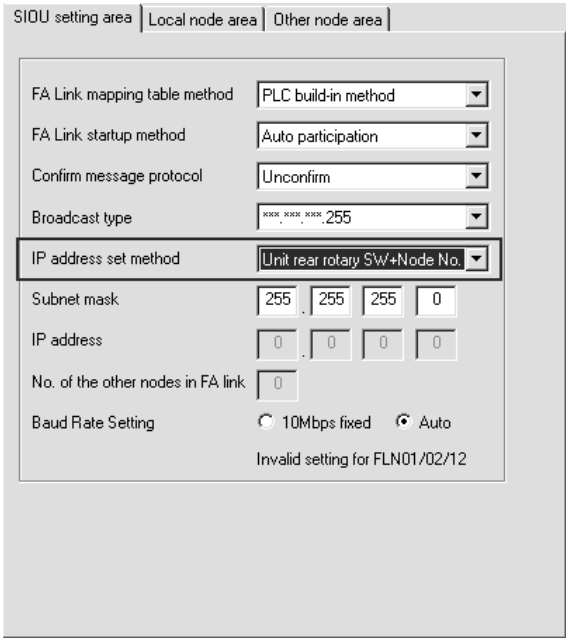
2. Set the hardware switches of the new CS1W-FLN22 to the same values as the CS1W-FLN12 being replaced. Use the rotary switches on the front of the Unit to make these settings.
   - Unit number setting rotary switch
   - Node address setting rotary switch

3. Turn OFF the power to the PLC, remove the CS1W-FLN12, and install the CS1W-FLN22.
4. Turn ON the power to the PLC and check that the RUN indicator on the CS1W-FLN22 is lit.
5. Write the data that was read using the CX-FLnet or FL-net Unit Support Software. Select ***System setting*** and ***Unit area setting***, and then click the **Write** Button in each of the dialog boxes to write the settings.
6. Restart the CS1W-FLN22 or cycle the PLC power to enable the new settings. Make sure that the RUN indicator on the CS1W-FLN22 is lit.

Changing the IP Address Setting Method

The IP address setting method must be changed to either the default setting (*192.168.250 + node No.*) or *Setup area* if the IP address for the CS1W-FLN12 was set using the rotary switch on the rear of the Unit. Use the following procedure to change the IP address setting method.

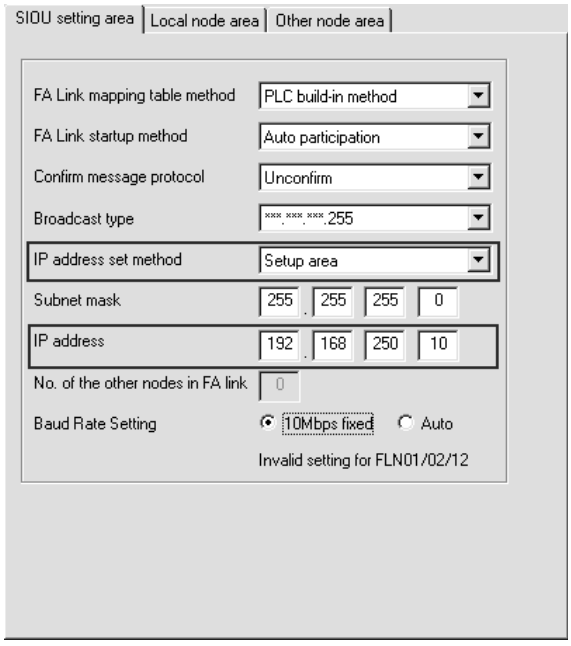
1,2,3... 1. From the CX-FLnet or FL-net Unit Support Software, read the settings from the CS1W-FLN12.
Check whether the IP address setting method is set to *Unit rear rotary SW + node No.* or *Unit rear rotary SW*.



2. Turn OFF the power to the PLC, remove the CS1W-FLN12, and confirm the IP address of the corresponding node from the settings for the IP address setting rotary switch on the rear of the Unit and the node address setting switch on the front of the Unit.

3. Select either of the following settings as the new IP address setting method.
   - 192.168.250 + node number
   - Setup area

   The address specified as 192.168.250 + node number is the default network address for the FL-net standard. The node number corresponds to the value set using the node address setting rotary switch on the front of the Unit. When *Setup area* is selected, enter the IP address for the CS1W-FLN12 confirmed in step 2.



4. Click the **OK** Button.
   For the remaining settings, refer to the procedure under *Replacing CS1W-FLN12 with CS1W-FLN22* and write the settings fro the new CS1W-FLN22. Each of the settings is enabled when the FL-net Unit is restarted or the PLC power is cycled.

Note

1. The CS1W-FLN22 (and CJ1W-FLN22) do not support the IP address setting methods *Unit rear rotary SW + node No.* or *Unit rear rotary SW.* If either of these methods is set the HER indicator on the front of the Unit will be lit red. Use the above procedure to correct the IP address setting method to either *192.168.250 + node No.* or *Setup area*.
2. Consider the following points when replacing a CS1W-FLN22 with a CS1W-FLN12.
   The following new functions provided by the CS1W-FLN22 cannot be used with a CS1W-FLN12.
   - Automatically detecting baud rate (100 Mbps)
   - Setting data link data order

   Even if these settings are transferred to the CS1W-FLN12, the FL-net Unit will operate using a baud rate of 10 Mbps and the data link data order will be in sequential order.
3. To replace a CS1W-FLN22 with another CS1W-FLN22, use the CX-FLnet or FL-net Unit Support Software Ver. 1.60 or later. If an earlier version of the FL-net Unit Support Software is used, the new functions of the CS1W-FLN22 cannot be set (i.e., the FL-net Unit will operate using a baud rate of 10 Mbps and the data link data order will be in sequential order).

Replacing Units Using the Simple Backup Function

The simple backup function can be used to replace Units when using a CS1-H, CJ1-H, CJ1M, or CS1D CPU Unit.

Note

1. The Memory Card must be installed in the CPU Unit to enable the simple backup function.
2. The simple backup function is supported by CS1W-FLN22 and CJ1W-FLN22 FL-net Units. The simple backup function cannot be used with CS1W-FLN02 or CS1W-FLN12. Refer to *Replacing CS1W-FLN12 with CS1W-FLN22* for details on replacing CS1W-FLN02 and CS1W-FLN12 FL-net Units.

1,2,3...

1. Turn ON the power to the CPU Unit and install the Memory Card.
2. Turn ON pin 7 of the DIP switch on the front of the CPU Unit.
3. Press the Memory Card power supply button for 3 seconds to write the set-up data to the Memory Card.
   The data will start being written to the Memory Card, during which time the MCPWR indicator on the front of the CPU Unit will be lit. The indicator will turn OFF after writing has completed normally, at which time all the setup data including the CPU Unit's ladder program will be saved as a file in the Memory Card in the CPU Unit.
4. Turn OFF the power to the CPU Unit and replace the FL-net Unit.
5. Set the rotary switches on the front of the new FL-net Unit (CPU Bus Unit number and node address) to the same settings as the previous FL-net Unit.
6. Make sure that pin 7 of the DIP switch on the front of the CPU Unit is turned ON to enable the setup data to be read from the Memory Card, and then turn ON the power to the CPU Unit. The FL-net Unit will start reading the data from the Memory Card, during which time the MCPWR indicator on the front of the CPU Unit will be lit. The indicator will turn OFF after reading has completed normally, at which time all the setup data including the CPU Unit's ladder program will be read to each Unit from the Memory Card in the CPU Unit.
7. Turn OFF the power to the CPU Unit and turn OFF pin 7 of the DIP switch on the front of the CPU Unit.
8. Turn ON the power to the CPU Unit and check the indicator display and status of the FL-net Unit.

Note For details on the simple backup function (e.g., procedures, file configuration, indicator displays), refer to the section on simple backup operation in the *SYSMAC CS/CJ-series Programmable Controllers Programming Manual* (W394).

SECTION 11
CX-FLnet Support Software Operations

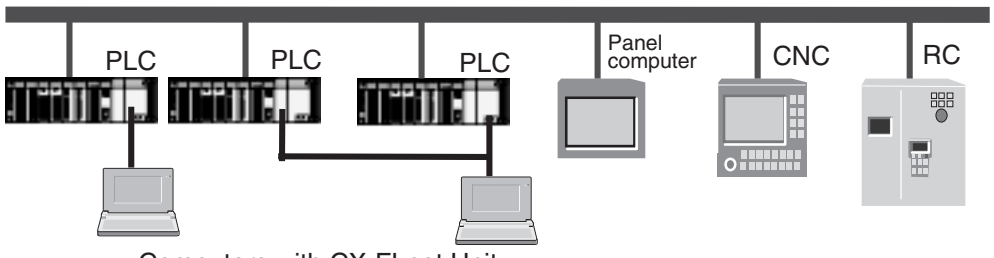
This section describes the CX-FLnet Support Software used to make settings for FL-net Units.

11-1 CX-FLnet

Overview

The CX-FLnet Support Software is used to make settings for OMRON FL-net Units mounted to Programmable Controllers (PLCs). The CX-FLnet Support Software is installed on a computer running Windows 7 (32-bit or 64-bit edition), Vista (32-bit or 64-bit edition), or XP (32-bit edition).

The CX-FLnet can be used to make settings for the following FL-net Units: CJ1W-FLN22, CS1W-FLN22, CS1W-FLN12, CS1W-FLN02, CS1-FLN01



CX-FLnet Functions

The CX-FLnet provides mainly the following functions.

Function	Description
Online connection	The following two methods can be used for connection. • Direct PLC Connection Perform the settings after making a direct serial connection to each PLC to which FL-net Units are mounted. • Connection via a Network Online connection and settings are made from the PLC connected to the computer running CX-FLnet (i.e., the gateway PLC) to each PLC (i.e., the target PLCs) to which FL-net Units are mounted via the FL-net network or other networks (e.g., Ethernet or Controller Link).
Settings	The following settings can be made. • CPU Bus Unit Setup Area • Data Link Setup - Local Node Setup Area - Other Node Setup Area - Extension Setting - Unit Area Setup (token watchdog timer)
File	Communications settings for the online connection and data link settings can be saved and read in CSV format.
Monitor	• Data Link Status • FL-net Unit Status (FA Link active status, transceiver power supply, received message or not, token monitoring timeout setting exceeded, and IP address setting error) • Communications Cycle Time • Message Sequential Status • FL-net Unit Error Log • Status of nodes participating in the FL-net network

Applicable Computers

The CX-FLnet is available only as one of the features of the CX-One FA Integrated Tool Package. Refer to the *CX-One Setup Manual* (W444) for details on the computer system requirements for the CX-One.

The following table shows the amount of hard disk space used when the CX-One is installed with only the CX-FLnet component selected.

CX-One component	Hard disk space used	Note
CX-FLnet	About 1 MB	Hard disk space used when only the CX-FLnet is selected during installation.
CX-Server and PLC Support Software	About 300 MB	These components are always installed.

Required Software

The following software must be installed on the same computer to use the CX-FLnet.

1. CX-FLnet
2. CX-Server (the communications driver)

CX-FLnet Availability

The CX-FLnet is available only as a component of the CX-One FA Integrated Tool Package. Refer to the *CX-One Setup Manual* (W444, provided with the CX-One) for the CX-One installation and uninstallation procedures.

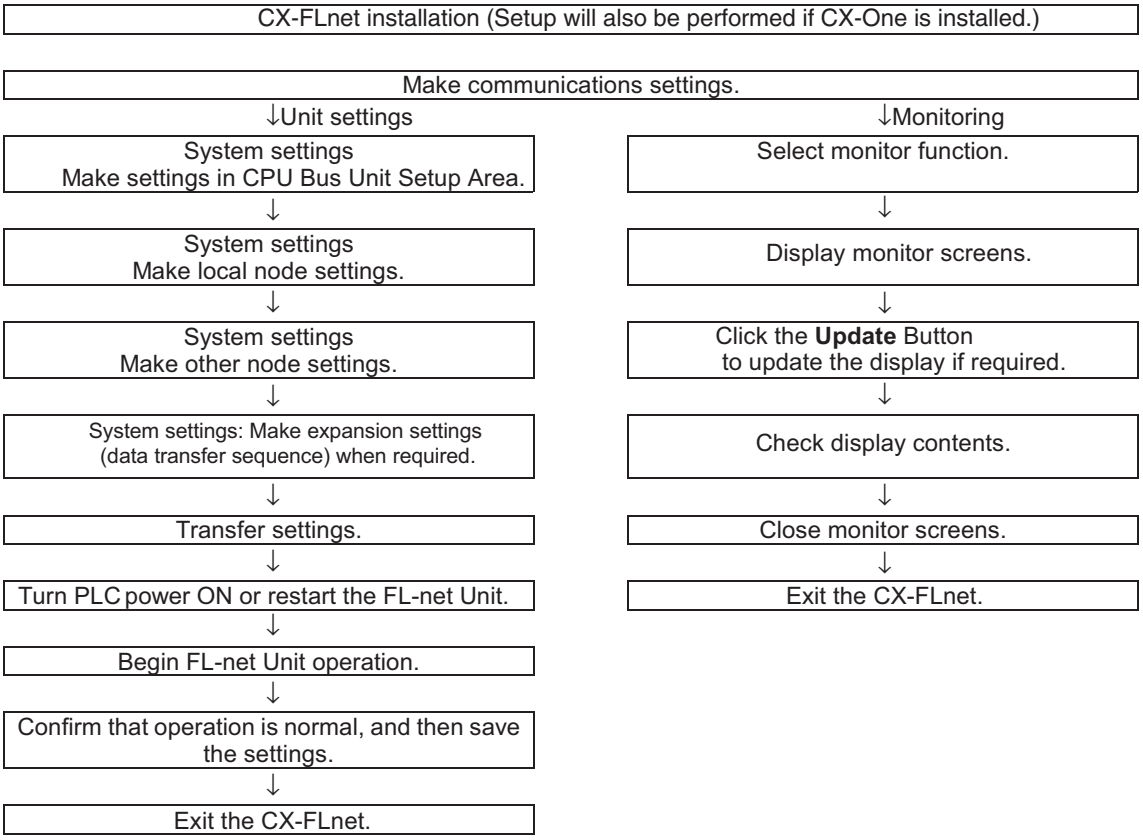
Cat. No.	Model	Manual name	Contents
W444	CXONE-AL□□C-E	CX-One Setup Manual	An overview of the CX-One FA Integrated Tool Package and the CX-One installation procedure

Checking the Package

Refer to the *CX-One Setup Manual* (W444) for details on the contents of the CX-One package that includes the CX-FLnet.

Cat. No.	Model	Manual name	Contents
W444	CXONE-AL□□C-E	CX-One Setup Manual	Installation and overview of CX-One FA Integrated Tool Package.

CX-FLnet 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 Operating Procedures

11-2-1 Starting

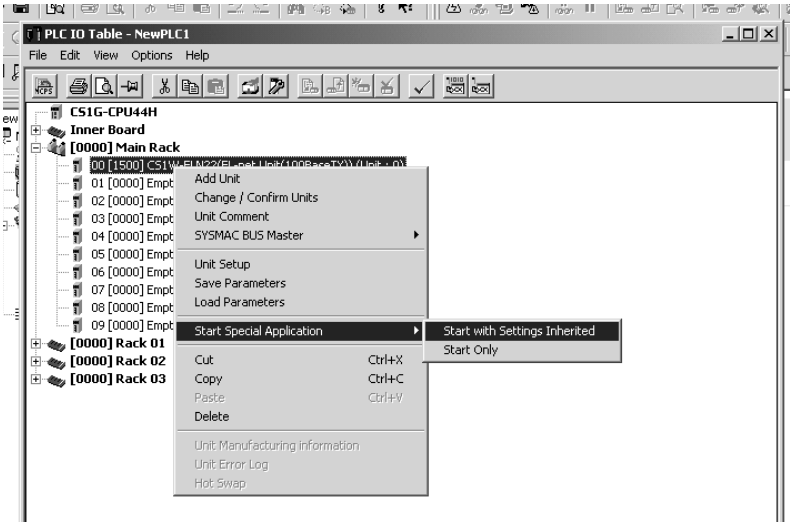
There are two methods of starting CX-FLnet.

Starting from the Start Menu

1,2,3...
1. Click the **Start** Button.
2. Select ***Program*** - ***OMRON - CX-One*** - ***CX-FLnet***.

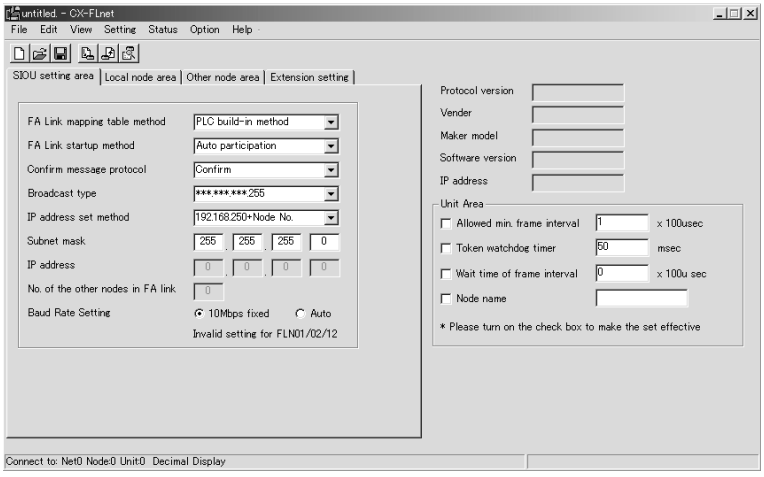
Starting from the CX-Programmer

1,2,3...
1. Click the I/O tables in the Project Workspace Window in the CX-Programmer.
2. Add an FL-net Unit to the I/O tables. (If the CX-Programmer is online to the PLC, transfer the I/O tables from the PLC to the computer.)
3. Right-click the FL-net Unit and select ***Start Special Application*** from the pop-up menu.



Note After starting the CX-Programmer inheriting the settings from the I/O tables, if ***File - New*** is selected, the unit number of the FL-net Unit for the communications setting will be cleared (i.e., default unit number 0). Reset the unit number of the FL-net Unit.

11-2-2 Main Window



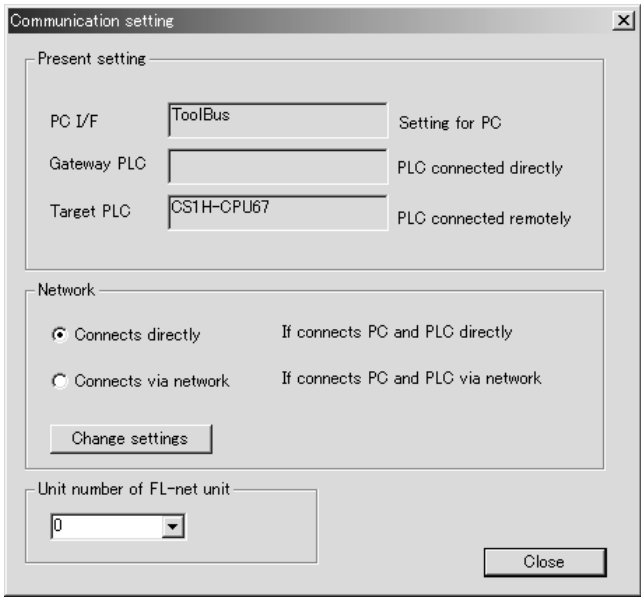
Menu	Command	Contents
File	New	Initializes the setup data to the defaults.
	Open	Reads saved setup data.
	Save	Saves edited setup data.
	Save As	Saves edited setup data with a new file name.
	Open for previous version	Reads setup data saved by previous FL-net Support Software (V1.*)
	Exit	Quits the CX-FLnet.
Edit	Clear all	Clears all entries in the mapped area table of other node areas.
	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.

Menu	Command	Contents
View	Toolbar	Switches the toolbar display.
	Status bar	Switches the status bar display.
Setting	To PLC	Writes to the setup data of the specified Unit.
	From PLC	Reads the contents of the setup data of the specified Unit to the computer.
	Compare with PLC	Compares system settings on the computer with the PLC.
	Network setting	Makes network settings to communicate with the PLC.
Status	Datalink Status	Shows the FL-net network data link status.
	Error Status	Shows the FL-net Unit error status.
	Communication cycle time	Shows the communications cycle time of the FL-net network.
	Message sequential status	Shows the message sequence status.
	Error log	Shows the FL-net Unit error log.
	Node status	Shows the node status in the FL-net network.
	Network status	Shows the FL-net network status.
Option	Extension setting	Changes the order of link data bytes.
	Switch display	Switches the display between decimal and hexadecimal.
Help	Index	Shows the help files.
	Version	Shows the CX-FLnet version.

11-2-3 Network Settings

This section explains how to connect the PLC to a computer on which the FL-net Unit Support Software is installed. These settings are not required if the CX-FLnet is launched from the I/O Table Component of the CX-Programmer. Change the communications settings in the following cases.

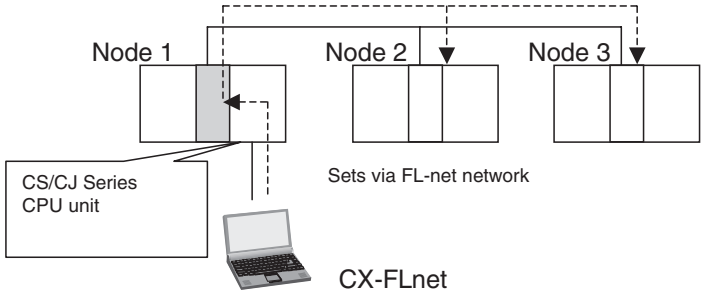
- When the CX-FLnet is launched from the I/O Table Component without inheriting network settings.
- When the CX-FLnet is started from the Windows Start Menu.
- When the FL-net target node is changed (i.e., when the network address, node address, or unit number is changed).



Note The network type (i.e., *Connects directly* or *Connects via network*) should normally be set to *Connects directly*. Use the *Connects via network* setting when connecting the computer to a C-series or CVM1/CV-series PLC.

Connecting Directly

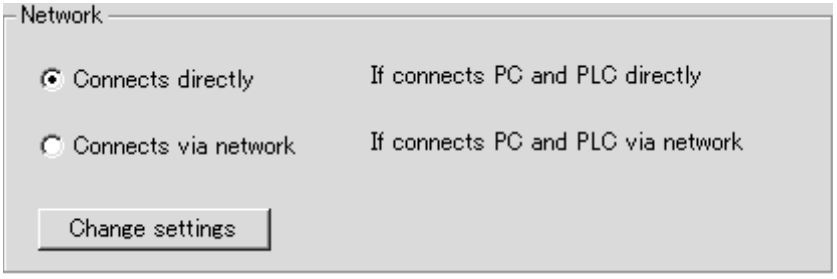
Select *Connects directly* if the computer is connected to the peripheral port (or COM port) of a CS/CJ-series PLC.



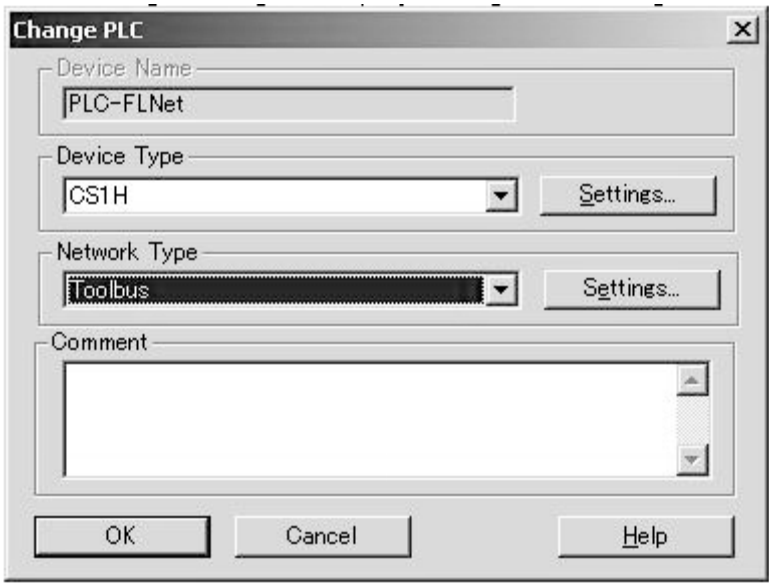
Use the following procedure.

1,2,3...

1. Select ***Network setting*** from the Setting Menu in the Main Window of the CX-FLnet to display the Communication Setting Dialog Box.
2. Select *Connects directly* in the *Network* Area.

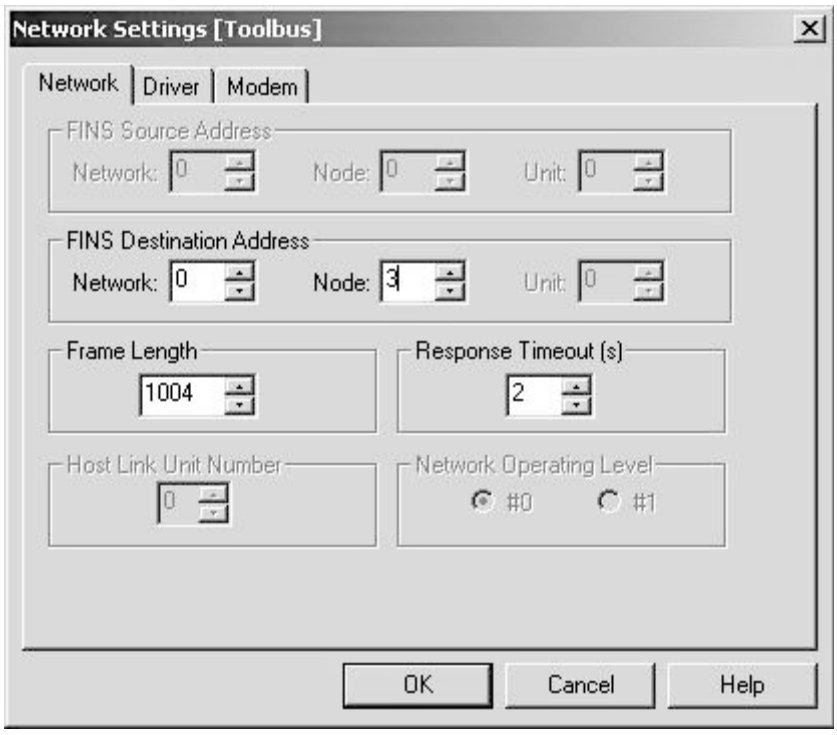


3. Click the **Change settings** Button to display Change PLC Dialog Box.

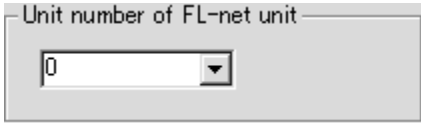


4. Set the PLC and network. To connect to another node on FL-net network, click the **Settings** Button and set the FINS destination network address and node address.

5. Click the **OK** Button to close the dialog box.



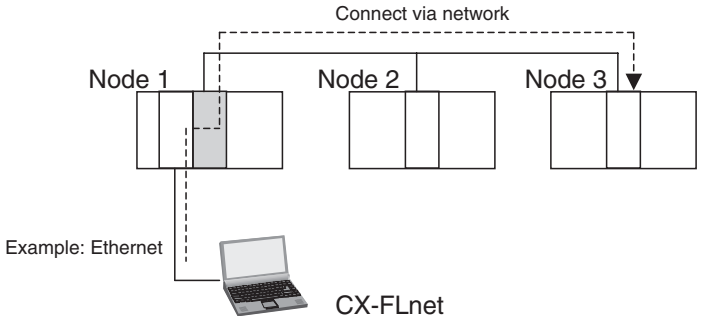
6. Input the unit number (0 to 15) of the FL-net Unit to be connected in the Communication Setting Dialog Box.



7. Click the **Close** Button to finish setting.

Connecting via the Network

Select *Connects via network* to connect the computer and make settings for each PLC (i.e., target PLC) with an FL-net Unit via the network by connecting the CX-FLnet to a C-series or CV/CVM1-series PLC (called a gateway PLC).

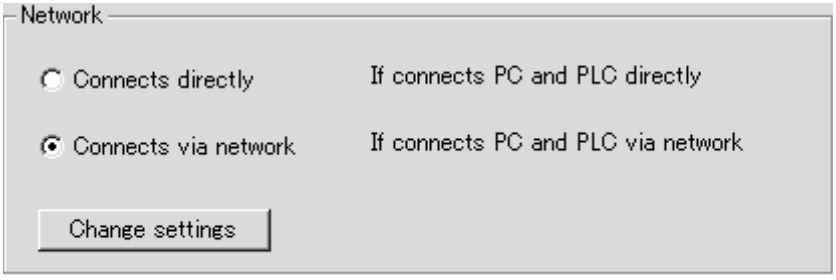


Use the following procedure.

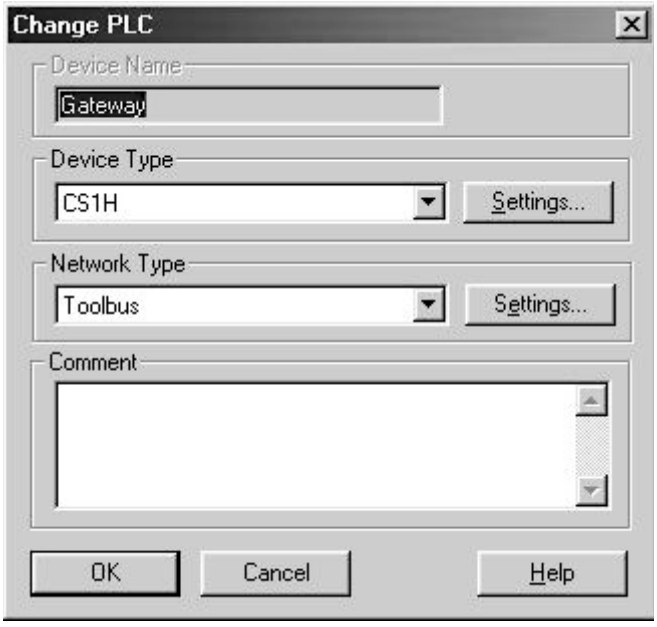
1,2,3...

1. Select ***Network setting*** from the Setting Menu in the Main Window of the CX-FLnet to display the Communication Setting Dialog Box.

2. Select *Connects via network* in the *Network* Area.

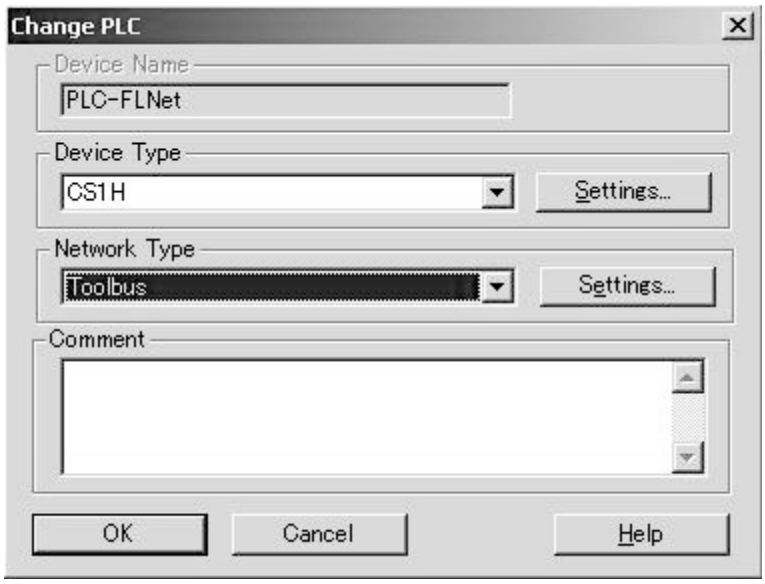


3. Click the **Change settings** Button to display the Change PLC Dialog Box. Set the data for the PLC directly connected to the CX-FLnet network. (The PLC name is “Gateway.”)



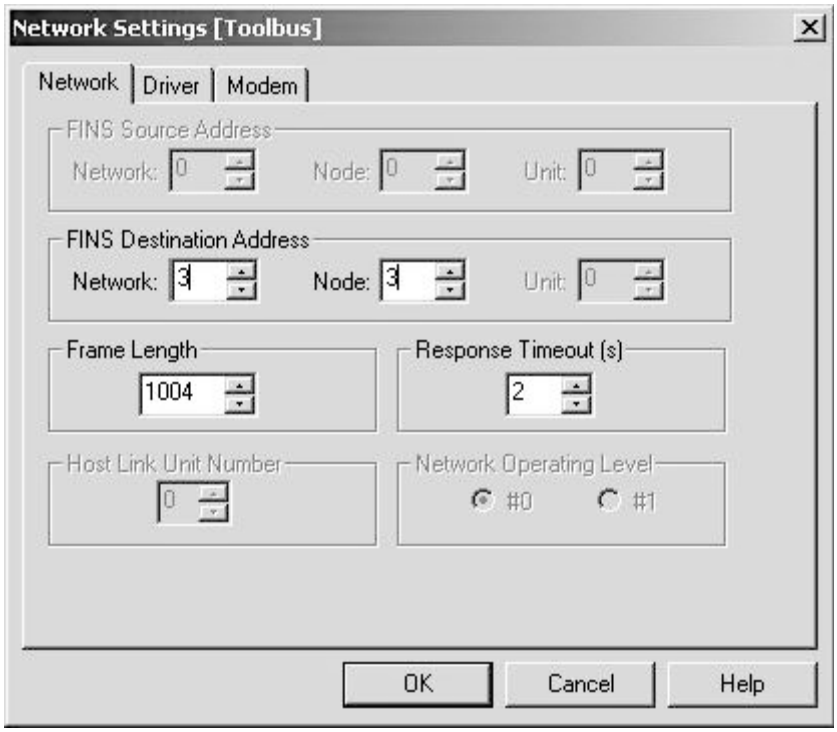
4. Set the PLC and network. To connect using Ethernet, select *Ethernet* in the *Network Type* List, and click the **Settings** Button to set the IP address of the destination node.
5. Click the **OK** Button to close the dialog box.

6. The following dialog box will be displayed. Make the settings for the FL-net node that will be connected.

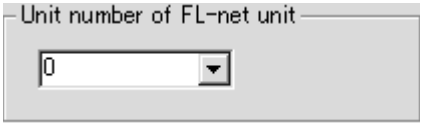


7. Change the network to *Gateway*.

8. Click the **Settings** Button to set the FINS destination network address and node address. The following figure shows the setting for an access node with network address 3 and node address 3.
9. Click the **OK** Button to close the dialog box.



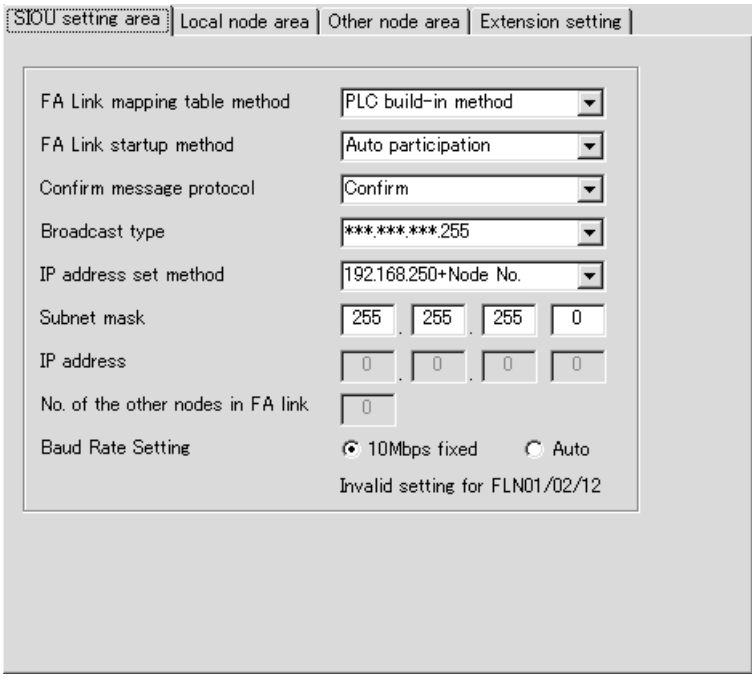
10. Input the unit number (0 to 15) of FL-net Unit to be connected in the Communication Setting Dialog Box.



11. Click the **Close** Button to finish setting.

11-2-4 System Setting - CPU Bus Unit Setup Area

Any of several operating parameters can be selected depending on the system, but the explanation is provided here for simple operating conditions.



Item	Content
FA Link mapping table method (default: PLC build-in method)	Selects the method (PLC build-in method or FA Link Unit build-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 or *C255.255.255.255*). Normally the default should be selected.
IP address set method (default: 192.168.250 + Node No.)	Selects the IP address setting method (*192.168.250 + Node No.*, *Unit rear rotary SW, Unit rear rotary SW + Node No.*, or *Setup Area*). Normally the default should be selected. When using the CS1W-FLN22 or CJ1W-FLN22, select either *192.168.250 + Node No* or *Setup Area*.
Sub-net mask (default: 255.255.255.0)	Sets the sub-net mask (user setting). Normally the default should be selected.

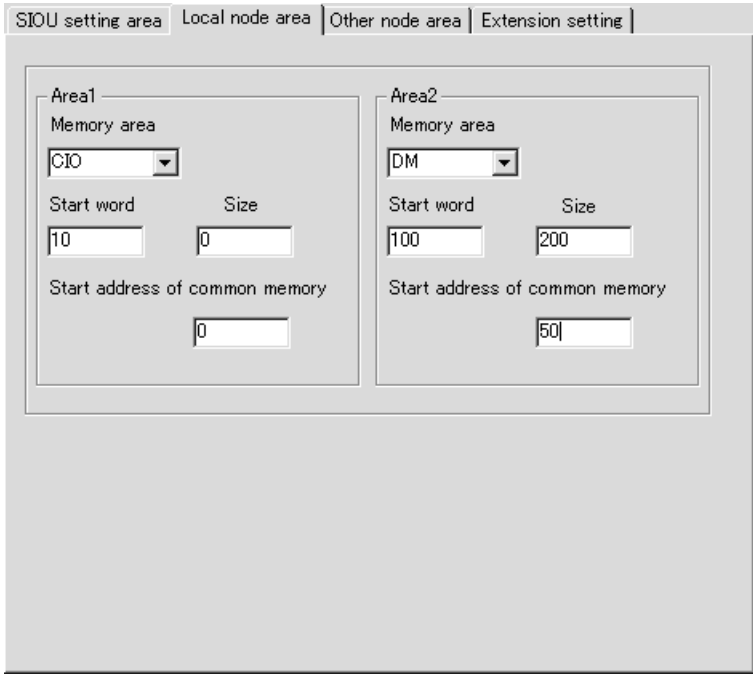
Item	Content
IP address (default: None)	Sets the IP address (user setting). The IP address does not need to be set except when the IP address set method is set to *Setup Area*.
No. of the other nodes in FA Link (default: None)	The number of remote nodes (user setting) in the FA Link configuration is displayed. This parameter cannot be set.
Baud Rate Setting (default: 10 Mbps (not variable))	Sets the baud rate for FL-net communications. To communicate at 100 Mbps, select *Auto*. The baud rate will be determined by the auto-negotiation function of the connected hub.

Note

1. To circulate a token among the 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.
2. If either *Unit rear rotary SW + node No.* or *Unit rear rotary SW* is set as the IP address setting method for the CS1W-FLN22 or CJ1W-FLN22, a setting error will occur (HER indicator will light). Set the IP address setting method to either *192.168.250 + node No.* (default) or *Setup Area*.
3. The baud rate setting is supported by the CS1W-FLN22 and CJ1W-FLN22 only. The setting cannot be made for the CS1W-FLN02 or CS1W-FLN12, which always communicate at 10 Mbps.
4. Select ***Option - Switch display - Hex*** in the Main Window. It will be possible to display and input the IP address and sub-net mask in hexadecimal.
5. If the communications are set to connect via the network and storage in the PLC is set to use the FA link allocation table storage method, the maximum number of nodes that can be registered in other node areas is 50.

11-2-5 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.

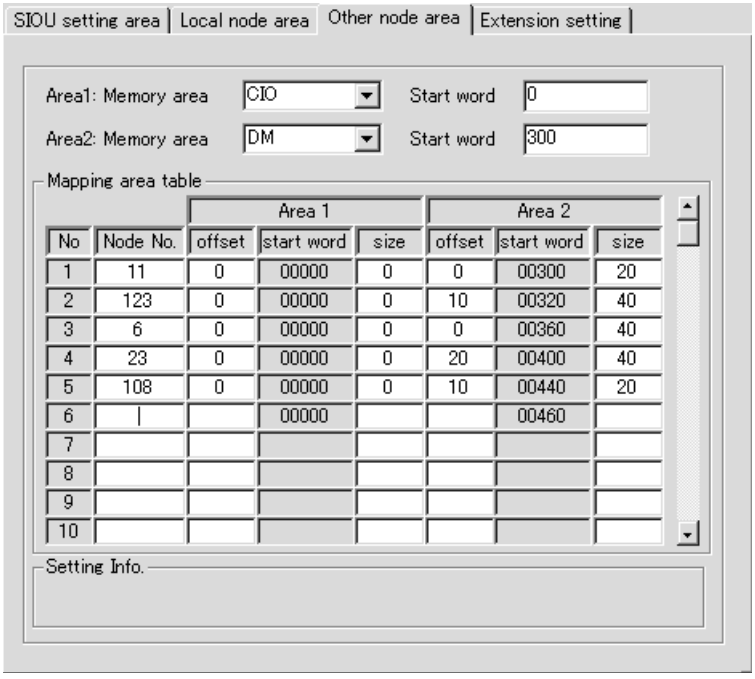


Item	Content
Area 1 (Area 2) Memory Area (default: Area 1 CIO, Area 2 DM)	Sets the PLC area in which Cyclic Data Areas 1 and 2 for the local node are stored. The following areas can be set: CIO, WR, HR, DM, and EM0 to EMC.
Area 1 (Area 2) start word (default: 0)	Sets the beginning word of the PLC area 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 for 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).

Note Select ***Option - Switch display - Hex***. It will be possible to display and input words, sizes, and addresses in hexadecimal.

11-2-6 System Setting - Other Node Setup Area

The other node setup areas are be set so that Common Memory data for remote nodes can be read to the local PLC areas.



The following functions can be used when setting the other node setup areas.

Item	Content
Area 1 (Area 2) Memory Area (default: Area 1 CIO, Area 2 DM)	Sets the PLC area in which Cyclic Data Areas 1 and 2 for the remote nodes are stored. The following areas can be 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.

Menu	Function
Edit - Clear all	Clear all data in the FA link table.

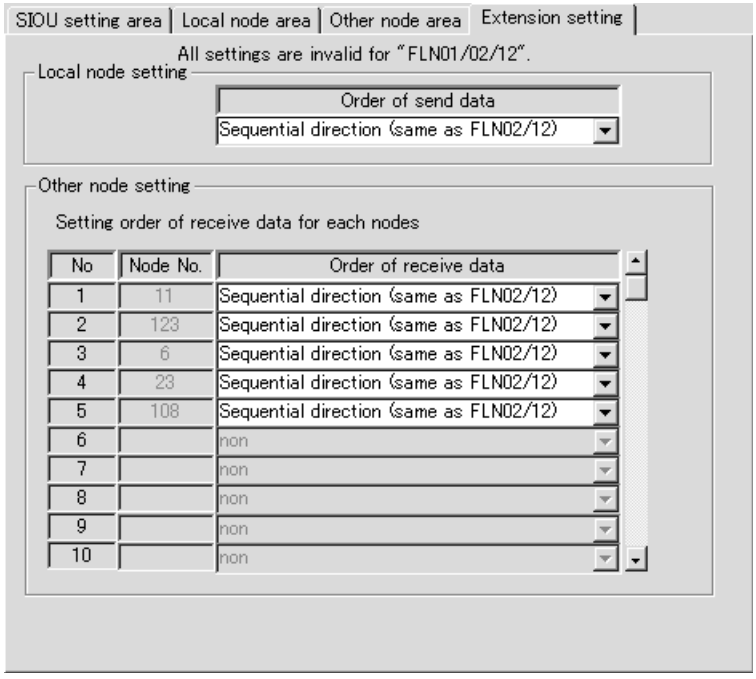
Menu	Function
Edit - Copy row	Copy a single data row data and add as a new row.
Edit - Delete	Delete a single data row.

Note

1. Do not assign the local node in the mapping area table.
2. Enter 0 in the *Node No.* Field and enter the size of the local node setup area in the *Size* Field for the area corresponding to that for the local node.
3. If the settings are made for only Area 1 (or Area 2), set the offset and size for the other area to 0.
4. Select ***Option - Switch display - Hex***. It will be possible to display and input words, sizes, and addresses in hexadecimal.
5. The “offset” designation tells 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.
6. Select ***Option - Switch Settings - Hex*** from the Main Menu. It will be possible to display and input words, sizes, and addresses in hexadecimal.

11-2-7 System Setting - Extension Setting

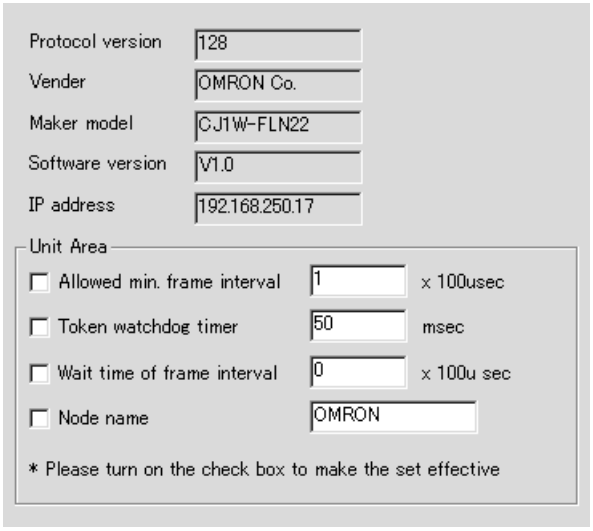
The order of link data bytes can be specified for each node according to the needs of the connected device, eliminating the need for upper/lower byte conversion (swapping) processing in the ladder program or user application.



Item	Content
Local node setup Order of send data	Set the order for transferring data for local nodes. Select sequential direction (same as the FLN02 and FLN12) or reverse direction.
Other node setup Order of send data	Set the order for transferring data for other nodes. Select sequential direction (same as the FLN02 and FLN12) or reverse direction.

11-2-8 Unit Area Setup

The Unit's data display and node name can be set.



Menu	Function
Allowed min. frame interval (default: 1 (100 us))	Sets the present minimum allowable frame interval. *Valid* must be selected to enable this setting. If communications errors occur, increase the value of this setting. The maximum allowable frame interval used for the entire network is that of the node with the longest minimum allowable frame interval. The present valid value for the network can be checked by selecting *Network status (FA Link)* in the *Monitor* Field. When a baud rate of 100 Mbps is used, set the minimum allowable frame interval to 1 ms or higher.
Token watchdog timer (default: 50 ms)	Sets the timeout time for monitoring token passing between nodes. For normal usage, use the default value.
Wait time of min. frame interval (default: 0)	Adds the value set here to the minimum allowable frame interval set in (1). This value is not used by the entire network. This value is only enabled for the corresponding node.
Node name	Sets the node name. *Valid* must be selected to enable this setting.

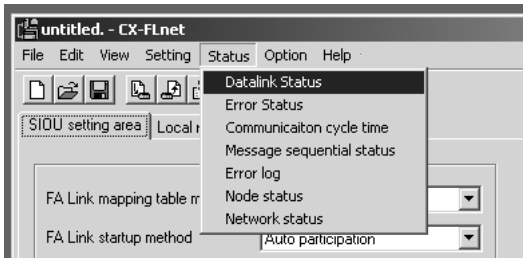
Note Select ***Option - Switch display - Hex***. It will be possible to display and input in hexadecimal.

11-2-9 Monitor Status Display Function

The CX-FLnet enables monitoring of various network conditions and settings.

■ Selecting the Status Display Function

Select the status from among those displayed in the Status Menu in the Main Menu.

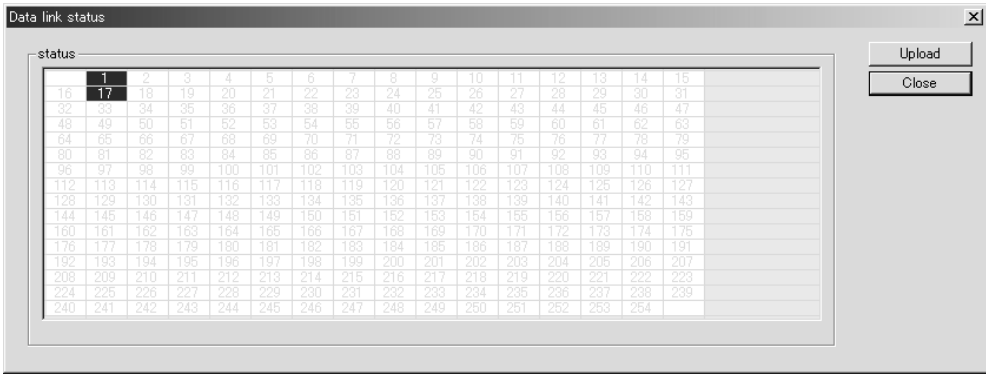


Note Each status is read from the FL-net Unit when the display function is started from the menu.

Data Link Status

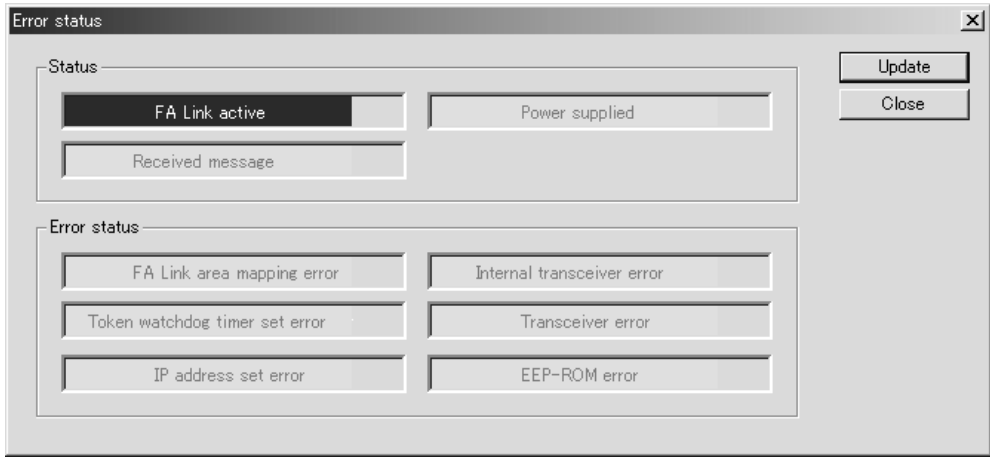
Shows the data link status of remote nodes participating in the FL-net network. The status shown here is the same as the connected node data which is reflected in the CIO Area.

Lit (blue) nodes are participating in the data link.



Error Status

The FL-net Unit status is displayed. The status shown here is the same as the Unit status which is stored 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 the network is incorrect. This error occurs for reasons such as a faulty network configuration.

Clear the error 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. Clear the error by resetting the Unit. If this is a recurring error, replace the Unit.

■ **Transceiver error**

Lit when an error occurs at the transceiver.

Clear the error by resetting the Unit.

If this is a recurring error, replace the Unit.

■ **EEPROM error**

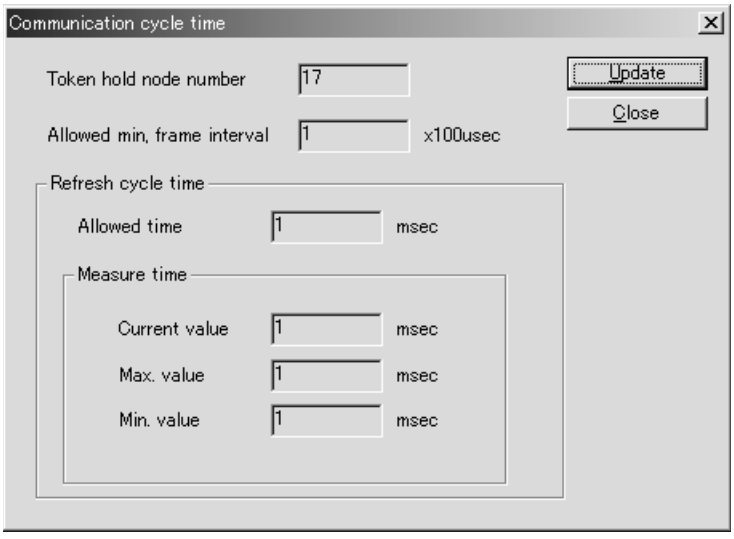
Lit when an error occurs in the EEPROM.

An error may recur in a Unit if there is a faulty network configuration. Recheck the settings.

If the error recurs after rechecking the settings, replace the Unit.

Communication Cycle Time

The network status is shown.



■ **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**

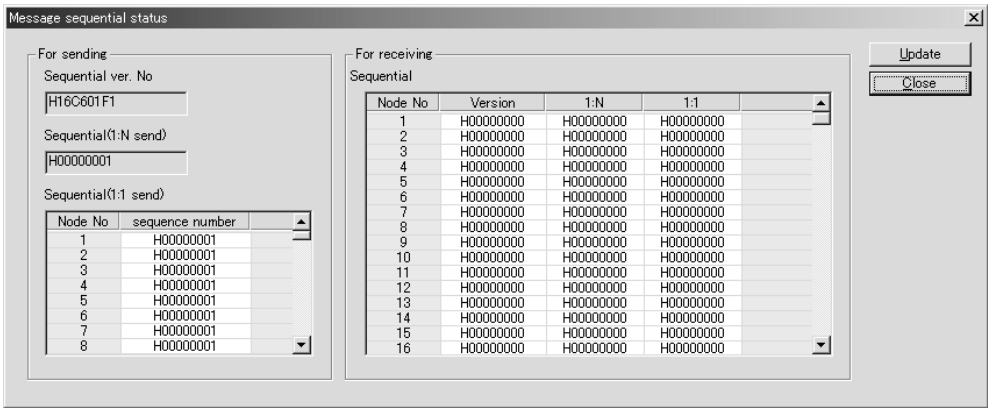
Displays the allowable refresh cycle time for the specified Unit.

■ **Measure time**

Displays the current value, maximum value, and minimum value of the measured refresh cycle time for the specified Unit.

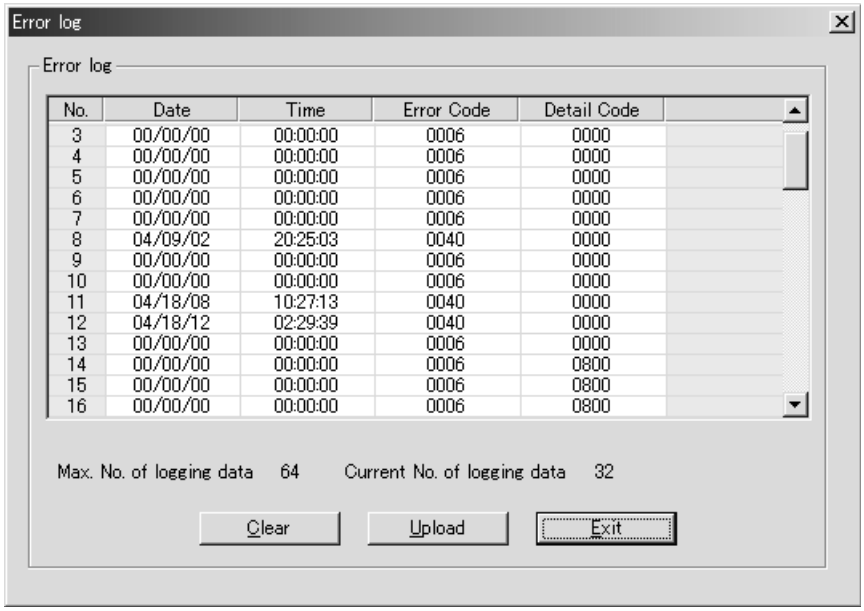
Message Sequential Status

The message sequential status is shown.



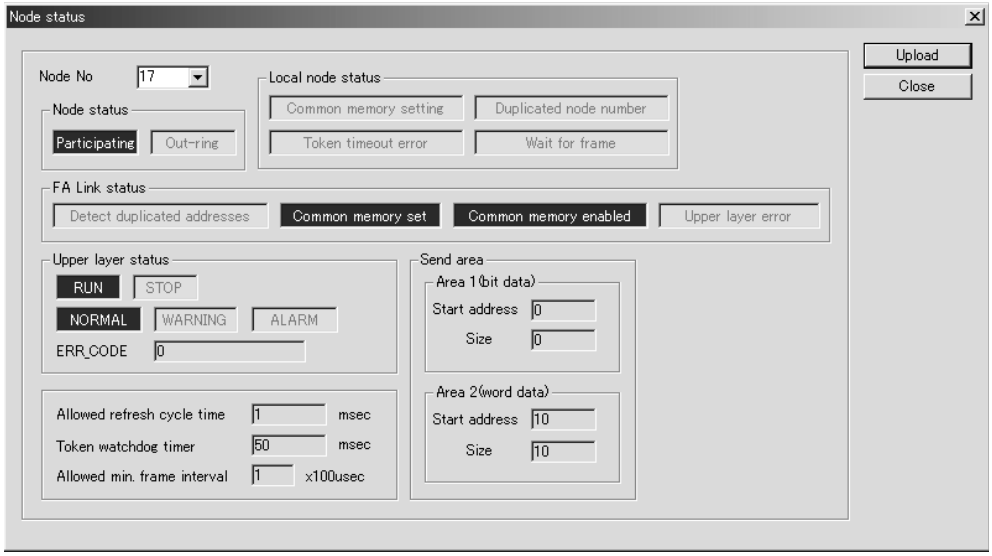
Error Log

The error log data is read from the FL-net Unit. Error log data in the FL-net Unit is deleted when the **Clear** Button is clicked.



Node Status

The status of remote nodes participating in the FL-net network is shown. 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.

Corresponding FL-net Standard Flag Names

CX-FLnet	FL-net standard flag name
Common memory setting range error	Initialization Error Flag
Duplicate node number notification	Duplicate Node Number Flag
Token monitoring timeout error	Token Monitoring Timeout Flag
Frame standby error	Reception Standby Flag

■ 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.

Status	Meaning
RUN	CPU Unit is running (RUN/MONITOR mode).
STOP	CPU unit is stopped (PROGRAM mode).

Status	Meaning
NORMAL	CPU Unit is normal.
WARNING	Non-fatal error has occurred.
ALARM	Fatal error has occurred

ERR_CODE	Meaning
0	Normal
1	Service is stopped.

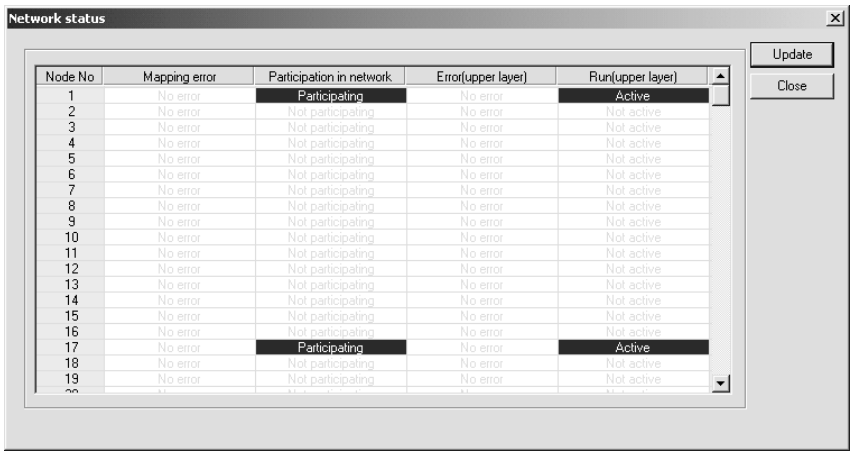
Note For information on FL-net node error codes in Units from other companies, refer to the relevant manuals.

■ **Allowed Refresh Cycle Time, Token Watchdog Timer, Allowed Minimum Frame Interval**

The allowed refresh cycle time, the token watchdog timer, and the allowed minimum frame interval are displayed for the node set by the node number.

Network Status

The status of remote nodes participating in the FL-net network is shown. The status shown here is the same as the network status which is stored in the DM Area.



■ **Mapping Error**

Indicates 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 is not valid if the node is not participating in the network. (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)**

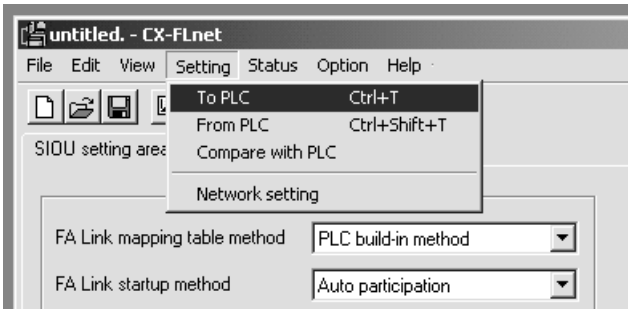
The operating status (active/not active) of applications installed at the node is stored.

Transferring and Comparing System Settings

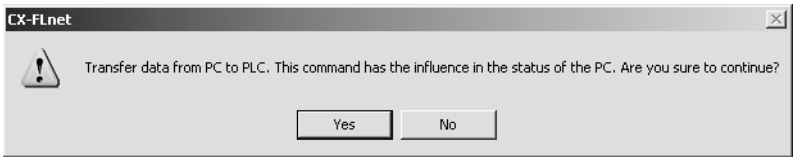
The CPU Bus Unit setup can be transferred and compared between the computer running the CX-FLnet and the PLC (CPU Unit or FL-net Unit).

Downloading FL-net Setup from the Computer to the PLC

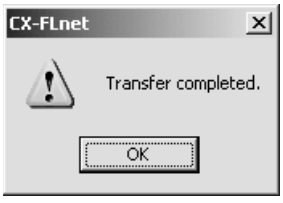
1,2,3... 1. Select ***Setting - To PLC.***



The following confirmation dialog box will be displayed.



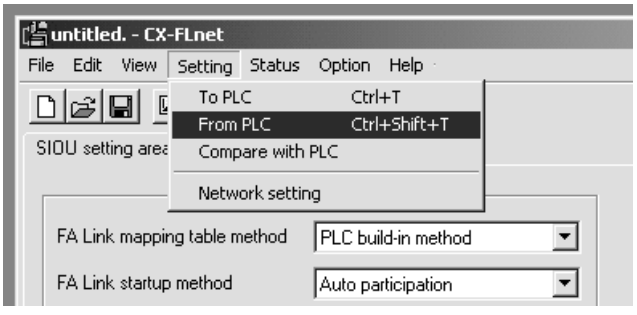
2. Click the **Yes** Button. The transfer will begin and the following message will be displayed if the transfer ends normally.



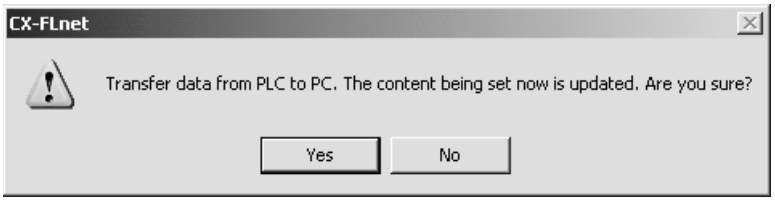
3. Click the **OK** Button.

Uploading the FL-net Unit Setup from the PLC to the Computer

1,2,3... 1. Select ***Setting - From PLC.***



The following confirmation dialog box will be displayed.

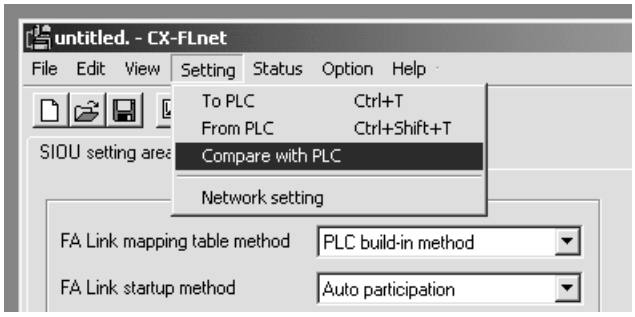


2. Click the **Yes** Button. The transfer will begin and the following message will be displayed if the transfer ends normally.

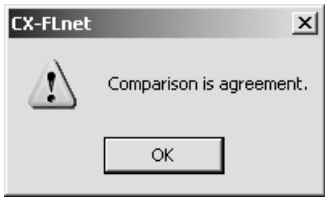
3. Click the **OK** Button.

Comparing the FL-net Setup on the Computer to the Setup in the PLC

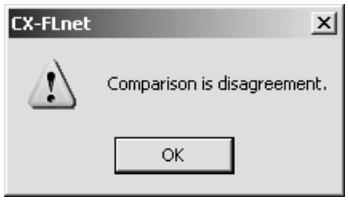
1,2,3... 1. Select ***Setting - Compare with PLC.***



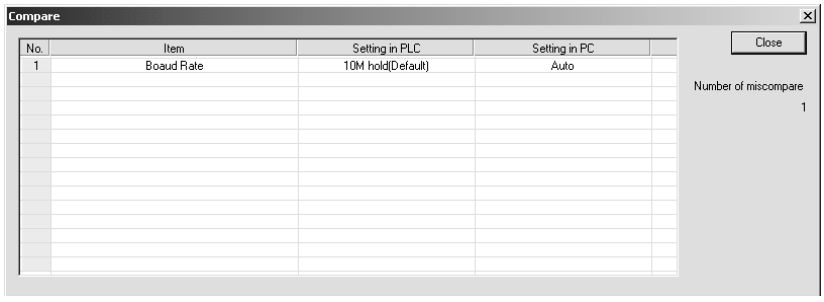
The results of comparison will be displayed.
When the Setup is the Same:



When There Are Differences



2. Click the **OK** Button. If there were differences, they will be displayed in a list.

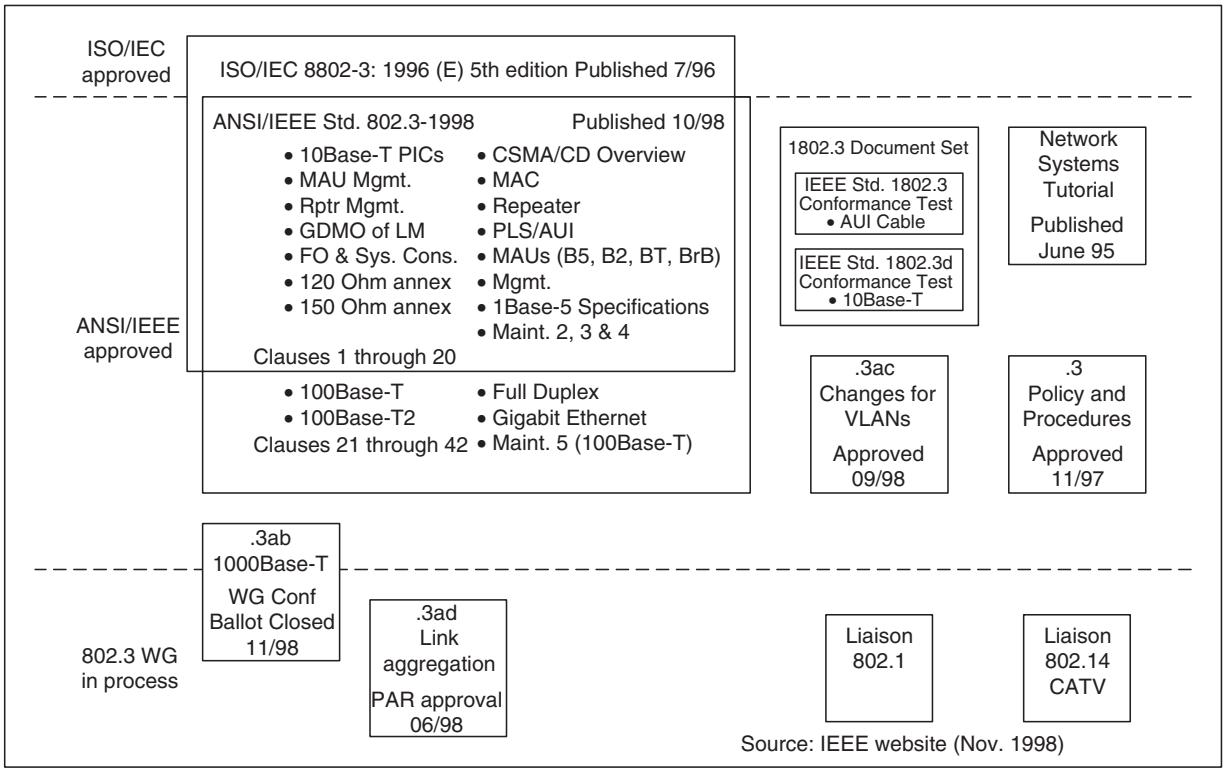


3. Click the **Close** Button.

Appendix A
System Configuration

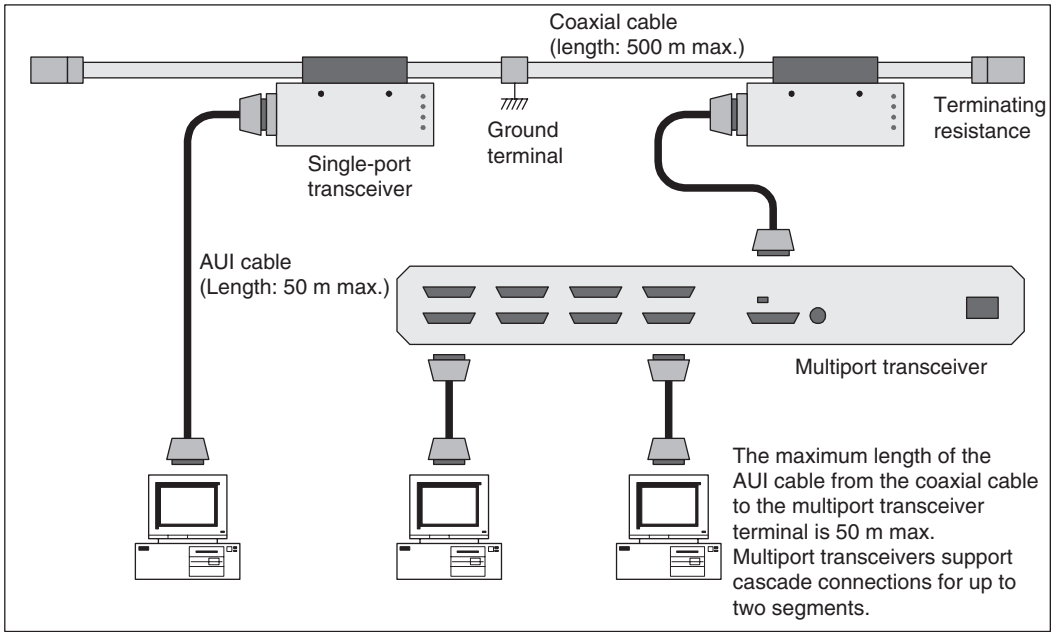
Ethernet Overview

Ethernet is a LAN (Local Area Network) standard for communications between personal computers and printers, and defines the network, including the communications data format, cables, and connectors. The Ethernet standard was formulated by the IEEE802.3 Working Group for Ethernet. At present, the Working Group has formulated the 10Base-5, 10Base-2, and 10Base-T standards. Other standards, such as 1000Base-T, are also currently being studied. The following diagram shows the progress of standardization by the IEEE802.3 Working Group.



10Base-5 Specifications

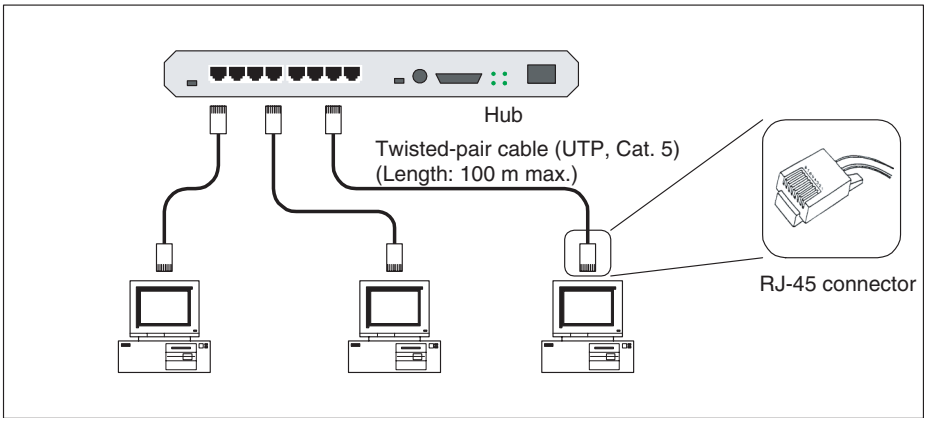
The 10Base-5 standard is an Ethernet connection method that uses thick coaxial cable (yellow cable) with a width of approximately 10 mm. The “10” in 10Base-5 indicates a baud rate of 10 Mbps. “Base” indicates that a baseband transmission method is used. The “5” indicates a transmission distance of 500 m for the trunk line. Coaxial cable is connected to a transceiver, which is then connected to the personal computer or other devices via transceiver cable (AUI cable).
10Base-5 Ethernet is not easy to lay due to the thick cables. Therefore, this method is hardly used in office networks. 10Base-5 is often used in trunk line networks, however, due to its long transmission distance.
The following diagram shows a 10Base-5 Ethernet configuration example.



10Base-T Specifications

The 10Base-T standard is an Ethernet connection method that uses twisted-pair cable. The “10” in 10Base-T indicates a baud rate of 10 Mbps. “Base” indicates that a baseband transmission method is used. The suffix “T” indicates that twisted-pair cables are used as the transmission media. Personal computers and other devices in a 10Base-T network must be connected in a star connection via a hub. Direct connections between devices are not supported. (Special cables called cross cables can be used for 1:1 direct connections, but such connections are not commonly used.) The cable length from the hub to each device is 100 m maximum.

10Base-T Ethernet uses thin cables, making it easy to lay the network. This method is often used in office networks because each device can be easily connected and removed from the network.
The following diagram shows a 10Base-T Ethernet configuration example.

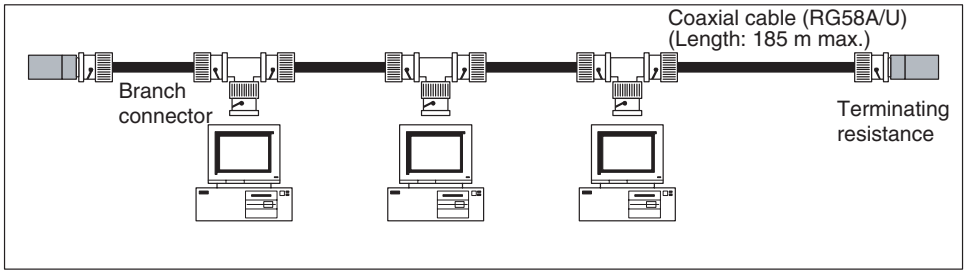


Other Ethernet Specifications

The 10Base-2 standard is an Ethernet connection method that uses 5-mm wide coaxial cables (also called thin cables). The “10” in 10Base-2 indicates a baud rate of 10 Mbps. “Base” indicates that a baseband transmission method is used. The “2” indicates a transmission distance of 185 m for the trunk line (approximately 200 m).

Personal computers and other Ethernet-compatible devices are connected to the 10Base-2 Ethernet by connecting a T-branch connector to the BNC connector of each device, with coaxial cable connected to the other two connectors on the T-branch connectors.

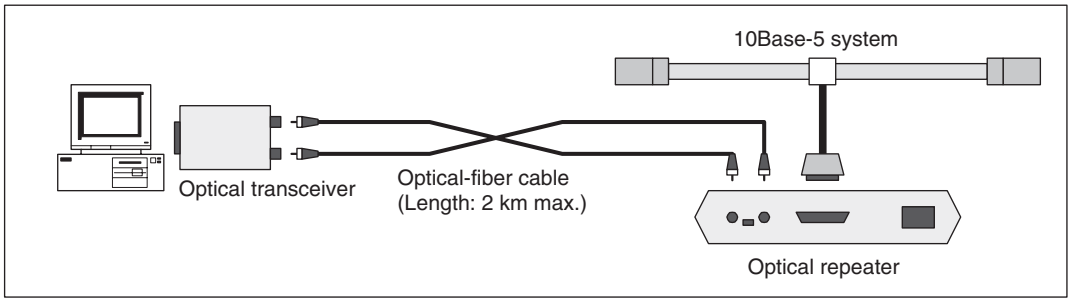
The following diagram shows a 10Base-2 Ethernet configuration example.



Optical Ethernet

Optical Ethernet uses optical fiber cables as the transmission media. Optical Ethernet is used in systems that require a transmission distance of 500 m or more or that require resistance to noise. Optical Ethernet connection methods standardized by IEEE802.3 include 10Base-FP, 10Base-FB, 10Base-FL, 100Base-FX, 1000Base-LX, and 1000Base-SX.

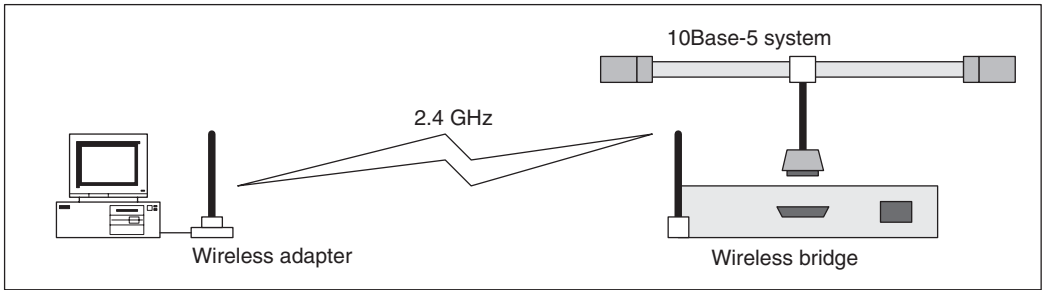
The following diagram shows an Optical Ethernet configuration example.



Wireless Ethernet

Wireless Ethernet is a wireless LAN that uses electromagnetic waves and infrared rays as the transmission media. This method is used to connect portable devices to the LAN. Standardization of wireless LAN is being pursued by the IEEE wireless LAN Working Group IEEE802.11. The MAC layer protocol for a wireless LAN is different from Ethernet. A bridge is therefore needed to interconnect the two types of networks.

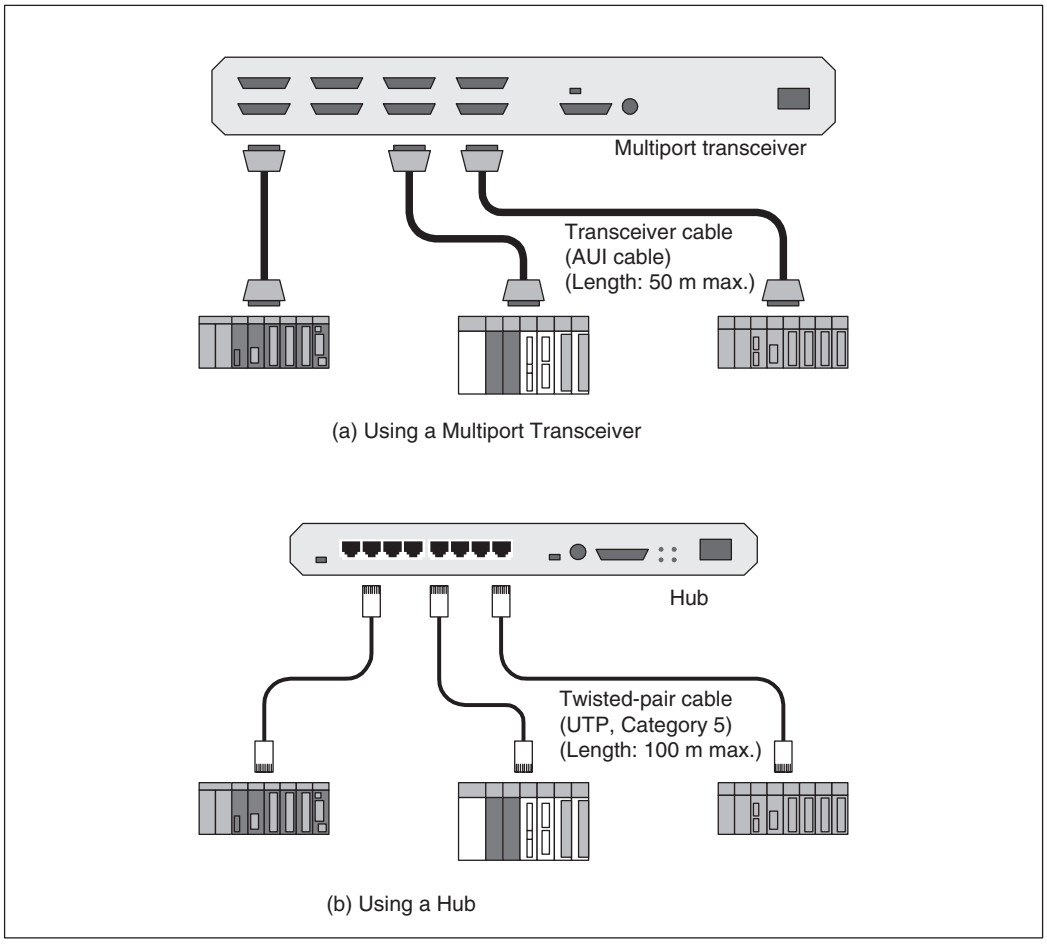
The following diagram shows a wireless Ethernet configuration example.



Appendix B
System Configuration Example

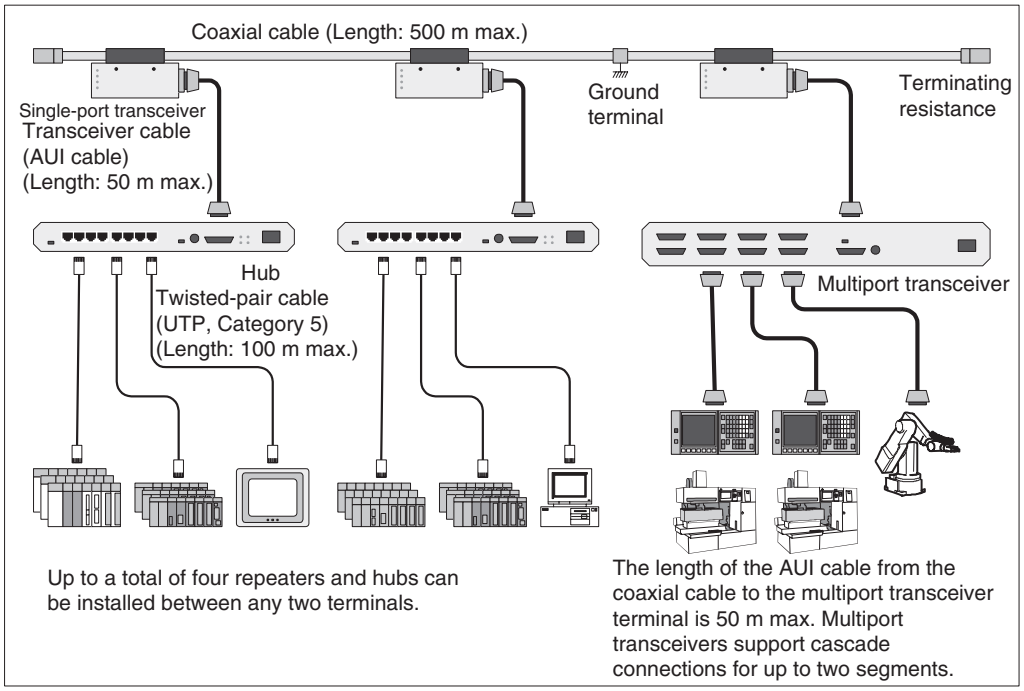
Small-scale Configuration

A network system of multiple devices can be configured using a single multiport transceiver or hub.



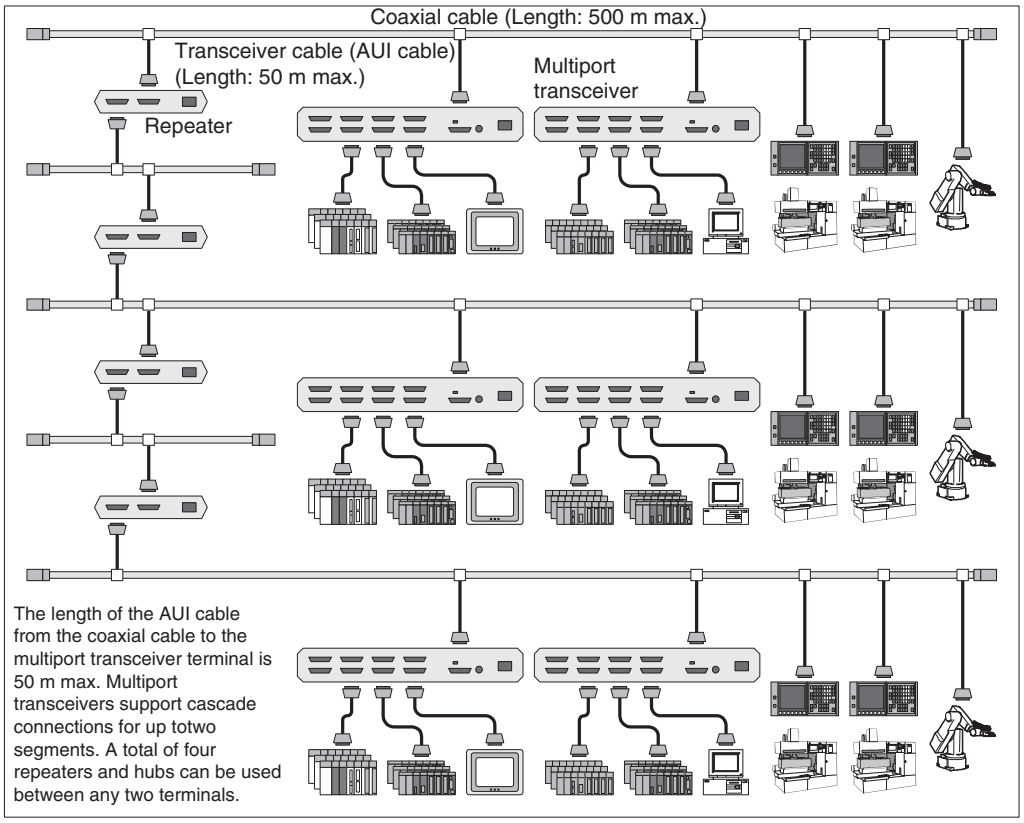
Basic Configuration

A network system consisting of several tens of devices can be configured by connecting several multiport transceivers or hubs to a single coaxial cable.



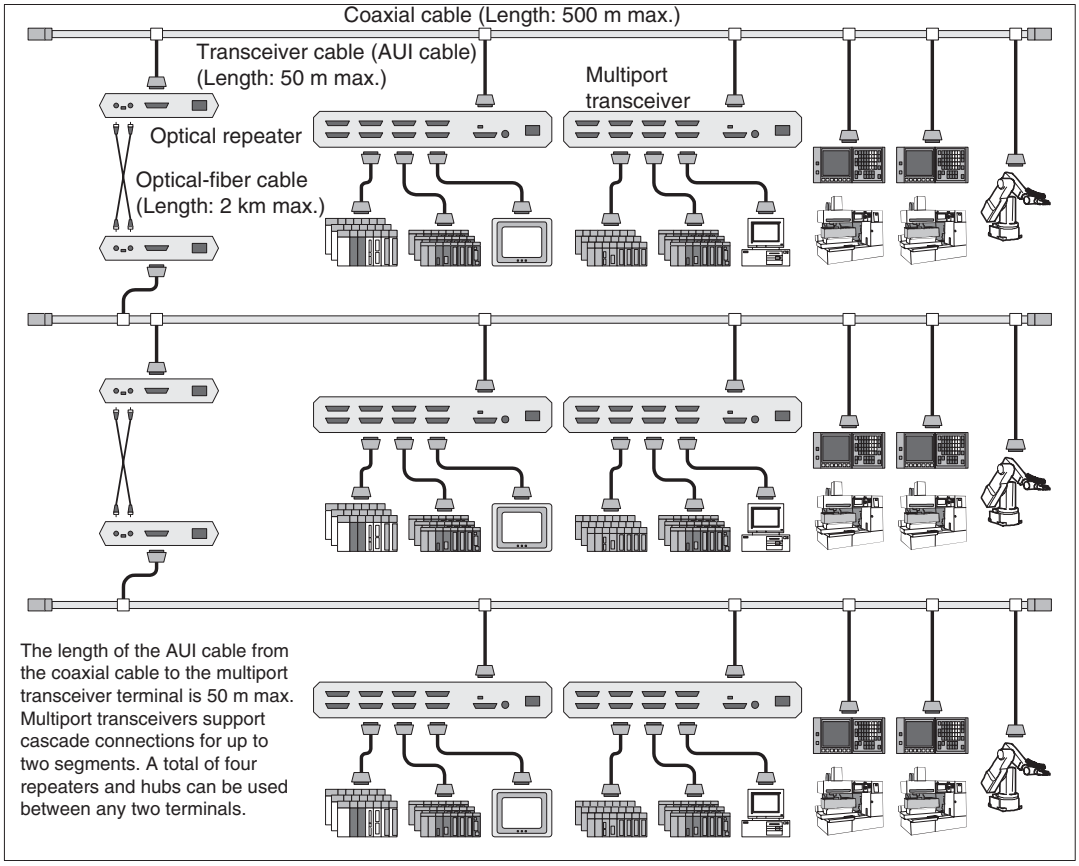
Large-scale Configuration

A large-scale network system consisting of hundreds of devices can be configured by connecting several 10Base-5 network segments together using repeaters.



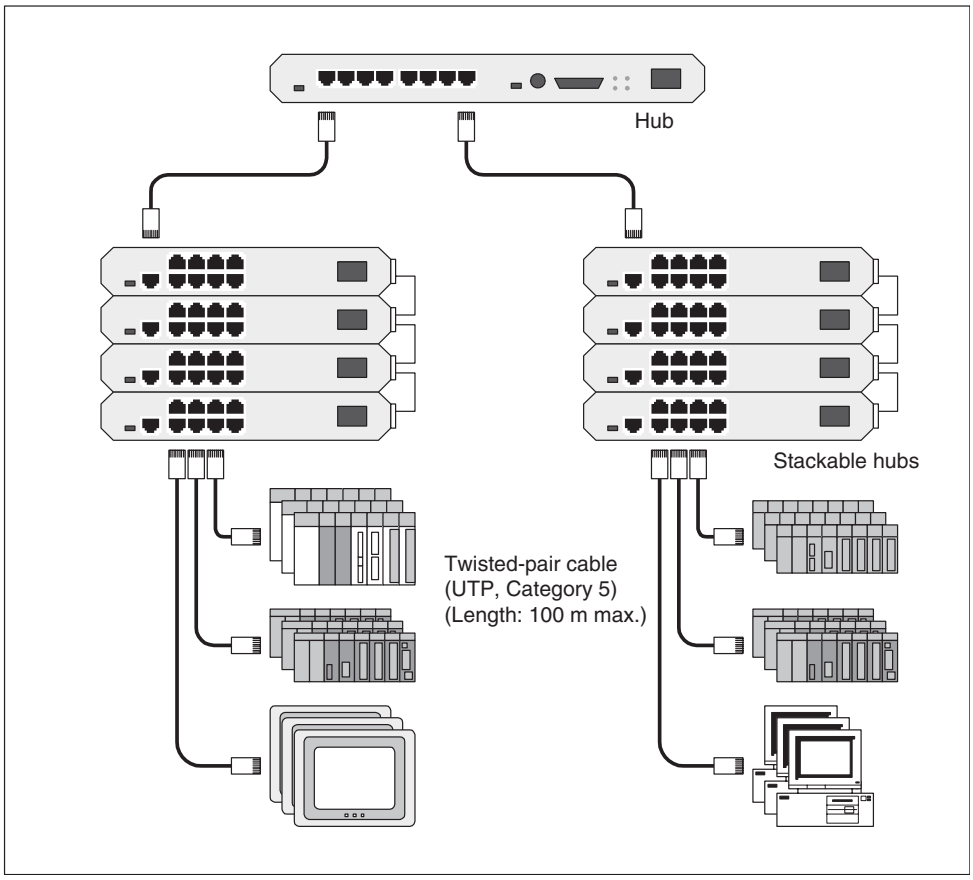
Long-distance Distributed Configuration

In large-scale network systems requiring a distance between network segments that exceeds the maximum 10Base-5 transmission distance of 500 m, optical repeaters can be connected to each network segment to enable a network configuration with 2 km between repeaters.



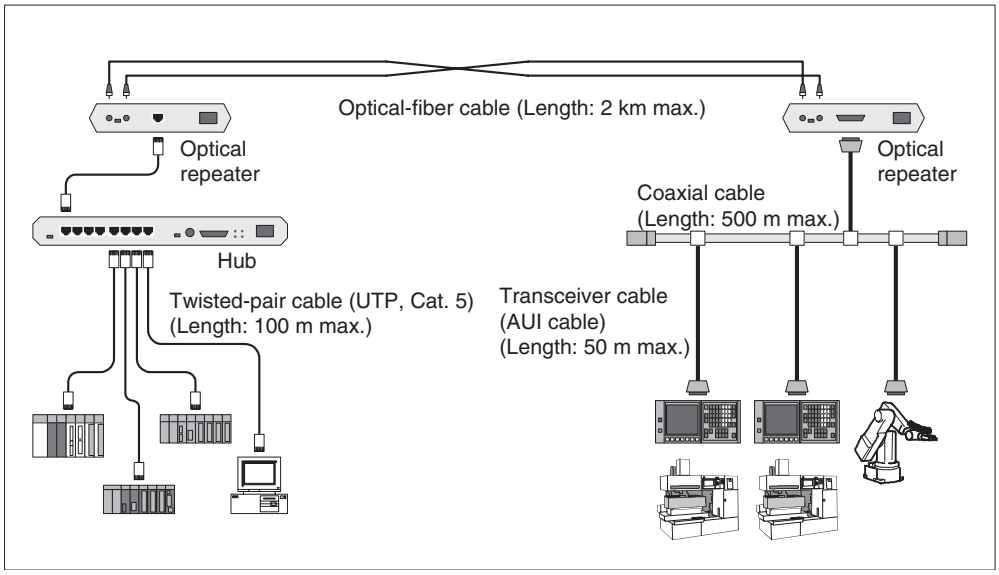
Local Centralized (Stack) Configuration

A network system can be configured using several tens of devices centralized using stackable hubs.



Local Configurations with Long-distance Distributed Segments

Basic network with a specific controller in a remote location, or a network that is near high-voltage power lines or a source of noise interference can be split into two segments, with optical repeaters connected between segments. This configuration enables a long-distance network with superior noise resistance.



Appendix C
Network System Definitions

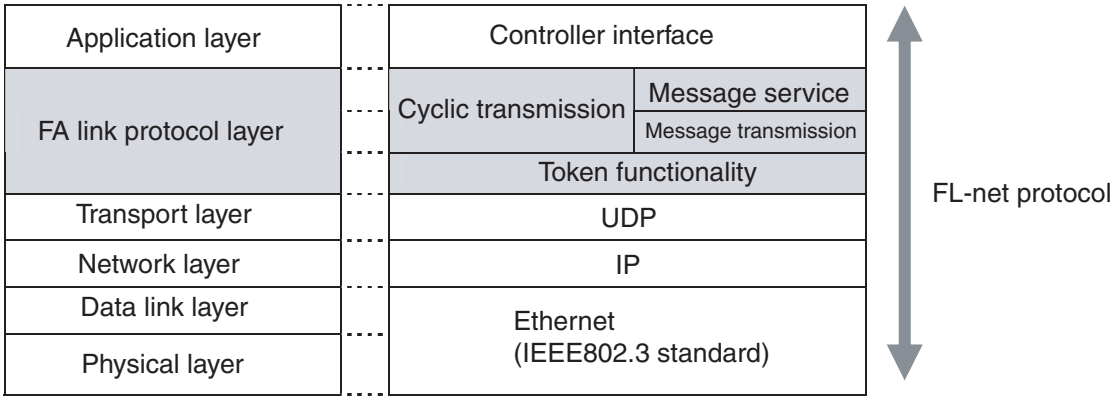
Communications Protocol Standard

The communications protocol indicates the rules for exchanging information through the communications lines between two systems. The communications protocol used by FL-net conforms to the following standards.

FL-net communications protocol	Standards
FL-net	FA link protocol specification (MSTC FA Open Systems Promotion Forum FA Control Network Technical Committee)
UDP	RFC768
IP, ICMP, etc.	RFC791, 792, 919, 922, 950
ARP etc.	RFC826,894
Ethernet	IEEE802.3

Communications Protocol Layer Configuration

The communications protocol is modeled in a layers, and is expressed and standardized using a layer configuration, in which communications processing is divided into several layers. FL-net consists of six protocol layers, as shown in the following diagram.



FL-net Physical Layer

When a baud rate of 10 Mbps is used, five transmission methods can be used in the Ethernet's physical layer, including 10Base-5, 10Base-2, 10Base-T, 10Base-F, and 10Broad-36 (although not commonly used). There is also 100 Mbps Ethernet. Of these transmission methods, FL-net uses 10Base-5 (recommended), 10Base-2, and 10Base-T.

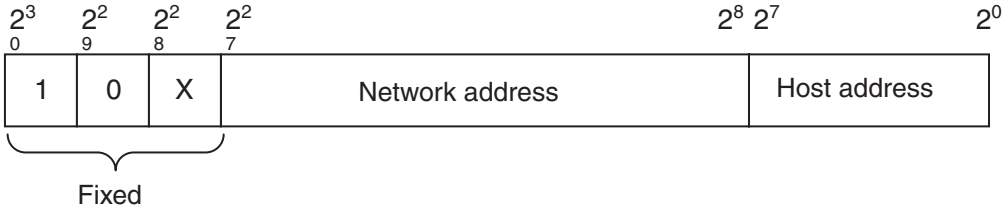
FL-net IP Address

IP addresses (INET addresses) are used to distinguish each communications device from multiple communications devices connected to the Ethernet. Therefore, a unique IP address must be set for each communications device connected to the Ethernet. An IP address is comprised of a network address indicating the network to which the communications device is connected, and the host address for the communications device. The networks are classified as class A, B, or C, depending on the network size (classes D and E are also supported for other specific purposes).

Class	First octet	Network address	Host address
A	0 to 127	xxx.xxx.xxx.xxx	Xxx.xxx.xxx.xxx
B	128 to 191	xxx.xxx.xxx.xxx	Xxx.xxx.xxx.xxx
C	192 to 223	xxx.xxx.xxx.xxx	Xxx.xxx.xxx.xxx

Note The parts shown in gray indicate the section of the IP address corresponding to the network and node addresses.

The IP addresses for communications devices connected to the same network will all have the same network address; each device will have a unique host address. The default FL-net IP address is 192.168.250.N (N: Node number between 1 and 254). It is recommended to use class C address, with the host address in the lower byte matching the FL-net protocol node number.



FL-net Subnet Mask

The FL-net subnet mask is always 255.255.255.0. Set the subnet mask to 255.255.255.0 in the FL-net Unit Setup (CPU Bus Unit Setup Area) using the FL-net Unit Support Software. This format is the same as that for the network address and host address used in class C.

TCP/IP and UDP/IP Communications Protocol

The main protocols used by Ethernet are TCP, UDP, and IP. IP is located in the network layer of the communications protocol, and controls the flow of communications data. TCP and UDP are located in the transport layer and both use IP as the network layer, but the service provided is significantly different. TCP provides a reliable delivery service that does not recognize delineation in the data for the upper layer. UDP, however, functions by transferring data packets from IP (datagrams) to the upper layer without modification, and without confirming whether the data has reached the destination. Data processing, such as reception confirmation and resending, is performed in the upper layer. UDP does not have the reliability of TCP, but can deliver communications services with small overhead.

FL-net uses UDP because TCP's elaborate data confirmation and resending procedures are redundant in an FL-net system. High-speed data exchange is enabled by replacing these procedures with procedures for controlling the right to transmit using tokens and performing multiple frame division/synthesis in the upper FL-net protocol layer.

FL-net Port Numbers

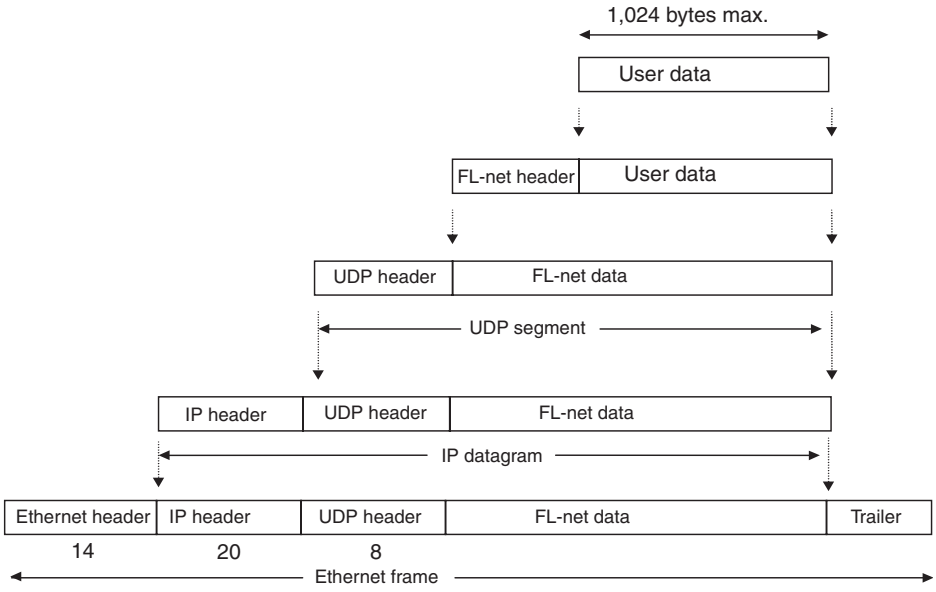
With FL-net, the following port numbers are assigned in advance to enable services in the FL-net protocol layer, which is located above the transport layer. FL-net users, however, do not need to set these port numbers in parameters or elsewhere.

No.	Name	Port No.
1	Cyclic transmission port number	55000 (fixed)
2	Message communications port number	55001 (fixed)
3	Participation request frame port number	55002 (fixed)
4	Send port number	55003 (fixed)

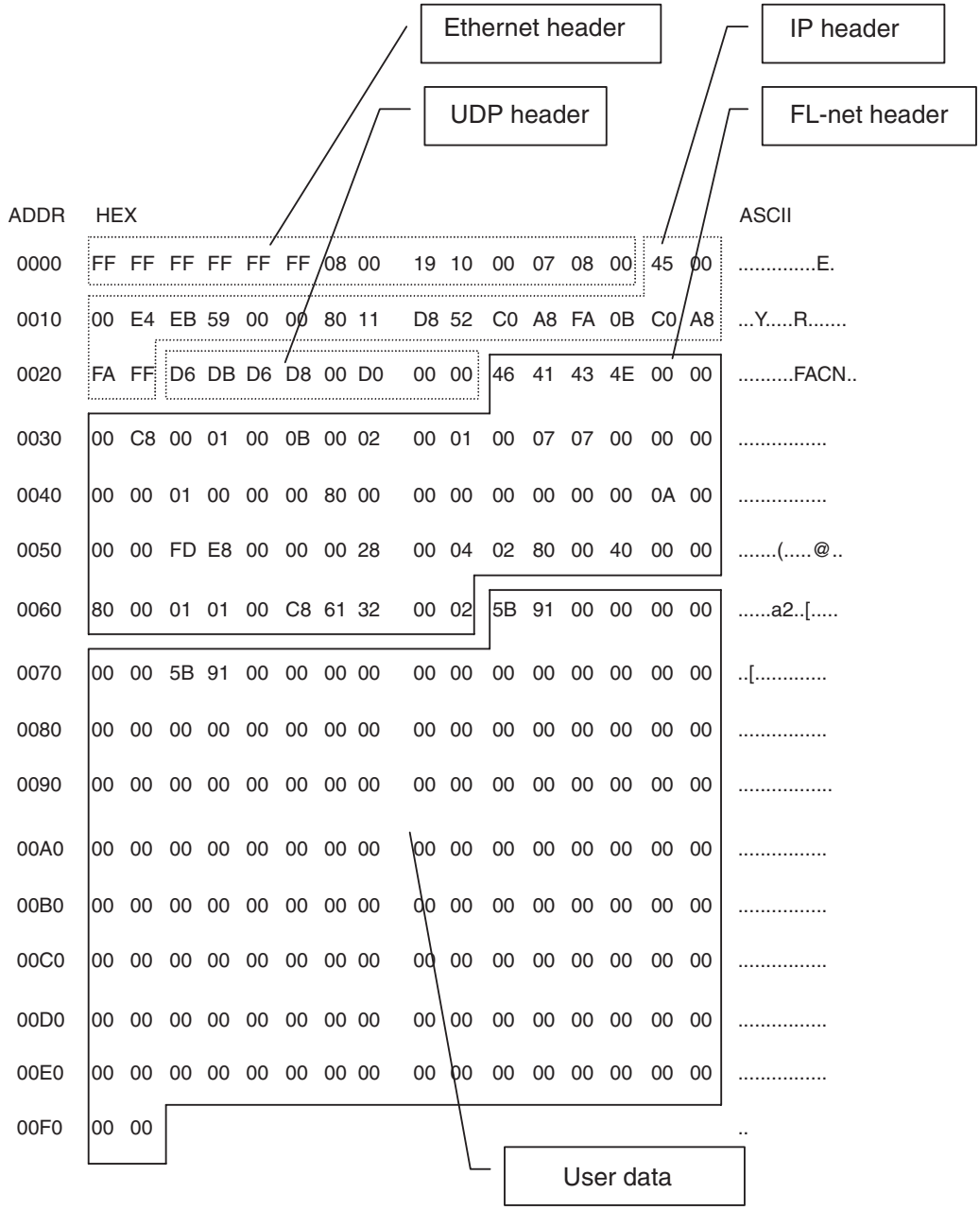
FL-net Data Format

FL-net Data Format Overview

The data sent and received using FL-net is encapsulated using the following communications protocol layers, as follows:

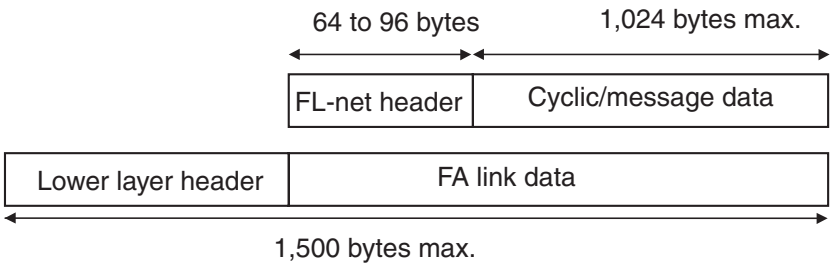


The FL-net data for a single frame that can be monitored on the communications line is shown in the following diagram. In this example, 128 bytes of cyclic data is being transferred.



FL-net Header Format

The FL-net header consists of between 64 and 96 bytes.



The FL-net header is added at the beginning of all frames in the FL-net protocol.

FL-net Transaction Codes

FL-net supports the following message transmission services.

FL-net message transmission service		Unit support	
		Client function	Server function
1	Read byte block	No	No
2	Write byte block	No	No
3	Read word block	Yes	Yes
4	Write word block	Yes	Yes
5	Read network parameter	No	Yes
6	Write network parameter	No	No
7	Stop command	No	No
8	Run command	No	No
9	Read profile	No	Yes
10	Read communications log data	No	Yes
11	Clear communications log data	No	Yes
12	Echoback message	Yes (See note.)	Yes
13	Send transparent message frame	Yes	Yes
14	Vendor message	Yes	Yes

Note This message service is provided as an internode test.

The header of each message contains a request transaction code or a response transaction code that distinguishes the type of message frame used.

Transaction code	Corresponding message
0 to 9999	Reserved
10000 to 59999	Transparent messages
60000 to 64999	Reserved
65000	Token header
65001	Cyclic header
65002	Participation request frame header
65003	Read byte block (request)
65004	Write byte block (request)
65005	Read word block (request)
65006	Write word block (request)
65007	Read network parameter (request)
65008	Write network parameter (request)
65009	Stop command (request)
65010	Run command (request)
65011	Read profile (request)
65012	Trigger header
65013	Read communications log data (request)
65014	Clear communications log data (request)
65015	Echoback message test (request)
65016	Vendor message (request)
65017 to 65202	Reserved (for future expansion)
65203	Read byte block (response)
65204	Write byte block (response)
65205	Read word block (response)
65206	Write word block (response)
65207	Read network parameter (response)

Transaction code	Corresponding message
65208	Write network parameter (response)
65209	Stop command (response)
65210	Run command (response)
65211	Read profile (response)
65212	Reserved
65213	Read communications log data (response)
65214	Clear communications log data (response)
65215	Echoback message test (response)
65216	Vendor message (response)
65217 to 65399	Reserved (for future expansion)
65400 to 65535	Reserved

Appendix D
FL-net Network Control

FL-net Token Control

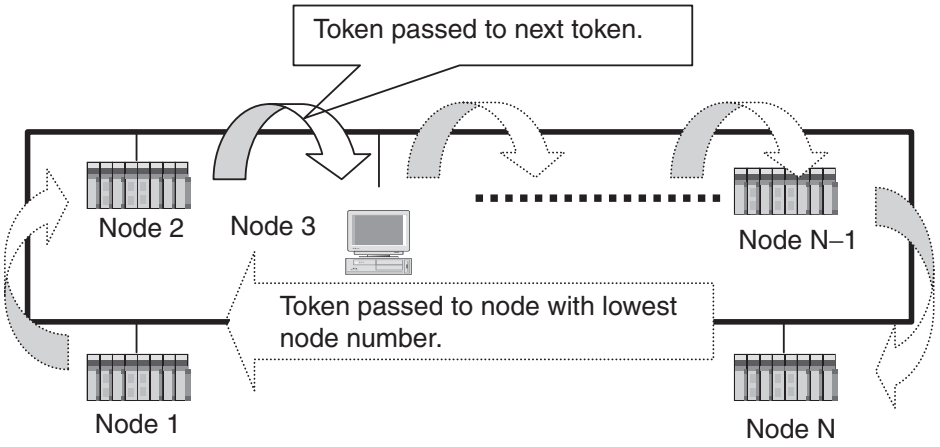
Tokens

Basically, a node can send data when it is holding the token. The only two types of data that can be sent by a node that is not holding the token are a request to resend the token when a token monitoring timeout occurs and a participation request frame for a node that is not participating in the network.

1. FL-net networks pass a single token between nodes.
2. After each node receives the token, it maintains the right to transmit in the network until the token is passed to the next node.
3. The token is passed to all nodes participating in FL-net.
4. The token can be sent together with cyclic data.
5. The token can also be passed alone without attached data.
6. The token is monitored by a timer and automatically resent if it is not passed through the network within a fixed period of time.
7. If two or more tokens are present in the network at the same time, they will be reduced to a single token.

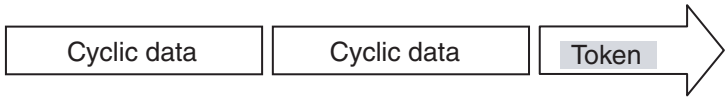
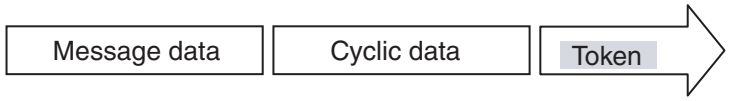
Token Flow

Generally, only a single token is present in a network at any one time. If two or more tokens are present in the network, the token at the node with the smallest destination node number is given priority, and the other tokens are discarded. The token frame is the frame that includes the token and 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. The token rotation order is determined by the node numbers. The token is passed to all nodes registered in the participating 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.



Token and Data Transmission Patterns

The following six types of transmission patterns can be used to send data with a token.

No.	Pattern	Details
1	No accompanying data	Sending token only
		
2	Cyclic data only	Cyclic data is sent, after which the token is sent.
		
3	Cyclic data only, which is split into different packets and then sent	Cyclic data is split into several packets and sent, after which the token is sent.
		
4	Message data only	Message data is sent, after which the token is sent.
		
5	Cyclic data and message data	Message data and cyclic data is sent, after which the token is sent.
		
6	Cyclic data and message data, of which the cyclic data is split into different packets and then sent	Message data is sent, after which the cyclic data is split into several packets and sent, followed by the token.
		

Frame Intervals (Minimum Allowable Frame Interval)

The frame interval is the time required until the local node sends a frame after receiving a token from another node. The minimum allowable frame interval is the least time that a node must wait until it can send a frame. FL-net uses the same minimum allowable frame interval for the entire network. Whenever a node joins or is removed from the network, each node updates the minimum allowable frame interval by calculating the maximum value for the minimum allowable frame interval set by the nodes participating in the network.

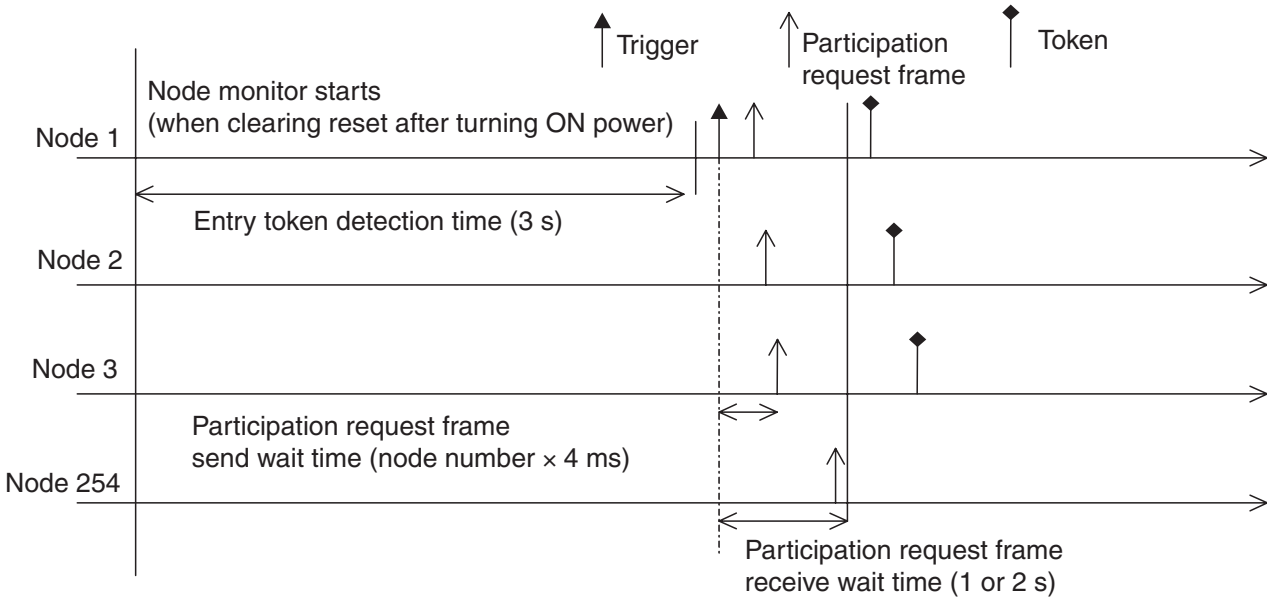
Joining and Leaving the FL-net

Joining FL-net

When a node is started, it monitors the communications line until the entry token detection timer times out. If a token is not received during this time, the node assumes the network has just been started and the node joins the network as a node in a new network. If a token is received, the node assumes that the network is active and the node joins the active network.

Participating in a New Network

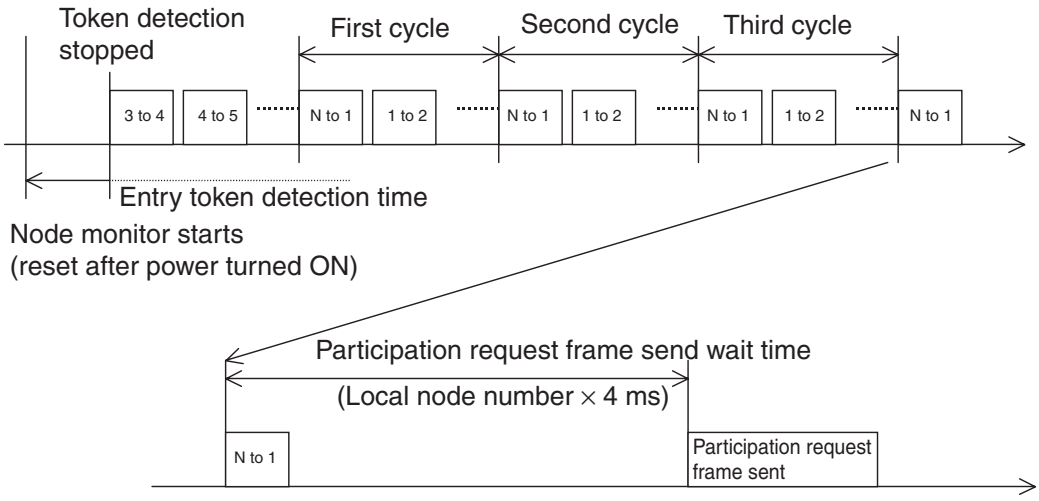
If a token is not received within the entry token detection time, a trigger transmission is prepared and a trigger is sent after dividing the node number by 8 and multiplying the remainder by 4 ms. If another trigger is received before the trigger is sent, the trigger will not be sent. From the time the trigger is received and for the duration of the participation request frame receive wait time (1,200 ms), the node number and address are checked for duplication, the participating node management table is updated, and participation request frames from all nodes are waited. The participation request frame is sent after the participation request frame send wait time (node number × 4 ms) times out after receiving the trigger. At this time, the beginning addresses of the Common Memories allocated for Area 1 and Area 2 and the Common Memory sizes are set to 0 and cyclic data is not sent by nodes for which the participation request frames from other nodes show address duplication. The Duplicate Common Memory Address Flag is turned ON for nodes confirmed to have duplicated addresses, and the Common Memory Data Validity Notification Flag is turned OFF. When the participation request frame receive wait time has lapsed, a token is sent first by the node with the smallest node number according to the node management table. Nodes confirmed to have duplicate node numbers will not send or receive tokens or data.



Joining an Active Network

When a token is received within the entry token detection time, the node assume links have been established and waits for a participation request frame to be sent until the token has been passed three times around the network. During that time, the node number and address are checked for duplication using the received frames, and the participating node management table is updated. At this time, if a duplicate address is detected, the beginning addresses of Common Memory Area 1 and Area 2, and the Common Memory size are set to 0, and cyclic data is not sent. The Duplicate Common Memory Address Flag will turn ON for nodes that are detected to have duplicate addresses, and the Common Memory Data Validity Notification Flag for the corresponding nodes will be turned OFF. If no node address error occurs, the participation request frame is sent after the participation request frame send wait time lapses. The participation request frame is sent regardless of whether the node is holding the token. The participation request frame will not be sent by nodes detected to have duplicate node numbers and these nodes will not join the network.

Note The entry token detection time is the time required to check whether the network is active. A standard cycle is based on the time taken for the token to be received at the node with the smallest node number. The participation request frame send wait time is the time before a participation request frame can be sent, so that the frame sent by the newly participating node does not collide with a frame being sent by another node (local node number × 4 ms).



Leaving the FL-net

The node number of each node is checked when the token frame is received, and nodes that do not receive the token frame for three successive passes of the token are removed from the network (including a token-holding node that does not send the token after the token monitoring time has timed out). When a node is determined to have been removed from the network, the node information is deleted from the management table.

Managing Node Status

Node status is managed using three types of management tables: Local node management tables, participating node management tables, and network management tables. A summary of these tables is provided below.

Table	Details
Local node management table	Manages the local node settings.
Participating node management table	Manages information on the nodes in the network.
Network management table	Manages information that is shared by all nodes on the network.

FL-net Local Node Management Table

Basic Functions

The data for setting local nodes is managed using the local node management table, as shown in the following table.

1. Local node management tables are used to read participation request frames and network parameters.
2. Management data is set from the FL-net upper layer when the node is started.
3. The node name and beginning address and size of the send area in Common Memory can be set from the CX-FLnet or FL-net Unit Support Software connected to the PLC.

Management Data

Item	Bytes	Contents (data range)
Node number	1 byte	1 to 254
Common Memory Area 1 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 first word	2 bytes	Word address (0 to 0x1fff)
Common Memory Area 2 data size	2 bytes	Size (0 to 0x2000) (See note.)
Upper layer status	2 bytes	RUN/STOP/ALARM/WARNING/NORMAL
Token monitoring time	1 byte	Unit: 1 ms

Item	Bytes	Contents (data range)
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 For details on FL-net Unit restrictions, refer to *Precautions* under *3-1 Before Operation*.

Participating Node Management Table

Basic Functions

The status of the nodes in the network is monitored using the participating node management table maintained by each node. Management data is managed for each node that has joined the network. A summary of the functions is provided below.

1. When a node is started, a token frame is received, and the participating node management table and network management table are updated.
2. For each token frame received, the node's participating node management table is updated.
3. When a participation request frame is received for a new node, the participating node management table is updated.
4. A node will be deleted from the table if the node does not receive a token frame or has consecutively timed out three times.

Management Data

The token for each node is constantly monitored and the participating node management table is created and managed, as shown in the following table.

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 0x1ff)
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 0x1fff)
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 μs
Link status	1 byte	Participating, not participating, etc.

Note (1) "0x1fff" refers to hexadecimal 1FFF.

(2) This information is included in the received token frame.

Network Management Tables

Basic Functions

Parameters that are shared by all nodes on the network are managed.

Management Data

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

Message Sequence Management

Basic Functions

The sequence number and sequence version number in message transmissions are managed.

Send Management Data

Item	Bytes	Contents (data range)
Sequence version number	4 bytes	Send message transmission sequential version
Sequence number (1:N send)	4 bytes	0x1 to 0xffffffff
Sequence number (1:1 send)	4 bytes × 256	0x1 to 0xffffffff

Note “0xffffffff” indicates FFFFFFFF hexadecimal.

Receive Management Data

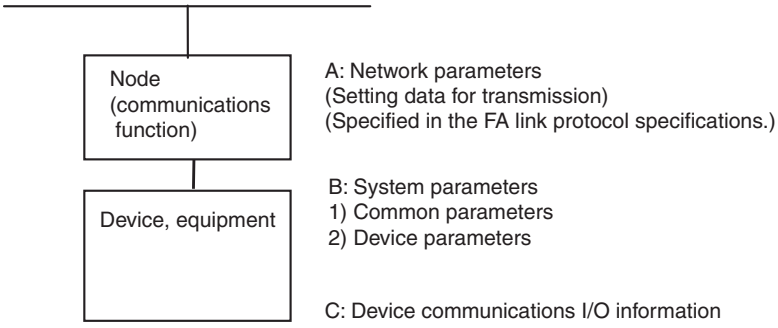
Item	Bytes	Contents (data range)
Sequence version number	4 bytes	0x1 to 0xffffffff
Sequence number (1:N receive)	4 bytes	0x1 to 0xffffffff
Sequence number (1:1 receive)	4 bytes	0x1 to 0xffffffff

Note “0xffffffff” indicates FFFFFFFF hexadecimal.

Appendix E
FL-net Profile

Device Communications Information Classification

The parameters and other information related to communications for devices connected to the network are classified into three types, as follows:



1. Network parameters (A) are parameters required for transmission.
2. System parameters (B) are static parameters used as management data for distinguishing what type of device is connected to the network.
3. Device communications I/O information (C) can be accessed from other devices on the network when required by an application. This information includes dynamic data that changes according to the application operation and device status.

Data Types Supported for System Parameters

The following table lists the data types that can be used for system parameters in the UNIVERSAL TAG.

Tag number (hexadecimal)	Type	Supported (See note 1.)	Remarks
00	(Reserved.)	No	
01	BOOLEAN	Yes	
02	INTEGER	Yes	
03	BIT STRING	Yes	
04	OCTET STRING	Yes	
05	NULL	Yes	
06	OBJECT IDENTIFIER	No	
07	ObjectDescriptor	No	
08	EXTERNAL	No	
09	REAL	No	
0A	ENUMERATED	No	
0B to 0F	(Reserved.)	No	
10	SEQUENCE and SEQUENCE OF	Yes	(See note 2.)
11	SET and SET OF	No	
12	NumericString	No	
13	PrintableString	Yes	
14	TeletexString	No	
15	VideotexString	No	
16	IA5String	No	
17	UTCTime	No	
18	GeneralizedTime	No	

Tag number (hexadecimal)	Type	Supported (See note 1.)	Remarks
19	GraphicString	No	
1A	VisibleString	No	
1B	GeneralString	No	
1C	CharacterString	No	
1D to 1E	(Reserved.)	No	

Note For the construction type only SEQUENCE and SEQUENCE OF can be used.

System Parameters

Message Transmission Service
The following services are used to access the system parameters.

TCD	Service name	Function
65011	Read profile (request)	Request to batch read system parameters (not supported by this Unit).
65211	Read profile (response)	Response to batch read of system parameters. Response data size is 1,024 bytes max.

Parameter Structure

The system parameters are configured of the following data in the order given in the table.

Parameter name	Details
Common parameters	Parameters common to all devices.
Device parameters	Vendor-specified parameters for each device (optional)

Common Parameters

The following parameters are mandatory.

Parameter name	Name text (PrintableString type) *Length, Text*	Data type	Parameter contents *Length_in_decimal, Contents* (Boxes indicate spaces.)
Device profile common specifications version	6,”COMVER”	INTEGER	1,1
System parameter ID	2,”ID”	PrintableString	7,”SYSPARA”
System parameter revision number	3,”REV”	INTEGER	1,0
System parameter revision date	7,”REVDATE”	[INTEGER],2,(0001-9999), [INTEGER],1,(01-12), [INTEGER],1,(01-31)	2,1999 1,06 1,30
Device type	10,”DVCATEGORY”	PrintableString	3,”PLC” (See note.)
Vendor name	6,”VENDOR”	PrintableString	9,”OMRON□Co.”
Device model name	7,”DVMODEL”	PrintableString	21,”CS1□FL-net□Unit□V1.00” or 21,”CJ1□FL-net□Unit□V1.00”

Note The parameter contents for device types are classified as follows:
“PC” or “PLC”: Programmable Controller
“NC” or “CNC”: Computerized numeric controllers
“RC” or “ROBOT”: Robot controllers
“COMPUTER”: Personal computers, panel computers, workstations, display devices, and other computers.
“SP-* *”: Vendor specific
“OTHER”: Other

The transfer syntax uses SEQUENCE structures for all system parameters, all common parameters, the system parameter revision data, and all device parameters (any data structure can be used within device parameters).

Device Parameters

Parameter name	Name text (PrintableString type) *Length, Text*	Data type	Parameter contents *Length_in_decimal, Contents* (Boxes indicate spaces.)
Device parameter ID	2,"ID"	PrintableString	7,"DEVPARA"
Device type	7,"DEVTYPE"	PrintableString	10,"CS1W-FLN22" or 10,"CJ1W-FLN22
Unit revision code	7,"UNITREV"	PrintableString	1, * (same value as unit profile)
PCB revision code	6,"PCBREV"	PrintableString	3, *** (same value as unit profile)
Software revision code	7,"SOFTREV"	PrintableString	2, ** (same value as unit profile)
Lot number	5,"LOTNO"	PrintableString	6, ****** (same value as unit profile)
Work area	8,"WORKAREA"	PrintableString	1, 10 (same value as unit profile)
Serial number	8,"SERIALNO"	PrintableString	1, **** (same value as unit profile)

Abstract Syntax

Type Definition

```
PlcmRecord::=      SEQUENCE
                   {
                   syspara     SysparaType,
                   plcmpara    PlcmType
                   }
SysparaType::=     SEQUENCE
                   {
                   nameCOMVER          NameType,
                   paraCOMVER          INTEGER,
                   nameID              NameType,
                   paraID              NameType,
                   nameREV             NameType,
                   paraREV             INTEGER,
                   nameREVDATE         NameType,
                   paraREVDATE         DateType,
                   nameDVCATEGORY      NameType,
                   paraDVCATEGORY      NameType,
                   nameVENDOR          NameType,
                   paraVENDOR          NameType,
                   nameDVMODEL         NameType,
                   paraDVMODEL         NameType
                   }
PlcmType::=        SEQUENCE
                   {
                   nameID              NameType,
                   paraID              NameType,
                   parameter           SEQUENCE OF ParaInfo
                                       DEFAULT{}z
```

```
                }
NameType::=     PrintableString
DateType::=     SEQUENCE
                year            INTEGER,
                month           INTEGER,
                day             INTEGER
                }
ParaInfo::=     SEQUENCE
                {
                namePARAMETER   NameType,
                paraPARAMETER   NameType
                }
```

Value Definitions

```
{
syspara     {
                    nameCOMVER      ìCOMVERî,
                    paraCOMVER      1,
                    nameID          ìIDî,
                    paraID          ìSYSPARAî,
                    nameREV         ìREVî,
                    paraREV         0,
                    nameREVDATE     ìREVDATEî,
                    paraREVDATE     {   year    1999,
                                        month   6,day   30   },
                    nameDVCATEGORY  ìDVCATEGORYî,
                    paraDVCATEGORY  ìPLCî,
                    nameVENDOR      ìVENDORî,
                    paraVENDOR      ìOMRON□Co.î,
                    nameDVMODEL     ìDVMODELî,
                    paraDVMODEL     ìCS1□FL-net□Unit□V1.00î,
                                    (CJ Series: ìCJ1□FL-net□Unit□V1.00î)
                    }
            plcmpara    {
                    nameID          ìIDî,
                    paraID          ìDEVPARAî,
                    parameter
                       {
                       namePARAMETER        ìDEVTYPEî
                       paraPARAMETER        ìCS1W-FLN22î,
                                            (CJ Series: ìCJ1W-FLN22î)
                       namePARAMETER        ìUNITREVî,
                       paraPARAMETER        ì1î,
                       namePARAMETER        ìPCBREVî,
                       paraPARAMETER        ì***î, (variable)
                       namePARAMETER        ìSOFTREVî,
                       paraPARAMETER        ì**î, (variable)
                       namePARAMETER        ìLOTNOî,
                       paraPARAMETER        ì******î, (variable)
                       namePARAMETER        ìWORKAREAî,
                       paraPARAMETER        ì*î, (variable)
                       namePARAMETER        ìSERIALNOî,
                       paraPARAMETER        ì****î, (variable)
                       }
                    }
            }
```

Transfer Syntax Data Array (Signed)

$30	$81	$F2	
$30		$79	
	$13	$06	“COMVER”
	$02	$01	1
	$13	$02	“ID”
	$13	$07	“SYSPARA”
	$13	$03	“REV”
	$02	$01	0
	$13	$07	“REVDATE”
$30		$0A	
	$02	$02	$07CF
	$02	$01	$06
	$02	$01	$1E
	$13	$0A	“DVCATEGORY”
	$13	$03	“PLC”
	$13	$06	“VENDOR”]
	$13	$09	“OMRON□Co.”
	$13	$07	“DVMODEL”
	$13	$15	“CS1□FL-net□Unit□V1.00" (CJ Series: "CJ1□FL-net□Unit□V1.00")
$30	$81	$74	
	$13	$02	“ID”
	$13	$07	“DEVPARA”
	$13	$07	“DEVTYPE”
	$13	$0A	"CS1W-FLN22" (CJ Series: "CJ1W-FLN22")
	$13	$07	“UNITREV”
	$13	$01	1
	$13	$06	“PCBREV”
	$13	$03	*** (variable)
	$13	$07	“SOFTREV”
	$13	$02	*(variable)
	$13	$05	“LOTNO”
	$13	$06	****** (variable)
	$13	$08	“WORKAREA”
	$13	$01	* (variable)
	$13	$08	“SERIALNO”
	$13	$04	**** (variable)

Communications Line Data Sequence

The following table shows the sequence used to send data on the communications line. Data is sent from the data starting from address 0 in the relative address 00 column in sequence moving left or right. Relative address 00 is followed by relative address 10, and data is sent in the order of relative addresses as shown below.

Data: Hexadecimal (Example)

Relative address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
00	30	81	F2	30	79	13	06	“C”	“0”	“M”	“V”	“E”	“R”	02	01	01
10	13	02	“I”	“D”	13	07	“S”	“Y”	“S”	“P”	“A”	“R”	“A”	13	03	“R”
20	“E”	“V”	02	01	00	13	07	“R”	“E”	“V”	“D”	“A”	“T”	“E”	30	0A
30	02	02	07	CF	02	01	06	02	01	1E	13	0A	“D”	“V”	“C”	“A”
40	“T”	“E”	“G”	“O”	“R”	“Y”	13	03	“P”	“L”	“C”	13	06	“V”	“E”	“N”
50	“D”	“O”	“R”	13	09	“O”	“M”	“R”	“O”	“N”	“ “	“C”	“o”	“.”	13	07
60	“D”	“V”	“M”	“O”	“D”	“E”	“L”	13	15	“C”	“S”	“1”	“ “	“F”	“L”	“-”
70	“n”	“e”	“t”	“ “	“U”	“N”	“i”	“t”	“ “	“V”	“1”	“.”	“0”	“0”	30	81
80	74	13	02	“I”	“D”	13	07	“D”	“E”	“V”	“P”	“A”	“R”	“A”	13	07
90	“D”	“E”	“V”	“T”	“Y”	“P”	“E”	13	0A	“C”	“S”	“1”	“W”	“-”	“F”	“L”
A0	“N”	“0”	“2”	13	07	“U”	“N”	“I”	“T”	“R”	“E”	“V”	13	01	“*”	13
B0	06	“P”	“C”	“B”	“R”	“E”	“V”	13	03	“*”	“*”	“*”	13	07	“S”	“0”
C0	“F”	“T”	“R”	“E”	“V”	13	02	“*”	“*”	13	05	“L”	“0”	“T”	“N”	“0”
D0	13	06	“*”	“*”	“*”	“*”	“*”	“*”	13	08	“W”	“O”	“R”	“K”	“A”	“R”
E0	“E”	“A”	13	01	“*”	13	08	“S”	“E”	“R”	“I”	“A”	“L”	“N”	“O”	13
F0	04	“*”	“*”	“*”	“*”											

Device Communications I/O Data

Device Communications I/O Data Resources

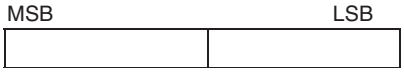
These resources are specific for each device called from the register data memory. The program area is also included in one of the resources, but the programs here are strictly indicating areas for storing programs and do not indicate programs that can be accessed as a block.

Area name	R/W	First word			End word		Size
DM	R/W	0x0002	0000	to	0x0002	7FFF	32768
TIM	R/W	0x0009	0000	to	0x0009	0FFF	4095
CNT	R/W	0x000A	0000	to	0x000A	0FFF	4095
EM0	R/W	0x0020	0000	to	0x0020	7FFF	32768
EM1	R/W	0x0021	0000	to	0x0021	7FFF	32768
EM2	R/W	0x0022	0000	to	0x0022	7FFF	32768
EM3	R/W	0x0023	0000	to	0x0023	7FFF	32768
EM4	R/W	0x0024	0000	to	0x0024	7FFF	32768
EM5	R/W	0x0025	0000	to	0x0025	7FFF	32768
EM6	R/W	0x0026	0000	to	0x0026	7FFF	32768
EM7	R/W	0x0027	0000	to	0x0027	7FFF	32768
EM8	R/W	0x0028	0000	to	0x0028	7FFF	32768
EM9	R/W	0x0029	0000	to	0x0029	7FFF	32768
EMa	R/W	0x002A	0000	to	0x002A	7FFF	32768
EMb	R/W	0x002B	0000	to	0x002B	7FFF	32768
EMc	R/W	0x002C	0000	to	0x002C	7FFF	32768
CIO	R/W	0x0030	0000	to	0x0030	17FF	6144
WR	R/W	0x0031	0000	to	0x0031	01FF	512

Area name	R/W	First word			End word		Size
HR	R/W	0x0032	0000	to	0x0032	01FF	512
AR	R	0x0033	0000	to	0x0033	03BF	960
AR	W	0x0033	01C0	to	0x0033	03BF	512

Note (1) Access unit: WORD

(2) Data sequence: A word corresponds to one word in a word block



Status/Mode

The data clarifying status/mode is shown below.

Item	Details
Status type	Normal Error (operation continues) Error (operation stops)
Status access method	Read: PARTICIPATING NODE STATUS READ (FINS 06 03)
Mode type	The operating mode can be selected from the following combinations FA link table storage method: PLC internal method (default)/Unit internal method FA link start method: Automatic addition (default)/manual addition Broadcast format: Class C broadcast (default)/fixed IP address specification method: 192.168.250 + node number (default)/Setup area
Mode information access method	Read: CPU UNIT DATA READ (FINS 05 01) Write: Set from the Support Software
Relation to ULS in FA link header	Operation in progress: RUN Operation stopped: STOP Normal operation: NORMAL Error (operation continues): WARNING Error (operation stopped): ALARM

Supported Message Services

The following table shows which message services are supported.

Message service	Client	Server
Read byte block	No	No
Write byte block	No	No
Read word block	Yes	Yes
Write word block	Yes	Yes
Read network parameter	No	Yes
Write network parameter	No	No
Stop command	No	No
Run command	No	No
Read profile	No	Yes
Send transparent message frame	Yes	Yes
Read communications log data	No	Yes
Clear communications log data	No	Yes
Echoback message	Yes (See note.)	Yes
Vendor message	Yes	Yes

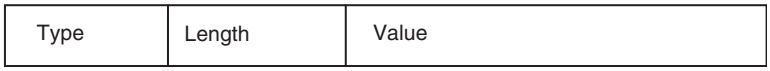
Note This message service is provided as an internode test.

Supplementary Profile Information

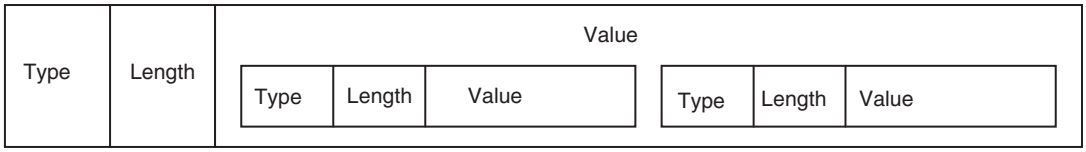
Summary of ASN.1 Transfer Syntax Format

A summary of the basic encoding rules for ISO/IEC 8825 ASN.1 (Abstract Syntax Notation One) relevant to FL-net are provided below.

Simple Format: ASN.1

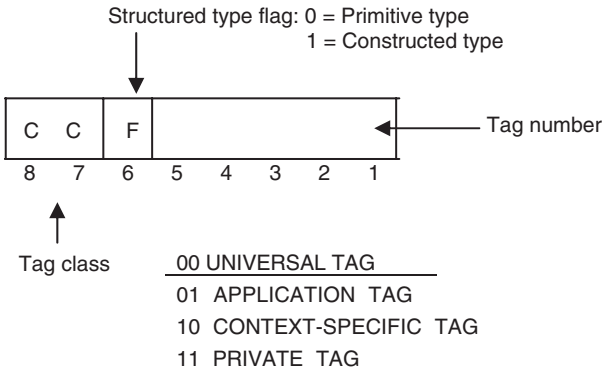


Structure Type Example with Signed ASN.1



Type Field

- Structure (Single Octet)



- Tag Number (UNIVERSAL TAG)

Tag number (hexadecimal)	Type	Tag number (hexadecimal	Type
00	(Reserved.)	11	SET and SET OF
01	BOOLEAN	12	NumericString
02	INTEGER	13	PrintableString
03	BIT STRING	14	TeletexString
04	OCTET STRING	15	VideotexString
05	NULL	16	IA5String
06	OBJECT IDENTIFIER	17	UTCTime
07	ObjectDescriptor	18	GeneralizedTime
08	EXTERNAL	19	GraphicString
09	REAL	1A	VisibleString
0A	ENUMERATED	1B	GeneralString
0B to 0F	(Reserved.)	1C	CharacterString
10	SEQUENCE and SEQUENCE OF	1D to 1E	(Reserved.)

- Structure Type Flag for Each Data Type

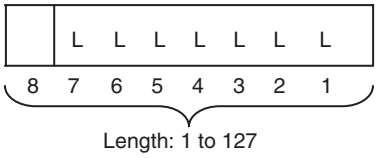
ASN.1	Primitive	Constructed
BOOLEAN, INTEGER, OBJECT IDENTIFIER, REAL, ENUMERATED	Supported	---
BIT STRING	Supported	Supported
OCTET STRING, NumericString or other character string	Supported	Supported
NULL (no value field)	Supported	---
SEQUENCE, SEQUENCE OF, SET, SET OF	---	Supported
EXTERNAL	---	Supported
CHOICE	Supported	Supported
ANY	Supported	Supported
With tag	Supported	Supported

- Printable Strings

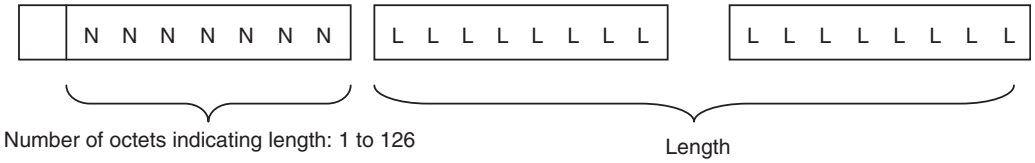
Name	Text	Code (hexadecimal)
Capital letters	A, B, ..., Z	41, 42, ..., 5A
Small letters	a, b, ..., z	61, 62, ..., 7A
Digits	0, 1, ..., 9	30, 31, ..., 39
Space	(space)	20
Apostrophe	‘	27
Left Parenthesis	(	28
Right Parenthesis	)	29
Plus sign	+	2B
Comma	,	2C
Hyphen	-	2D
Full stop	.	2E
Solidus	/	2F
Colon	:	3A
Equal sign	=	3D
Question mark	?	3F

Length Field

- Fixed-length Short Format



- Fixed-length Long Format



- Data Send Sequence
  The data send sequence is in big endian format for sending the first octet of data.
- Profile Resources
  - OKANE, Hisao *TCP/IP to OSI nettowaku kanri* [TCP/IP and OSI Network Management], 1993, Soft Research Center

- ISO/IEC 8824 Information technology - Open Systems Interconnection - Specification of Abstract Syntax Notation One (ASN.1), 1990 Second edition, (ISO/IEC 8824-1 1995, ISO/IEC 8824-2 1995, ISO/IEC 8824-3 1995, ISO/IEC 8824-4 1995)
- ISO/IEC 8825 Information technology - Open Systems Interconnection - Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1), 1990 Second edition, (ISO/IEC 8825-1 1995, ISO/IEC 8825-2 1996)

Data Read by Log Data Read Service

The following table shows which data can be read by the log data read service.

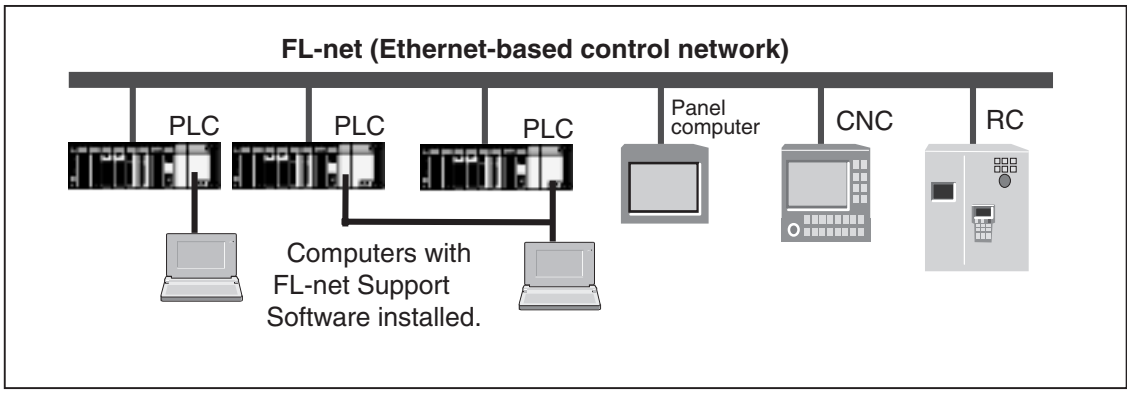
Item		Supported	Remarks
Send/receive	Total number of socket sends	Yes	
	Total number of socket send errors	Yes	
	Total number of Ethernet send errors	No	
	Total number of receives	Yes	
	Total number of receive errors	Yes	
	Total number of Ethernet receive errors	No	
Frame type	Number of token sends	No	
	Number of cyclic frame sends	No	
	Number of 1:1 message sends	No	
	Number of 1:N message sends	No	
	Number of token receives	No	
	Number of cyclic frame receives	No	
	Number of 1:1 message receives	No	
	Number of 1:N message receives	No	
Cyclic transmissions	Number of cyclic send/receive errors	Yes	
	Number of cyclic address size errors	No	
	Number of cyclic CBN errors	No	
	Number of cyclic TBN errors	No	
	Number of cyclic BSIZE errors	No	
Message transmissions	Number of message resends	Yes	
	Number of message resend overflows	Yes	
	Number of message send/receive errors	Yes	
	Number of message send sequence version errors	No	
	Number of message sequence resend validations	No	
ACK related	Number of ACK errors	Yes	
	Number of ACK sequence version errors	No	
	Number of ACK sequence number errors	No	
	Number of ACK node number errors	No	
	Number of ACK TCD errors	No	
Token related	Number of token multiplexing errors	Yes	
	Number of token discards	Yes	
	Number of token resends	Yes	
	Number of token holding timeouts	No	
	Number of token monitoring timeouts	No	
Status 1	Total operating time	No	
	Number of frame waits	Yes	
	Number of participations	Yes	
	Number of self-removals	Yes	
	Number of skip removals	Yes	
	Number of other node removals	Yes	
Status 2	List of participating nodes	No	
Implementer-defined area	(Undefined)	---	

Appendix F

FL-net Unit Support Software Ver. 1.6

FL-net Unit Support Software Overview

The FL-net Unit Support Software is used to make settings for OMRON FL-net Units mounted to Programmable Controllers (PLCs). The FL-net Unit Support Software is installed on a computer running Windows 7 (32-bit or 64-bit edition), Vista (32-bit or 64-bit edition), or XP (32-bit edition). This computer is connected to a PLC to which an FL-net Unit is mounted.



Note (1) The FL-net Unit Support Software is designed especially for OMRON FL-net Units.

(2) For information on node settings for FL-net devices from other companies, contact the particular companies.

(3) The Window operating system is not provided with the Support Software and must be purchased separately.

Operating Environment

Item	Conditions
Operating systems	Microsoft Windows 7 (32-bit or 64-bit edition) Microsoft Windows Vista (32-bit or 64-bit edition) Microsoft Windows XP (32-bit edition)
Hard disk	1 Mbyte or more of free space
Floppy disk drives	1 or more
Display	Resolution: 1,024 x 768 pixels min.
Other CPU and memory requirements	Must meet at least the recommended standards for the operating system.

Note (1) Make sure the user has Administrator authority when installing the FL-net Unit Support Software in a computer running Windows.

(2) Use the FL-net Unit Support Software Ver. 1.60 or later to set the CS1W-FLN22 and CJ1W-FLN22. Earlier versions of the FL-net Unit Support Software cannot be used to make the following settings.

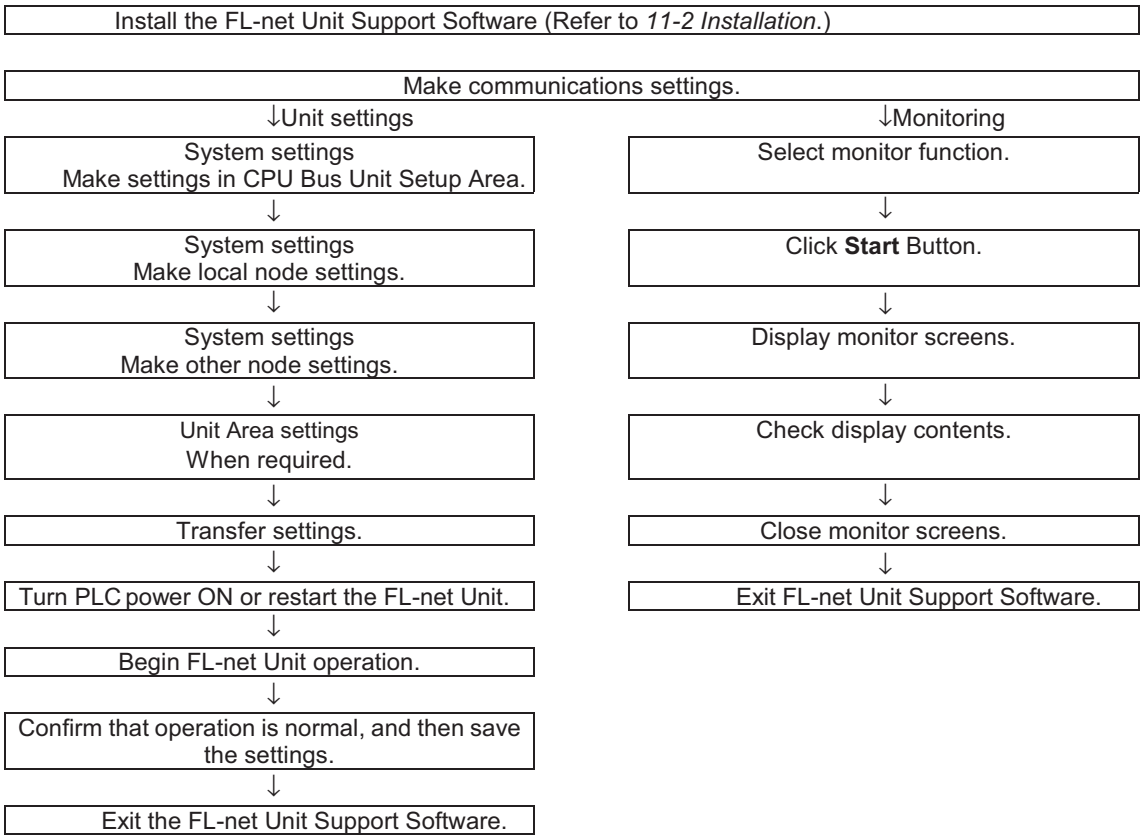
- Setting baud rate
- Switching upper/lower byte order of data link data

(3) If the FL-net Unit Support Software Ver. 1.51 or earlier is used to set the CS1W-FLN22 or CJ1W-FLN22, the baud rate will be fixed at 10 Mbps and the data link data upper/lower byte order will be set to sequential order (the same settings as for CS1W-FLN02 and CS1W-FLN12).

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 (Japanese)	Saves edited setup data in CSV format.
Save to file (English)	Saves edited setup data in CSV format. Use this setting to read data from an English version of the FL-net Unit Support Software.
Communications settings	Makes communications settings for connecting the computer to the PLC, and the settings for Unit designation.
System setting (CPU Bus Unit setup area)	Sets the basic FL-net 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 Unit at the local node.
System setting (Other node setup)	Makes settings related to cyclic data for the FL-net Units at remote nodes.
Unit area setting	Makes settings related to the settings and information in the Unit Area for the FL-net 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.
Option (Network setting)	Sets the communications settings when setting FL-net Unit settings of other nodes via the FL-net network.
Option (Extension setting)	Sets the order of data link data.

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.

Installation

This section explains how to install the software for setting the FL-net Unit's operating parameters.

Installation Procedure

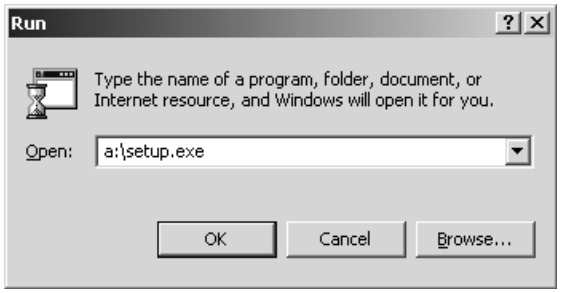
The procedure for installing the FL-net Unit Support Software is given below. Use the special-purpose Support Software Installer to install the software.

Note (1) Make sure the user has Administrator authority when installing the FL-net Unit Support Software in a computer running Windows.

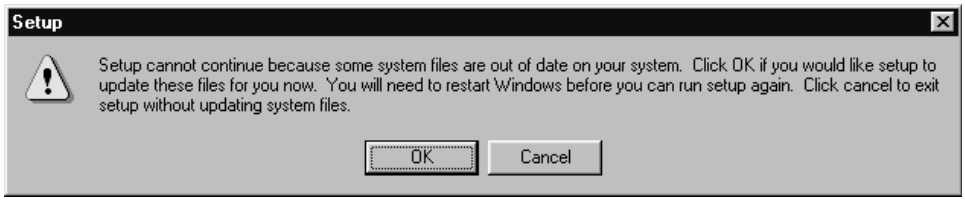
(2) Operations and screen displays will vary slightly according to the Windows system which is used.

(3) The FL-net Unit Support Software uses the following four setup files:
1) SETUP.EXE
2) SETUP.LST
3) FL_NET1.CAB
4) FL_NET2.CAB
When setting up from a floppy disk, store files 1 to 3 on one disk (Setup Disk 1) and file 4 on a second disk (Setup Disk 2). When setting up from a hard disk, compact flash memory, or other memory storage location, store files 1 to 4 in a user-specified folder.

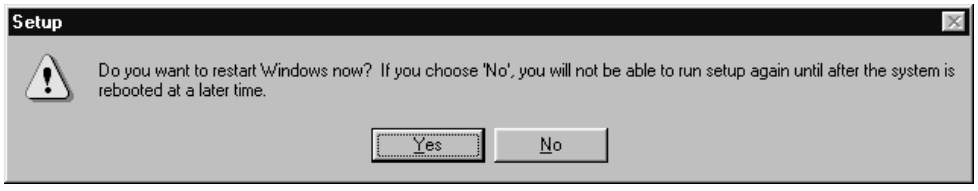
1. Close all applications that are running.
2. Insert the Support Software's Setup Disk 1 into the drive. This operation is not required when copying setup files from a memory storage location such as a hard disk.
3. Click the **Start** Button, and select ***Run***.
4. As shown in the following diagram, 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.



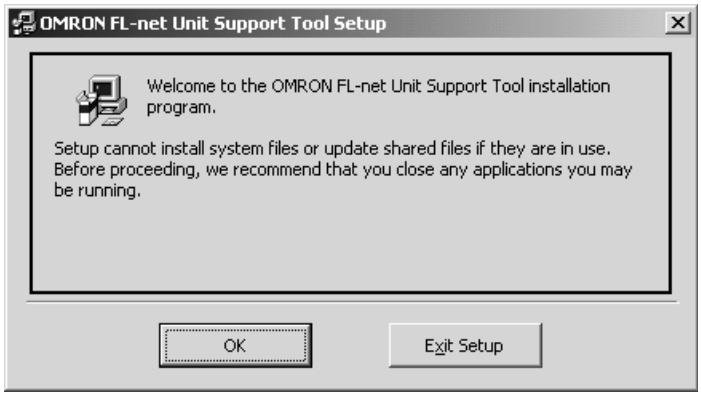
5. Depending on the Windows system being used, some of the system files may be modified for the setup, and it may be necessary to restart Windows.
If the following message is displayed, click the OK Button. If it is not displayed, proceed to Step 7.



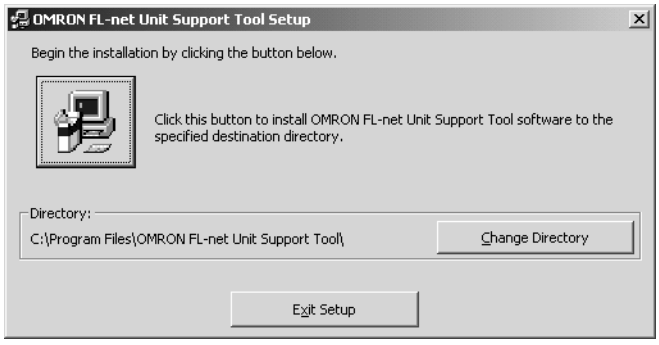
6. Click the **Yes** Button. After the computer has been restarted, the setup will be started when setup.exe is again executed.



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 Software 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.

Connecting the Computer to the PLC

This section explains how to connect to the PLC the computer in which the FL-net Unit Support Software 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 Software (i.e., the set values used during operation).

Specifications		Remarks
Communications protocol	Tool bus	---
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 FL-net Unit Support Software cannot be connected online at the same time as CX-Programmer or CX-Net. The following error message will be displayed if online connection is attempted when either of these applications is online.

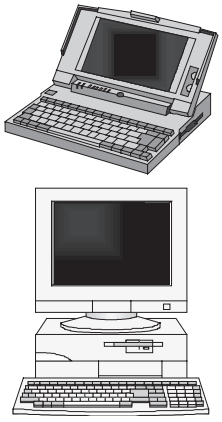
(2) The above specifications are automatically set and used internally by the FL-net Unit Support Software when it connects through the serial port of the computer.

(3) By setting the CS/CJ 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 Programmable Controllers Operation Manual* (W339) or *CJ Series Programmable Controllers Operation Manual* (W393).

(4) These settings do not depend on the serial port settings in the operating system, and there is no need to change the Windows settings.

(5) If the communications settings are all set manually, the settings must be made in the PLC Setup. For details, refer to the *CS Series Programmable Controllers Operation Manual* (W339) or *CJ Series Programmable Controllers Operation Manual* (W393)

Examples: Connecting the Computer and PLC

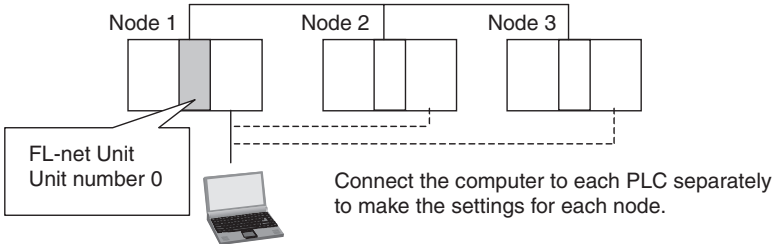
Computer	Connecting Cable	PLC
	CQM1-CIF01 ←RS-232C Peripheral port→	CS/CJ  Auto-detect Programming Device connection enabled by setting DIP switch pin No. 4 to OFF.
	RS-232C Cable CQM1-CIF01 ←RS-232C RS-232C port→	CS/CJ  Auto-detect Programming Device connection enabled by setting DIP switch pin No. 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*.

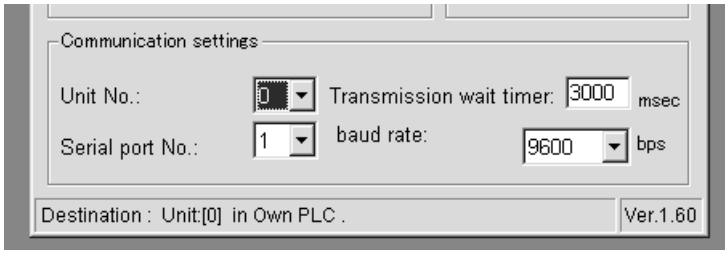
Connecting to the PLC Via the FL-net Network

Use either of the following two setting methods from the FL-net Unit Support Software Ver. 1.60.

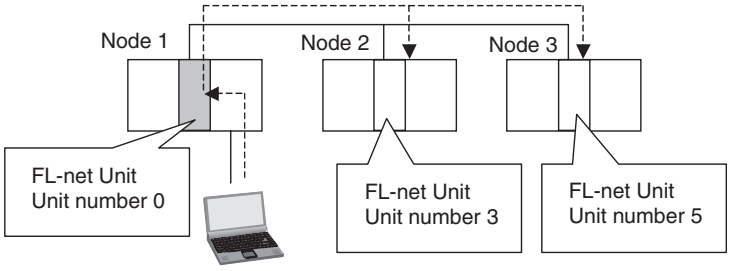
Directly Connecting to PLC to which an FL-net Unit Is Mounted



Specify the FL-net Unit's unit number in the *Unit No.* field under *Communication settings* in the Main Window of the FL-net Unit Support Software.



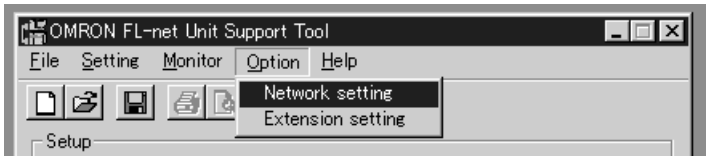
Connecting Via the FL-net Network



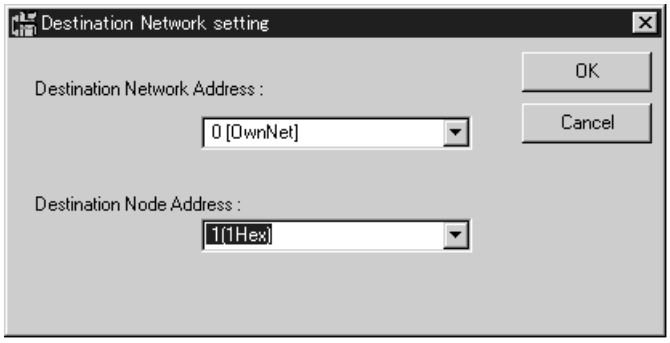
Make the settings via the FL-net network.

Select ***Network setting*** from the Option Menu in the Main Window of the FL-net Unit Support Software, and specify the remote PLC's network address and node address. Specify the unit number for the FL-net Unit in the *Unit No.* field under *Communication settings*.

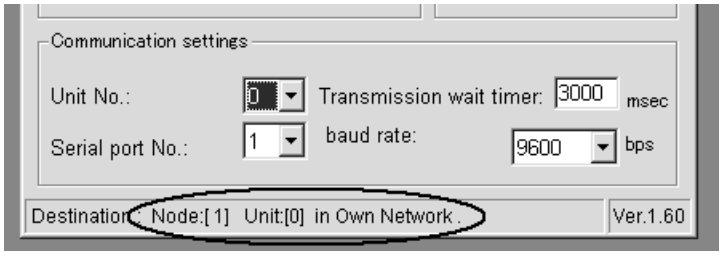
1. Select ***Network setting*** from the Option Menu in the Main Window of the FL-net Unit Support Software to display the Destination Network Setting Dialog Box.



2. Select the destination node in the *Destination Node Address* field (1 in this example) and click the **OK** Button.

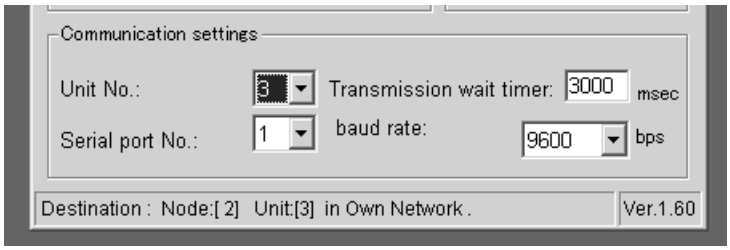


3. Specify the unit number for the FL-net Unit (0 in this example) in the Unit No. field under Communication settings in the Main Window of the FL-net Unit Support Software. The specified destination address will be displayed in the status bar.

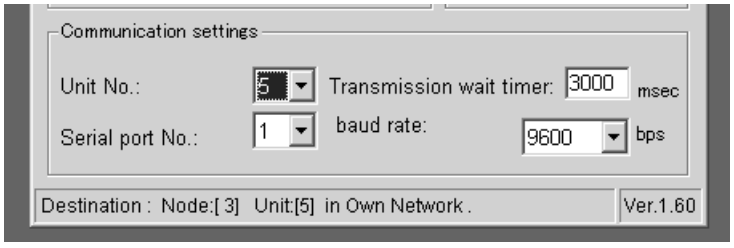


The unit number of the remote FL-net Unit must be specified when connecting via the FL-net network. In this configuration example, after specifying the destination node address in the Destination Node Setting Dialog Box, node 2 is set to unit number 3, and node 3 is set to unit number 5.

- Specifying Node 2 (FL-net Unit number 3)



- Specifying Node 3 (FL-net Unit number 5)



Note (1) Connection via the FL-net network is only supported for FL-net Unit Support Software Ver. 1.60 or later (FL-net Unit Support Software Ver. 1.51 or earlier cannot be used.)

(2) The unit number of the remote node's FL-net Unit must be specified when connecting via the FL-net network.

(3) The FL-net Unit Support Software cannot be used at the same time (i.e., communicate online) as CX-Programmer, CX-Net, or other Support Software.

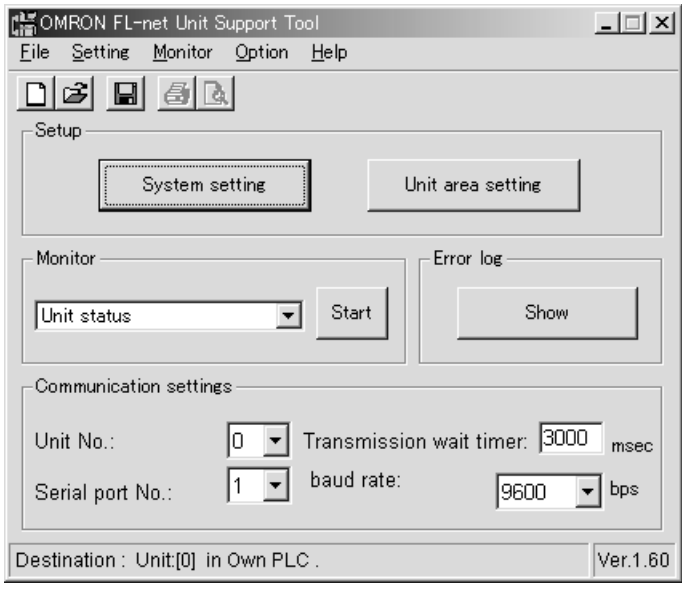
Using Support Software Functions

Basic Operations

Starting

1. Click the **Start** Button.
2. Display the menu by moving the cursor from Program to OMRON.
3. Select ***FL-net Unit Support Software*** to start the program. The following screen will be displayed.

Main Screen



Initializing

1. Select ***Initialize*** from the File Menu.
2. The system and communications settings will be initialized to their default values.

Opening

1. Select ***File Open*** from the File Menu.
2. When any file is selected, the previously-set contents of that file can be read.

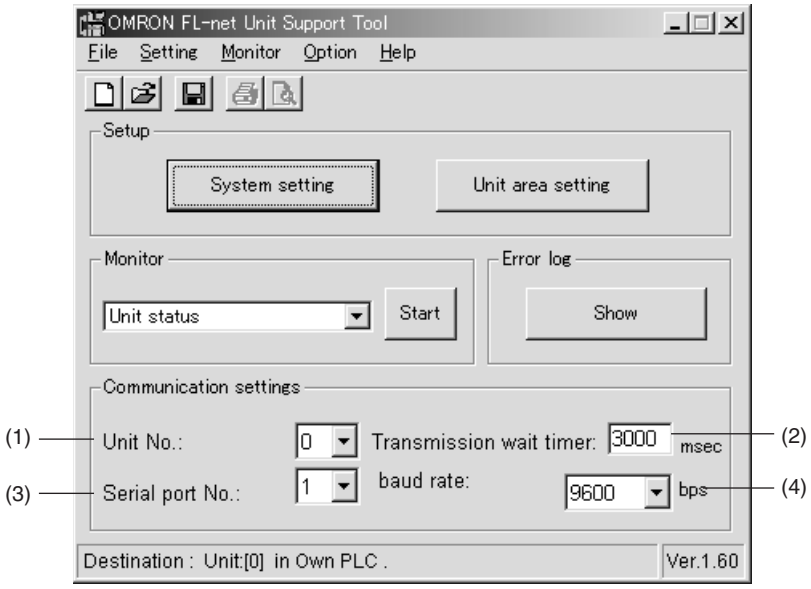
Saving

1. Select ***Save to file*** from the File Menu.
2. The contents of a file can be saved by specifying the filename.

Exiting

1. Select ***Exit*** from the File Menu.
2. The FL-net Unit Support Software 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 number to be used at the computer (for cable connection).

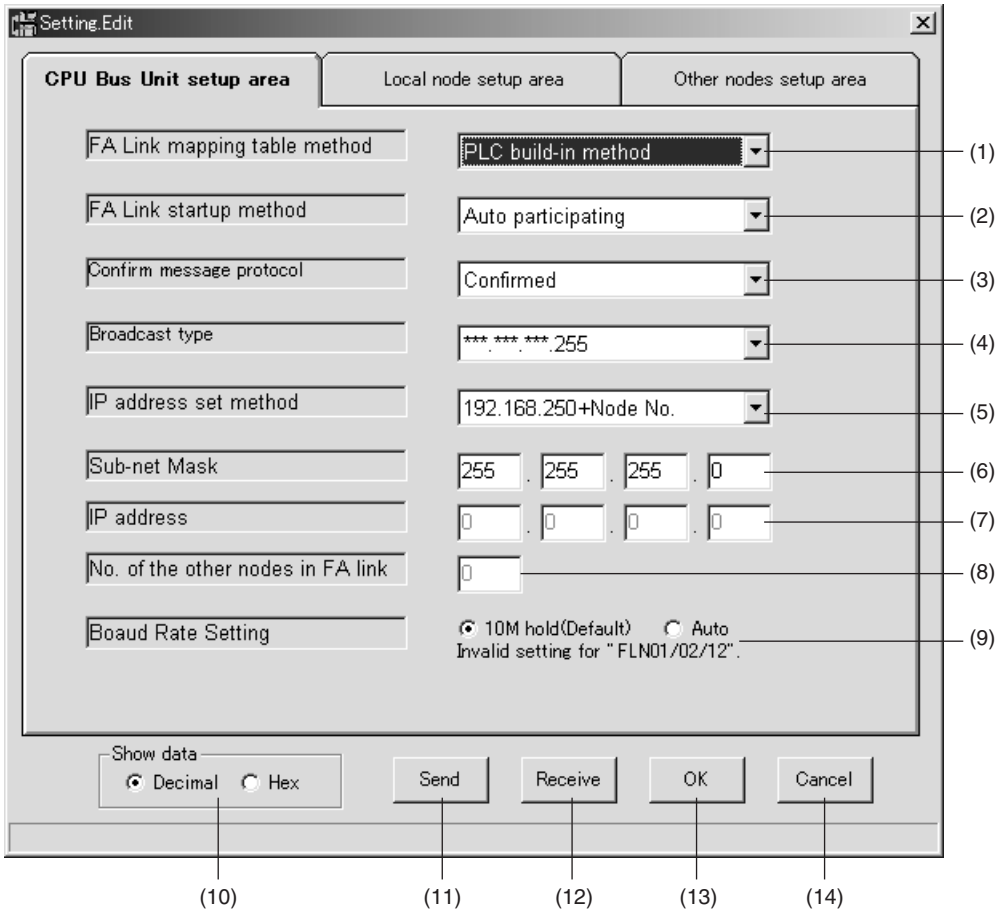
(4) Baud Rate (Default: 9,600 bps)

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.



(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 No.)

Selects the IP address setting method (*192.168.250 + Node No.*, *Unit rear rotary SW*, *Unit rear rotary SW* + Node No., or *Setup area*).

Normally the default should be selected.

When using CS1W-FLN22 or CJ1W-FLN22, select either *192.168.250 + Node No* or *Setup area.*

(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 *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 cannot be set.

(9) Baud Rate Setting (Default: 10 Mbps (not variable))

Sets the baud rate for FL-net communications. To communicate at 100 Mbps, select *Auto*. The baud rate is determined by the auto-negotiation function of the connected hub.

(10) Show data

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

(11) Send

Writes to the System Setup Area of the specified Unit.

(12) Receive

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

(13) OK

Validates the changed settings and closes the window.
When the System Setup Window is next opened, the changed settings will be displayed.

(14) 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 (1) 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.

(2) If either *Unit rear rotary SW + node No.* or *Unit rear rotary SW* is set as the IP address setting method for a CS1W-FLN22 or CJ1W-FLN22, a setting error will occur (HER indicator will light). Set the IP address setting method to either *192.168.250 + node No.* (default) or *Setup area*.

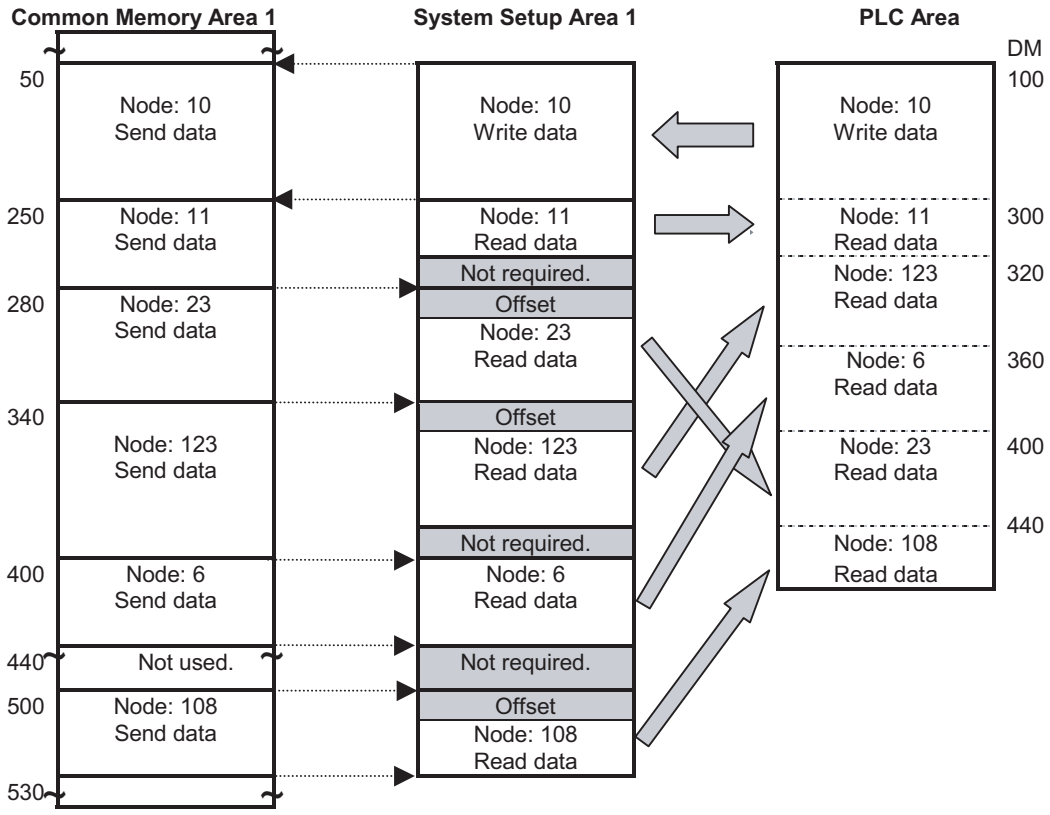
(3) The baud rate setting is supported by CS1W-FLN22 and CJ1W-FLN22 only. The setting cannot be made for CS1W-FLN02 or CS1W-FLN12, which always communicate at 10 Mbps.

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.

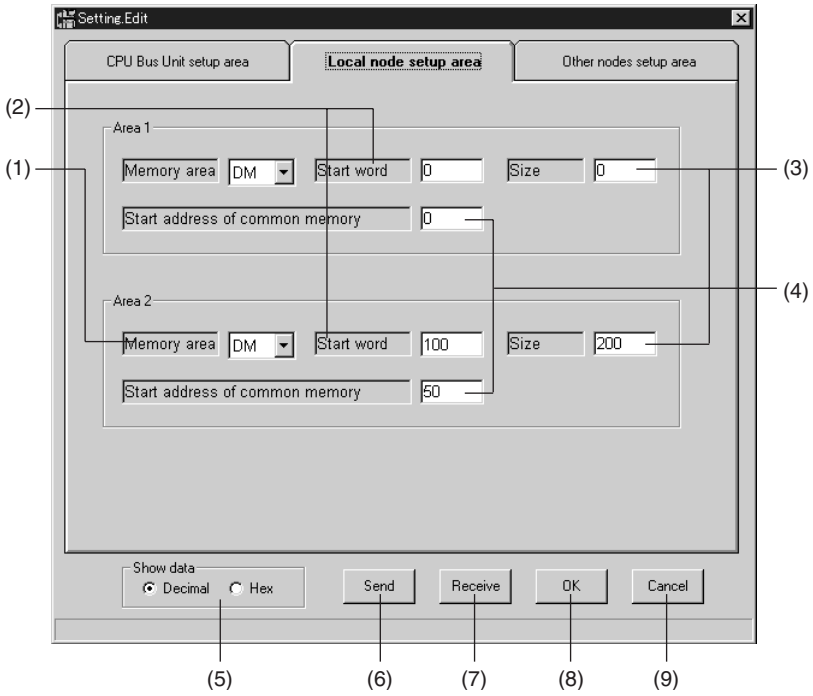
Example

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 can be 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 Software.

(8) OK

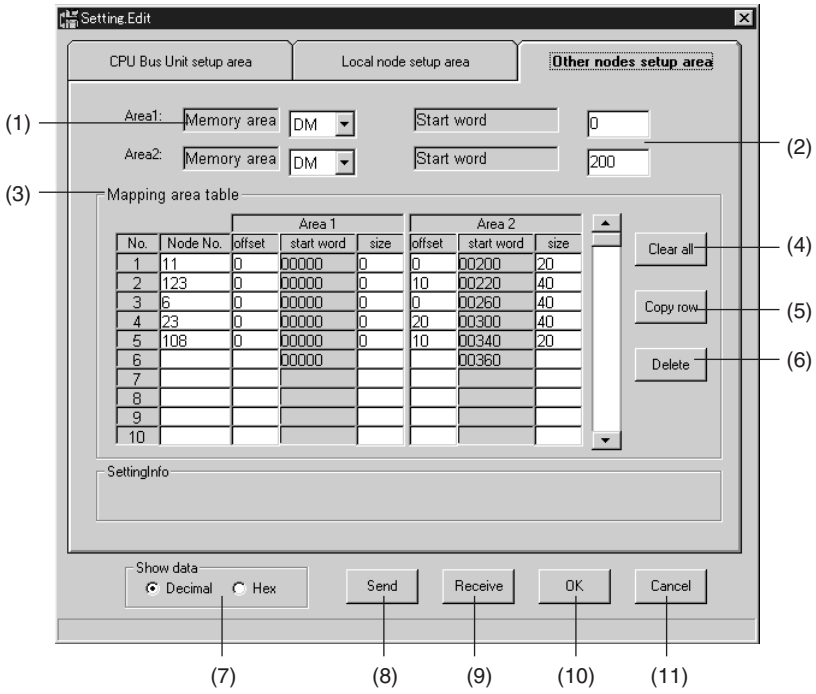
Validates the changed settings and closes the window.
When the System Setup Window is next opened, the changed settings will be displayed.

(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 can be 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. (See note 1.)

(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 Software.

(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

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 (1) Do not assign the local node to the mapping area table.

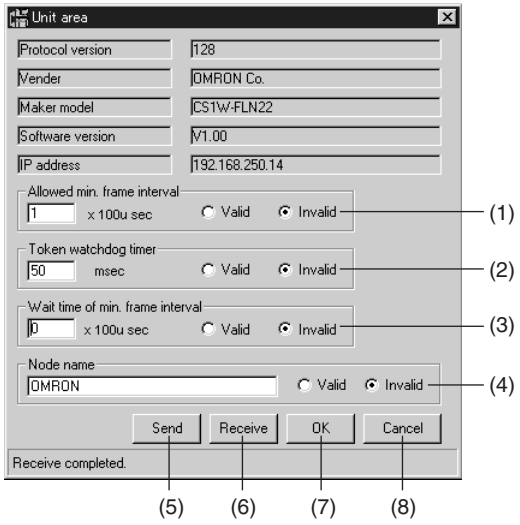
(2) Enter 0 in the *Node No.* field and enter the size of the local node setup area in the *Size* field for the area corresponding to that for the local node.

(3) If the settings are made for only Area 1 (or Area 2), set the offset and size for the other area to 0.

(4) 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.



(1) Allowed min. frame interval (default: 1 (100 μs))

Sets the present minimum allowable frame interval. *Valid* must be selected to enable this setting. If communications errors occur, increase the value of this setting. The maximum allowable frame interval used for the entire network is that of the node with the longest minimum allowable frame interval. The present valid value for the network can be checked by selecting ***Network status (FA Link)*** in the *Monitor* field. When a baud rate of 100 Mbps is used, set the minimum allowable frame interval to 1 ms or higher.

(2) Token watchdog timer (default: 50 ms)

Sets the timeout time for monitoring token passing between nodes. For normal usage, use the default value.

(3) Wait time of min. frame interval (default: 0)

Adds the value set here to the minimum allowable frame interval set in (1). This value is not used by the entire network. This value is only enabled for the corresponding node.

(4) Node name

Sets the node name. *Valid* must be selected to enable this setting.

(5) Send

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

(6) Receive

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

(7) OK

Validates the changed settings and closes the window.
When the Unit Area Setup Window is next opened, the changed settings will be displayed.

(8) Cancel

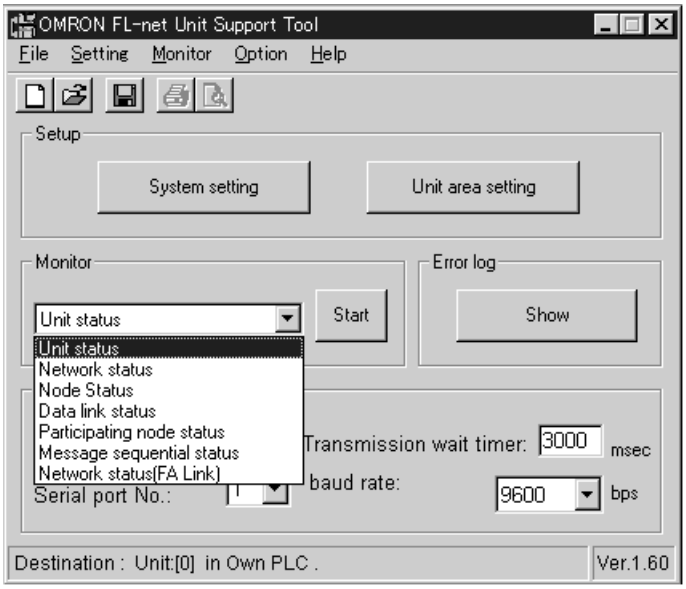
Cancels the changes to the settings and closes the window.
When the Unit Area Setup Window is next opened, the settings prior to the changes will be displayed.

Monitoring Function

The FL-net Unit Support Software 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

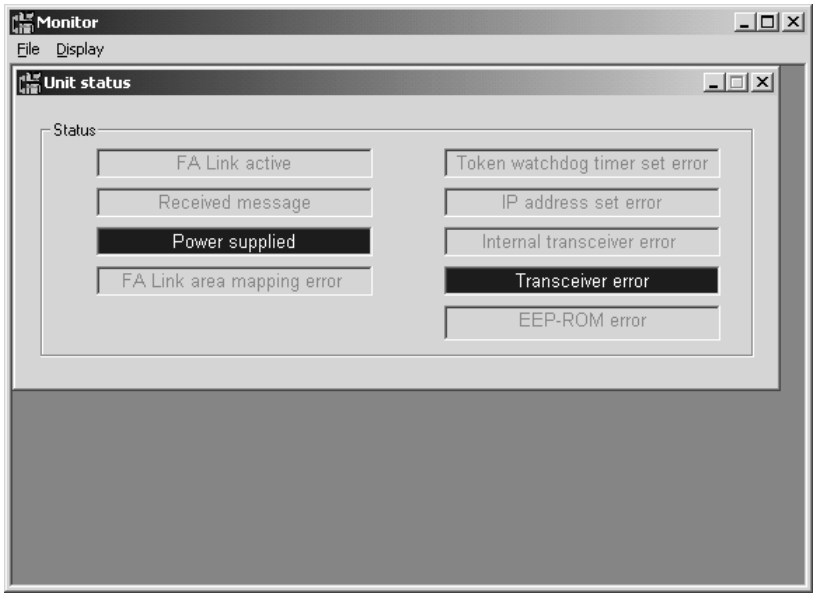
Select the data to be monitored, and then click the Start Button.



Note The monitoring function periodically reads data from the FL-net 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 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.

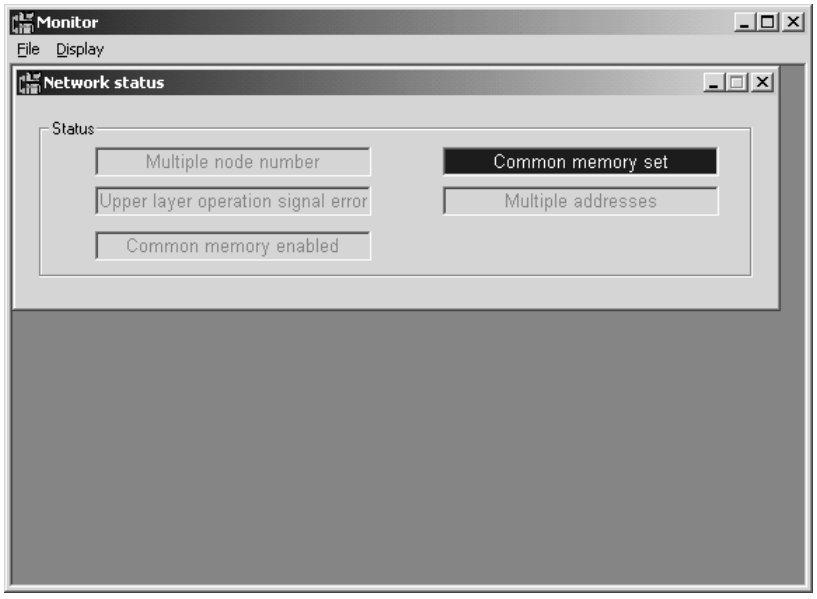
Internal transceiver error
Lit when an error occurs during a transceiver test. Restore by resetting the Unit.
If this is a recurring error, replace the Unit.

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 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.

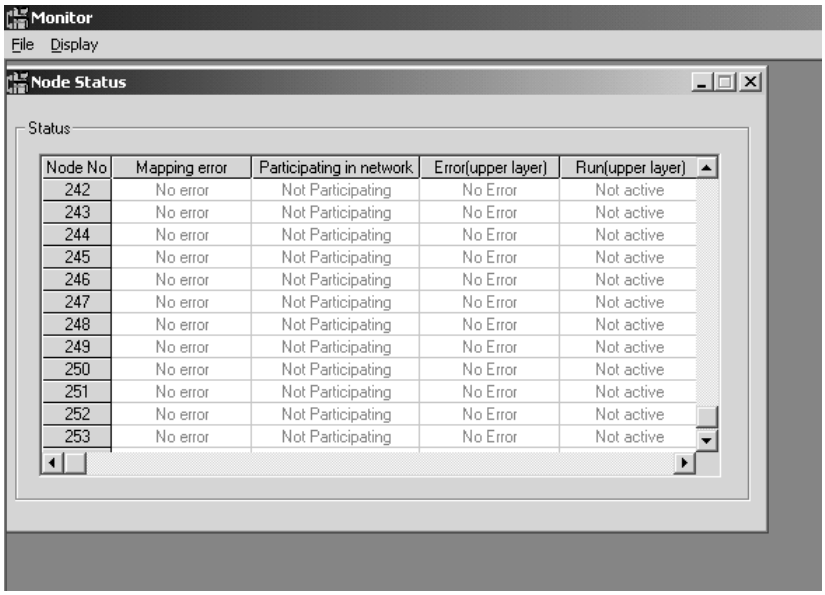
Common Memory set
Lit when Common Memory settings are completed.
Lit after Unit restart if the settings are normal.

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.



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)

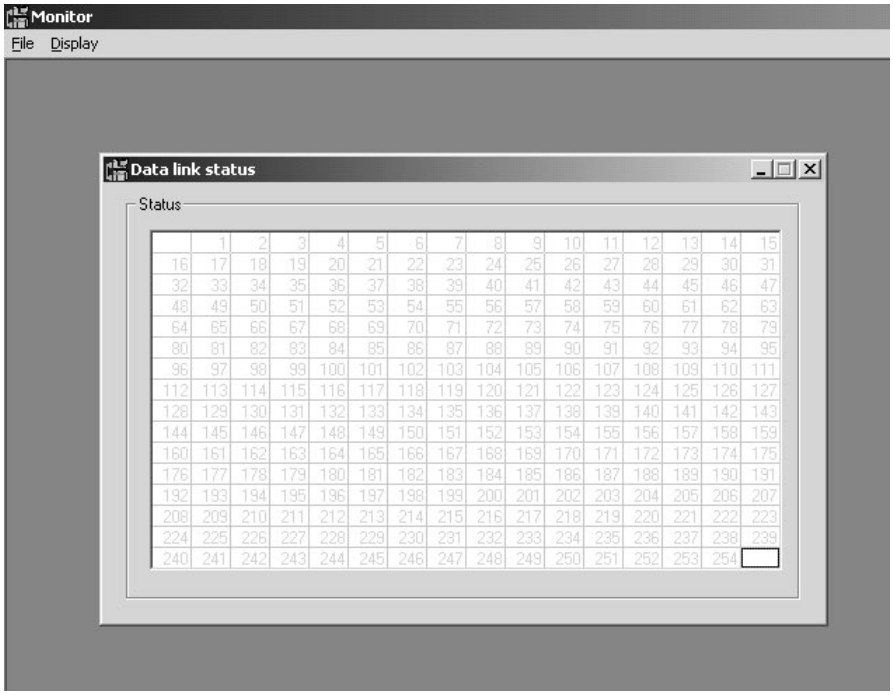
The error status (Error/No error) of applications installed at the node is stored.

Run (Upper Layer)

The operating status (Active/Not active) of applications installed at the node is stored.

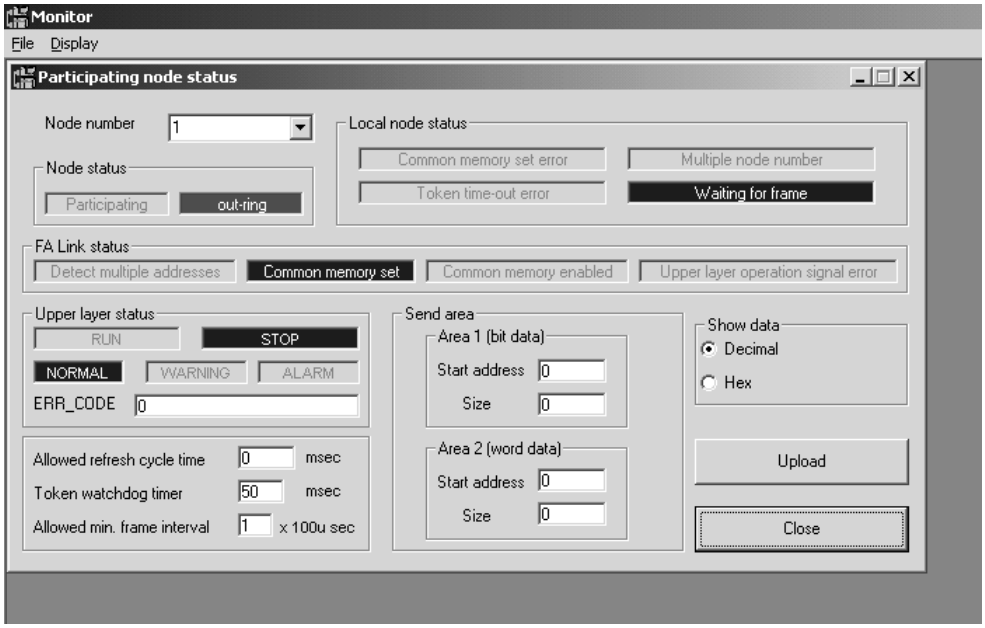
Monitor (Data Link Status)

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.

Corresponding FL-net Standard Flag Names

FL-net Unit Support Software	FL-net standard flag name
Common Memory setting range error	Initialization Error Flag
Duplicate node number notification	Duplicate Node Number Flag
Token monitoring timeout error	Token Monitoring Timeout Flag
Frame standby error	Reception Standby Flag

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.

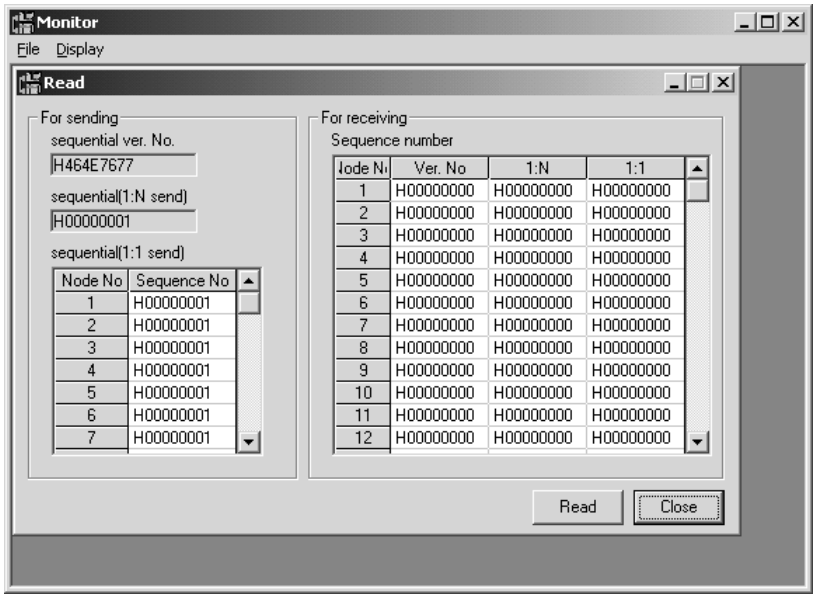
ERR_CODE	Meaning
0	Normal
1	CPU Unit servicing stopped.

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.

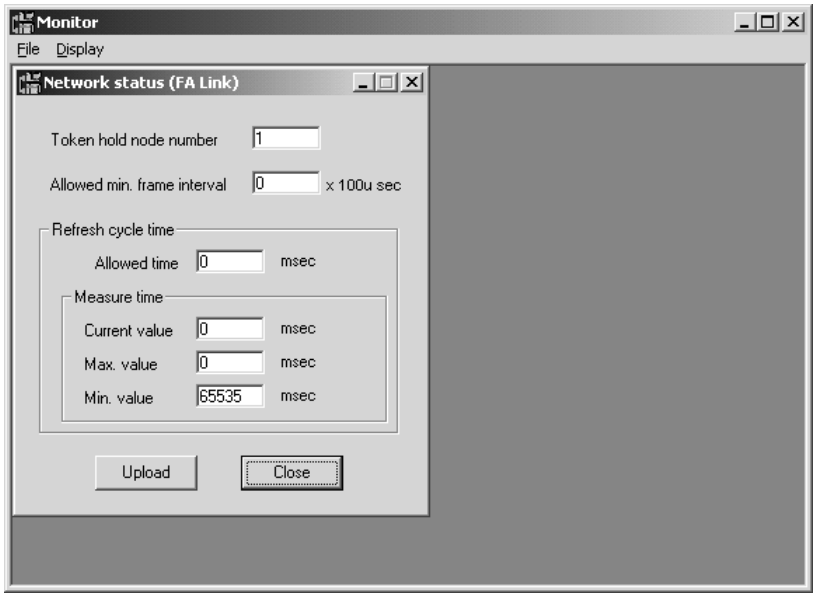
Monitor (Message Sequential Status)

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

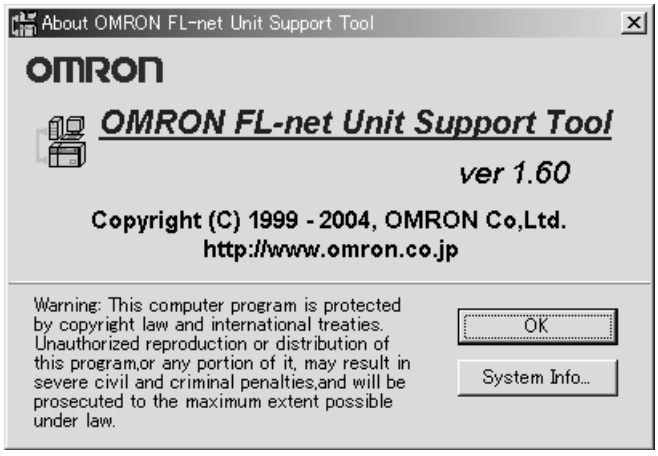
Displays the allowable refresh cycle time for the specified Unit.

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 Software version number can be displayed by selecting Help from the menu, and then selecting ***About OMRON FL-net Unit Support Software***.
Check the version number when making inquiries about the Support Software.



Appendix G
International System of Units

The International System of Units (SI) consists of base units, supplementary units, and derived units. SI is founded on the seven base units, which have been used historically and technically, and are used to define the other quantities. The base units include the meter (m) to express length, kilogram (kg) to express mass, second (s) to express time, Ampere (A) to express current, Kelvin (K) to express thermodynamic temperature, mole (mol) for expressing amount of substance, and the candela (cd) for expressing luminous intensity.

SI Base Units and Definitions

Quantity	Unit name	Unit symbol	Definition
Unit of length	Meter	m	The meter is the length of the path travelled by light in vacuum during a time interval of 1/299 792 458 of a second.
Unit of mass	Kilogram	kg	The kilogram is the unit of mass. It is equal to the mass of the international prototype of the kilogram.
Unit of time	Second	s	The second is the duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium 133 atom.
Unit of electric current	Ampere	A	The ampere is that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section, and placed 1 meter apart in vacuum, would produce between these conductors a force equal to 2×10^{-7} newton per meter of length.
Unit of thermodynamic temperature	Kelvin	K	The kelvin, unit of thermodynamic temperature, is the fraction 1/273.16 of the thermodynamic temperature of the triple point of water (see note).
Unit of amount of matter	Mole	mol	The mole is the amount of matter of a system which contains as many elementary entities as there are atoms in 0.012 kilogram of carbon 12. When the mole is used, the elementary entities must be specified and may be atoms, molecules, ions, electrons, other particles, or specified groups of such particles.
Unit of luminous intensity	Candela	cd	The candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540×10^{12} hertz and that has a radiant intensity in that direction of 1/683 Watt per steradian.

Note The triple point of water is the point at which the water can coexist in equilibrium in all three phases, i.e., liquid, solid (ice), and gas (water vapor).

Units that are expressed as products or divisions of powers of basic units are called derived units, such as square meters (m^2) and meters per second (m/s). When many base units are used to express a derived unit, resulting in a complicated expression, special names are sometimes used, e.g, Hertz (Hz) = 1/s is used to express frequency and Newton (N) = $kg \cdot m/s^2$ is used to express force. The Newton (N) is used to express the amount of force required to accelerate a mass of one kilogram at a rate of one meter per second squared. Similarly, the SI unit of pressure is the Pascal (Pa).

A new concept established supplementary units as a separate class from base units including the radian for plane angles and the steradian for solid angles. These units can also be considered as derived units, but in mathematics and other specific fields, they are used as if they were base units. Therefore, the General Conference on Weights and Measures designated these units as supplementary units to base units. Whether these are designated as supplementary units or derived units is left to the discretion of each country. Japan's Measurement Law defines these units as derived units.

SI Supplementary Units

Quantity	Unit name	Unit symbol	Definition
Plane angle	Radian	rad	A radian is the plane angle between two radii of a circle that cuts off on the circumference an arc equal in length to the radius.
Solid angle	Steradian	sr	A steradian is the solid angle that, having its vertex in the center of a sphere, cuts off an area of the surface of the sphere equal to that of a square with sides equal in length to the radius of the sphere.

SI Derived Units

Quantity	Unit name	Unit symbol	Expressed in terms of other SI units
Plane angle	radian	rad	---
Solid angle	steradian	sr	---
Frequency	hertz	Hz	$1\ Hz = 1\ s^{-1}$
Force	newton	N	$1\ N = 1\ kg{\cdot}m{\cdot}s^{-2}$
Pressure, stress	pascal	Pa	$1\ Pa = 1\ N{\cdot}m^{-2}$
Energy, work, quantity of heat	joule	J	$1\ J = 1\ N{\cdot}m$
Power, radiant flux	watt	W	$1\ W = 1\ J{\cdot}s^{-1}$
Electric charge, quantity of electricity	coulomh	C	$1\ C = 1\ A{\cdot}s$
Electric potential, electromotive force	volt	V	$1\ V = 1\ W{\cdot}A^{-1}$
Electric capacitance	farad	F	$1\ F = 1\ C{\cdot}V^{-1}$
Electrical resistance	ohm	Ω	$1\ \Omega = 1\ V{\cdot}A^{-1}$
Electric conductance	siemens	S	$1\ S = 1\ A{\cdot}V^{-1}$
Magnetic flux	weber	wb	$1\ wb = 1\ V{\cdot}s$
Magnetic flux density	tesla	T	$1\ T = 1\ wb{\cdot}m^{-2}$
Inductance	henry	H	$1\ H = 1\ wb{\cdot}A^{-1}$
Temperature	degree Celsius	°C	$t°C = (t + 273.15)\ K$
Luminous flux	lumen	lm	$1\ lm = 1\ cd{\cdot}sr$
Illuminance	lux	lx	$1\ lx = 1\ cd{\cdot}s{\cdot}rm^{-2}$

To indicate decimal multiples or submultiples of these units, the following list of prefixes was established. For example, the hectopascal (hPa), a unit commonly heard in weather forecasts, is one pascal (Pa) multiplied by 10^2, which is indicated by adding the prefix hecto (h). The current SI units specify 20 prefixes from 10^{24} to 10^{-24}. For practical purposes, these units are also used in combination with time units (minute, hour, and second), angle units (degree, minute, second), volume units (liter), and mass units (ton).

SI Unit Prefixes

Multiple	Prefix	
	Symbol	Name
10^{-24}	y	yocto
10^{-21}	z	septo
10^{-18}	a	atto
10^{-15}	f	femto
10^{-12}	p	pico

Multiple	Prefix	
	Symbol	Name
10^{-9}	n	nano
10^{-5}	μ	micro
10^{-3}	m	milli
10^{-2}	c	centi
10^{-1}	d	deci
10^{1}	da	deka
10^{2}	h	hecto
10^{3}	k	kilo
10^{5}	M	mega
10^{9}	G	giga
10^{12}	T	tera
10^{15}	P	peta
10^{18}	E	exa
10^{21}	Z	zetta
10^{24}	Y	yotta

SI Unit Conversion Table

Quantity	Unit name	Symbol	SI conversion rate	SI unit name	SI unit symbol
Angle	Degree Minute Second	° ‘ “	π/180 π/10800 π/648000	Radian	rad
Length	Meter Micron Nano Angstrom Nautical mile	M μ n Å mile	1 10^{-6} 10^{-9} 10^{-10} 1852	Meter	m
Area	Square meter Are Hectare	m^2 a ha	1 10^{2} 10^{4}	Square meter	m^2
Volume	Cubic meter Liter	m^3 l	1 10^{3}	Cubic meter	m^3
Mass	Kilogram Ton Atomic mass unit	kg t u	1 10^{3} 1.66057×10^{-7}	Kilogram	kg
Time	Second Minute Hour Day	s min h d	1 60 3600 86400	Second	s
Speed	Meter per second Knot	m/s kn	1 1852/3600	Meters per second	m/s
Frequency	Cycle	S^{-1}	1	Hertz	Hz
Rotation speed	Revolution per minute	rpm	1/60	Reciprocal second	S^{-1}
Angular velocity	Radian per second	rad/s	1	Radians per second	rad/s
Acceleration	Meter per second G	m/s G	1 9.80665	Meters per second	m/s^2

Quantity	Unit name	Symbol	SI conversion rate	SI unit name	SI unit symbol
Force	Kilogram force Deadweight ton Dyne	kgf tf dyn	9.80665 9806.65 10^{-5}	Newton	N
Moment of force	Kilogram-force meter	kgf·m	9.80665	Newton-meter	N·m
Stress, pressure	Kilogram-force per square meter Kilogram-force per square centimeter Kilogram-force per square millimeter	kgf/m^2 kgf/cm^2 kgf/mm^2	9.80665 9.80665×10^4 9.80665×10^6	Pascal	Pa
Pressure	Meter of hydraulic pressure Millimeter of mercury Torr Atmospheric pressure Bar	mH_2O mmHg Torr Atm bar	9.80665 101325/760 101325/760 101325 10^5	Pascal	Pa
Energy	Erg I.T. calorie Kilogram-force meter Kilowatt hour Metric horsepower hour Electronvolt	erg cal_T kgf·m kW·h PS·h eV	10^{-7} 4.1868 9.80665 3.600×10^6 2.64779×10^6 1.60219×10^{-19}	Joule	J
Workrate, power	Watt Metric horsepower hour Kilogram-force second per meter	W PS·h kgf·m/s	1 735.5 9.80665	Watt	W
Viscosity	Poise Centipoise Kilogram-force second per square meter	P cP $kgf·s/m^2$	10^{-1} 10^{-3} 9.80665	Pascal second	Pa·s
Kinematic viscosity	Stokes Centistokes	St cSt	10^{-4} 10^{-6}	Viscosity square meter per second	m^2/s

Code Tables

Hexadecimal-to-Decimal Conversion Table

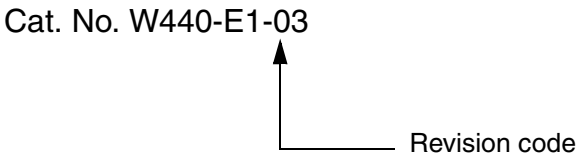
	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
10	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
20	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
30	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
40	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
50	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
60	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
70	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
80	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
90	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
A0	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
B0	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
C0	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
D0	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
E0	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
F0	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255

ASCII Codes

	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0	nul	soh	stx	etx	eot	enq	ack	bel	bs	ht	lf	vt	ff	cr	so	si
10	dle	dcl	dc2	dc3	dc4	nak	syn	etb	can	em	sub	esc	fs	gs	rs	us
20	sp	!	“	#	$	%	&	‘	(	)	*	+	,	-	.	/
30	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
40	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
50	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
60	‘	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
70	p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	del

Revision History

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



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 2004	Original production
02	November 2005	"PC" replaced globally to "PLC" in the sense of Programmable Controller. "CX-FLnet" added globally to FL-net Unit Support Software. **Page v:** Signal word definitions changed. **Page xi:** Table of manuals reworked. **Page xxi:** Two precautions added in middle of page and addition about Startup Mode made to existing precaution. **Page 8:** New section 1-4 on CX-FLnet added. **Page 12:** "10Base5" corrected to "100Base5" at top right corner. **Page 19:** "0x2000" changed to "0x1fff" and "0x200" changed to "0x2000" in table. **Page 29:** Additions made in the right column for HER and PER. **Pages 39, 42, 145:** "CX-Net" changed to "CX-Integrator." **Page 39:** Last paragraph in *Applicable Programming Devices* deleted and addition made to the paragraph before it. **Pages 50 and 51:** Section 4-2-1 reworked. **Pages 66 to 69:** Most of section 5-2-1 reworked. **Pages 79 and 80:** Figures replaced. **Page 79:** Sentence removed from step 2. **Pages 91 and 96:** "/CJ" added. **Pages 149 and 152:** "CX-Programmer" changed to "CX-Integrator." **Pages 163 to 189:** Moved to the last appendix and new section added.
03	October 2010	System requirements for FL-net setting tool changed.

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