FL-net(OPCN-2) Interface Module

User's Manual

MITSUBISHI

Mitsubishi Programmable
Logic Controller

MELSEC-Q

QJ71FL71-T
QJ71FL71-B5
QJ71FL71-B2
GX Configurator-FL
(SW0D5C-QFLU-E)

• SAFETY PRECAUTIONS •

(Always read these instructions before using this equipment.)

Before using this product, please read this manual and the relevant manuals introduced in this manual carefully and pay full attention to safety to handle the product correctly.
The instructions given in this manual are concerned with this product. For safety instructions of the programmable controller system, please read the CPU module user's manual.
In this manual, the safety instructions are ranked as "DANGER" and "CAUTION".

⚠ DANGER	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

Note that the ⚠ CAUTION level may lead to serious consequence according to the circumstances. Always follow the instructions of both levels because they are important to personal safety.

Please store this manual in a safe place and make it accessible when required. Always forward it to the end user.

[Design Instructions]

⚠ DANGER

- Refer to Section 6.2.7 of this manual for information about the operation of each node when the cyclic transmission generates a communication error when using FL-net (OPCN-2). The wrong output or erroneous operation could result in an accident.
- Never write data to the "system area" of the buffer memory for the intelligent function unit buffer memory. In addition, never output (set to on) the "use prohibited" signal during an output signal from the PLC CPU to the intelligent function unit. Writing data to the "system area" or output of a "use prohibited" signal could result in the malfunction of the sequence system.

⚠ CAUTION

- Do not bundle the control wires and communication cables with the main circuit or power wires, or install them close to each other.
  They should be installed at least 100mm(3.94 in.) away from each other.
  Failure to do so may generate noise that may cause malfunctions.

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[Mounting Instructions]

⚠ CAUTION

- Use the PLC in the operating environment that meets the general specifications of this manual. Using the PLC in any other operating environments may cause electric shocks, fires or malfunctions, or may damage or degrade the product.
- While pressing the installation lever located at the bottom of module, insert the module fixing tab into the fixing hole in the base unit until it stops. Then, securely mount the module with the fixing hole as a supporting point.
  If the module is not installed properly, it may cause the module to malfunction, fail or fall off.
  Secure the module with screws especially when it is used in an environment where constant vibrations may occur.
- Be sure to tighten the screws using the specified torque.
  If the screws are loose, it may cause the module to short-circuit, malfunction or fall off.
  If the screws are tightened excessively, it may damage the screws and cause the module to short-circuit, malfunction or fall off.
- Before mounting or dismounting the module, make sure to shut off all phases of the external power supply and FL-net (OPCN-2) system's power supply. Failure to do so may damage the product.
- Do not directly touch the conducting parts and electronic parts of the module. This may cause the module to malfunction or fail.

[Wiring Instructions]

⚠ CAUTION

- When making wiring connections of the connectors for external connections, always properly crimp or clamp the wires with tool specified by the manufacture or solder them. An incomplete connection could cause malfunctioning.
- Make sure that the power supply for the sequencer for the station where the unit is mounted and the power supply for the FL-net (OPCN-2) system are off before making AUI cable connections.
- Make sure the connectors are securely mounted to the unit.
- Make sure to place the communication and power cables to be connected to the module in a duct or fasten them using a clamp. If the cables are not placed in a duct or fastened with a clamp, their positions may become unstable and may move, or they may be pulled inadvertently. This may damage the module and the cables or cause the module to malfunction because of faulty cable connections.
- Always tighten the screws to within the specified torque range.
  If the screws are loose, shorting or malfunctioning could result. If the screws are too tight, they could break off, fall into the unit and cause shorting or malfunctioning.
- When disconnecting the communication and power cables from the module, do not pull the cables by hand. When disconnecting a cable with a connector, hold the connector to the module by hand and pull it out to remove the cable. When disconnecting a cable connected to a terminal block, loosen the screws on the terminal block first before removing the cable. If a cable is pulled while being connected to the module, it may cause the module to malfunction or damage the module and cables.

[Wiring Instructions]

⚠ CAUTION
• Be careful not to let foreign particles such as chaff and wire chips get inside the module. They may cause a fire, mechanical breakdown or malfunction. • The top surface of the module is covered with a protective film to prevent foreign objects such as wire chips from entering the module during wiring work. Do not remove this film until all the wiring work is complete. Before operating the system, be sure to remove the film to provide adequate heat ventilation.

[Startup/Maintenance Instructions]

⚠ CAUTION
• Never disassemble or modify the module. This may cause breakdowns, malfunctions, injuries or fire. • Before mounting or dismounting the module, make sure to shut off all phases of the external power supply and FL-net (OPCN-2) system's power supply. Failure to do so may damage the module or result in malfunctions • Do not mount/remove the module onto/from base unit more than 50 times (IEC61131-2 compliant), after the first use of the product. Failure to do so may cause malfunction. • Do not touch the terminals while the power is on. Doing so may cause malfunctions. • Before cleaning the module or retightening the terminal screws and module installation screws, make sure to shut off all phases of the external power supply and FL-net (OPCN-2) system's power supply. Failure to completely shut off all phases of the external power supply may cause module breakdowns and malfunctions. If the screws are loose, it may cause the module to short-circuit, malfunction or fall off. If the screws are tightened excessively, it may damage the screws and cause the module to short circuit, malfunction or fall off. • Always make sure to touch the grounded metal to discharge the electricity charged in the body, etc., before touching the module. Failure to do so may cause a failure or malfunctions of the module.

[Disposal Instructions]

⚠ CAUTION
• When disposing of this product, treat it as industrial waste.

REVISIONS

* The manual number is given on the bottom left of the back cover.

Print Date	* Manual Number	Revision
Oct., 2000	SH (NA) 080130-A	First printing
May, 2001	SH (NA) 080130-B	Addition Appendix 10 Correction Related Manuals, About the Generic Terms and Abbreviations, Section 1.1, 3.1.1, 3.1.2, 3.2.2, 3.2.6, 3.4, 5.1.1, 5.1.2, 6.2.8, 6.4.3, 6.4.4, 6.5.4, 8.5.2, Appendix 5.1, 7.1 Changes in Chapter, Section number From Section 3.3.2 to 3.5, from Section 3.4 to 3.6
Feb., 2002	SH (NA) 080130-C	Correction About the Generic Terms and Abbreviations, Section 3.1.1, 6.2.8, 6.4.3, 6.4.4
Mar., 2006	SH (NA) 080130-D	The entire manual was reviewed.

Japanese Manual Version SH-080086-G

INTRODUCTION

Thank you for purchasing the MELSEC-Q series PLC.
Before using the equipment, please read this manual carefully to develop full familiarity with the functions and performance of the Q series PLC you have purchased, so as to ensure correct use.
Please forward a copy of this manual to the end user.

CONTENTS

Compliance with the EMC and Low Voltage Directives

When incorporating the Mitsubishi PLC into other industrial machinery or equipment and keeping compliance with the EMC and low voltage directives, refer to Chapter 3 "EMC Directive and Low Voltage Instruction" of the User's Manual (Hardware) for the CPU module used or the PLC CPU supplied with the base unit.
The CE logo is printed on the rating plate of the PLC, indicating compliance with the EMC and low voltage directives.
For making this product compliant with the EMC and low voltage directives, please refer to Section 3.1.3 "Cable" in Chapter 3 of the above-mentioned user's manual.

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● How to use this manual

This manual is organized to provide information for specific usage applications for the FL-net module (QJ71FL71-T, QJ71FL71-B5, QJ71FL71-B2). Refer to this manual for information on the following topics.

(1) When you want a list of features and utilities . .

(a) To find out about features and functions
- The features of the FL-net module are provided in Chapter 1.
- The common functions, specifications and other details about FL-net are provided in Chapter 3.

(b) When you want to know about the parts provided and component parts of the network . . .
- The "Product Composition" at the front of Chapter 1 provides a list of the parts provided in the package at the time of purchase of the FL-net module.
- Section 3.1.2 provides a description of the system components for the FL-net module. The user is responsible for obtaining the parts and materials required that have not been provided with the FL-net module.

(2) When you want to know the necessary procedures before starting the FL-net module. . .

(a) To find out the start-up procedure
- Section 6.3.1 provides a summary of the procedures required up to operating the FL-net module.

(b) To find out information about connecting to the FL-net (OPCN-2) network system. . .
- Section 3.1.2 provides information about the equipment required for connecting to the FL-net (OPCN-2) network system.
- Chapter 5 provides the connection methods for connecting to the FL-net (OPCN-2) network system, listed by connected type.

(c) To find out the necessary procedures before starting the FL-net module. . .
- There are parameter setting screens from GX Developer for using the FL-net module. Section 6.3.2 provides information about the types of parameter setting screens.

(d) To find out the method for confirming whether or not the FL-net module has failed . . .
- Section 6.3.1(1) provides the self-diagnosis tests for the FL-net module.

(e) To find out the method for confirming whether or not there is an error in the connection with corresponding equipment . .
- Section 8.2 (3) provides the method for confirming using the "PING" command.

(3) When you want to know about the types of data communication with detailed explanations. . .

(a) To find out about the types of data communications. . .
- Section 6.2.3 provides information about the types of data communication for the FL-net module.

(b) To find out about the location of detailed explanations about each of the communication methods . . .
- Section 6.2.7 provides information about cyclic transmissions and areas.
- Section 6.2.8 provides information about message transmissions.

(4) When you want to know about the program methods for performing communication with the FL-net module. . .
- The beginning of Section 6.5 provides information about the procedures for creating programs.
- Section 6.5.4 provides sample programs.

(5) When you want to know how to perform inspections and maintenance on the FL-net module and how to remove and replace components. . .

(a) To find out about inspections and maintenance. . .
- Section 7.1 provides information about inspection and maintenance of the FL-net module.

(b) To find out about the procedure for removing and replacing components. . .
- Section 7.2 provides the operating procedure when replacing the FL-net module and replacing the CPU.

(6) When you want to know how to confirm an errors and the methods for responding to them. . .

(a) To find the meanings of the error codes . . .
- Chapter 8 provides the methods for troubleshooting and error confirmation and also provides a description of the error codes and the methods for responding to them.

(b) To find the storage locations of the error codes in the FL-net module. . .
- Chapter 8.5.2 provides information on the storage destination for the error codes for the buffer memory.

● Structure of this manual

(1) Settings from GX Developer

(a) The FL-net module performs the parameter settings from GX Developer, allowing the sequence program for performing communication with corresponding equipment to be simplified.

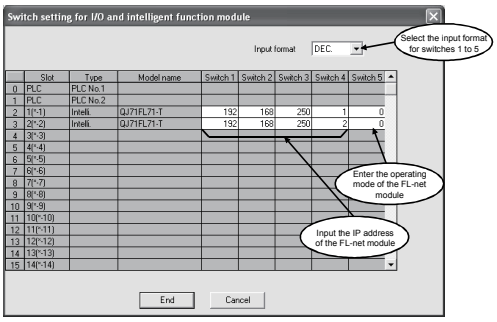
(b) Section 6.3.2 provides a summary of the types of setting screens and the setting items.

(c) Use Section 6.3.2 to set the relevant parameters and write them to the PLC CPU for the FL-net module equipped station.

(2) Explanation of the GX Developer setting screen

In this manual, the intelligent function module switch settings from the GX Developer are explained in the format shown below. (Section 6.3.2 (2))

(2) Intelligent function module switch setting



Shows the GX Developer Intelligent function module switch setting screen.

(a) Switch 1 to switch 4
Sets the IP address of the FL-net module.
Consult with the network manager (the person who plans the network or managers the IP addresses) about the IP address and set so that is no duplication with remote nodes.

1) Switch 1
Sets the first digit of the IP address.
If set to "No setting (Blank)", the default setting is used.
• Default value : 192

POINT
FL-net (OPCN-2) uses Class C IP address.
Setting values can be set within a range from 192 to 223.

2) Switch 2
Sets the second digit of the IP address.
If set to "No setting (Blank)", the default setting is used.
• Default value : 168
• Setting range : 0 to 255

3) Switch 3
Sets the third digit of the IP address.
If set to "No setting (Blank)", the default setting is used.
• Default value : 250
• Setting range : 0 to 255

4) Switch 4
Sets the fourth digit of the IP address. (This is the node number.)
If set to "No setting (Blank)", the default setting is used.
• Default value : 1
• Setting range : 1 to 254

(b) Switch 5
This inputs the operating mode of the FL-net module.
0 : "Off line" (Default, communicate with other nodes)
1 : "Off line" (Disconnects local node)
2 : "Loopback test"
3 : "Hardware test"

Shows the setting contents of each switch.

(c) Input format
Select the input format for the settings.
• Decimal
• Hexadecimal (default)

Shows the setting contents of the input format.

* The page illustrated above is provided for example only and is different from any actual page.

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About the Generic Terms and Abbreviations

Unless otherwise stated, the following generic terms and detailed names are used for explaining the QJ71FL71-T, QJ71FL71-B5, QJ71FL71-B2 type FL-net (OPCN-2) interface module.

Generic terms/Abbreviations	Description of generic terms and abbreviations
GX Developer	Abbreviations for GX Developer software application.
GX Configurator-FL	Abbreviations for GX Configurator-FL package.
Personal computer	IBM PC/AT or 100 % compatible personal computer.
FL-net module	Abbreviations for QJ71FL71-T, QJ71FL71-B5, QJ71FL71-B2 type FL-net (OPCN-2) interface module.
Ethernet network system	Abbreviations for 10BASE2, 10BASE5 ,10BASE-T network system.
Corresponding equipment	PC, calculator, workstation (WS) or other device connected by FL-net (OPCN-2) for data communication.
AnNCPU	Generic terms for A0J2HCPU, A1SCPU, A1SCPUC24-R2, A1SHCPU, A1SJCPU, A1SJCPU-S3, A1SJHCPU, A1NCPU, A2CCPU, A2CCPUC24, A2CCPUC24-PRF, A2CJCPU, A2NCPU, A2NCPU-S1, A2SCPU, A2SHCPU, A1FXCPU, A3NCPU.
AnACPU	Generic terms for A2ACPU, A2ACPU-S1, A3ACPU.
AnUCPU	Generic terms for A2UCPU, A2UCPU-S1, A2USCPU, A2USCPU-S1, A2USHCPU-S1, A3UCPU, A4UCPU.
QnACPU	Generic terms for Q2ACPU, Q2ACPU-S1, Q2ASCPU, Q2ASCPU-S1, Q2ASHCPU, Q2ASHCPU-S1, Q3ACPU, Q4ACPU, Q4ARCPU.
QCPU	Generic term for Q00JCPU, Q00CPU, Q01CPU, Q02CPU, Q02HCPU, Q06HCPU, Q12HCPU, Q25HCPU, Q12PHCPU, Q25PHCPU.
Q00J/Q00/Q01CPU	Generic term for Q00JCPU, Q00CPU, Q01CPU.
Q02/Q02H/Q06H/Q12H/ Q25HCPU	Generic term for Q02CPU, Q02HCPU, Q06HCPU, Q12HCPU, Q25HCPU.
Q12PH/Q25PHCPU	Generic term for Q12PHCPU, Q25PHCPU.
ACPU	Generic terms for AnNCPU, AnACPU, AnUCPU.

Product Composition

This unit is comprised of the following products.

Model Name	Product Name	Qty
QJ71FL71-T	QJ71FL71-T type FL-net (OPCN-2) interface module	1
QJ71FL71-B5	QJ71FL71-B5 type FL-net(OPCN-2)interface module	1
QJ71FL71-B2	QJ71FL71-B2 type FL-net(OPCN-2) interface module	1
SW0D5C-QFLU-E	GX Configurator-FL Version 1 (Single license product) (CD-ROM)	1
SW0D5C-QFLU-E-A	GX Configurator-FL Version 1 (Volume license product) (CD-ROM)	1

1 INTRODUCTION

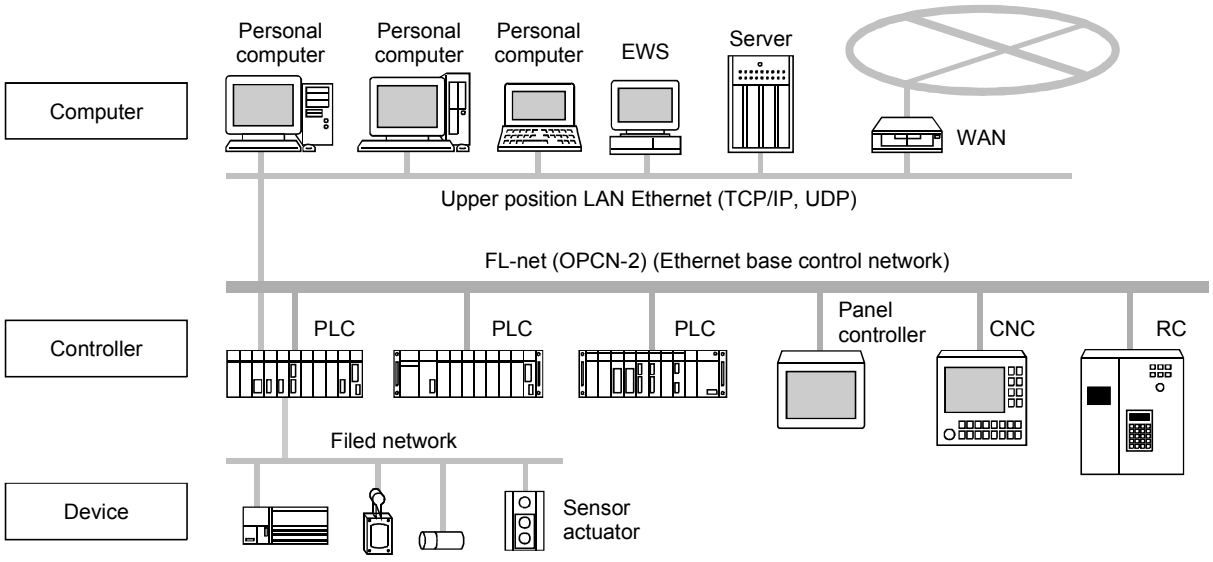
This manual applies to the MELSEC-Q Series QJ71FL71-T, QJ71FL71-B5, QJ71FL71-B2 type FL-net (OPCN-2) interface module (hereafter called the FL-net module) and provides information about the specifications, procedures used up to operation, the methods of data communication, inspection, maintenance and troubleshooting.

POINT

- The QJ71FL71-T/QJ71FL71-B5/QJ71FL71-B2 are FL-net modules that can connect to FL-net (OPCN-2) Version 1.00 network.
  They cannot communicate with the QJ71FL71-T-F01/QJ71FL71-B5-F01/QJ71FL71-B2-F01 (or third party Version 2.00 product) that can be connected to the FL-net (OPCN-2) Version 2.00 network.
- The sequence programs and network devices for QJ71FL71-T-F01/ QJ71FL71-B5-F01/QJ71FL71-B2-F01 are compatible with the QJ71FL71-T/QJ71FL71-B5/ QJ71FL71-B2.
  However, the QJ71FL71-T/QJ71FL71-B5/QJ71FL71-B2 and QJ71FL71-T-F01/QJ71FL71-B5-F01/QJ71FL71-B2-F01 cannot be connected together because FL-net (OPCN-2) Version 1.00 is not compatible with FL-net (OPCN-2) Version 2.00.

1.1 What is the FL-net (OPCN-2)?

FA-net (OPCN-2) (the generic term for a network featuring FA link protocol) is standardized by the Japan FA Open Systems Promotion Group (JOP) of the Manufacturing Science and Technology Center, a group affiliated with the Ministry of Economy, Trade and Industry (the former Ministry of International Trade and Industry.) The FA link protocol is intended for the FL-net to be used for data exchange between various control modules in manufacture systems such as programmable logic controller (PLC), robot controller (RC) and numerical control module (NC), and personal computers for control.



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1.2 Features of the FL-net (OPCN-2)

The FL-net (OPCN-2) has the following features.

(1) Overall features of the FL-net (OPCN-2)

(a) Realizes multi-vendor support
The FL-net (OPCN-2) can be interconnected to controllers, PLCs and other devices for manufacturers' PLCs (PLC) or numerically controlled devices (CNC) and other devices that are very different and provide control and monitoring.

(b) Complies to standard specifications
It can use components commonly used for office automation equipment using Ethernet network equipment (such as transceivers, hubs, cables and LAN cards for Personal computer).

(c) Designed for future speed increases
Anticipates future transmission speed increases 10 Mbps → 100 Mbps → 1 Gbps.

(d) For large-scale networks
Up to 254 modules of equipment (nodes) can be connected.
(Of the 254 modules, 249 can be used for control. The remaining five modules are assigned for failure diagnosis.)

(e) Two types of communication functions to match the application
Supports both types of communication functions: cyclic transmission which is a common memory function that allows each node to normally share the same data and message communication function in which only the required data is acquired when needed.

(f) Large-capacity common memory
The common memory is large: 8 k bits + 8 k words.

(g) Masterless method provides high reliability
Because there is no master and because the participation and release of each node does not affect communication of remote nodes, any node can freely turn the power supply on and off or perform maintenance.

(2) Features of the QJ71FL71-T, QJ71FL71-B5, QJ71FL71-B2

(a) Data integrity
In area 2 (word area), double word (32-bit) data identity is ensured.
(The separation prevention (∗1))

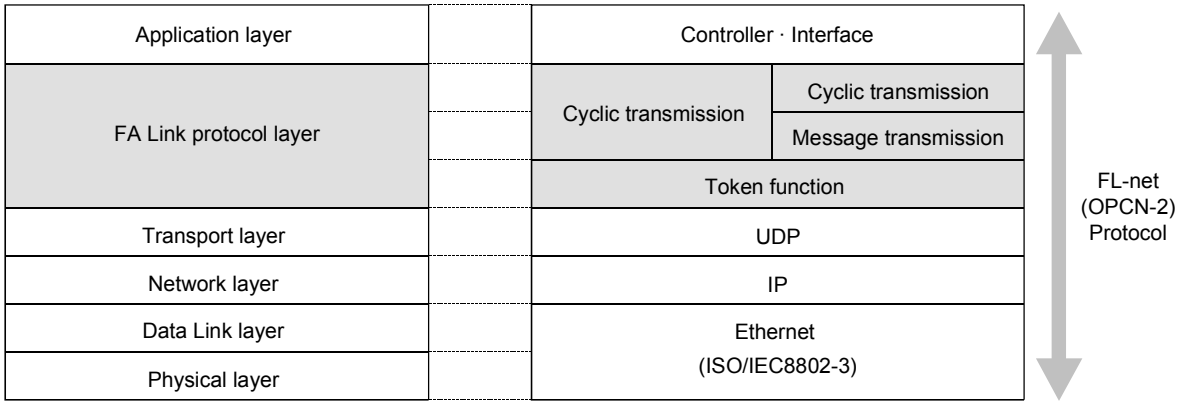
∗1: The separation prevention
The separation prevention is the data that has the meaning in a 2-word (32-bits) for current value for the positioning module and it uses the timing of cyclic transmission to prevent the new data and old data from being separated in 1-word units (16-bits).

(b) Three types of modules available for the cable used
QJ71FL71-T - Supports 10BASE-T
QJ71FL71-B5 - Supports 10BASE5
QJ71FL71-B2 - Supports 10BASE2

(c) Supports the PING command response function
When there is a PING command from a corresponding node, the FL-net module responds to the PING command.

(d) Equipped with self-diagnosis function
The FL-net module can perform Hardware test and self-return test.

<Basic structure of FL-net (OPCN-2) protocol>



(e) Easy setting by using utility package software
The utility package software (GX Configurator-FL) is available separately. Although use of this software is not required, it allows on-screen setting of the initial setting and auto refresh setting, reduction in programming steps and easy check of the setting and operation status.

1.3 Frequently Asked Questions about the FL-net (OPCN-2)

The following are some of questions commonly asked about FL-net module (OPCN-2). Please use them for your reference.

	Question	Answer
1	What is Ethernet?	Ethernet is a specification for defining the types of cables that is used in a Local Area Network (LAN). With Ethernet, data can be transferred among computers at a communication speed of 10 Mbps to 100 Mbps. Currently, the Ethernet most used for office applications is the 10 Mbps twisted pair cable (UTP). Ethernet uses the software protocol that is sent out by many multi-vendors to make communication possible.
2	What is FL-net (OPCN-2)?	FL-net (OPCN-2) is a network that connects FA controllers, such as PLCs (PLC) or numerical control devices (CNC) and performs high-speed interactive exchanging of control data among these controllers. The cables and other components are the same as those used in Ethernet systems.
3	What is the difference between FL-net (OPCN-2) and Ethernet?	Ethernet connects host computers, personal computer and other types of controllers and is used for giving production instructions, collecting various production data and control applications. In addition, FL-net (OPCN-2) is used for making connections among controllers and using it for the high-speed exchange of controller data. When there is one controller module and when the FL-net (OPCN-2) is mounted on both the Ethernet for the host and for among the controllers, use extreme care not to mis-connect the cables.
4	How do you use the FL-net (OPCN-2)?	The FL-net module is mounted to FA controllers such as PLCs (PLC) or numerical control devices (CNC) and by simply performing the link allocation settings for the station number (node number) and common memory (link register) in the same way as a "CPU link module" on a conventional computer, the cyclic sending and receiving of data among the controllers can be performed. Accordingly, no special communication program is required for the PLC or other control devices. Moreover, no special communication program is required for reading and rewriting PLC memory or communication parameter data from the personal computer. It should be noted that each controller will need a program if data transmission is performed using message transmission interactively among the controllers.
5	What is protocol? Specifically, what protocol does FL-net (OPCN-2) support?	Protocol consists of the rules necessary for communicating. FL-net (OPCN-2) supports UDP/IP and uses the dedicated "FA Link Protocol" for FL-net (OPCN-2) for positioning on the upper layer.
6	Can FL-net (OPCN-2) be connected to a conventional PC?	The FL-net module mounted to FA controllers such as PLCs (PLC) and numerical control devices (CNC) have intelligent modules that have processors in the boards. Ethernet cards are referred to as "dumb boards", which means that they use a non-intelligent format so their use will depend on the performance of the personal computer and how it is used. Generally speaking, the use of the intelligent type FL-net (OPCN-2) board is recommended.

(Continued on next page)

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	Question	Answer
7	What is topology?	Network topology indicates the layout of the wiring. Generally speaking, there are three main layouts: star (tree), bus and ring. It is probably easier to think of these as logical arrangements rather than the physical layout of the cables. The 10BASE-T used on FL-net (OPCN-2) is star topology. 10BASE5 is bus topology.
8	What is the relationship between the type of network cable and the length and number of modules that can be connected?	The following are some of the standards, characteristics and limitations of Ethernet cable, which is the most commonly used type. Note: Values shown in ( ) indicate that a repeater is used. 10BASE-T: Twisted pair cable (UTP). The maximum transmission distance per segment is 100 m (500 m). The maximum number of modules that can be connected per segment is 254. 10BASE5: Thick coaxial cable (yellow cable). The maximum transmission distance per segment is 500 m (2500 m). The maximum number of modules that can be connected per segment is 100 (254). 10BASE-FL: Optical fiber cable. The maximum transmission distance per segment is 2000 m. The maximum number of modules that can be connected per segment is 254.
9	Are special Ethernet specifications required for systems using FL-net (OPCN-2)?	No. When constructing a FL-net (OPCN-2) system, uses Ethernet specifications (IEEE802.3 standards). There are no special specifications.
10	How is connection with FL-net (OPCN-2) made?	Different types of Ethernet media can be interconnected to Ethernet cable by using devices such as repeaters and media conversion adapters. These products are sold by a most vendors.
11	What is the best cables to use when constructing a FL-net (OPCN-2) system?	The following are the most commonly used cables. • Trunk lines : 10BASE5 (Thick coaxial cable, yellow cable) • Inside control panels and for office applications: 10BASE-T (Twisted pair cable, UTP category 5) • Locations with high-voltage power supplies or other types of electric noise: 10BASE-FL (optical fiber cable)
12	How do you set the IP address for FL-net (OPCN-2)?	The FL-net (OPCN-2) IP address is network address: 192.168.250. Host number (node number): 1 to 254 is standard. Note that node numbers 250 to 254 are reserved for maintenance use.
13	What is the compatibility and interconnectability of FL-net (OPCN-2) compatible equipment?	There is a certification organization for FL-net (OPCN-2) that performs compatibility and interconnectability testing. Equipment that pass these tests are issued a certificate to show that they are FL-net (OPCN-2) compatible equipment.

1.4 FL-net (OPCN-2) Version Information

The FL-net (OPCN-2) authorization version of the FL-net module can be confirmed with the buffer memory (Address: $9CA_H$).
The FL-net (OPCN-2) protocol version of the FL-net module can be checked with the buffer memory (Address: $9C9_H$).
(Refer to Section 3.2.6 (2).)

2 SAFETY PRECAUTIONS

The beginning of this manual contains "SAFETY PRECAUTIONS". Read and understand them before using this product.
In addition, before using this product read this manual and all other related manuals introduced in this manual. Always keep safety the top priority when using this equipment.

2 - 1

MEMO

2 - 2

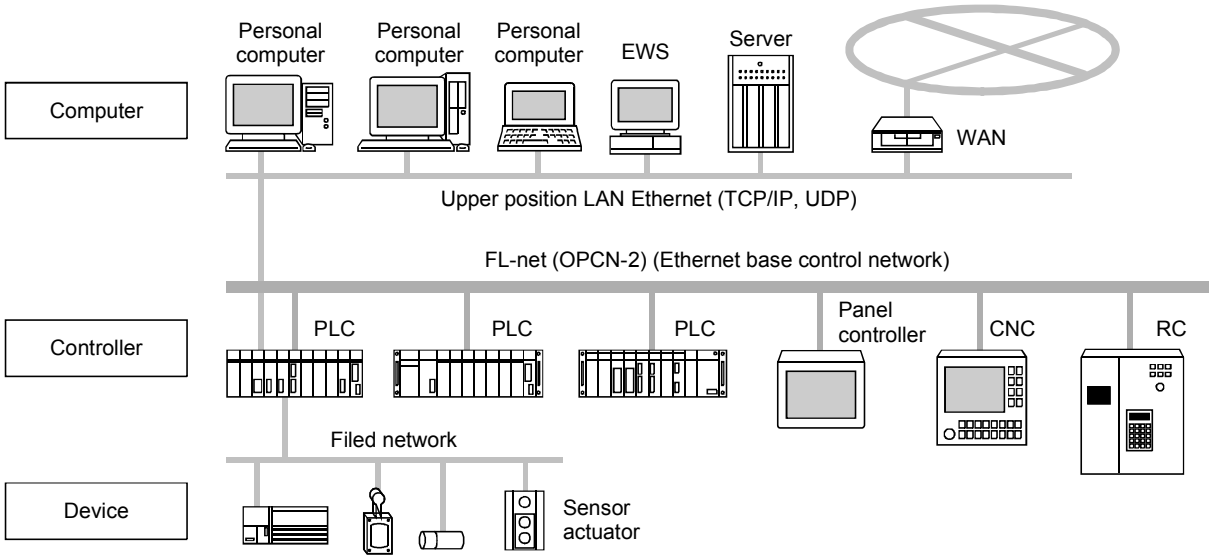
3 FL-net MODULE

3.1 System Configuration

This section introduces the system configuration possible using FL-net module combinations.

(1) Basic system

The FL-net module can communicate with FL-net (OPCN-2) compatible Personal computer and equipment. (Use dedicated FL-net (OPCN-2) wiring for the Ethernet wiring.)



(2) Mixed system

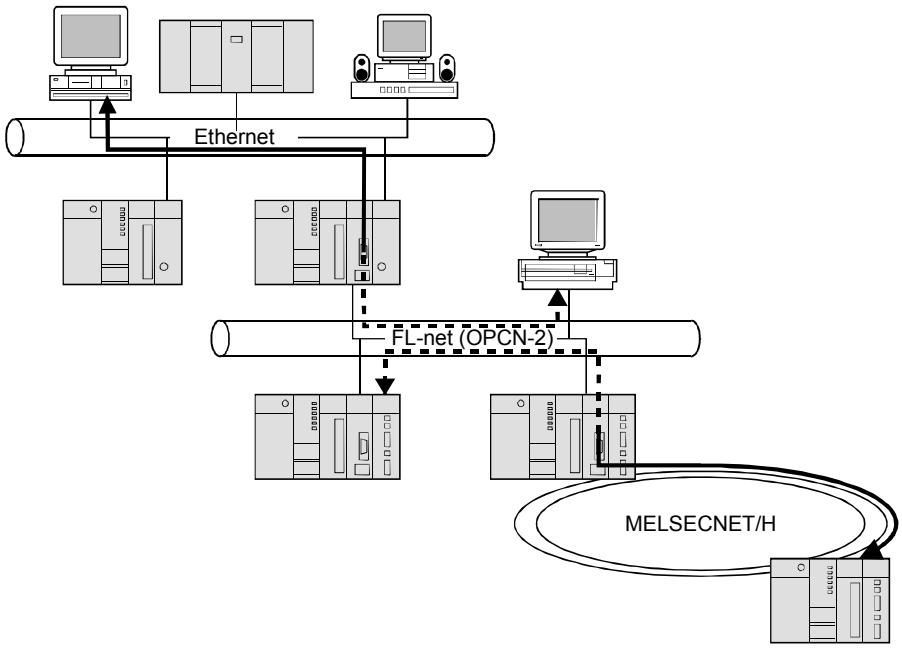
The following is the type of communication possible with mixed systems.

(a) Cyclic transmissions

Data transmissions can be performed within FL-net (OPCN-2).
Communication with other networks can be performed by interchanging the CPU module and using a sequence program.

(b) Message transmissions (transient transmission)

Data transmissions can be performed within FL-net (OPCN-2).
Communication with other networks can be performed by interchanging the CPU module and using a sequence program.



3.1.1 Applicable systems

The FL-net module can use the following systems.

(1) Applicable modules and number of mountable cards

PLC station to connect the FL-net module and number of mountable cards are shown.

Applicable modules		Number of mountable cards	Notes
CPU module	Q00JCPU	Maximum 8	(*1)
	Q00CPU Q01CPU	Maximum 24	
	Q02CPU	Maximum 64	Can only be mounted in Q mode (*1)
	Q02HCPU		
	Q06HCPU		
	Q12HCPU		
	Q25HCPU		
	Q12PHCPU	Maximum 64	(*1)
	Q25PHCPU		
Network remote modules	QJ72LP25-25	Maximum 64	MELSECNET/H remote I/O station (*2)
	QJ72LP25G		
	QJ72LP25GE		
	QJ72BR15		

*1 See User's Manual (Function Explanation, Program Fundamentals) for the CPU module to use.
*2 See Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network).

(2) Mountable base units

The FL-net module can be mounted in the optional I/O (*1) slot of the base unit.
Note that mounting is not possible in the base units for the A-Series (QA1S35B, QA1S68B, etc.)
*1: Limited to within the I/O point range of the CPU module.

(3) Multiple CPU systems

When using the FL-net module on a multiple CPU system, refer to the QPU User's Manual (Multiple CPU System) before operation.

(a) Applicable FL-net module
If using the FL-net module on a multiple CPU system, use function version B of the FL-net module.

(b) Intelligent function module parameter
To write the intelligent function module parameter on a PLC, be sure to write it in the FL-net module control PLC only.

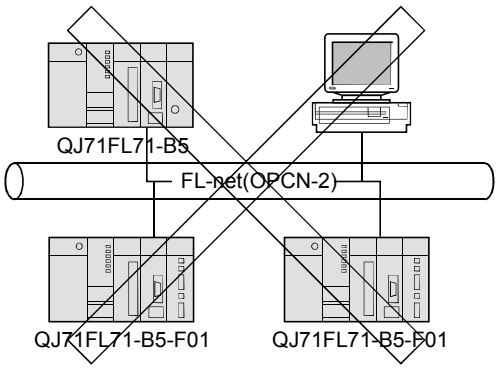
(4) Applicable software package

The following are the software packages compatible with FL-net module.
The GX Developer is required when using the FL-net module.

		Software Version	
		GX Developer	GX Configurator-FL
Q00J/Q00/Q01CPU	Single PLC system	Version 7 or later	Version 1.10L or later
	Multiple PLC system	Version 8 or later	
Q02/Q02H/Q06H/ Q12H/Q25HCPU	Single PLC system	Version 4 or later	SW0D5C-QFLU-E 00A or later
	Multiple PLC system	Version 6 or later	
Q12PH/Q25PHCPU	Single PLC system	Version 7.10L or later	Version 1.13P or later
	Multiple PLC system		
If installed to MELSECNET/H remote I/O station		Version 6 or later	SW0D5C-QFLU-E 00A or later

(5) Restrictions on system configuration

The QJ71FL71-T/QJ71FL71-B5/QJ71FL71-B2 and QJ71FL71-T-F01/ QJ71FL71-B5-F01/QJ71FL71-B2-F01 use different FL-net protocols. Therefore, the QJ71FL71-T/QJ71FL71-B5/QJ71FL71-B2 cannot communicate with the QJ71FL71-T-F01/QJ71FL71-B5-F01/QJ71FL71-B2-F01 or Version 2.00 products manufactured by other company.

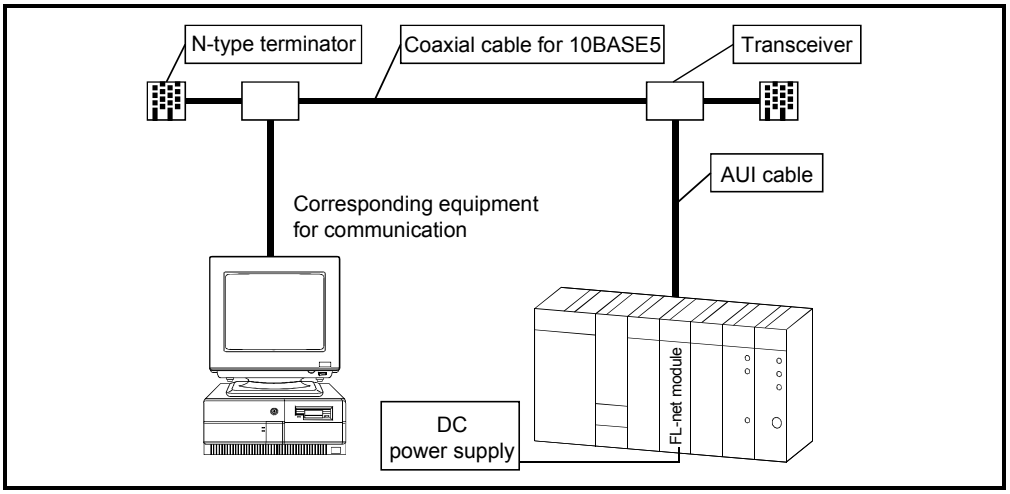


3.1.2 Equipment required when configuring the network

The following introduces the component equipment of the network.
Since installing the network requires the utmost of safety, always have the work done by trained specialists.

(1) When configuring a network with QJ71FL71-B5

(a) When connecting with 10BASE5.



1) Makes sure that the coaxial cable for 10BASE5, N-type terminator, transceiver, AUI cable (transceiver cable) all meet Ethernet standards.
2) Use a transceiver with an operating SQE TEST (Signal Quality Error Test) or heart beat.
3) Use the power supply for the transceiver that satisfies the transceiver and AUI cable specifications.

REMARK

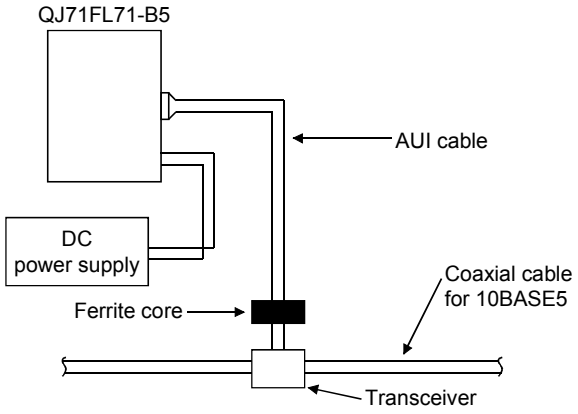
Electrical characteristics of the transceiver
• Input terminal voltage 12 V $^{-6\ \%}$ to 15 V $^{+5\ \%}$
• AUI cable direct resistance 40 Ω / km or less, maximum length: 50 m
• Maximum current consumption: 500 mA or less

In consideration of the above characteristics, the power supply for the transceiver will be 13.28V to 15.75V.

POINT

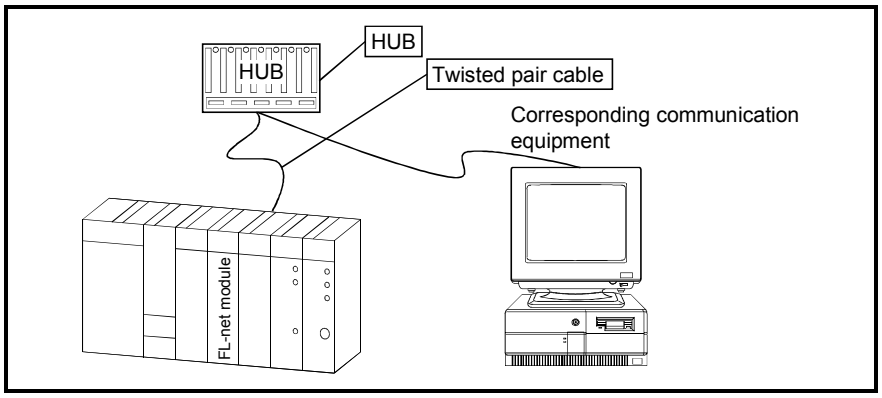
(1) Consult a network specialist for information about the required equipment.

(2) When 10BASE5 is used and countermeasures against noise and high-frequency waves are required for the installation environment of the QJ71FL71-B5, attaching a ferrite core (∗1) to the transceiver side of the AUI cable is often effective.
∗1: Can use ZCAT 2032-0930, manufactured by TDK



(2) When configuring a network with QJ71FL71-T

(a) Connection using 10BASE-T

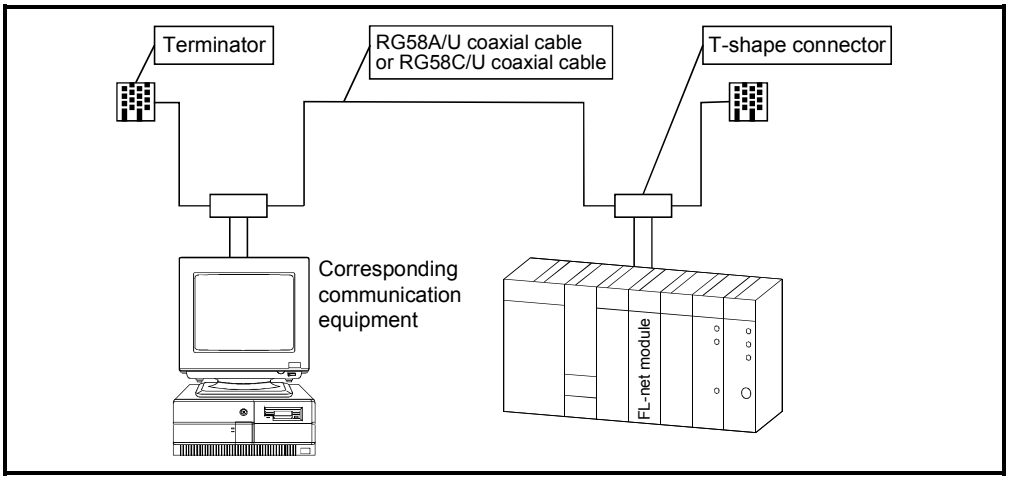


1) Use equipment that meets IEEE802.3 10BASE-T specifications. (Equipment from the HUB and below)
   - Unshielded twisted pair cable (UTP) or shielded twisted pair cable (STP), category 3, 4, 5
   - RJ45 jack
   - Hub for 10 Mbps

POINT
Consult a network specialist for the equipment required.

(3) When configuring a network with QJ71FL71-B2

(a) Connection using 10BASE2



1) Use devices that meet the standards of IEEE802.3 and 10BASE2.
   - RG58A/U or RG58C/U (coaxial cable 50 Ω)
   - BNC-type Terminator (product equivalent to 221629-4 manufactured by Tyco Electronics AMP K. K.)
   - T-shaped adapter (product equivalent to UG-274/U(15) manufactured by Hirose Electric Co., Ltd.)

POINT
Consult a network specialist for the equipment required.

3.2 Specifications

This section explains the FL-net module performance specifications and transmission specifications.

3.2.1 General specifications

Refer to the QCPU (Q mode) User's Manual for the general specifications of the FL-net module.

3.2.2 Performance specifications

The following are the performance specifications of the FL-net module.

Table 3.1 Performance specifications

Items		Specifications		
		QJ71FL71-B5	QJ71FL71-T	QJ71FL71-B2
		10BASE5	10BASE-T	10BASE2
Transmission specifications	Data transmission speed	10Mbps		
	Transmission method	Base band		
	Electric interface	IEEE802.3 standard (CSMA/CD standard)		
	Transmission protocol	UDP/IP FA link protocol		
	Maximum distance between nodes	2500m	—	925m
	Maximum segment length	500m	100m	185m
	Maximum number of nodes in system	254		
	Maximum number of nodes	100 units/segment	254 units/All the hab (12 units ∗1)	30 units /segment
	Minimum node interval	2.5m	—	0.5m
	Cyclic data volume	Maximum (8 k bits + 8 k words)/system Maximum (8 k bits + 8 k words)/node		
	Message data volume	Maximum 1024 bytes		
Link data specifications	Common memory area	Area 1 (bit area): 8 k bits Area 2 (word area): 8 k words		
	Virtual address space and physical memory	—		
	Error log memory area	512 words		
	Status memory area	Bit area: 2 k bits Word area: 2 k words		
	Local node network parameter setting area	96 words		
	Other node network parameter setting area	2048 words		
	Network parameter acquisition area	512 words		
	Device profile memory area	512 words		
	Message area (Transient area)	Maximum 1024 bytes × 2 (transmit - receive 1 each)		

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Items		Specifications		
		QJ71FL71-B5	QJ71FL71-T	QJ71FL71-B2
		10BASE5	10BASE-T	10BASE2
Transmission specifications	Message transmission	500 ms or less (1:1 Arrival time of one-way message)		
	Token start time	New participation: Start time = 3000 + (Minimum node number/ 8 remaining) × 4 + 1200ms Underway participation: Participation time = Refresh cycle × 3 + local node number × 4ms		
	Refresh time	(*2)		
	Transmission delay time	(*3)		
Number of input/output points		32 points (I/O allocation: intelligent)		
5VDC internal current consumption		0.50A	0.50A	0.60A (*4)
Noise resistance		According to the power supply specifications of the station to which the FL-net module is mounted.		
Voltage resistance				
Insulation resistance				
External dimensions		98 (H) × 27.4 (W) × 90 (D)mm		
Weight		0.12kg	0.11kg	0.13kg (*4)

*1 : Up to 12 units can be connected to a center hub.
Up to 4 connection steps are possible.

*2 : See Appendix 5.1 (6) for the send time between cyclic data area and device area.

*3 : The following is the send time between cyclic data area and device area.
(a) Minimum transmission delay time [ms] = "SM1" + token hold time + "SM2"
(b) Maximum transmission delay time [ms] = "SM1" + (Refresh cycle × 4) + "SM2"
SM1: Transmit sequence scan (including refresh time)
SM2: Receive sequence scan (including refresh time)

*4 : The 5VDC internal current consumption and weight of the product whose first five digits of serial No. are 05079 or earlier are as follows.
- 5VDC internal current consumption: 0.70A
- Weight: 0.14kg

3.2.3 FL-net module function list

Table 3.2 shows the function list of the FL-net module.

Table 3.2 FL-net module functions list

Function	Description of function	Reference
Cyclic transmission	(1) Communication of large data volume The common memory method enables cyclic transmission of data as follows. • Area 1 (bit area): 8 k bits (512 words) • Area 2 (word area): 8 k words (8192 words) (Transmitting and receiving up to 8. 5 k words/node cyclic data is possible.) (2) Guaranteed refresh cycle time Since the permissible refresh cycle time is dynamically determined, message transmission (transient transmission) can be controlled with the refresh cycle time guaranteed.	Section 6.2
Message transmission	(1) Transparent message transmission • Message data (up to 1024 bytes) for the message area of a specified node can be sent and received. • Possible to send and receive transaction codes other than those used by the system. (2) Reading and writing of data in word blocks. By using the virtual memory access method, it is possible to read and write the virtual address space data assigned by each manufacturer in word units. (3) Message return data response It is possible to return the received data as-is whenever a message return command is received. (4) Reading of the network parameters It is possible to read the network parameters for each node (such as vendor name, token monitoring time, etc.). (5) Reading and clearing of log data It is possible to read and clear the communication log data held by each node. (6) Reading of device profile It is possible to read the device profile data held by each node.	Section 6.2
Self diagnosis function	(1) Hardware test The GX Developer can be used to set the hardware test mode to perform hardware testing of the FL-net module. (2) Self-loopback test The GX Developer can be used to set the loopback test mode to perform tests of the send/receive functions of FL-net module and the status of the lines.	Section 6.3.1
Ping command response function	(1) Ping command compatibility It is possible to confirm the IP address of the FL-net module by issuing a ping command to your local station FL-net module from a corresponding device (personal computer, etc.) connected to the FL-net (OPCN-2) network.	Section 8.2(3)
Multiple PLC function compatibility	(1) Multiple PLC functions It is possible to control by optional CPU modules, even when multiple card CPU modules are mounted to the same base unit.	-

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Function	Description of function	Reference
Parameter setting by GX Configurator-FL	(1) Initial setting Network parameter for common memory allocations, monitoring time and others can be set by GX Configurator-FL. (2) Auto refresh setting It is possible to perform cyclic data auto refresh. (3) Monitor/test The buffer memory and I/O signals of the FL-net module can be monitored and tested.	Section 6.4

3 - 11

3.2.4 Input/output signal for the CPU module

The section explains the input/output signals for the FL-net module.

(1) Input/output signal list

The allocations for the input/output signals are shown for when the FL-net module is mounted to the 0 slot of the main base unit.
Device X is the input signal from the FL-net module to the CPU module and device Y is the output signal from the CPU module to the FL-net module.
Table 3.3 shows the input/output list for the CPU module.

Table 3.3 Input/output signal for the CPU module

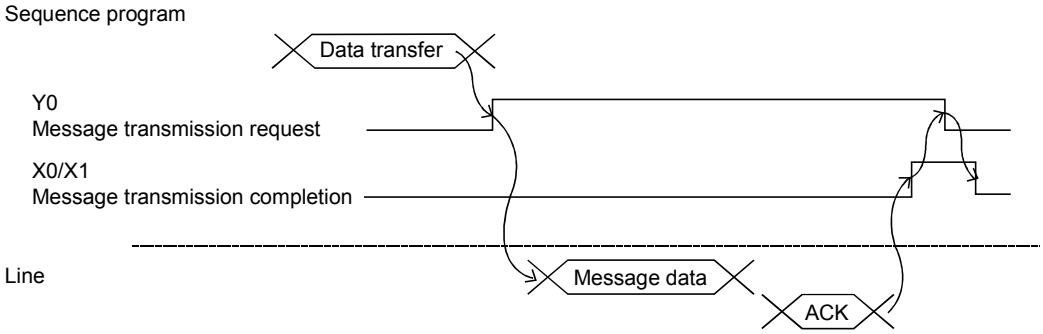
Signal direction: CPU module ← FL-net module		Signal direction: CPU module → FL-net module	
Input No.	Signal name	Output No.	Signal name
X00	Message transmission normal completion signal ON: Normal completion OFF: —	Y00	Message transmission request ON: Request OFF: —
X01	Message transmission abnormal completion signal ON: Abnormal completion ending OFF: —	Y01	Use prohibited
X02	Message being received signal ON: Being received OFF: No signal received	Y02	Message reception completion confirmation ON: Request OFF: —
X03 to X0F	Use prohibited	Y03 to Y0F	Use prohibited
X10	Network parameter write completion signal ON: Completed OFF: —	Y10	Network parameter write request ON: Request OFF: —
X11	Network parameter/participation node data read completion signal ON: Completed OFF: —	Y11	Network parameter/participation node data read request ON: Request OFF: —
X12	Use prohibited	Y12	Use prohibited
X13	Device profile read completion signal ON: Completed OFF: —	Y13	Device profile read request ON: Request OFF: —
X14	Log data clear completion signal ON: Completed OFF: —	Y14	Log data clear request ON: Request OFF: —
X15	Log data read completion signal ON: Completed OFF: —	Y15	Log data read request ON: Request OFF: —
X16	Use prohibited	Y16 to Y1F	Use prohibited
X17	Use prohibited		
X18	Network parameter setting status signal ON: Error OFF: Normal		
X19	Token participation status signal ON: Participation OFF: Released		
X1A	Use prohibited		
X1B	Use prohibited		
X1C	Module ready ON: Preparation completed OFF: In initialization		
X1D	Use prohibited		
X1E	Use prohibited		
X1F	Watchdog timer error detection signal ON: Detected OFF: Not detected		

IMPORTANT
Never set any output signal for the CPU module designated as " Use prohibited " for output (set to ON). The output of a "Use prohibited" signal will cause the PLC system to malfunction.

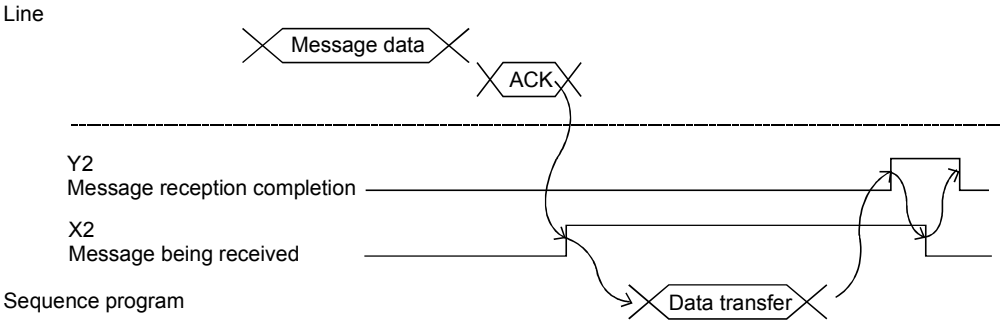
(2) Details of the input/output signal

This section explains the ON/OFF timing, conditions and other items related to the input/output signals shown in Table 3.3
Data in ( ) indicates the corresponding device number in Table 3.3

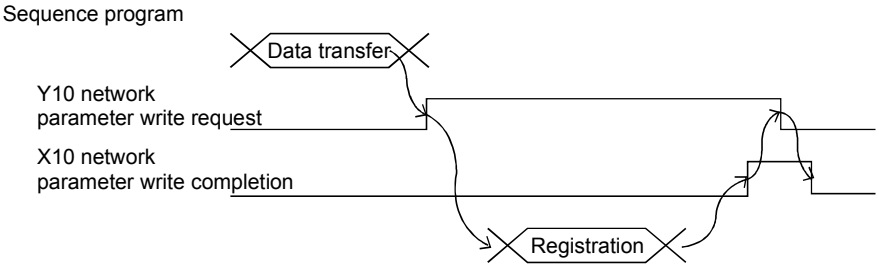
(a) Message transmission normal completion signal/Message transmission abnormal completion signal (X00/X01)
Message transmission request (Y00)
The data is sent by setting the data in the message send area of the buffer memory beforehand and setting of the message transmission request (Y00) to ON. After the send completion confirmation by the message transmission completion signals (X00/X01), set message transmission request (Y00) to off.
For message transmission, refer to Section 6.5.3 (5).



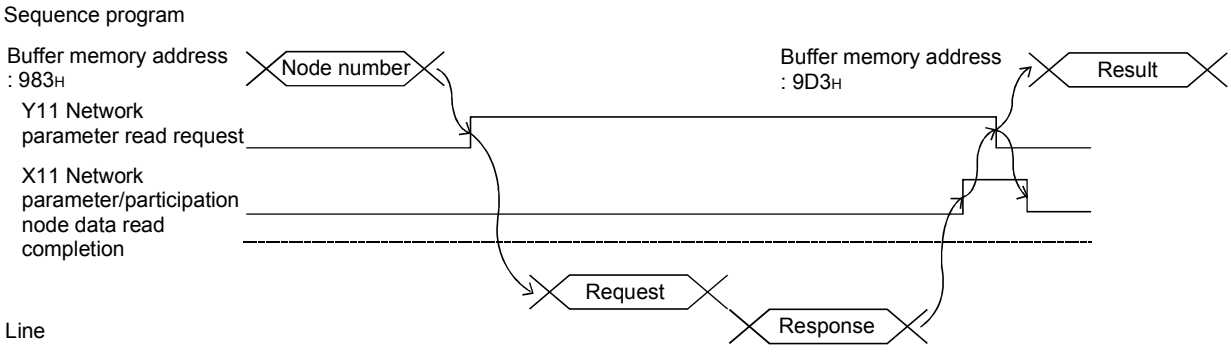
(b) Message being received signal (X02)
Message reception completion confirmation (Y02)
The data from other nodes is set in the message received area of the buffer memory and the message being received signal (X02) is set to on.
After the message data has been transferred to the device (read), set the message reception completion signal (Y02) to on.
After confirming that the message being received signal (X02) is off, set the message reception completion signal (Y02) to off.
For message reception, refer to Section 6.5.3 (5).



(c) Network parameter write completion signal (X10)
Network parameter write request (Y10)
The data is set in the network parameter area of its local node buffer memory beforehand and the network parameter is registered by setting the network parameter write request (Y10) to on.
After the write completion has been confirmed by the on of the network parameter write completion signal (X10), set the network parameter write request (Y10) to off.
For registration of local node network parameters, refer to Section 6.5.1.



(d) Network parameter/participation node data read completion signal (X11)
Network parameter/participation node data read request (Y11)
By turning on the network parameter/participation node data read request (Y11), data of the target node are read out into the network parameter/participation node data acquisition area of the buffer memory.
After the acquisition completion has been confirmed by the on of the network parameter/participation node data read request signal (X11), set the network parameter/participation node data read request (Y11) to off.
For the network parameter/participation node data read, refer to Section 6.5.3 (1).



POINT
The switching of network parameter/participation node data reading is distinguished by buffer memory address 983H . . . b15. (Refer to Section 3.2.6.(2)) 0: Read network parameter data 1: Read participation node data

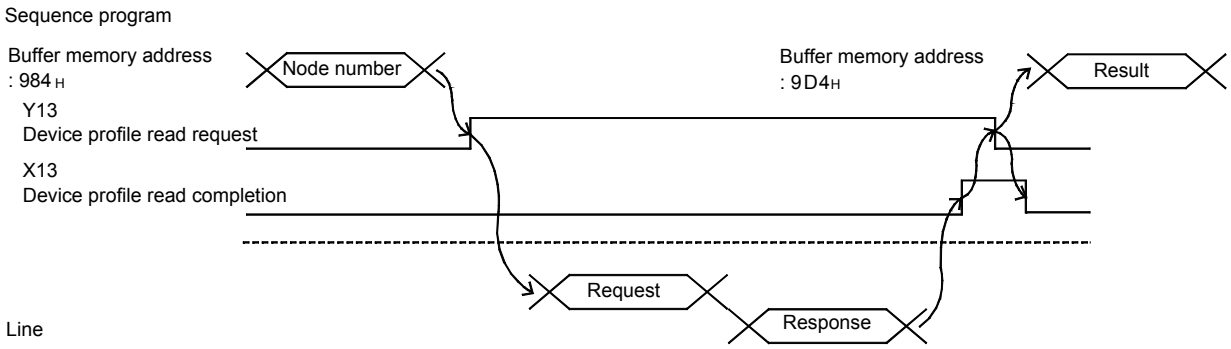
(e) Device profile read completion signal (X13)

Device profile read request (Y13)

By turning on the device profile read request (Y13), the device profile of the target node is read out into the device profile acquisition area of the buffer memory.

After the acquisition completion has been confirmed by the on of the device profile read signal (X13), set the device profile read request (Y13) to off.

For the device profile read, refer to Section 6.5.3 (2).



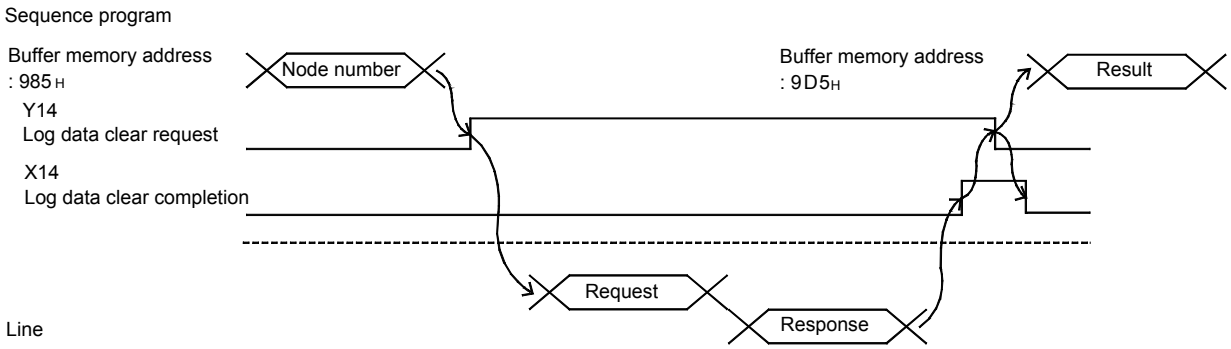
(f) Log data clear completion signal (X14)

Log data clear request (Y14)

By turning on the log data clear request (Y14), the log data of the target node are cleared.

After the completion of the clear has been confirmed by the on of the log data clear signal (X14), set the log data clear request (Y14) to off.

For the log data clear, refer to Section 6.5.3 (4).

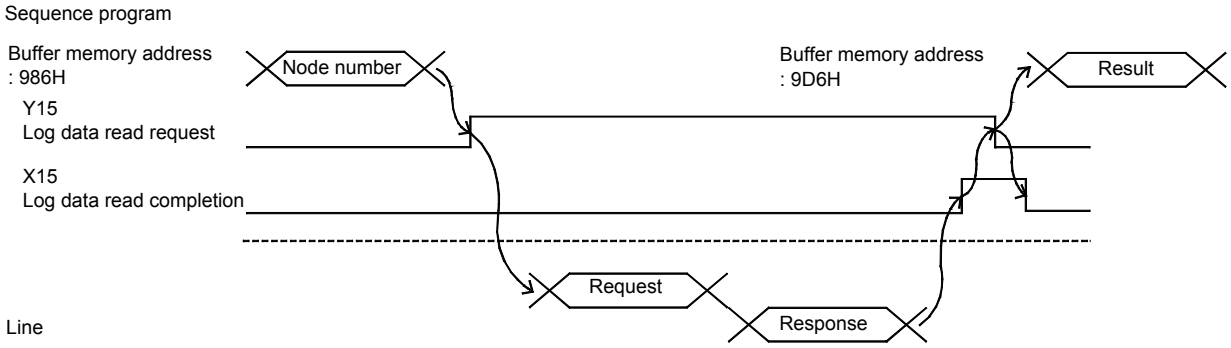


(g) Log data read completion signal (X15)

Log data read request (Y15)

By turning on the log data read request (Y15), the log data of the target node are read out into the log data acquisition area of the buffer memory. After the completion of the acquisition has been confirmed by the on of the log data read signal (X15), set the log data read request (Y15) to off.

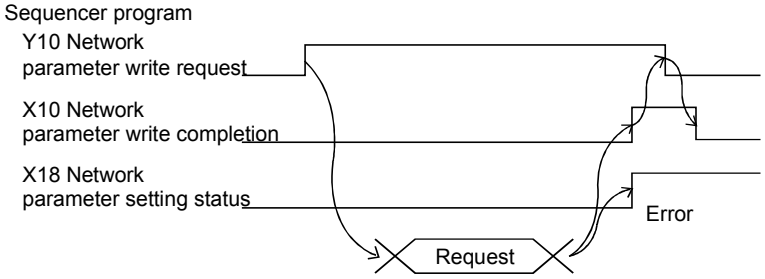
For the log data read, refer to Section 6.5.3 (3).



(h) Network parameter setting status signal (X18)

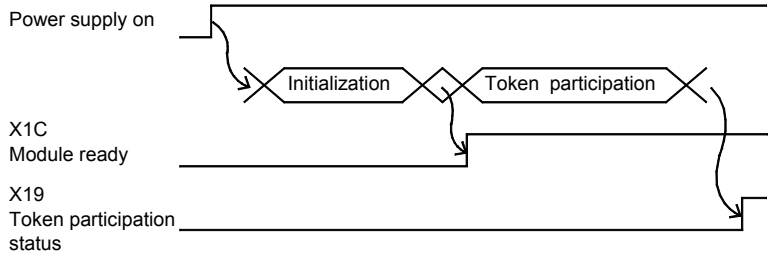
When the writing of the network parameter has been completed and a network parameter setting error is issued, the network parameter setting status signal (X18) is set to on.

For registration of local node network parameters, refer to Section 6.5.1.



(i) Token participation status signal (X19)

Shows the token participation status to the network. The token participation status signal (X19) is on during token participation.



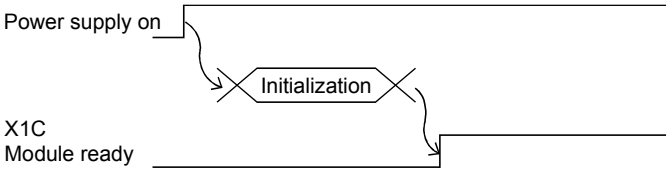
(j) Module ready (X1C)

Shows the results of the initial check of the FL-net module.

The initial check is completed approximately 1s after the power is turned on.

It the initial check is normal, module ready (X1C) is set to on.

If module ready (X1C) does not come on after 1s or more after the power has been turned on, use the intelligent function module switch settings from GX Developer (Refer to Section 6.3.2) to adjust. If the intelligent function module switch settings are normal, the FL-net module will proceed to its self-diagnostic test. (Refer to Section 6.3.1 (1).)



3.2.5 Buffer memory

This section introduces the CPU module in the FL-net module and buffer memory used for handling its data.

(1) Applications of the buffer memory

The buffer memory is comprised of an area for use by the user and a system area as shown below.

(a) Area for use by user

1) This is the area other than the system area shown below.

2) It has the following areas: area for setting the various parameters for initialization processing or data communication, area for data communication and an area for storing data about the communication status or communication errors.

3) For reading from and writing to the area for use by user, refer to the corresponding section.

(b) System area

The is the area used by the FL-net module.

Important
Never write data to the "System Area" of the buffer memory for the FL-net module. If any data are written to the "System Area", the PLC system will malfunction.

(2) Buffer memory allocation

The buffer memory is comprised of 1 address 16 bits.
The following is the overall structure of the buffer memory.

<Bit structure diagram>

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0

Table 3.4 shows the buffer memory list.

Table 3.4 Buffer memory list

Address Decimal (Hexadecimal)	Item	Contents
0 to 127 (0 to 7F$_H$)	Local node network parameter area (128 words)	Set network parameters of the local node.
128 to 2175 (80 to 87F$_H$)	Other node network parameter area (2048 words)	Stores network parameters of the other nodes participating in the network.
2176 to 2303 (880 to 8FF$_H$)	System area (128 words)	—
2304 to 2431 (900 to 97F$_H$)	Status data area Bit area: 2 k bits (128 words)	Stores status data bit data.
2432 to 4479 (980 to 117F$_H$)	Status data area Word area: 2 k words (2048 words)	Stores status data word data.
4480 to 4607 (1180 to 11FF$_H$)	System area (128 words)	—
4608 to 5119 (1200 to 13FF$_H$)	Network parameter/participation node data acquisition area (512 words)	After execution of message transmission, the network parameter/participation node data read, this area stores the network parameter/participation node data of the target node.
5120 to 5631 (1400 to 15FF$_H$)	Device profile acquisition area (512 words)	After execution of message transmission, the device profile read, this area stores the device profile data of the target node.
5632 to 6143 (1600 to 17FF$_H$)	Log data acquisition area (512 words)	After execution of message transmission, the log data read, this area stores the log data of the target node.
6144 to 7167 (1800 to 1BFF$_H$)	System area (1024 words)	—
7168 to 7679 (1C00 to 1DFF$_H$)	Cyclic data area Area1: 8 k bits (512 words)	Set bit cyclic data of the local node. Stores bit cyclic data of the other nodes.
7680 to 8191 (1E00 to 1FFF$_H$)	System area (512 words)	—
8192 to 16383 (2000 to 3FFF$_H$)	Cyclic data area Area 2: 8 k words (8192 words)	Set word cyclic data of the local node. Stores word cyclic data of the other nodes.
16384 to 24575 (4000 to 5FFF$_H$)	System area (8192 words)	—
24576 to 25599 (6000 to 63FF$_H$)	Message data Send area (1024 words)	Set send data for transparent type message transmission.
25600 to 26623 (6400 to 67FF$_H$)	Message data Receiving area (1024 words)	Stores data received by transparent type message transmission.
26624 to 32767 (6800 to 7FFF$_H$)	System area (6144 words)	—

(3) Details of buffer memory

This section explains the details of the buffer memory.

(a) Local node network parameter area (Address: 0 to 7F$_H$)

Set network parameters of the local node.

POINT

(1) The IP address of the FL-net module is set in GX Developer's intelligent function module switch setting. (Refer to Section 6.3.2 (2).)

(2) For the local node network parameter setting other than the above, refer to the following:
- When using the initial setting of GX Configurator-FL: Section 6.4.8
- When setting on the sequence program: Section 6.5.1

0 to 4$_H$	Node name (Equipment name)
5 to 6$_H$	IP address
7$_H$	System area
8$_H$	Area 1 first address
9$_H$	Area 1 size
A$_H$	Area 2 first address
B$_H$	Area 2 size
C$_H$	Token monitoring time out time
D$_H$	Minimum permissible frame interval
E$_H$	Message data unit selection
F to 7F$_H$	System area

[1] Node name (Equipment name)

Sets node name (Equipment name)
- Setting range : Optional data
- Default : No setting

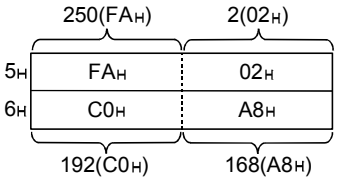
[2] IP address

Sets the IP address (32 bit) of the FL-net module.
- Setting range : 0 · · · GX Developer's intelligent function module switch setting (*1) is valid
  : Other than 0 · · · Sets 32 bit logic address (*2)
- Default: Intelligent function module switch setting or "192.168.250.1"

*1: Refer to Section 6.3.2.(2) for details about intelligent function module switch setting.

*2: Set the IP address as shown below.

When the IP address is "192.168.250.2"



POINT

There will be double intelligent function module switch settings in relation to the IP address, but the value that has been set in the network parameter area will become the enabled IP address for the FL-net module.

[3] Area 1 first address

The first address of the local node common memory area 1 (bit area) is set in this area.

• Setting range: 0 to 1FF$_H$ · · · Set an offset value of the cyclic data area (Area 1) (Address: 1C00 to 1DFF$_H$) in the buffer memory.

• Default : No setting

[4] Area 1 size

The size of the local node common memory area 1 (bit area) is set in this area. Set the area 1 size in units of one word (16 bits).

• Setting range : 0 to 200$_H$ (1 word units)
(Set "2$_H$" when specifying the size for 32 bits.)

• Default : No setting

[5] Area 2 first address

The first address of the local node common memory area 2 (word area) is set in this area.

• Setting range: 0 to 1FFF$_H$ · · · Set an offset value of the cyclic data area (Area 2) (Address: 2000 to 3FFF$_H$) in the buffer memory.

• Default : No setting

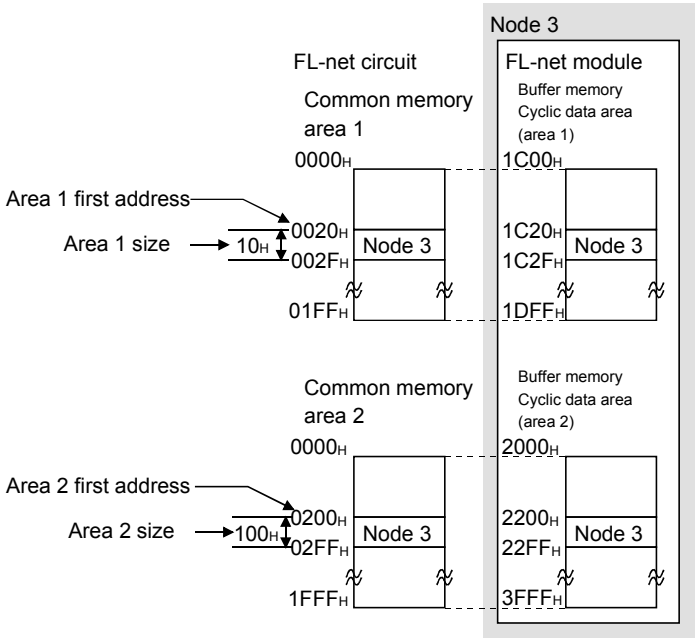
[6] Area 2 size

The size of the local node common memory area 2 (word area) is set in this area.

• Setting range : 0 to 2000$_H$ (1 word units)

• Default : No setting

(Example) Setting example for common memory area 1 (bit area) and area 2 (word area) of the local node (When the local node is node 3)



[7] Token monitoring time out time
Sets the monitoring time from the local node address token receive signal to the next node token transfer.
(If the token is held by another node, it monitors the time up to the release of the token by the node holding the token.)
• Setting range : 1 to 255 (1 ms units)
• Default : 50

[8] Minimum permissible frame interval
Sets the time from local node address token receive signal to the number of frames until local node sends.
In addition, it can also be used for message sending or frame interval time for frame division.
• Setting range : 0 to 50 (100 μ s units)
• Default : 0

[9] Message data unit selection
Sets the unit for when message data is handled.
• Setting range : 0 · · · Word unit
: 1 · · · Byte unit
• Default: 0

Important

Never write data to the "System Area" of the buffer memory for the FL-net module.
If writing of data is performed to the "System Area", the PLC system will malfunction.

POINT

Because this area is also used when the GX Configurator-FL is used, it can be operated by sequence program settings if there is conflict with the sequence program.

(b) Other node network parameter area (address: 80 to 87FH)

Stores network parameters of the other nodes participating in the network.

80H	Area 1 first address	Node number 1 area (8 words)
81H	Area 1 size	
82H	Area 2 first address	
83H	Area 2 size	
84H	Token monitoring time out time	
85H	Minimum permissible frame interval	
86H	Refresh cycle permissible time / RCT setting value	
87H	Upper layer - link status	
88 to 8FH	Same as node number 1 area	Node number 2 area (8 words)
to	to	
868 to 86FH	Same as node number 1 area	Node number 254 area (8 words)
870 to 87FH	System area	

POINT

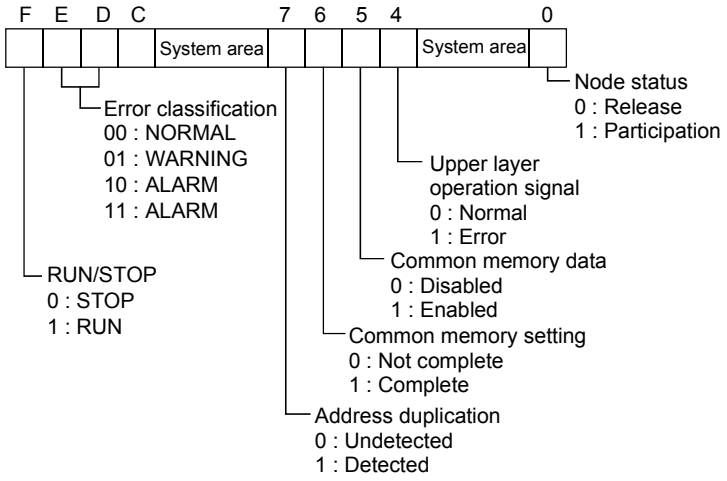
The following settings have the same data format as the settings shown in "(a) Local node network parameter area (3) to (8): "Area 1 first address", " Area 1 size", "Area 2 first address", " Area 2 size", "Token monitoring time out time" and "Minimum permissible frame interval".

[1] Refresh cycle permissible time / RCT setting value

Stores the refresh cycle permissible time (value of 120 % of 1 cycle).

[2] Upper layer - link status

Stores the status of the upper layer (CPU module) and link status.



(c) Status data area (Address: 900 to 117F$_H$)

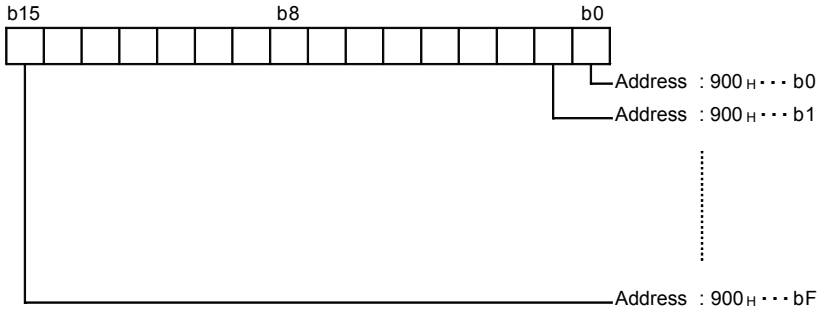
Refer to Section 3.2.6 for details about the status data.

1) Status bit area (Address: 0900 to 097F$_H$)

Stores the status data bit data.

900 to 902$_H$	900 · · · b0 to 902 · · · bF CPU module → FL-net module	Write area (48 bits)
903 to 97F$_H$	903 · · · b3 to 97F · · · bF CPU module ← FL-net module	Read area (2000 bits)

<Structure diagram>

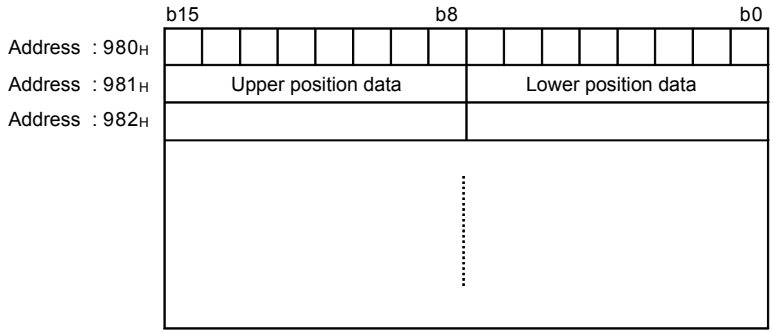


2) Status word area (Address: 0980 to 117F$_H$)

Stores the status data word data.

980 to 9AF$_H$	980 to 9AF CPU module → FL-net module	Write area (48 words)
9B0 to 117F$_H$	9B0 to 117F CPU module ← FL-net module	Read area (2000 words)

<Structure diagram>



(d) Network parameter/participation node data acquisition area (Address: 1200 to 13FF$_H$)

After execution of message transmission, the network parameter/participation node data read, this area stores the network parameter/participation node data of the target node.

For the message transmission, the network parameter/participation node data read, refer to Section 6.5.3 (1).

POINT

Switching of network parameter/participation node data is determined by buffer memory address 983$_H$ · · · b15. (See Section 3.2.6 (2))
0: Network parameter data reading
1: Participation node data reading

		Network parameter	Participation node
1200 to 1204$_H$	Node name (Equipment name)	○	○
1205 to 1209$_H$	Vendor name	○	○
120A to 120E$_H$	Manufacturer model	○	○
120F$_H$	Area 1 first address	○	○
1210$_H$	Area 1 size	○	○
1211$_H$	Area 2 first address	○	○
1212$_H$	Area 2 size	○	○
1213$_H$	Token monitoring time out time	○	○
1214$_H$	Minimum permissible frame interval	○	○
1215$_H$	Link status	○	○
1216$_H$	Protocol version	○	—
1217$_H$	Upper layer status	○	○
1218$_H$	Refresh cycle permissible time / RCT setting value	○	○
1219$_H$	Current value of refresh cycle	○	—
121A$_H$	Maximum value of refresh cycle	○	—
121B$_H$	Minimum value of refresh cycle	○	—
121C to 13FF$_H$	System area	—	—

○ : Stored — : Not stored

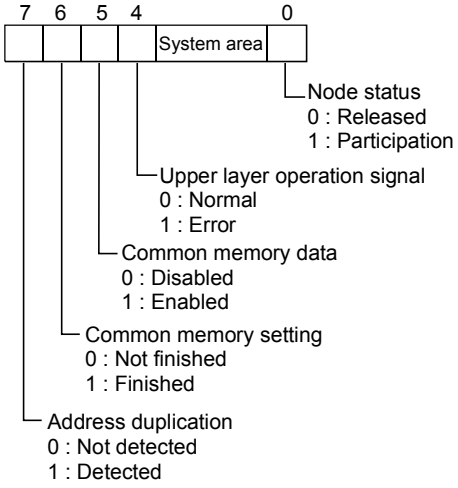
[1] Node name (Equipment name)
Stores the node name (equipment name) of the node to be the object.

[2] Vendor name
Stores the vendor name of the node to be the object in ASCII characters.
(Example) Mitsubishi Electric: MELCO

[3] Manufacturer model
Stores the manufacturer model of the node to be the object in ASCII characters.
• QJ71FL71-T : "QJ71FL71T "
• QJ71FL71-B5 : "QJ71FL71B5"
• QJ71FL71-B2 : "QJ71FL71B2"

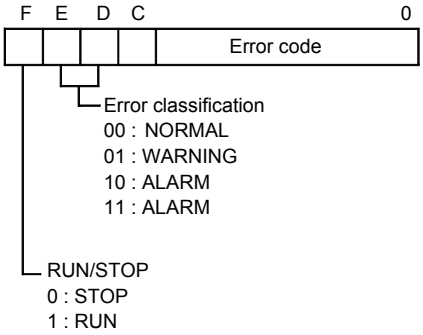
[4] Area 1 first address, Area 1 size, Area 2 first address, Area 2 size, Token monitoring time out time and Minimum permissible frame interval
Stores each of the settings for the node to be the object.

[5] Link status
Stores the network status of the node to be the object.



[6] Protocol version
Stores the protocol version for FL-net (OPCN-2).
• Protocol version: 0080H fixed

[7] Upper layer status
Stores the status of the upper layer (CPU module) of the node to be the object.



[8] Refresh cycle permissible time / RCT setting value
Stores the refresh cycle permissible time (value of 120 % of 1 cycle).

[9] Refresh cycle current value, maximum value and minimum value
Stores the measured value for one cycle of the node to be the object.

(e) Device profile acquisition area (Address: 1400 to 15FF$_H$)

After execution of message transmission, the device profile read, this area stores the device profile data of the target node.

For the message transmission, the device profile read, refer to Section 6.5.3 (2).

Refer to "Appendix 9 – Profile Supplement".

Parameter name		Name characters		Data type	Parameter contents	
		Length	Characters	[Type]	Length	Characters
SysPara	Device profile common specification version	6	"COMVER"	INTEGER	1	1
	System parameter identification characters	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 1 1	2003 7 1
	Device category	10	"DVCATEGORY"	PrintableString	3	“PLC"
	Vendor name	6	"VENDOR"	PrintableString	10	“MELCO "
	Device model name	7	"DVMODEL"	PrintableString	10	"QJ71FL71T " (∗1) "QJ71FL71B5" (∗2) "QJ71FL71B2" (∗3)

∗1: QJ71FL71-T

∗2: QJ71FL71-B5

∗3: QJ71FL71-B2

(f) Log data acquisition area (Address: 1600 to 17FF$_H$)

After execution of message transmission, the log data read, this area stores the log data of the target node.

For the message transmission, the log data read, refer to Section 6.5.3 (3).

1600 to 1617$_H$	Send and receive	(24 words)
1618 to 162F$_H$	Frame types	(24 words)
1630 to 1647$_H$	Cyclic transmission	(24 words)
1648 to 165F$_H$	Message transmission	(24 words)
1660 to 1677$_H$	ACK related	(24 words)
1678 to 168F$_H$	Token related	(24 words)
1690 to 16A7$_H$	Status 1	(24 words)
16A8 to 16BF$_H$	Status 2	(24 words)
16C0 to 17FF$_H$	System area	(320 words)

1) Send and receive (Address: 1600 to 1617$_H$)

Stores log data related to send and receive.

1600 to 1601$_H$	Totaling socket sending count
1602 to 1603$_H$	Totaling sock send error count
1604 to 1605$_H$	Ethernet send error count
1606 to 160B$_H$	System area
160C to 160D$_H$	Total receive count
160E to 160F$_H$	Total receive error count
1610 to 1611$_H$	Ethernet receive error count
1612 to 1617$_H$	System area

[1] Totaling socket sending count
Stores the accumulated count of sending to transmission line.

[2] Totaling sock send error count
Stores the accumulated count of send errors detected at the transmission line.

[3] Ethernet send error count
Stores the accumulated count of send errors detected at the data link and physical layer.

[4] Total receive count
Stores the accumulated count of receive signals to the transmission line.

[5] Total receive error count
Stores the accumulated count of receive errors detected at the transmission line.

[6] Ethernet receive error count
Stores the accumulated count of receive errors detected at the data link and physical layer.

2) Frame type (Address: 1618 to 162F$_H$)

Stores the log data related to the frame types.

1618 to 1619$_H$	Token send count
161A to 161B$_H$	Cyclic frame send count
161C to 161D$_H$	1 : 1 message frame send count
161E to 161F$_H$	1 : n message send count
1620 to 1623$_H$	System area
1624 to 1625$_H$	Token receive count
1626 to 1627$_H$	Cyclic frame receive count
1628 to 1629$_H$	1 : 1 message frame receive count
162A to 162B$_H$	1 : n message receive count
162C to 162F$_H$	System area

[1] Token send count
Stores the accumulated count of tokens sent (token + cyclic).

[2] Cyclic frame send count
Stores the accumulated count of cyclic frames sent.

[3] 1 : 1 message frame send count
Stores the accumulated count of 1:1 message frames sent.

[4] 1 : n message send count
Stores the accumulated count of 1:n (broadcast) message frames sent.

[5] Token receive count
Stores the accumulated count of local node address tokens (token + cyclic) received.

[6] Cyclic frame receive count
Stores the accumulated count of cyclic frames received.

[7] 1 : 1 message frame receive count
Stores the accumulated count of local node address 1:1 message frames received.

[8] 1 : n message frame receive count
Stores the accumulated count of 1:n (broadcast) message frames received.

3) Cyclic transmission (Address: 1630 to 1647H)
Stores log data related to cyclic transmission.

1630 to 1631H	Cyclic frame receive error count
1632 to 1633H	Cyclic address size error count
1634 to 1635H	Cyclic CBN error count
1636 to 1637H	Cyclic TBN error count
1638 to 1639H	Cyclic BSIZE error count
163A to 1647H	System area

[1] Cyclic frame receive error count
Stores the accumulated count of cyclic frame receive error detections.

[2] Cyclic address size error count
Stores the accumulated count of address size error detections in the cyclic frame.

[3] Cyclic CBN error count
Stores the accumulated count of CBN (block number) error detections in the cyclic frame.

[4] Cyclic TBN error count
Stores the accumulated count of TBN (number of total blocks) error detections in the cyclic frame.

[5] Cyclic BSIZE error count
Stores the accumulated count of BSIZE (data size including frame header) error detections in the cyclic frame.

4) Message transmission (Address:1648 to 165FH)
Stores log data related to message transmission.

1648 to 1649H	Message transmission resend count
164A to 164BH	Message transmission resend over count
164C to 1655H	System area
1656 to 1657H	Message transmission receive error count
1658 to 1659H	Message transmission communication number error count
165A to 165BH	Message transmission resend recognition count
165C to 165FH	System area

[1] Message transmission resend count
Stores the accumulated count of resends in the message frame.

[2] Message transmission resend over count
Stores the accumulated count of resend over in the message frame.

[3] Message transmission receive error count
Stores the accumulated count of receive error detections in the message frame.

[4] Message transmission communication number error count
Stores the accumulated count of communication number error detections in the message frame.

[5] Message transmission resend recognition count
Stores the accumulated count of resend recognition in the message frame.

5) ACK related (Address: 1660 to 1677H)
Stores log data related to ACK.

1660 to 1661H	ACK error count
1662 to 1663H	Serial number version error count
1664 to 1665H	Serial number error count
1666 to 1667H	Node number error count
1668 to 1669H	TCD error count
166A to 1677H	System area

[1] ACK error count
Stores the accumulated count of ACK header error detections.
[2] Serial number version error count
Stores the accumulated count of serial number version error detections (mis-match detection).
[3] Serial number error count
Stores the accumulated count of serial number error detections (non-continuous detection).
[4] Node number error count
Stores the accumulated count of node number error detections.
[5] TCD error count
Stores the accumulated count of TCD (transaction code) error detections

6) Token related (Address : 1678 to 168FH)
Stores log data related to token.

1678 to 1679H	Token multiplexing recognition count
167A to 167BH	Token destruction count
167C to 167DH	Token resend count
167E to 1683H	System area
1684 to 1685H	Token hold time out count
1686 to 1687H	Token monitoring time out count
1688 to 168FH	System area

[1] Token multiplexing recognition count
Stores the accumulated count of optional node address (including local node address) tokens detected while the token is being held.
[2] Token destruction count
Stores the accumulated count of node address tokens having a value that is less than that of local node while the token is being held.
[3] Token resend count
Stores the accumulated count of token resends.
[4] Token hold time out count
Stores the accumulated count of time out detections for token hold time out time (value that does not exceed the token monitoring time out time).
[5] Token monitoring time out count
Stores the accumulated count time out detections for token monitoring time out time.

7) Status 1 (Address:1690 to 16A7H)
Store log data related to status 1.

1690 to 1691H	Total operating time
1692 to 1693H	Frame wait status count
1694 to 1695H	Subscription count
1696 to 1697H	Self-release count
1698 to 1699H	Release-by-skip count
169A to 169BH	Other node release count
169C to 16A7H	System area

[1] Total operating time
Stores the total operating time. (Unit: ms)

[2] Frame wait status count
Stores the accumulated count that frame wait status has become.

[3] Subscription count
Stores the accumulated count of local node subscription.

[4] Self-release count
Stores the accumulated count of self release (when token hold time for local node up is generated 3 consecutive times).

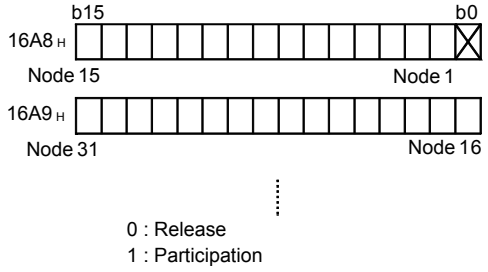
[5] Release-by-skip count
Stores the accumulated count of release by skip (local node address token is pulled out 3 consecutive times).

[6] Other node release count
Stores the accumulated count of detections of other node releases.

8) Status 2 (Address:16A8 to 16BFH)
Stores log data related to status 2.

16A8 to 16B8H	Participation node list
16B9 to 16BFH	System area

[1] Participation node list
Stores the token participation status at other node tokens in bit units.



(g) Cyclic data area

The cyclic data area consists of area 1 (bit area) and area 2 (word area).

POINT

For the information on how to transfer data between the cyclic data area (areas 1, 2) in the buffer memory and PLC CPU devices, refer to the following:

- Transfer by the auto refresh setting of GX Configurator-FL: Section 6.4.9
- Transfer using sequence program: Section 6.5.2

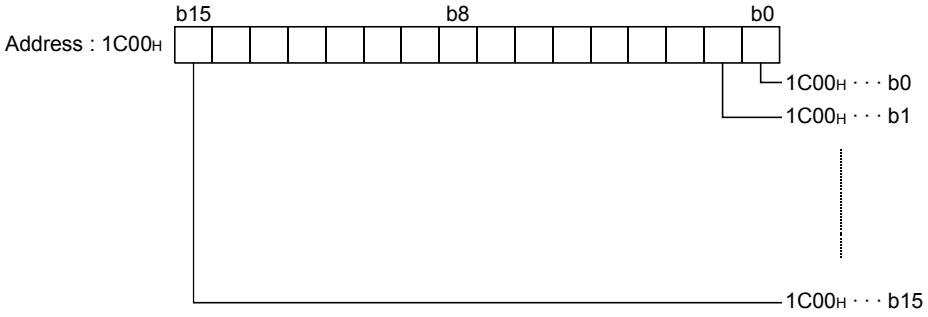
1) Area 1 (Address: 1C00 to 1DFF$_H$)

Set bit cyclic data of the local node.

Stores bit cyclic data of the other nodes.

1C00 to 1DFF$_H$	Read/write area (8192 bits)

<Structure diagram>



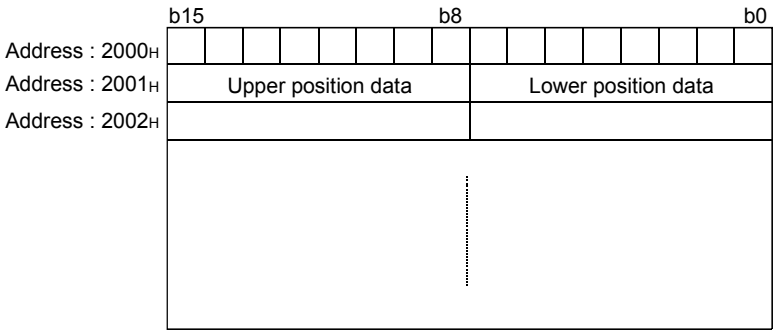
2) Area 2 (Address: 2000 to 3FFF$_H$)

Set word cyclic data of the local node.

Stores word cyclic data of the other nodes.

2000 to 3FFF$_H$	Read/write area (8192 words)

<Structure diagram>



POINT

The area allocated in the send area of the local node is the "write area" and the rest is the "read area".

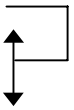
(h) Message data area

The message data area sets and stores the data related to transparent type message transmissions.
For the transparent type message transmission, refer to Section 6.5.3 (5).
The message data area has a send area and a receive area.

1) Send area (Address: 6000 to 63FF$_H$)

Data such as the object node number and message data to be transmitted is set in the send area.

6000$_H$	Object node number
6001$_H$	Transaction code
6002$_H$	Send data size (Byte/word length)
6003 to 6202$_H$	Send data area (512 words)
6203 to 63FF$_H$	System area



[1] Object node number
- 0 : Use prohibited
- 1 to 254 : Object node number
- 255 : All stations (Global)
- 256 and more : Use prohibited

[2] Transaction code
Sets the transaction code.
Refer to Section 6.2.8. (4) for details about the transaction code.

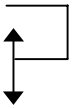
[3] Send data size
Sets the message data size to be sent.
The data unit (byte or word) is selected in "Message Data Unit Select" of the network parameter.
- Word unit: 0 to 512
- Byte unit: 0 to 1024

[4] Send data area
Sets the size of the message data to be sent (up to 512 words or 1024 bytes).

2) Receive area (Address: 6400 to 67FFH)

The send source node number, receive message data and other data is stored in the receive area.

6400H	Send source node number
6401H	Transaction code
6402H	Receive data size (byte/word length)
6403 to 6602H	Receive data area (512 words)
6603 to 67FFH	System area



[1] Send source node number

Stores the node number for the node to be the send source.
If all stations, arrange so that there is no answer.

- 1 to 254: Send source node number
- 255: All stations (Global)

[2] Transaction code

Stores the transaction codes for received message data.
Refer to Section 6.2.8. (4) for details about the transaction code.

[3] Receive data size

Stores the size of the message data that has been received.
The data unit (byte or word) is selected in "Message Data Unit Select" of the network parameter.

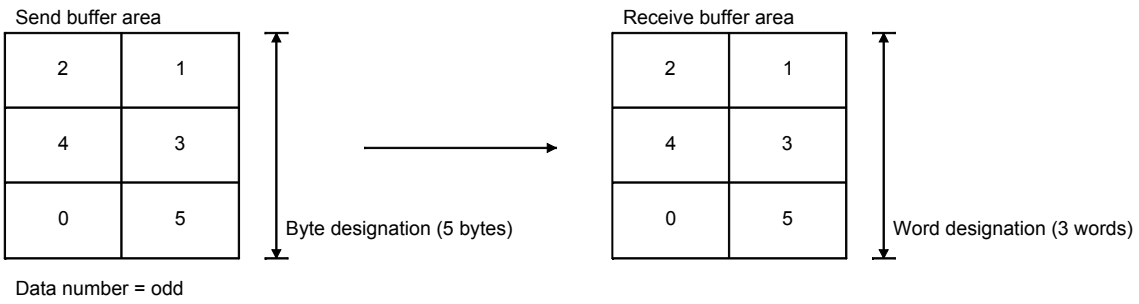
- Word unit: 0 to 512
- Byte unit: 0 to 1024

[4] Receive data area

Stores the size of the message data received (up to 512 words or 1024 bytes).

REMARK

When the data unit designation for send and receive is different
The follow explains when the send side is in byte units and the receive side is in word units.
When the send data number is an odd number, a zero (0) is stored at the end of the data stored in the receive buffer area.



3.2.6 Status data details

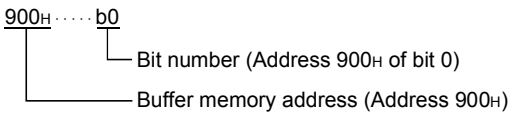
This section explains the details about status data.
Status data stores the following data.

1) Status bit
   a) Indication area "CPU → FL-net (OPCN-2)"
   b) Local node data area "FL-net (OPCN-2) → CPU"

2) Status word
   a) Indication area "CPU → FL-net (OPCN-2)"
   b) Message data area "CPU → FL-net (OPCN-2)"
   c) Local node data area "FL-net (OPCN-2) → CPU"
   d) Other node data area "FL-net (OPCN-2) → CPU"
   e) Log data area "FL-net (OPCN-2) → CPU"
   f) Message data area "FL-net (OPCN-2) → CPU"

(1) Status bit details

This section explains the status data bit area.
The notation method for the buffer memory address is shown below.
(Buffer memory address indication)



Operation mode shows the valid/invalid for each mode of the online/offline.

(a) Indicated area "CPU → FL-net (OPCN-2)"

Buffer memory address	Name	Description	Operating mode	
			On line	Off line
900H · · · b9	Log data clear	Indicates clearing of log data in buffer memory (Address:A80H to B38H) (*1) 0: No clear instruction 1: Clear instruction	○	—

○ : Valid — : Invalid

*1: Clear is executed during on status.

(b) Local node data area "FL-net (OPCN-2) → CPU"

Buffer memory address	Name	Description	Operating mode	
			On line	Off line
904H · · · b3	Operation data	Indicates node switch of module. 0: On 1: Other than On	○	○
904H · · · b6	Setting data	Indicates node number switch of module. 0: Normal 1: Setting error (node number=0, 256 or more, or mode = other than test, online)	○	○
904H · · · b7	Module type	Indicates module type ＊1 0: QJ71FL71-T (10BASE-T), QJ71FL71-B5 (10BASE5) 1: QJ71FL71-B2 (10BASE2)	○	○
904H · · · b8	Local node communication status	Indicates local node communication (token participation) status. 0: Normal 1: Error	○	—
904H · · · bA	Local node CPU status 1	Indicates local node Qn(H) CPU self-diagnosis result. 0: Normal 1: Warning	○	—
904H · · · bB	Local node CPU status 2	Indicates local node Qn(H) CPU self-diagnosis result. 0: Normal 1: Alarm	○	—
905H · · · b0	Node initialization status	Indicates the initialization completion status of the FL-net module. 0: Completed 1: Not completed	○	—
905H · · · b1	Network parameter setting status	Indicates network parameter setting status from Qn(H) CPU. 0: Setting complete 1: Setting not complete	○	—
905H · · · b2	Network parameter data	Indicates receive network parameter data. 0: Normal 1: Setting error	○	—
905H · · · b8	Receive signal wait status (waiting for network subscription)	Indicates local node receive signal wait status. 0: No receive signal wait 1: Receive signal wait	○	—
905H · · · b9	Token monitoring time out error status	Indicates token transmission monitoring time out error status. 0: Normal 1: Token monitoring time out error	○	—
905H · · · bA	Node number multiplexing detection status	Indicates whether or not local node number duplicates other node number. 0: Normal 1: Duplicate node number detected	○	—
905H · · · bB	Area 1 address multiplexing detection signal	Indicates whether or not local node common memory area 1 (bit area) duplicates other node common memory area. 0: Normal 1: Duplicate address detected	○	—
905H · · · bC	Area 2 address multiplexing detection signal	Indicates whether or not local node common memory area 2 (word area) duplicates other node common memory area. 0: Normal 1: Duplicate address detected	○	—
90BH · · · bF	Message transmission data	Indicates whether a message transmission error is present or not. 0: No error 1: Error occurred	○	—

○ : Valid — : Invalid

＊1: When making module recognition in a sequence program, etc., use the 9C7H data.

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(2) Status word details

This section explains the status data word range.

(a) Indicated area "CPU → FL-net (OPCN-2)"

Buffer memory address	Name	Description	Operating mode	
			On line	Off line
983H	Other node number setting for network parameter use	Indicates node number if reading network parameter/participation node data for other node. (*1) 1 to 254: Node number b15 (Top bit) 0: Network parameter data read 1: Participation node data read	○	—
984H	Other node number setting for device profile	Indicates node number if reading device profile for other node. 1 to 254: Node number	○	—
985H	Other node number setting (1) for log data	Indicates to node number if clearing log data for other node. 1 to 254: Node number	○	—
986H	Other node number setting (2) for log data	Indicates to node number if clearing log data for other node. 1 to 254: Node number	○	—

○ : Valid — : Invalid

*1: The points of difference between network parameter data read and participation node data read are as follows.
Network parameter data read: Message issued and acquired by object node and responds.
Participation data read: Responds based on data in cyclic frame.

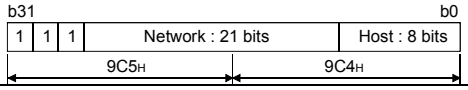
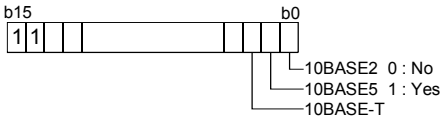
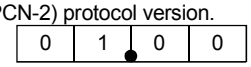
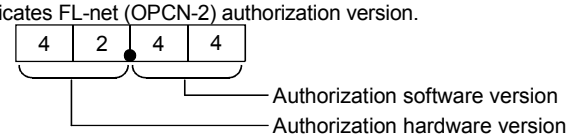
(b) Message data area "CPU → FL-net (OPCN-2)"

Buffer memory address	Name	Description	Operating mode	
			On line	Off line
9A0H	Response message classification	Indicates the message classification (status) of message transmission using message send area. 00H: Normal message response or request message. 01H: Error message response 02H: Not supported (*1)	○	—
9A1H	Virtual address space data size	Indicates data size (*2) when using virtual address space in the transmission of message used for message send area. Range: 0H (Does not use virtual address space) 1H to FFFFH	○	—
9A2H to 9A3H	Virtual address space first address	Indicates the first address (32 bits) when using virtual address space in the transmission of message used for message send area. Range: 0H to FFFFFFFFH	○	—

○ : Valid — : Invalid

*1: This is the responding message when own system receives message it does not support.
*2: The virtual address space data size is dependent on the transaction code without relation to the message data unit selection made in the network parameter settings.

(c) Local node data area "FL-net (OPCN-2) → CPU"

Buffer memory address	Name	Description	Operating mode	
			On line	Off line
9C2H	Node number	Indicates the node number of the FL-net module. 1 to 249: Node number	○	○
9C3H	Mode switch	Indicates the FL-net module mode switch status. 0: On line 1: Off line 2: Loopback test 3: Hardware test Other: Setting error	○	○
9C4H to 9C5H	IP address	Indicates FL-net module address status. 	○	○
9C6H	Intelligent function module switch setting status	Indicates setting status of switches. 0: Normal 1 to: Error code	○	○
9C7H	Module recognition	Indicates if local node module has Ethernet interface. 	○	○
9C8H	Local node communication status	Indicates data link (cyclic transmission) of local node. 0: During data link 3: Disconnecting (Network parameter error detection) 4: Disconnecting (Token monitoring time out) 5: Disconnecting (Node number multiplexing detection) 6: Disconnecting (Receive wait status) FE: Initializing FFF: Resetting	○	—
9C9H	FL-net (OPCN-2) protocol version	Indicates FL-net (OPCN-2) protocol version. 	○	○
9CAH	FL-net (OPCN-2) authorization version	Indicates FL-net (OPCN-2) authorization version. 	○	○
9CBH	Local node CPU status	Indicates results of local node CPU self diagnosis. 0: Normal 1 to: Error code	○	—

○ : Valid — : Invalid

(Continued on next page)

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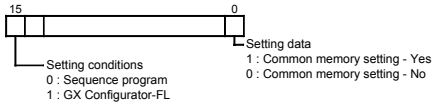
(Continued from previous page)

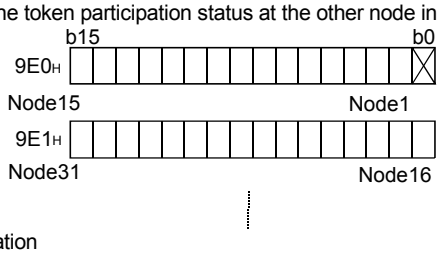
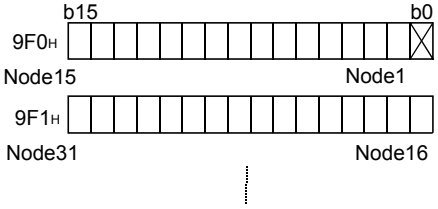
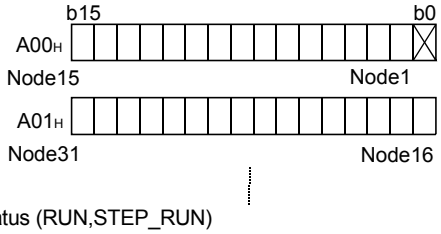
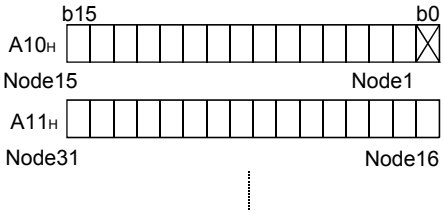
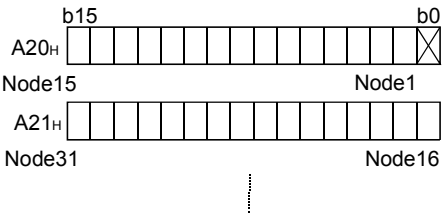
Buffer memory address	Name	Description	Operating mode	
			On line	Off line
9D0H	Maximum communication node number	Indicates the maximum node number of node normally communicating (token participation).	○	—
9D2H	Network parameter setting status	Indicates the network parameter setting contents status. 0: Normal 1 to: Error code	○	—
9D3H	Network parameter read results	Indicates network parameter read results. 0: Normal 1 to: Error code	○	—
9D4H	Device profile read results	Indicates device profile read results. 0: Normal 1 to: Error code	○	—
9D5H	Log data clear results	Indicates log data clear results. 0: Normal 1 to: Error code	○	—
9D6H	Log data read results	Indicates log data read results. 0: Normal 1 to: Error code	○	—
9D7H	Transparent message send results	Indicates transparent message send results. 0: Normal 1 to: Error code	○	—
9D8H	Token monitoring time	Indicates maximum token monitoring time for each node that has been set by the network parameters. 0: No setting 1 to 255: Setting (Unit: ms)	○	—
9D9H	Maximum permissible frame interval	Indicates maximum permissible frame intervals for each node that has been set by the network parameters. 0: No setting 1 to 50: Setting (Unit: 100μs)	○	—
9DAH	Refresh cycle permissible time / RCT setting value	Indicates refresh cycle time of 120% of value. (Unit: ms)	○	—
9DBH	Network parameter data	Stores the network parameter data. (Network parameter setting status: Enabled when 905H · · · b1 is off (0)) 	○	—
9DCH	Message unit data	Stores the unit of the data handled by the message area. 1: Word unit 2: Byte unit	○	—
9DDH	Current value refresh cycle time	Indicates refresh cycle time during data link (cyclic transmission) execution. (Unit: ms)	○	—
9DEH	Maximum value refresh cycle time	Indicates maximum refresh cycle time during data link (cyclic transmission) execution. (Unit: ms)	○	—
9DFH	Minimum value refresh cycle time	Indicates minimum refresh cycle time during data link (cyclic transmission) execution. (Unit: ms)	○	—

○ : Valid — : Invalid

POINT

When the error code is in 4000, refer to the error code list for the CPU module.

(d) Other node data area "FL-net (OPCN-2) → CPU "

Buffer memory address	Name	Description	Operating mode	
			On line	Off line
$9E0_H$ to $9EF_H$	Participation node list	Indicates the token participation status at the other node in bits.  0: Participation 1: Release	○	—
$9F0_H$ to $9FF_H$	Other node network parameter setting status	Indicates the network parameter setting status at the other node in bits. (＊1)  0: Setting 1: No setting	○	—
$A00_H$ to $A0F_H$	Other node CPU execution status	Indicates the execution status of Qn (H) CPU, etc., at the other node. (＊1)  0: RUN status (RUN,STEP_RUN) 1: STOP status (STOP, PAUSE)	○	—
$A10_H$ to $A1F_H$	Other node CPU operation status (Low level error) ＊2	Indicates the results of self-diagnosis of Qn (H) CPU, etc., at the other node. (＊1)  0: Normal 1: Warning	○	—
$A20_H$ to $A2F_H$	Other node CPU operation status (Medium, high level errors) ＊3	Indicates the results of self-diagnosis of Qn (H) CPU, etc., at the other node. (＊1)  0: Normal 1: Alarm	○	—

○ : Valid — : Invalid

＊1: Participation node only is object.
＊2: Low level error is a error during which the CPU module continues to operate.
＊3: Medium and high level errors are errors which stop the operation of the CPU module.

(e) Log data area "FL-net (OPCN-2) → CPU"

Buffer memory address	Name	Description	Operating mode	
			On line	Off line
A80H to A81H	Totaling socket sending count	Indicates the accumulated count of sending to transmission line.	○	—
A82H to A83H	Totaling socket send error count	Indicates the accumulated count of send errors detected at the transmission line.	○	—
A84H to A85H	Ethernet send error count	Indicates the accumulated count of send errors detected at the data link and physical layer.	○	—
A8CH to A8DH	Total receive count	Indicates the accumulated count of receive signals to the transmission line.	○	—
A8EH to A8FH	Total receive error count	Indicates the accumulated count of receive errors detected at the transmission line.	○	—
A90H to A91H	Ethernet receive error count	Indicates the accumulated count of receive errors detected at the data link and physical layer.	○	—
A98H to A99H	Token send count	Indicates the accumulated count of tokens sent (token + cyclic).	○	—
A9AH to A9BH	Cyclic frame send count	Indicates the accumulated count of cyclic frames sent.	○	—
A9CH to A9DH	1:1 message frame send count	Indicates the accumulated count of 1:1 message frames sent.	○	—
A9EH to A9FH	1:n message frame send count	Indicates the accumulated count of 1:n (broadcast) message frames sent.	○	—
AA4H to AA5H	Token receive count	Indicates the accumulated count of local node address tokens (token + cyclic) received.	○	—
AA6H to AA7H	Cyclic frame receive count	Indicates the accumulated count of cyclic frames received.	○	—
AA8H to AA9H	1:1 message frame receive count	Indicates the accumulated count of local node address 1:1 message frames received.	○	—
AAAH to AABH	1:n message frame receive count	Indicates the accumulated count of 1:n (broadcast) message frames received.	○	—
AB0H to AB1H	Cyclic frame receive error count	Indicates the accumulated count of cyclic frame receive error detection.	○	—
AB2H to AB3H	Cyclic address size error count	Indicates the accumulated count of address size error detection in the cyclic frame.	○	—
AB4H to AB5H	Cyclic CBN error count	Indicates the accumulated count of CBN (block number) error detection in the cyclic frame.	○	—
AB6H to AB7H	Cyclic TBN error count	Indicates the accumulated count of TBN (number of total blocks) error detection in the cyclic frame.	○	—
AB8H to AB9H	Cyclic BSIZE error count	Indicates the accumulated count of BSIZE (data size including frame header) error detection in the cyclic frame.	○	—

○ : Valid — : Invalid

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(Continued from previous page)

Buffer memory address	Name	Description	Operating mode	
			On line	Off line
$AC8_H$ to $AC9_H$	Message transmission resend count	Indicates the accumulated count of resends in the message frame.	○	—
ACA_H to ACB_H	Message transmission resend over count	Indicates the accumulated count of resend over in the message frame.	○	—
$AD6_H$ to $AD7_H$	Message transmission receive error count	Indicates the accumulated count of receive error detections in the message frame.	○	—
$AD8_H$ to $AD9_H$	Message transmission communication number error count	Indicates the accumulated count of communication number error detections in the message frame.	○	—
ADA_H to ADB_H	Message transmission resend recognition count	Indicates the accumulated count of resend recognition in the message frame.	○	—
$AE0_H$ to $AE1_H$	ACK error count	Indicates the accumulated count of ACK header error detections.	○	—
$AE2_H$ to $AE3_H$	Serial number version error count	Indicates the accumulated count of serial number version (*1) error detections (mis-match detection).	○	—
$AE4_H$ to $AE5_H$	Serial number error count	Indicates the accumulated count of serial number (*1) error detections (non-continuous detection).	○	—
$AE6_H$ to $AE7_H$	Node number error count	Indicates the accumulated count of node number error detections.	○	—
$AE8_H$ to $AE9_H$	TCD error count	Indicates the accumulated count of TCD (transaction code) error detections.	○	—
$AF8_H$ to $AF9_H$	Token multiplexing recognition count	Indicates the accumulated count of optional node address (including local node address) tokens detected while the token is being held.	○	—
AFA_H to AFB_H	Token destruction count	Indicates the accumulated count of node address tokens having a value that is less than that of local node while the token is being held.	○	—
AFC_H to AFD_H	Token resend count	Indicates the accumulated count of token resends.	○	—
$B04_H$ to $B05_H$	Token hold time out count	Indicates the accumulated count of time out detections for token hold time out time (value that does not exceed the token monitoring time out time).	○	—
$B06_H$ to $B07_H$	Token monitoring time out count	Indicates the accumulated count time out detections for token monitoring time out time.	○	—
$B10_H$ to $B11_H$	Total operating time	Indicates the total operating time. (Unit: ms)	○	—
$B12_H$ to $B13_H$	Frame wait status count	Indicates the accumulated count that frame wait status has become.	○	—
$B14_H$ to $B15_H$	Subscription count	Indicates the accumulated count of local node subscription.	○	—
$B16_H$ to $B17_H$	Self-release count	Indicates the accumulated count of self release (when token hold time for local node up is generated 3 consecutive times).	○	—

○: Valid —: Invalid

*1: This is message transfer frame serial numbers (serial numbers) and its start value. (serial versions)

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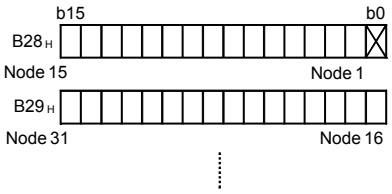
Buffer memory address	Name	Description	Operating mode	
			On line	Off line
B18H to B19H	Release-by-skip count	Indicates the accumulated count of release by skip (local node address token is pulled out 3 consecutive times).	○	—
B1AH to B1BH	Other node release count	Indicates the accumulated count of detections of other node releases.	○	—
B28H to B37H	Participation node list	Indicates the token participation status at the other node in bits.  0: Release 1: Participation	○	—

○ : Valid — : Invalid

(f) Message data area "FL-net (OPCN-2) → CPU"

Buffer memory address	Name	Description	Operating mode	
			On line	Off line
C00H	Response message classification	Stores the message classification (status) of message transmission using message send area. 00H: Normal message response or request message. 01H: Error message response 02H: Not supported (*1)	○	—
C01H	Virtual address space data size	Stores data size (*2) when using virtual address space in the transmission of message used for message send area. Range: 0H (Does not use virtual address space) 1H to FFFFH	○	—
C02H to C03H	Virtual address space first address	Stores the first address (32 bits) when using virtual address space in the transmission of message used for message send area. Range: 0H to FFFFFFFFH	○	—

○ : Valid — : Invalid

*1: This is the responding message when own system receives message it does not support.

*2: The virtual address space data size is dependent on the transaction code without relation to the message data unit selection made in the network parameter settings.

3.3 Multiple PLC Systems

This section introduces the multiple PLC systems.
When using FL-net module with a multiple PLC system, the QCPU (i.e. control PLC) controlling the FL-net module is set by GX Developer.

POINT

In a multiple PLC system to which an FL-net module is mounted, only the control PLC for the FL-net module can use the FL-net module functions.

REMARK

For information about the procedure for setting multiple PLC systems, refer to Section 6.3.2 "Setting the GX Developer" and the QCPU User's Manual (Multiple CPU System).

3.4 When Using the FL-net Module with the Q00J/Q00/Q01CPU

This section explains when the FL-net module is used with the Q00J/Q00/Q01CPU.

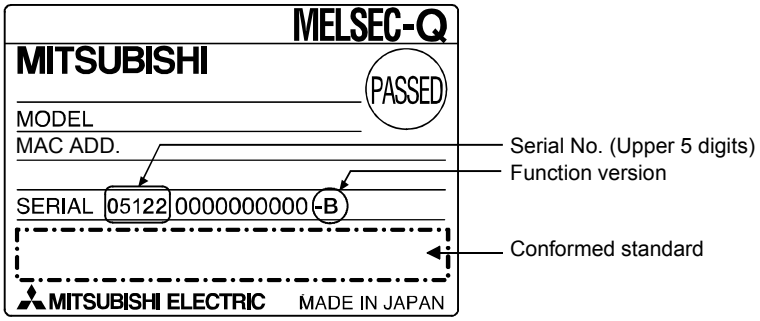
(1) Number of FL-net modules that can be mounted when used with the Q00J/Q00/Q01CPU

For the number of FL-net modules that can be mounted when used with the Q00J/Q00/Q01CPU, see Section 3.1.1.

3.5 Confirming the Function Version and Software Version

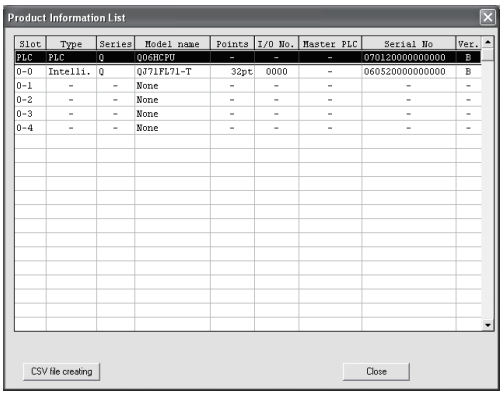
(1) Confirming function version of Q series PLC

(a) When confirming by using the rating plate on the module side.
The function version of the corresponding module is shown at the SERIAL column on the rating plate.



(b) When confirming by using GX Developer
The function version is shown on the "Product Information List" or "module detailed information" screen of the GX Developer.
The following is the procedure for confirming the function version by using the "Product Information List."

[Starting procedure]
"Diagnosis" → "System monitor" → "Product Information List"



[Serial No., Ver.]
- The Corresponding module's serial No. is shown in the Serial No. column.
- The function version of the corresponding module is shown in the Ver. column.

POINT

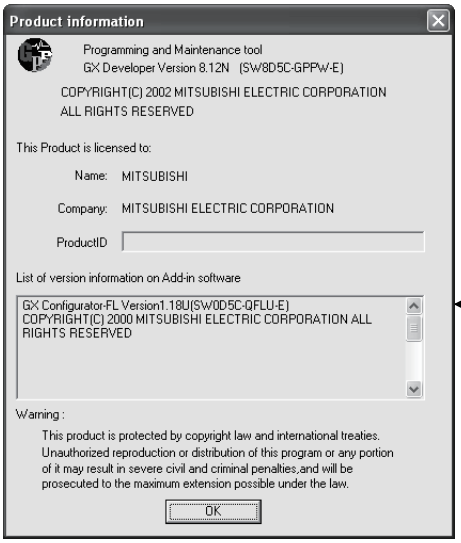
The serial No. described on the rated plate may not match with the serial No. displayed on the product information of GX Developer.
- The serial No. on the rated plate describes the management information of the product.
- The serial No. displayed on the product information of GX Developer describes the function information of the product.
  The function information of the product is updated when adding functions.

(2) Confirming software version of GX Configurator-FL

Software version of GX Configurator-FL can be confirmed with GX Developer "Product Information" screen.

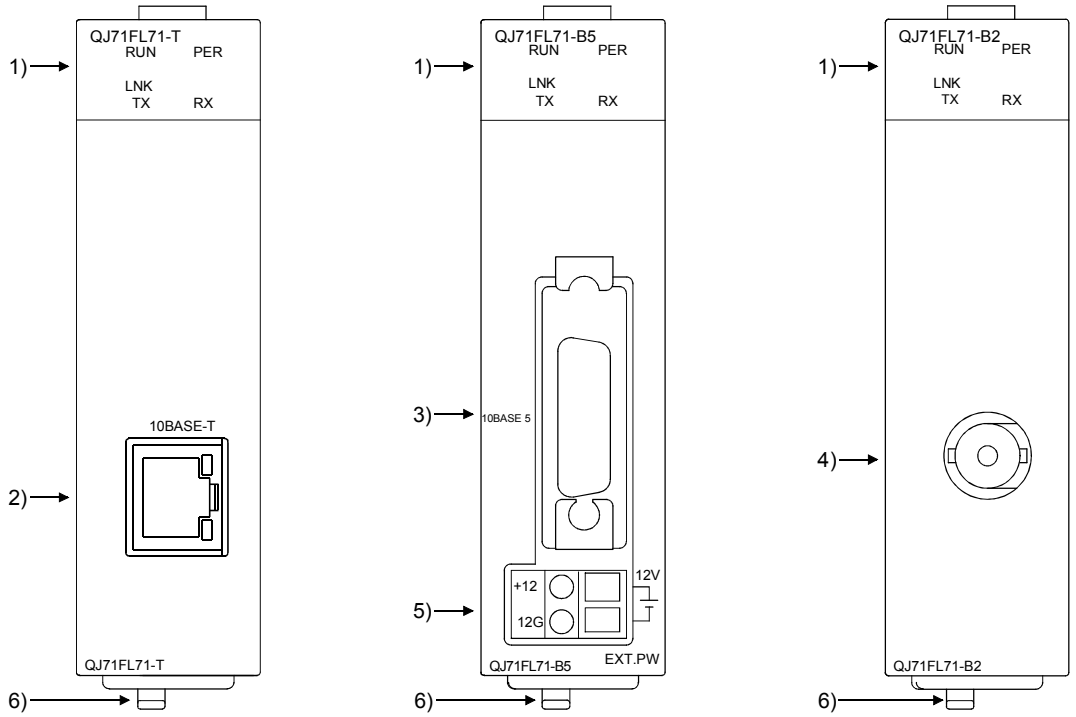
[Starting procedure]

"Help" → Product Information



3.6 Functions and Names of Parts of FL-net Module

The following introduces the functions and names of parts of the FL-net module.



	Name	Contents
1)	LED indicator	(1) Refer to display contents of LED indicator.
2)	10BASE-T connection connector (QJ71FL71-T only)	Connector for connecting FL-net module to 10BASE-T.
3)	10BASE5 connection connector (QJ71FL71-B5 only)	Connector for connecting FL-net module to 10BASE5. (For connecting 10BASE5 AUI cable (transceiver cable))
4)	10BASE2 connection connector (QJ71FL71-B2 only)	Connector for connecting FL-net module to 10BASE2. (For connecting 10BASE2 coaxial cable)
5)	External power supply terminal	Terminal for connecting power supply to the transceiver in the connection for 10BASE5. (13.28 V to 15.75 V)
6)	Lever for mounting module	Guide for correctly mounting FL-net module to base unit.

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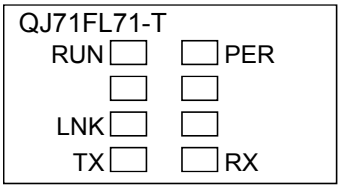
(1) Description of LED indicators

1) LED indicators



LED Name	Display contents	LED on	LED off
RUN (G)	Normal operation display	Normal	Error (*1)
— (G)		(No processing)	
LNK (G)	Token subscription indicator	Token status indicator	Token release status
TX (G)	Data send status indicator	Sending data	Not sending data
PER (R)	Network parameter setting display	Setting error (*2)	Setting normal
— (R)		(No processing)	
— (R)		(No processing)	
RX (R)	Data receiving status display	Receiving data	Not receiving data

*1 : [RUN]LED will be off under the following conditions.
- Hardware error
- Watchdog timer error

*2 : [PER]LED will be on under the following conditions.
- Setting outside range (mode, node number, allocation)
- When critical error is detected

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4 MOUNTING THE FL-net MODULE

This chapter explains the precautions during the mounting and installation of the FL-net module and introduces information about the installation environment.

4.1 Mounting and Installation

Refer to the user's manual for the PLC CPU module being used for details about the mounting and installation of the FL-net module.

4.2 Precautions when Handling

This section explains the precautions for the FL-net module itself.

(1) The case for the FL-net module is plastic. Do not drop it or expose it to strong impact.

(2) The tightening torque ranges for the mounting screws and terminal screws are provided below.

Screw location	Torque range
External power supply terminal screw (M2.5 screw) (＊1)	0.40 N•m
Module mounting screw (Normally not required) (M3) (＊2)	0.36 to 0.48 N•m

＊1 : External supply power input terminal to be used to supply power to the transceiver for connection to 10BASE5.

＊2 : There are hooks at the top of the module that allow it to be easily secured o the base unit. The mounting screws are recommended whenever the module is mounted in an area exposed to vibration or impact.

⚠DANGER

- Never touch the terminals or connectors while the power is on. Electrical shock or malfunctioning could result.
- Before cleaning the module or retightening the terminal screws and module installation screws, make sure to shut off all phases of the external power supply and FL-net (OPCN-2) system's power supply. Failure to completely shut off all phases of the external power supply may cause module breakdowns and malfunctions. If the screws are loose, it may cause the module to short-circuit, malfunction or fall off. If the screws are tightened excessively, it may damage the screws and cause the module to short circuit, malfunction or fall off.
- Always use the utmost care when performing control operations (especially when changing the data, program or operating status conditions) when the PLC is in operation.

⚠CAUTION	• While pressing the installation lever located at the bottom of module, insert the module fixing tab into the fixing hole in the base unit until it stops. Then, securely mount the module with the fixing hole as a supporting point. If the module is not installed properly, it may cause the module to malfunction, fail or fall off. Secure the module with screws especially when it is used in an environment where constant vibrations may occur. • Never allow foreign material, such as metal particles or small pieces of wire, to enter the module. It could cause malfunctioning, damage or fire. • Never disassemble or modify the module. This may cause breakdowns, malfunctions, injuries or fire. • Before mounting or dismounting the module, make sure to shut off all phases of the external power supply and FL-net (OPCN-2) system's power supply. Failure to do so may damage the product. • Always tighten the screws to within the specified torque range. If the screws are loose, shorting or malfunctioning could result. If the screws are too tight, they could break off, fall into the module and cause shorting or malfunctioning. • Never directly touch the electrical parts or any conductive component of the module. It could cause shorting or malfunctioning of the module. • Dispose of this product as industrial waste.

4.3 Installation Environment

Avoid the following environments for the PLC.

- An environment in which the ambient temperature exceeds a range of 0 to 55 °C.
- An environment in which the relative humidity exceeds a range of 5 to 95 % RH.
- An environment in which rapid temperature fluctuations could cause condensation.
- An environment in which there is corrosive or flammable gas.
- An environment in which there is a high concentration of dust, metal particles or other such conductive particles, oil mist, salt, or organic solvents.
- An environment that is exposed to direct sunlight.
- An environment in which strong electric or magnet fields are generated.
- An environment that is exposed to direct vibration or impact.

⚠CAUTION	• Use the PLC in the operating environment that meets the general specifications of this manual. Using the PLC in any other operating environments may cause electric shocks, fires or malfunctions, or may damage or degrade the product.

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5 WIRING THE FL-net MODULE

This chapter explains the methods for connecting the FL-net module to a 10BASE5, 10BASE-T or 10BASE2 network.

5.1 Communication Cable Connections

The following are the precautions to be followed when connecting the FL-net module to a network. Always read and understand the procedures and precautions before starting the operations. Keep safety a priority at all times.

(1) The installation of 10BASE5, 10BASE-T or 10BASE2 networks requires strict adherence to safety precautions. Always consult with a network specialist about key areas, such as making cable connections and selecting the main cable.

(2) The cables used must meet the specifications shown in Section 3.1.2.

(3) Coaxial cable has a limited permissible bending radius. Accordingly, if the coaxial cable is to be bent during routing, a space greater than its permissible bending radius is required. The permissible bending radius of the coaxial cable being used is provided by the manufacturer of the cable.

⚠CAUTION

- When routing AUI cable (transceiver cable)/coaxial cable, never bundle them with or position them near other cables, especially main circuit cables and power cables. Always provide at 100 mm or more between them. Positioning the cables too close to each other could cause the module to malfunction from the electrical noise.
- Make sure that the power supply for the sequencer for the station where the unit is mounted and the power supply for the FL-net (OPCN-2) system are off before making AUI cable connections.
- Make sure to place the communication and power cables to be connected to the module in a duct or fasten them using a clamp. If the cables are not placed in a duct or fastened with a clamp, their positions may become unstable and may move, or they may be pulled inadvertently. This may damage the module and the cables or cause the module to malfunction because of faulty cable connections.
- When disconnecting the communication and power cables from the module, do not pull the cables by hand. When disconnecting a cable with a connector, hold the connector to the module by hand and pull it out to remove the cable. When disconnecting a cable connected to a terminal block, loosen the screws on the terminal block first before removing the cable. If a cable is pulled while being connected to the module, it may cause the module to malfunction or damage the module and cables.

5.1.1 Connecting to QJ71FL71-B5

This section explains the methods for connecting the QJ71FL71-B5 module to the network.

(1) Connecting to 10BASE5 network

This section introduces the methods for connecting the FL-net module to a 10BASE5 network. (Target module of explanation : QJ71FL71-B5)

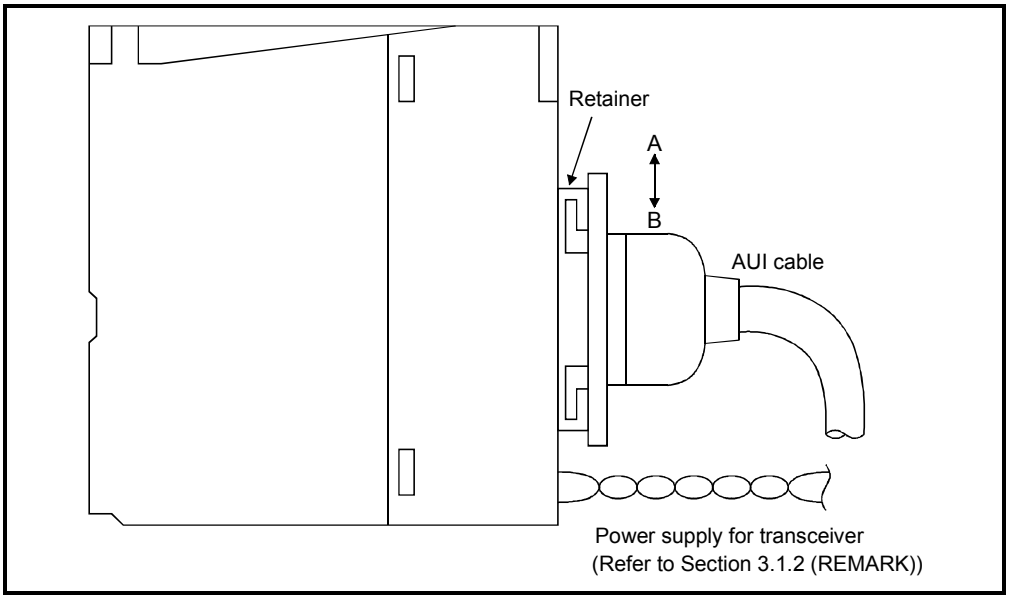


Fig. 5.1 Diagram of AUI cable connection

<Operating procedure>

(Step 1) Slide the retainer in direction B shown in Fig. 5.1
(Step 2) Insert the AUI connector all the way.
(Step 3) Slide the retainer in direction A shown in Fig. 5.1
(Step 4) Check that the AUI cable is locked.
(Step 5) Turn on the power supply to the transceiver (*1).

*1 : Use a general SQE TEST or so-called heart beat function (this acts as a transceiver function by confirming that the transceiver is operating normally signals are sent) for the transceiver.

CAUTION

- Make sure that the power supply for the sequencer for the station where the unit is mounted and the power supply for the FL-net (OPCN-2) system are off before making AUI cable connections.

POINT

(1) When connecting to the network using 10BASE5 and countermeasures against noise and high-frequency waves are required for the installation environment of the FL-net module, attaching a ferrite core to the transceiver side of the AUI cable is often effective.
Refer to the Point provided in Section 3.1.2.

(2) Refer to Section 3.1.2 (1) for the example of device and system configuration which is required to connect to the 10BASE5.

5.1.2 Connecting to QJ71FL71-T

This section explains the methods for connecting the QJ71FL71-T module to the network.

(1) Connecting to 10BASE-T network

This section explains the methods for connecting the FL-net module to a 10BASE-T network. (Target module of explanation : QJ71FL71-T)

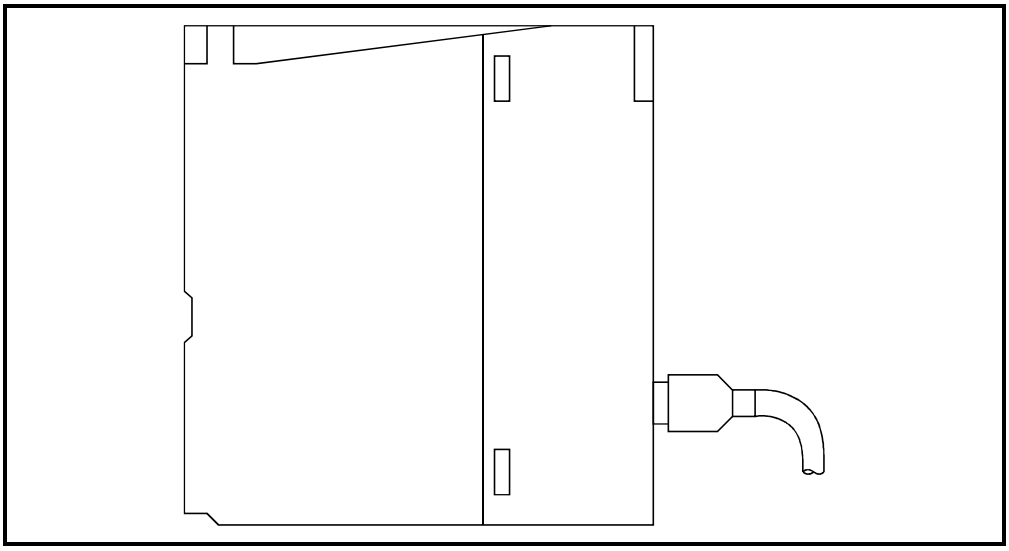


Fig. 5.2 Diagram of 10BASE-T cable connection

<Operating procedure>

(Step 1) Connect the twisted pair cable to the hub.

(Step 2) Connect the twisted pair cable to the FL-net module.

POINT
(1) Refer to Section 3.1.2 (2) for the example of device and system configuration which is required to connect to the 10BASE-T.

5.1.3 Connecting to QJ71FL71-B2

This section introduces the methods for connecting the QJ71FL71-B2.

(1) Connecting to 10BASE2 network

This section explains the methods for connecting the FL-net module to a 10BASE2. (Target module of explanation : QJ71FL71-B2)

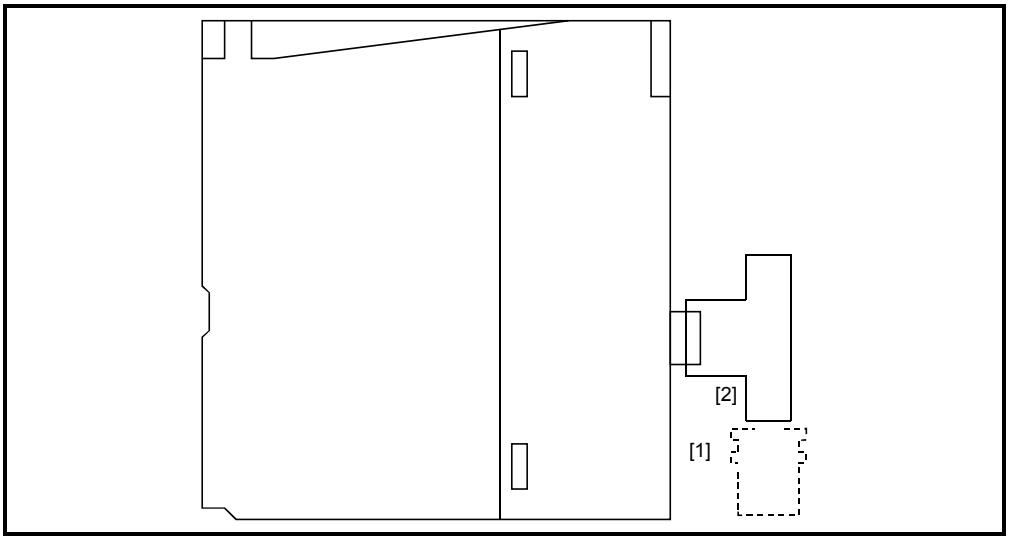


Fig. 5.3 Diagram of 10BASE2 cable connection

<Operating procedure>

(Step 1) As shown in Fig. 5.3, align the grooves (1) and tab (2) and push in.

(Step 2) While pushing the connector in, turn the connector to the right until it locks.

(Step 3) Confirm that the connector has been locked.

POINT
Refer to Section 3.1.2 (3) for the example of device and system configuration which is required to connect to the 10BASE2.

REMARK

Connecting the connector for the coaxial cable
The following explains the methods for connecting the cable and BNC connector (the connector plug used for coaxial cable).

(1) Configuration of BNC connector and coaxial cable

The configuration of the BNC connector and coaxial cable is shown in Fig. 5.4.

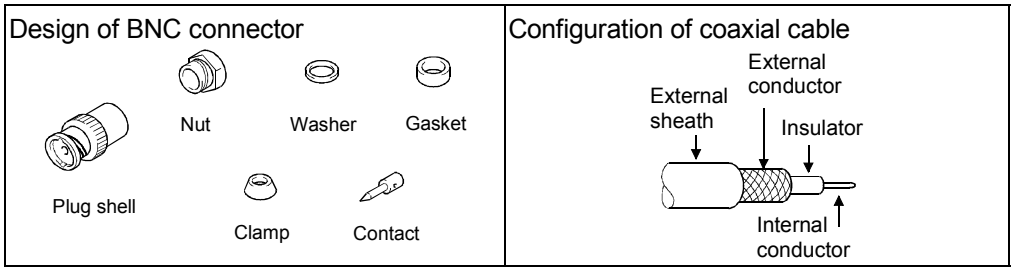
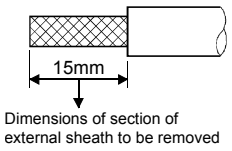


Fig. 5.4 Configuration of BNC connector and coaxial cable

(2) Connecting BNC connector and coaxial cable

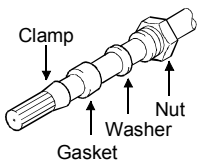
The method for connecting BNC connector and coaxial cable is shown below.

(a) Remove the external sheath for the coaxial as shown in the illustration on the right. Use care not to damage the external conductor. . . . . .



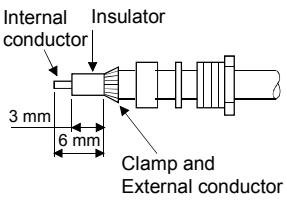
↓

(b) Place the nut, washer, gasket and clamp on the coaxial cable as shown in the illustration on the right and expose the outer conductor. . . . . .



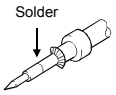
↓

(c) Cut the external conductor, insulator and internal conductor to the dimensions shown in the illustration on the right. Note that the external conductor is cut to the same dimension as the tapered section of the clamp and connect the clamp. . . . . .



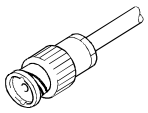
↓

(d) Solder the contact to the internal conductor. . . . . .



↓

(e) Push the contact assembly created in (d) into the plug shell and tighten the nut. . . . . .



POINT

Pay attention to the following precautions when soldering the internal conductor and contact.

(1) Use care to prevent the solder from building up on the soldered section.
(2) Use care to prevent a gap from forming between the cable insulator and the contact. Also use care to prevent them from digging into each other.
(3) Perform the soldering quickly to prevent deformation of the insulator.

6 USAGE GUIDE

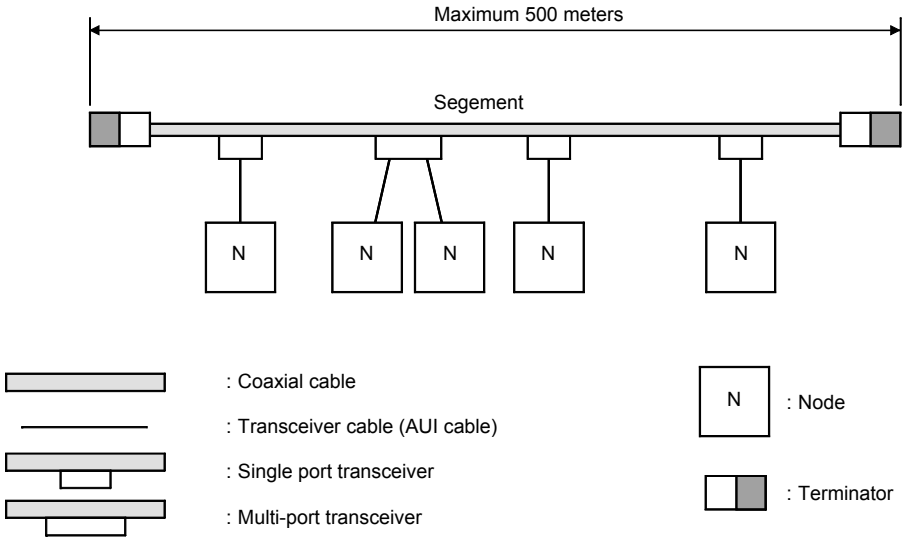
This chapter explains an general summary of FL-net (OPCN-2), the settings required for communication and an introduction of how to use it.

6.1 About Ethernet

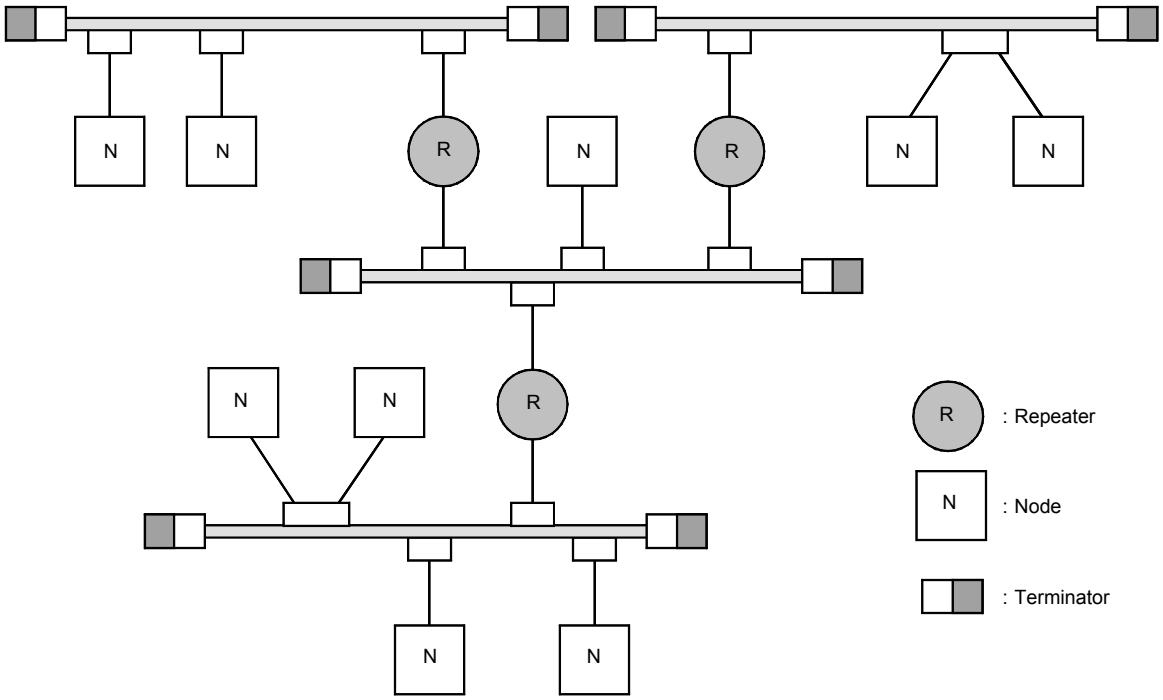
FL-net (OPCN-2) uses Ethernet as the communication medium (physical level, data link) among FA controllers.

6.1.1 10BASE5 system

As shown below, the basic structure is comprised of a coaxial cable up to 500 meters long to which the nodes are attached. The nodes are connected to the coaxial cable by a transceiver cable (AUI cable) and transceiver. There are two types of transceivers: the single port transceiver to which only one transceiver cable (AUI cable) can be attached and the multi-port transceiver to which multiple cables can be attached.
This basic design is called a segment. Each segment can have up to 100 nodes.



When the distance between nodes exceeds 500 meters, a repeater can be used to increase the number of segments as shown in the illustration below. The system shown in the illustration below has a maximum distance of less than 1500 meters and is arranged so that there will be two repeaters or less between any two nodes.



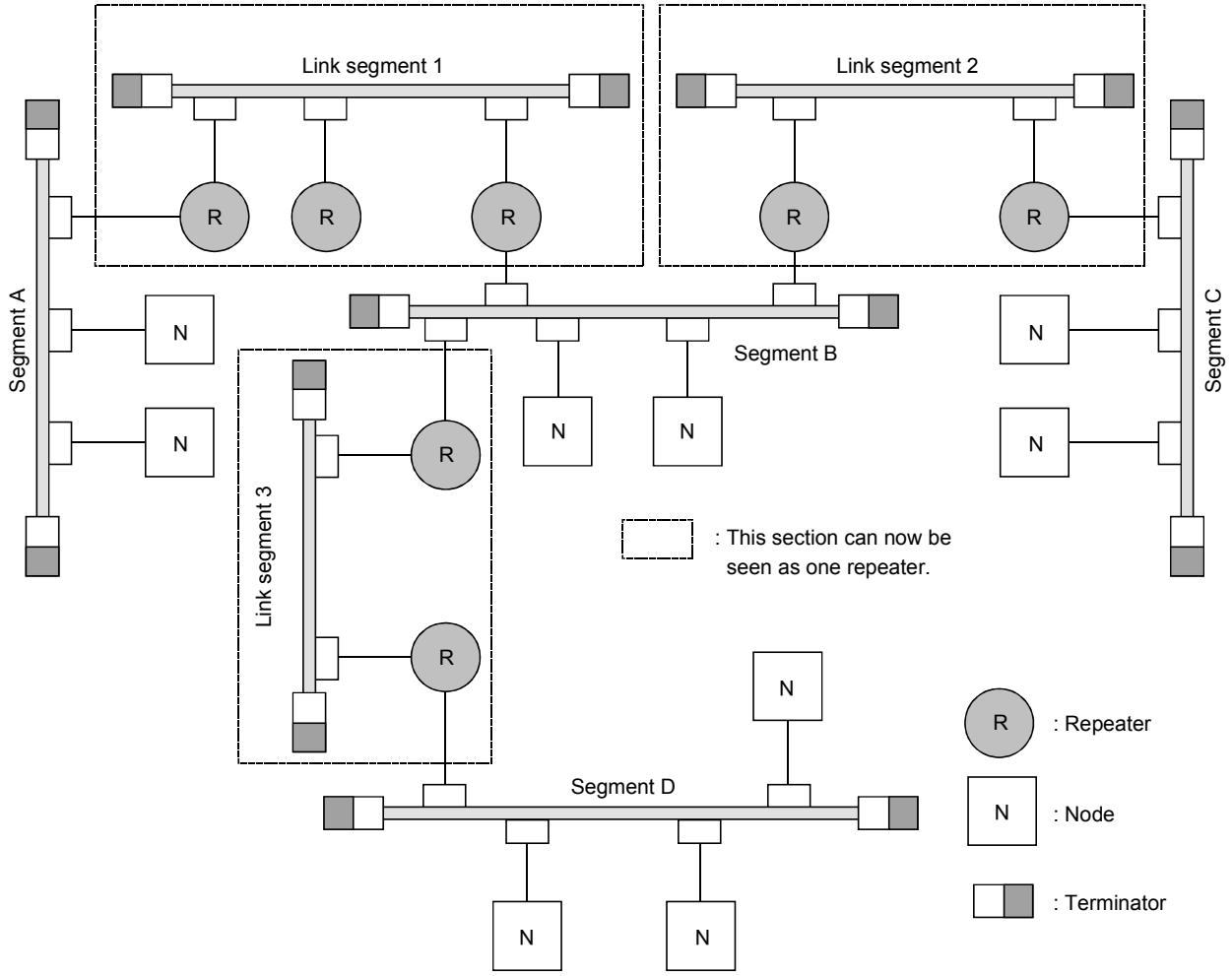
POINT

(1) The repeater is connected to the coaxial cable via a transceiver and transceiver cable.

(2) A repeater can be mounted to a transceiver at any position along a coaxial cable segment.

(3) Mounting interval for a transceiver should be an integral multiple of 2.5 meters.

In the example in the illustration below, the maximum distance between nodes is 2,500 meters. In order to increase the transmission distance, a link cable (the maximum is 500 meters for coaxial cable) with repeaters installed at both ends is used. This is called a linked segment.
Note that there are no nodes connected to the link segment. Instead of a node, the link segment with repeaters at both ends, shown in the dotted line boxes in the illustration below, can be counted as one repeater and thereby reduce the limit for the total number of repeaters between any given node segment.



POINT

(1) The maximum length of a link segment is 500 meters.

(2) Do not connect nodes within a link segment.

(3) The link segment with repeaters at both ends, within area indicated by the dotted line boxes ___ in the illustration, can be viewed as one repeater.

(4) Use two or less repeaters within between any given node segment.

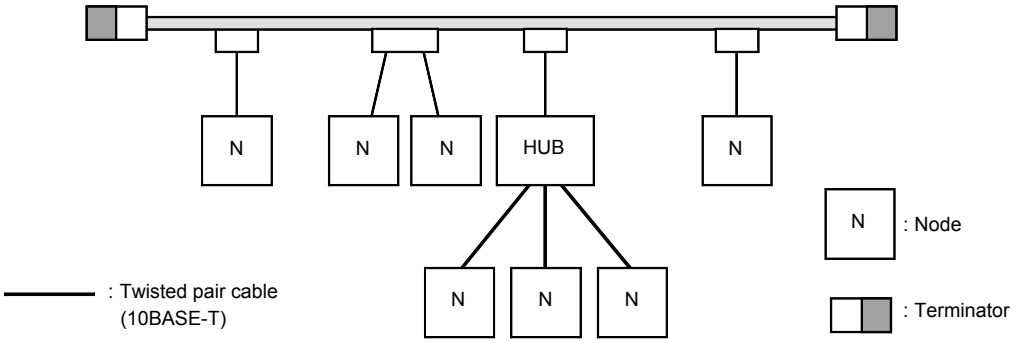
(5) Even if more than two repeaters can be connected within any segment, it should be viewed as one repeater.

The following shows the general specifications for configuring an Ethernet system.

Item	Specification
Maximum segment length	500 m
Maximum number of transceivers that can be mounted within on segment	100 units
Maximum distance between nodes	2500 m or less
Maximum number of nodes per system	254 nodes
Maximum length of transceiver cable (AUI cable)	50 m
Cable length between transceiver and repeater	2 m or less (recommended)
Maximum number of repeaters that can be used within a node segment system	2 repeaters (Note that a link segment with a repeater at each end is seen as one repeater)

6.1.2 10BASE-T system

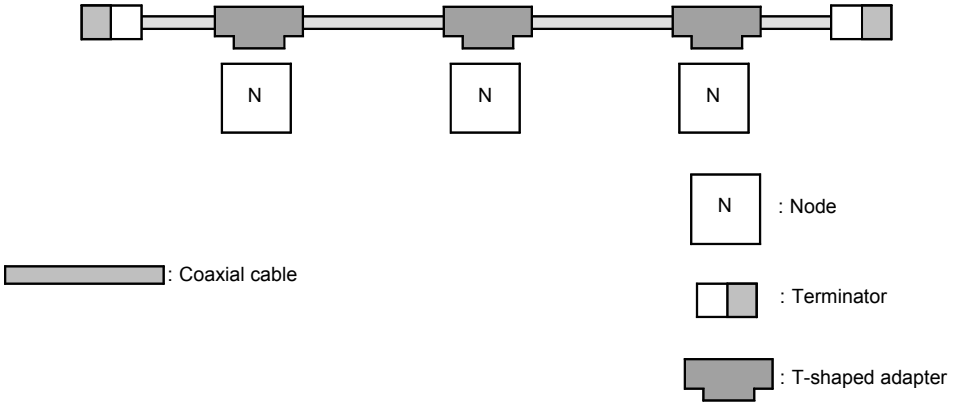
If a HUB is used to connect the transceiver cable to the transceiver, multiple nodes can be connected to the hub. Use a twisted pair cable (10BASE-T) to connect the nodes to the HUB.



In addition, if the distance between nodes is short, the twisted pair cable can be connected to the HUB without passing through a coaxial cable or transceiver.

6.1.3 10BASE2 system

A T-shaped branch connector is mounted to the BNC connector on each node and coaxial cable is connected to both ends of it.



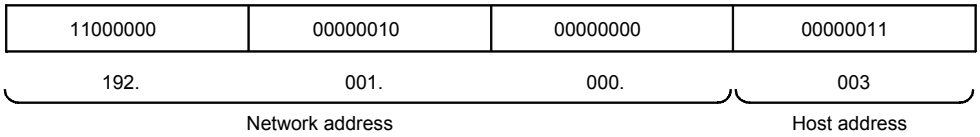
6.1.4 Ethernet IP address

Generally speaking, a 32 bit logical address called an IP address is used in UDP/IP. The IP address consists of a network address and host address. In the FA field, Class C is the most commonly used.

Class C

1	1	0	X	Network address (20 bits)	Host address (8 bits)

Note that this address is separated by a period (.) every 8 bits to make it a decimal expression. The following is an example of an address as expressed in Class C.



POINT

(1) A Class C IP address is used for FL-net (OPCN-2). Set the IP address within the following range.
Setting range: 192 to 223. ***. ***. ***

(2) The following is the address default value for FL-net module.
Default value: 192.168.250.1

(3) The IP address of the FL-net module is set in the intelligent function module switch setting of GX Developer. (Refer to Section 6.3.2.)

6.2 FL-net (OPCN-2)

The section explains a summary of the FL-net (OPCN-2) and the features of its transmission method.

6.2.1 Summary of FL-net (OPCN-2)

(1) Concept of FL-net (OPCN-2)

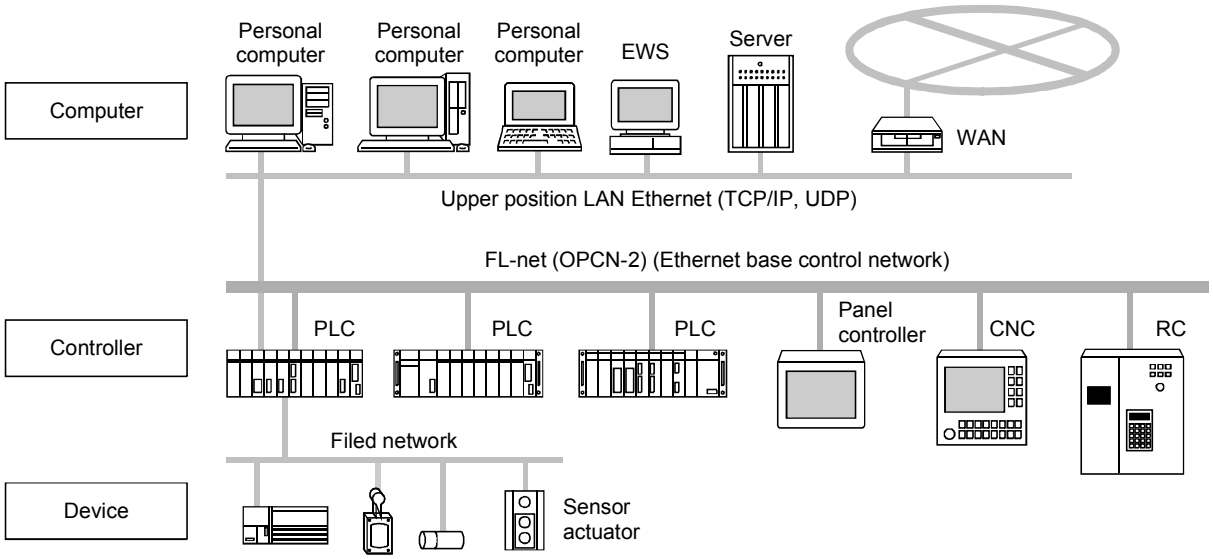
FL-net (OPCN-2) is an Ethernet-based FA control network.
FL-net (OPCN-2) has both a cyclic transmission function and a message transmission function.
The basic concepts of FL-net (OPCN-2) are as follows.

(a) It uses Ethernet as the communication medium (physical level, data link) among FA controllers.

(b) It uses the UDP/IP propagated on the Ethernet as the basic method for sending data.

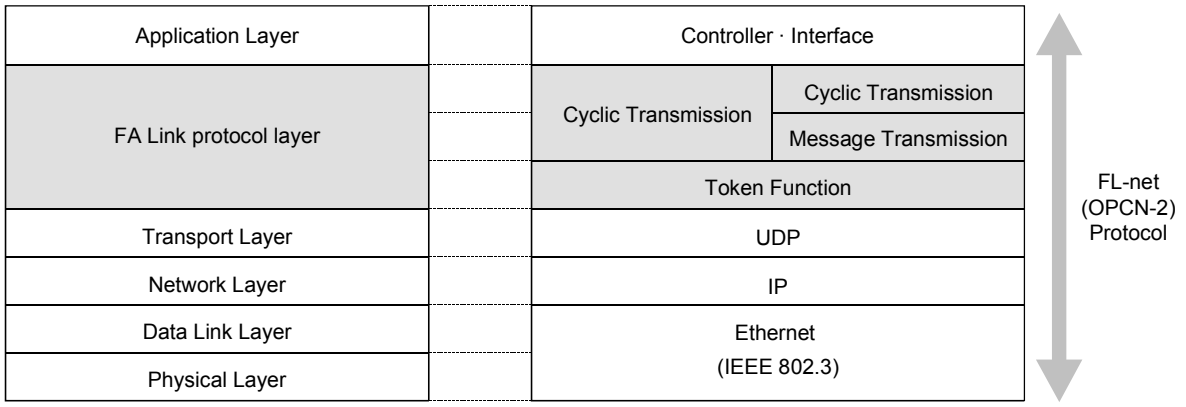
(c) It manages/controls (collision avoidance) communication medium access for each node on the network to guarantee transmission within a fixed time.

The object of FL-net (OPCN-2) is to be a FA control network for exchanging data among the PLCs (PLC), robot controllers (FC), numerical control devices (CNC) and other control devices and personal computers found in manufacturing system.



(2) FL-net (OPCN-2) protocol

FL-net (OPCN-2) has been designed from the following six protocol layers.



POINT

UDP/IP is used in the transport and network layers and the data link layers and physical layers use Ethernet.

(3) Features of the FL-net (OPCN-2) transmission method

The following shows the features of the "FA link protocol layer" for FL-net (OPCN-2).

(a) Transmission control using "masterless token" system avoids collision.

(b) Refresh cycle time can be specified since the system circulates a token in a fixed time.

(c) The token is transmitted together with a cyclic data.

(d) The node with a smallest node number among those who participate the network at start-up time shall start to send the token.

(e) If no token is transmitted for a specified period, next node in the token circulation ring shall send a new token.

(f) The masterless token system (characterized by the above two items) will keep the network from stopping in case of failure of some nodes.

(g) The protocol provides information management tables (Other node network parameter area) for useful information to refer operation status of other nodes such as operation mode (RUN/STOP) and hardware malfunction (ALARM).

(4) FL-net (OPCN-2) IP address

The IP address for each node of FL-net (OPCN-2) uses Class C and must be individually set. An IP address is the "address" that designates a specific node (station) when transmission is performed using IP (internet protocol). Because of this, there is a need to set and manage the IP addresses so that there is no duplication. Class C IP address is used for FL-net (OPCN-2).

FL-net (OPCN-2) IP address

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

6.2.2 Number of modules connected and node numbers

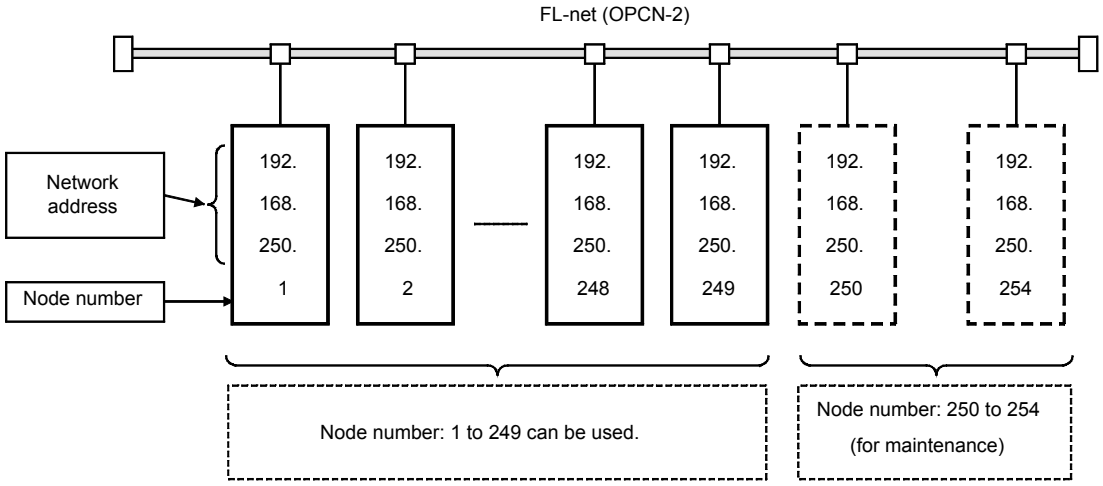
The IP address for each node of FL-net (OPCN-2) uses Class C and must be individually set. Because of this, there is a need to set and manage the IP addresses so that there is no duplication.
The maximum number of modules that can be connected is 254.

(a) Node number : (1 to 249) For conventional FL-net (OPCN-2) usage

(b) Node number : (250 to 254) For FL-net (OPCN-2) maintenance

(c) Note number : (255) Used internally by FL-net (OPCN-2).
This cannot be used by the user. (It is used for global address broadcasting.)

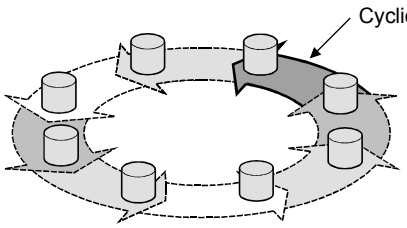
(d) Node number : (0) Used internally by FL-net (OPCN-2).
This cannot be used by the user.



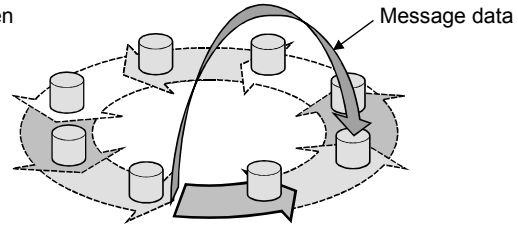
6 - 9

6.2.3 Data communication type

Two types of data communication are supported by FL-net (OPCN-2): cyclic transmission and message transmission. Send timing is controlled by a token. When there is only one token in the network, the station holding the token can send. When there are two or more tokens, the smallest address node number has priority while other are eliminated to continue the network.



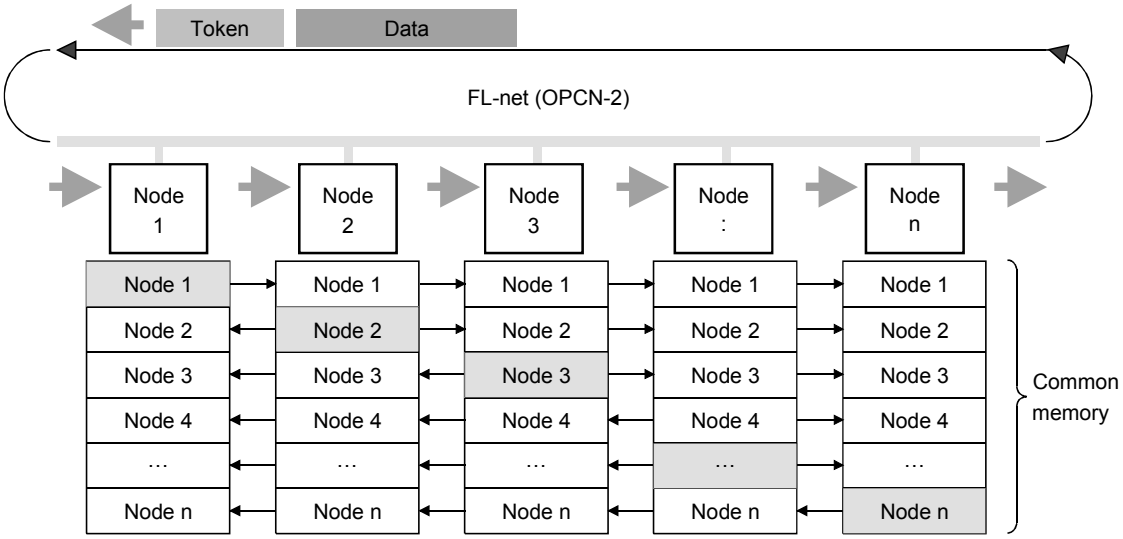
Cyclic transmission



Cyclic transmission and message transmission

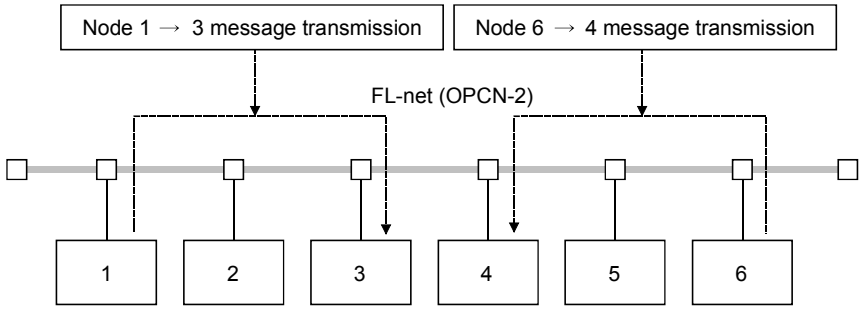
(1) Cyclic transmission

As its name implies, cyclic transmission performs cyclic transmission of the data. Each node is linked to common memory and data is shared.



(2) Message transmission

Conversely, data is not transmitted on cyclically but communication is performed only to a specified node when there has been a request for transmission.

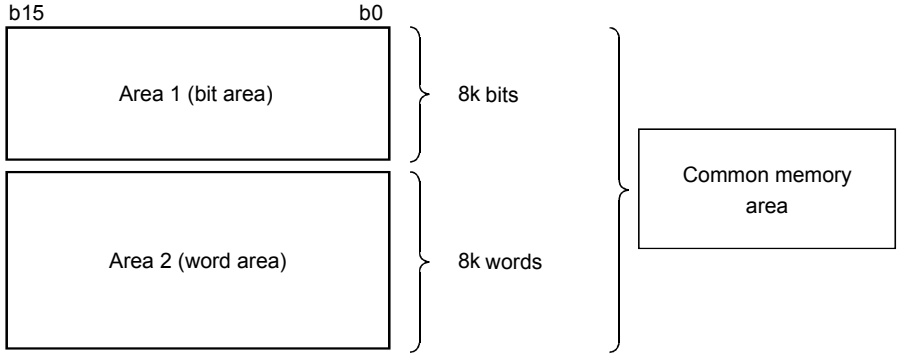


6.2.4 Transmission data volume

This section explains the transmission data volume of cyclic transmissions and message transmissions.

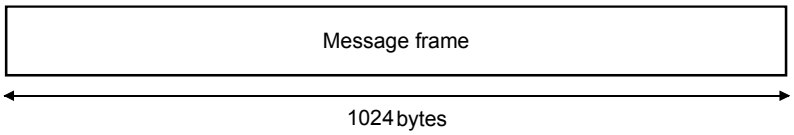
(1) Cyclic transmissions

The overall network has 8 k bits and + 8 k words common memory areas. The maximum usable send data volume for each node is 8.5 k words. Note that one word is two bytes.



(2) Message transmission

The maximum data volume for one message frame is 1024 bytes (not including the header section).

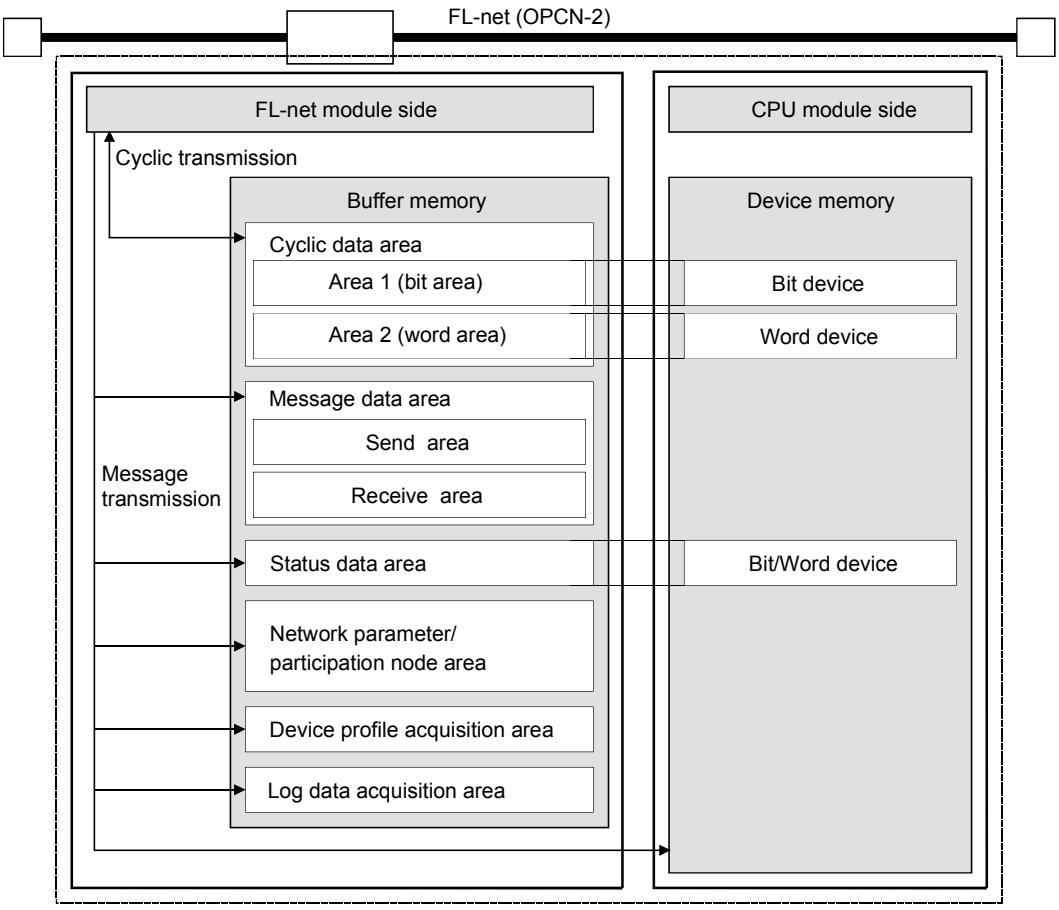


6.2.5 Transfer cycles

In cyclic communication, the common memory is refreshed in nearly fixed cycles. The sending of message communications is controlled so that single message communication will not allow the common memory refresh cycle time to exceed the permissible refresh cycle time. Each node monitors the normal time for message the communication frame that flows in the network from the time the token addressed to the local node is received until it is received by the next local node. During this one cycle, when there is not even one message communication frame flowing in the network, the value that is 120 % of the refresh cycle permissible time is the permissible refresh cycle time.
The permissible refresh cycle time is actively determined by the monitoring process presented above and the number of nodes subscribing to the network.

6.2.6 Data area and memory

The FL-net module has a memory area corresponding to the path for each type.
Exchange with the CPU module takes place through the buffer memory.



6.2.7 Cyclic transmission and area

(1) Summary of cyclic transmission

Cyclic transmission is the function that supports the cyclic data exchange generated among nodes.

(a) It realizes the common memory function.

(b) The node sends when it is holding the token.

(c) Nodes participating in the network are recognized as entities performing cyclic transmission.

(d) When the token is being held, all cyclic data to be sent is sent.

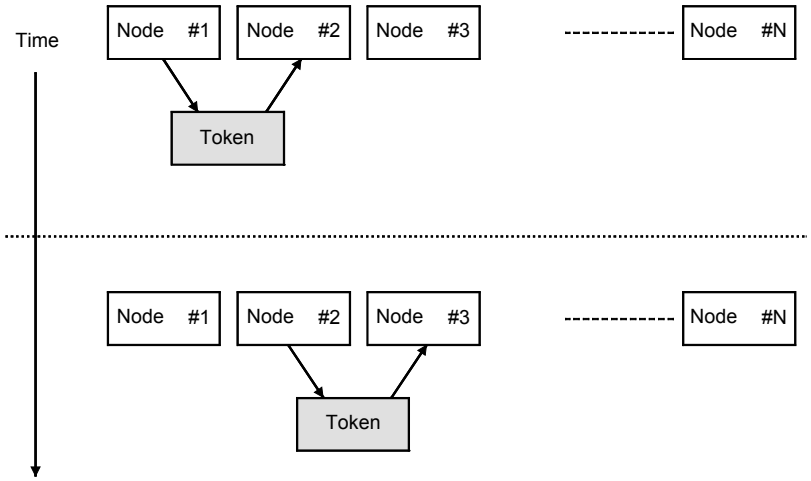
1) Token
Basically, there is only one token for the network. When there are two or more tokens, the smallest address node number has priority while others are eliminated.

2) Token frame
The frame that includes the token (token frame) has a token address node number and a token dispatch node number. When the node matches the token address node number of the token frame received, it becomes the token holding node.

3) Token sequence
The sequence of the token rotation is determined by the node number. Rotation is performed in ascending order among the nodes that are registered in the participating node control table. The highest node number passes the token to the lowest node number.

(e) Data from a node that has separated from the network retains the data before the separation because there has been no communication.

<Token rotation and cyclic transmission 1>



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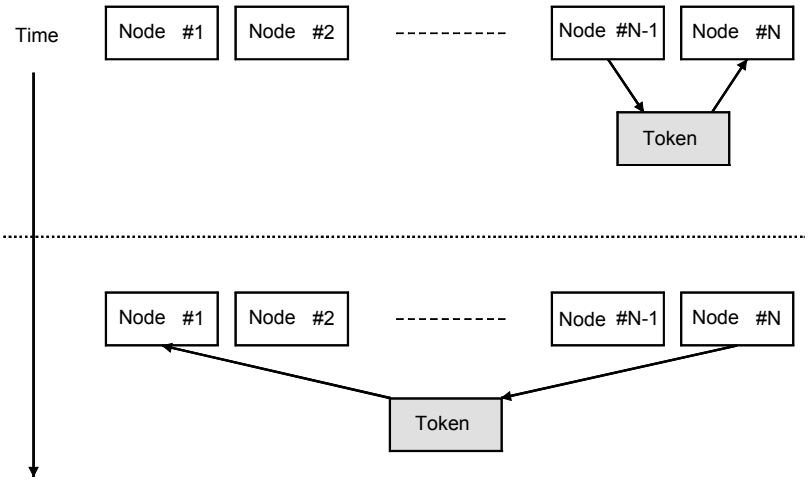
<Token rotation and cyclic transmission 2>



(2) Common memory

The following introduces the concepts for the common memory.

(a) The common memory interface provides nodes with a service that can be regarded as a memory shared among them.

(b) Two area types (Area 1 (bit area) and Area 2 (word area)) may be assigned for a node.

(c) Multiple frames may be used if the transmitting area size of a node exceeds the transmission size of one frame, that is, 1024 bytes.

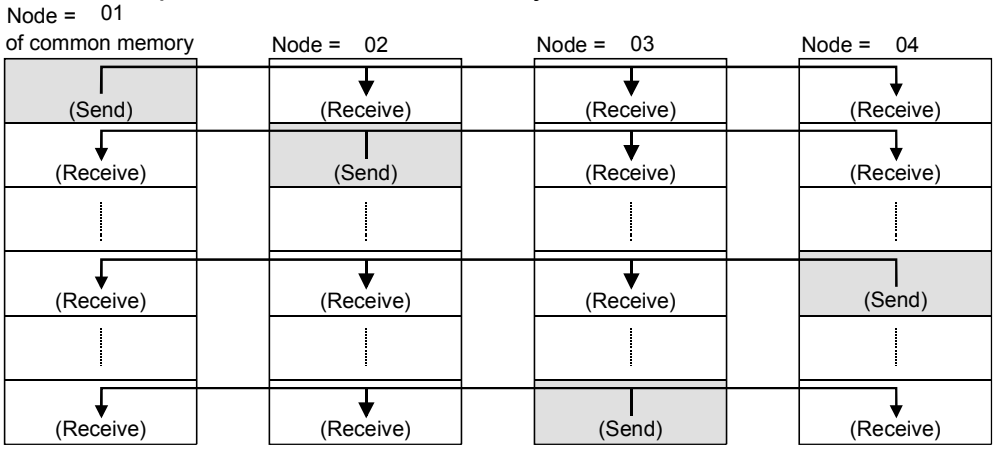
(d) The common memory will not update itself with receiving data until all frames from a node are successfully received in case of the item (c). Thus time coherency of data from a node will be guaranteed.

(e) Communication unit of each node shall provide fixed area of 8k bits + 8k words = 8.5 k words as the common memory.

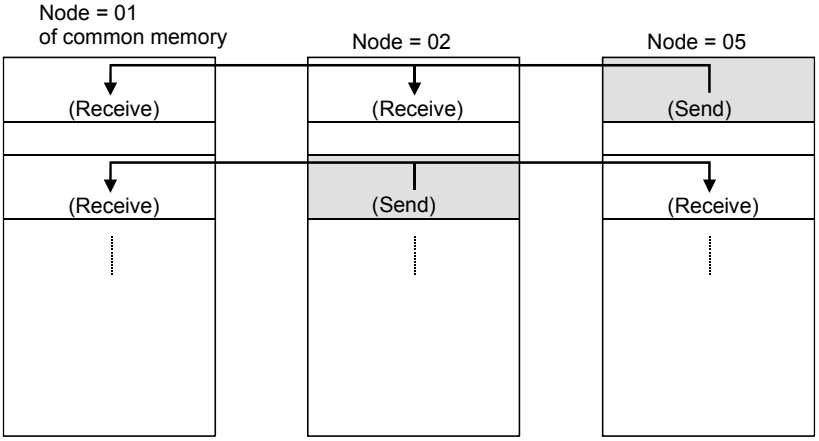
(f) Both Area 1 (bit area) and Area 2(word area) can be set at any size within the maximum.

(g) Each node cyclically provides a function for sharing the same data with the entire system by broadcasting the data. Each node in FL-net (OPCN-2) reciprocally divides and receives a send area that is not to be duplicated and data exchange is performed. In the operation of the common memory, the send area allocated in a given node becomes the receiving area for another node.

<Example 1 of common area for cyclic transmission>



<Example 2 of common area for cyclic transmission>



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(3) Common memory area 1 (bit area) and 2 (word area)

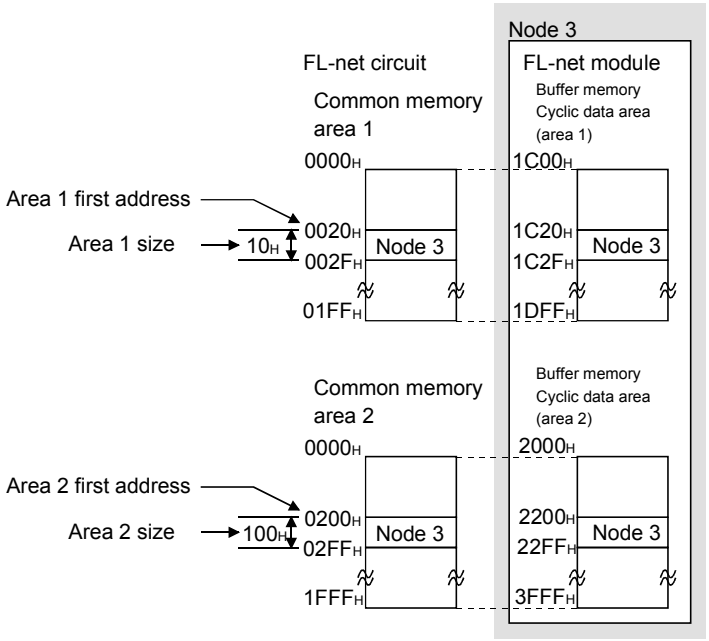
A node shall be assigned two data areas, area 1 (bit area) and area 2 (word area), as the transmitting areas in its common memory.

Set transmission areas by the first addresses and the sizes of area 1 (bit area) and 2 (word area).

For access between areas 1 (bit area) and 2 (word area), word addresses are used.

Area 1 (bit area) consists of 8 k bits and area 2 (word area) consists of 8 k words.

(Example) Setting example for common memory area 1 (bit area) and area 2 (word area) of the local node (When the local node is node 3)



(4) Common memory assignment

(a) Common memory assignment of the local node

Each node assigns only the common memory area (for the node to store send data) of its own node to the local node network parameter area.

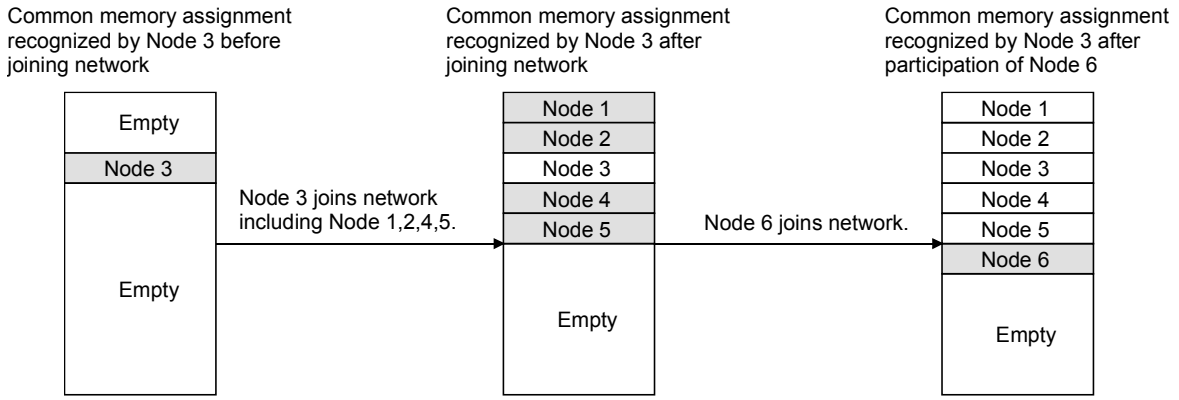
POINT

(1) For the information on how to set the local node network parameter area, refer to the following:
- When using the initial setting of GX Configurator-FL: Section 6.4.8
- When setting on the sequence program: Section 6.5.1

(2) The common memory of the local node can be assigned without specific attention to the order of nodes. (Note that overlapping with those of other nodes is not allowed.)

(b) Acquisition timing for common memory assignment of other nodes

A node acquires common memory assignment data of the other nodes participating in the network automatically when the node joins the network. Also, it automatically acquires common memory assignment data of a new node when the new node joins the network.



POINT

Common memory assignment of the other nodes can be confirmed in the other node network parameter area (Address: 0080 to 087F$_H$) in the buffer memory. (Refer to Section 3.2.5 (3) (b).)

(c) When common memory assignment is overlapped

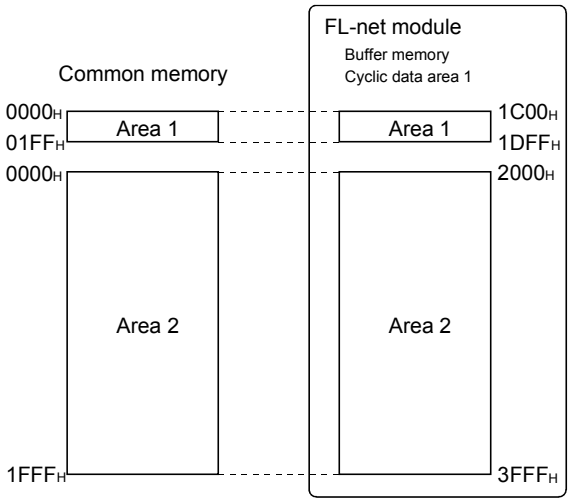
Common memory assignment must not be overlapped among multiple nodes.

Before participation in the network, check the common memory assignment of all nodes currently participating in the network. If any duplication is identified, the local node will detect an error. (No error will be detected on the other nodes currently participating in the network.)

(5) Common memory and buffer memory

The common memory represents a virtual memory area and consists of area 1 (bit area) and area 2 (word area).

The FL-net module stores the data of area 1 (bit area) and area 2 (word area) into the cyclic data area (Area 1) (Address: 1C00$_H$ to 1DFF$_H$) and (Area 2) (Address: 2000$_H$ to 3FFF$_H$) accordingly.



(6) Transfer methods between the cyclic data area (Area 1, 2) in the buffer memory and PLC CPU devices

Data are transferred between the cyclic data area (Area 1, 2) in the buffer memory and PLC CPU devices by either of the following methods.

Transfer method	Description	Reference
Using the auto refresh setting	In the auto refresh setting of GX Configurator-FL, specify No. of data transferred and an offset value from the first address of the cyclic data area. No sequence program for transfer is needed.	Section 6.4.9
Using sequence program	On the sequence program, specify No. of data transferred and the cyclic data area using the intelligent function module device (Un\G[]).	Section 6.5.2

(7) Guaranteeing the simultaneity of the data

In cyclic transmission, the frame is divided into multiples according to the volume of the data to be sent. While the FL-net module and CPU module operate asynchronously, the following procedure is used to ensure the simultaneity of the node-unit common memory.

(a) Dispatch timing

The sending node receives the token and sends the cyclic data preparing for sending. At this time, transmission from the CPU is performed in the sequence: area 2 (word area), area 1 (bit area) and transmission from the FL-net module is performed in the sequence area 1 (bit area), area 2 (word area).

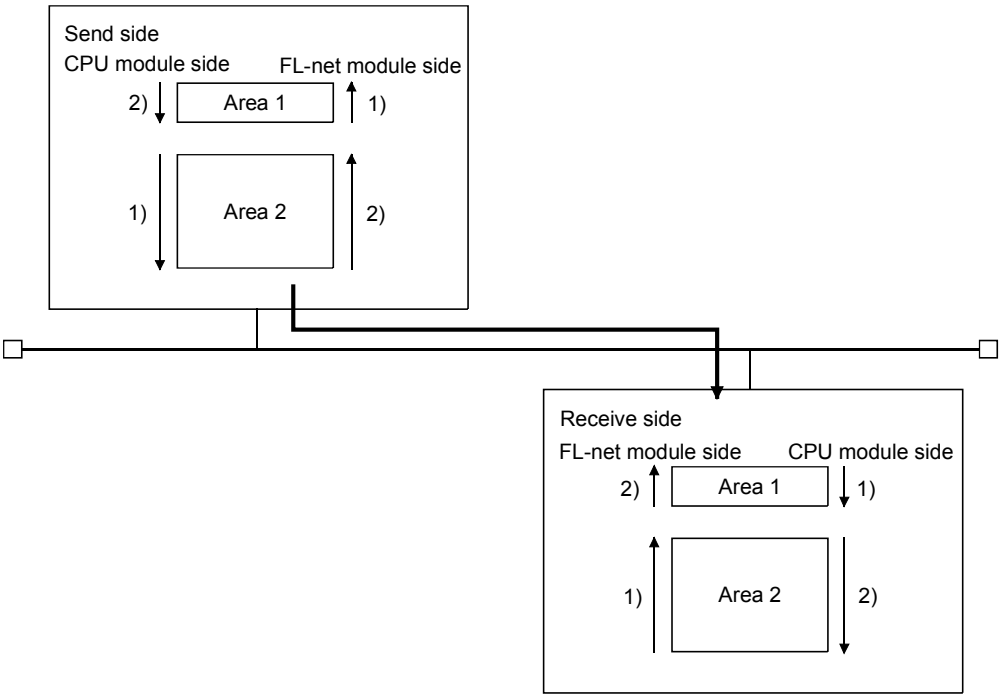
If the size of the data is larger than the size that can be sent by one frame, the data is temporarily copied to the buffer in the FL-net module. This buffer memory is divided into multiple frames and sent in sequence.

(b) Refresh timing when receiving

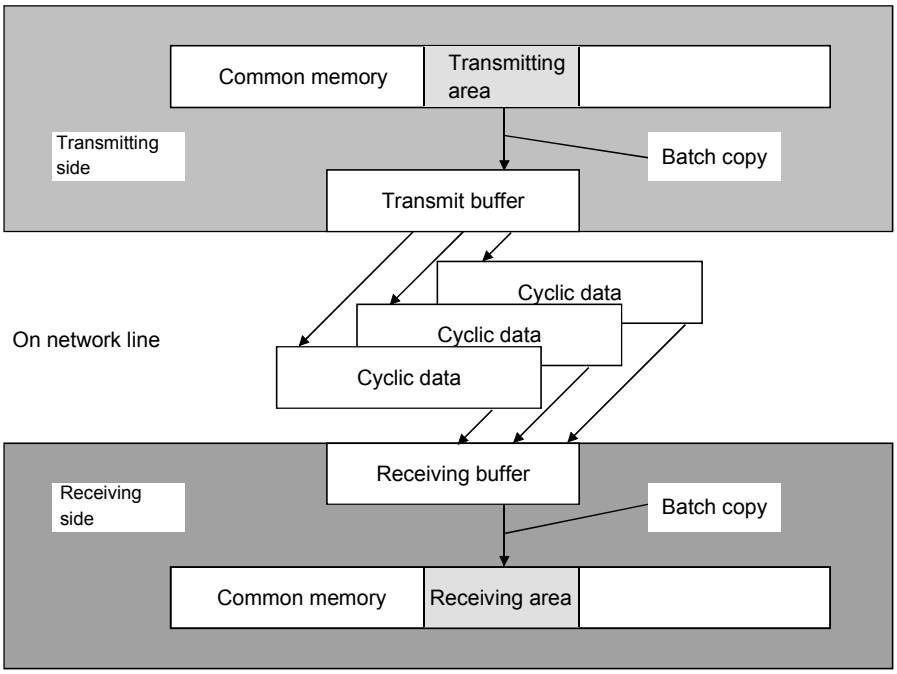
When the receiving node has finished receiving all the cyclic data from a single node, it temporarily copies the cyclic data to the buffer inside the FL-net module in order to transfer it.

At this time, it is transferred from the FL-net module in the following sequence: area 2 (word area), area 1 (bit area), and transferred from the CPU in the following sequence: area 1 (bit area), area 2 (word area). Note that if the frame that has been divided and sent from the frame is not a complete set, all the data from that node is destroyed.

<Guaranteeing the simultaneity of the data by transfer direction and transfer sequence>



<Guaranteeing the simultaneity of the divided frame data>

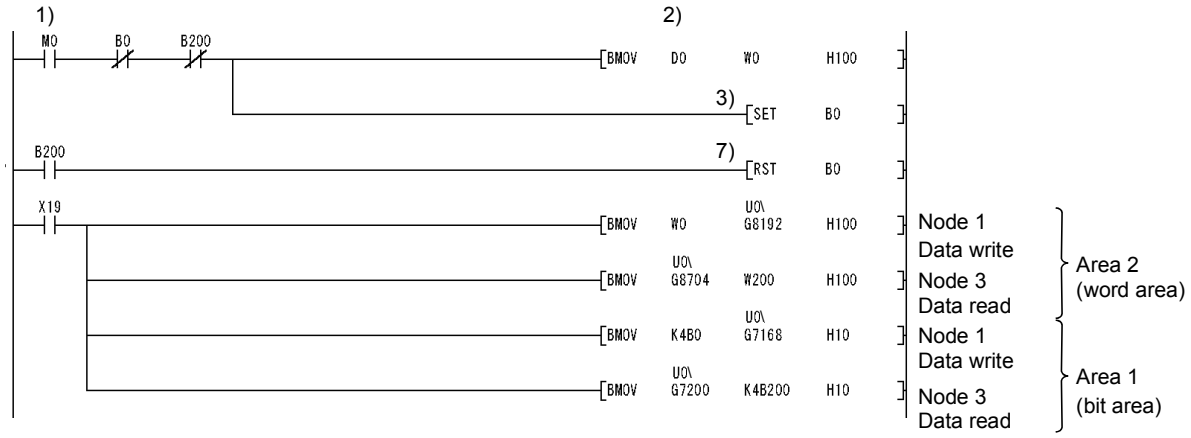


(c) Interlock program example

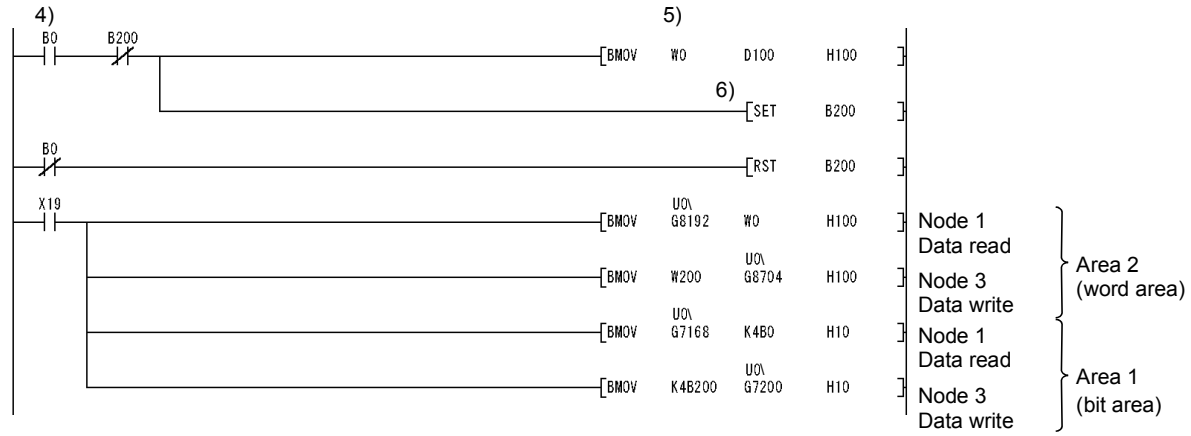
When data of 3 words or more are sent at a time by cyclic transmission, new and old data may be mixed in units of one word (16 bits) on the receiving end.

Please create an interlock with area 1 (bit area) data as shown below.

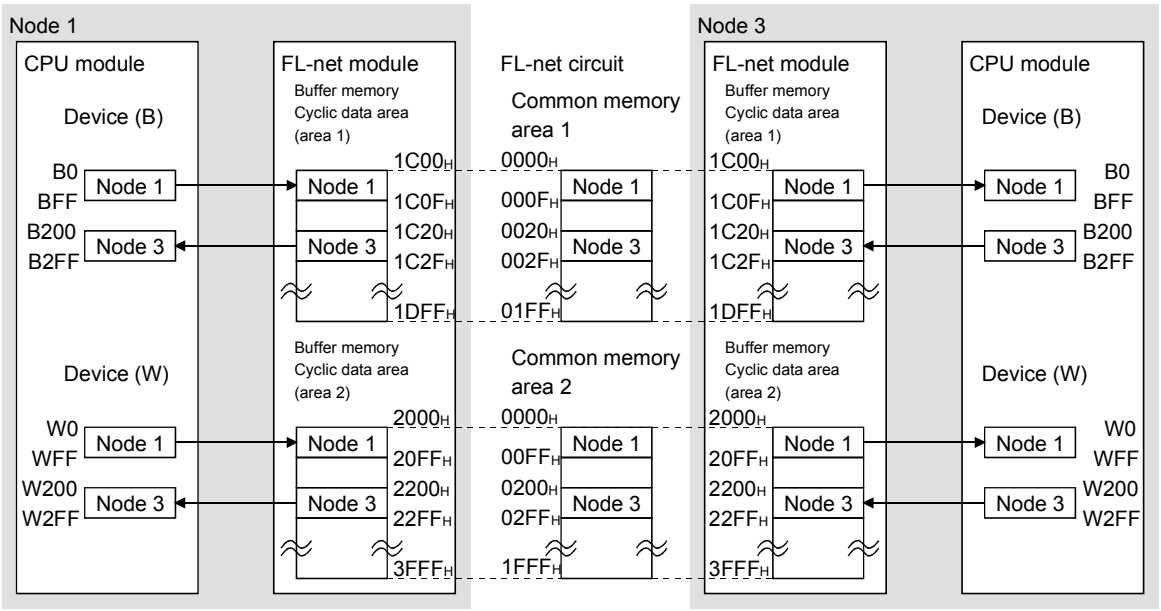
Sending station (Node 1)



Receiving station (Node 3)



1) Send command (M0) turns ON.
2) Data in D0 to D255 are stored in W0 to WFF.
3) Upon completion of the storage into W0 to WFF, B0 for handshake turns ON.
4) After the area 2 (word area) data are sent by cyclic transmission, the area 1 (bit area) data are sent and B0 of the receiving station turns ON.
5) Data in W0 to WFF are stored in D100 to D355.
6) Upon completion of the storage into D100 to D355, B200 for handshake turns ON.
7) When data are received on the receiving station, B0 turns OFF.


Node 1
CPU module
Device (B)
B0
BFF
B200
B2FF
Node 1
Node 3
Device (W)
W0
WFF
W200
W2FF
FL-net module
Buffer memory
Cyclic data area
(area 1)
1C00H
1C0FH
1C20H
1C2FH
1DFFH
Buffer memory
Cyclic data area
(area 2)
2000H
20FFH
2200H
22FFH
3FFFH
FL-net circuit
Common memory
area 1
0000H
000FH
0020H
002FH
01FFH
Common memory
area 2
0000H
00FFH
0200H
02FFH
1FFFH
Node 3
FL-net module
Buffer memory
Cyclic data area
(area 1)
1C00H
1C0FH
1C20H
1C2FH
1DFFH
Buffer memory
Cyclic data area
(area 2)
2000H
20FFH
2200H
22FFH
3FFFH
CPU module
Device (B)
B0
BFF
B200
B2FF
Device (W)
W0
WFF
W200
W2FF

6.2.8 Message transmission

(1) Summary of message transmission

Message transmission is the function supporting the asynchronous data exchange generated among nodes.

(a) When a node receives a token, it sends up to one (message) frame before transmitting cyclic frames.

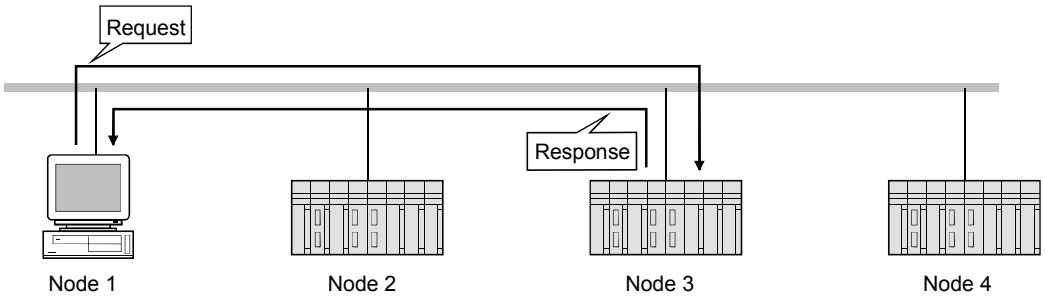
(b) Data volume that can be transmitted in a frame is equal to or less than 1024 bytes. (excluding the header).

(c) Algorithm is provided so as not to exceed allowable refresh cycle time for cyclic transmission.

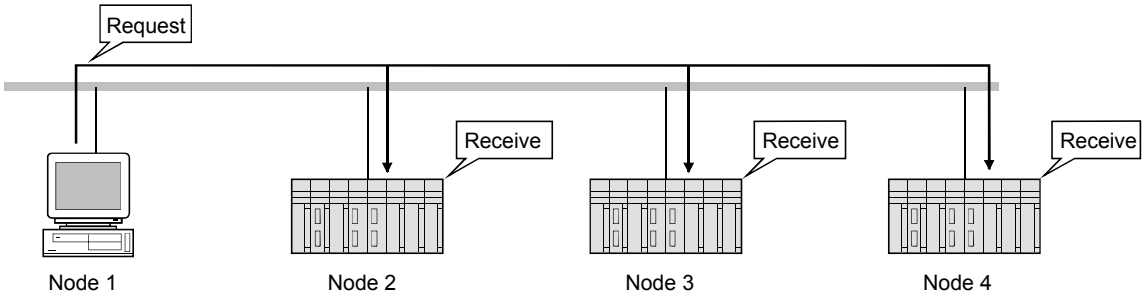
(d) Both 1 : 1 transmission to a specific destination node and 1 : n broadcast transmission to all nodes are provided.

(e) Delivery acknowledgement function is provided to confirm successful delivery of data to the destination node on the 1 : 1 message transmission.

(f) If message transmission is implemented for a node that has been removed from the network, FL-net module detects an error (error code: C322H or C323H).



1 : 1 Transmission



1 : N Transmission

(2) Support message list

No.	Message	1 : 1	1 : n	Server function (*1)	Client function (*2)	Reference
1	Byte block read	○	×	×	○*3	Section 6.5.3(6)
2	Byte block write	○	×	×	○*3	
3	Word block read	○	×	○	○*3	
4	Word block write	○	×	○	○*3	
5	Network parameter read	○	×	○	○	Section 6.5.3(1)
6	Network parameter write	○	×	×	○*3	Section 6.5.3(6)
7	Operate/stop command	○	×	×	○*3	
8	Device profile read	○	×	○	○	Section 6.5.3(2)
9	Log data read	○	×	○	○	Section 6.5.3(3)
10	Log data clear	○	○	○	○	Section 6.5.3(4)
11	Message return	○	×	○	○*3	Section 6.5.3(6)
12	Transparent message transmission	○	○	○	○	Section 6.5.3(5)

○: Enable ×: Disable

*1 : Server function ··· Functions that create a response frame for the request message that has been received and send it.

*2 : Client function ···· Functions that send the response message and receive the response frame.

*3 : Realized by the transparent message transmission. Refer to Section 6.5.3 (5)(6) for the sending method for transparent type message transmission. Also, refer to the external device manual for transaction code.

(3) Transaction code

In each of the messages, its header has a transaction code for requesting or a transaction code for responding that is used for identifying the message frame.

Transaction code		Application
Decimal	Hexadecimal	
0 to 59599	0000H to E8CFH	Transparent type message transmission (User-defined)
59600 to 59999	E8D0H to EA5FH	Reserved
60000 to 64999	EA60H to FDE7H	Reserved
65000	FDE8H	Cyclic header (with token)
65001	FDE9H	Cyclic header (no token)
65002	FDEAH	Participation request frame header
65003	FDEBH	Byte block data read (request)
65004	FDECH	Byte block data write (request)
65005	FDEDH	Word block data read (request)
65006	FDEEH	Word block data write (request)
65007	FDEFH	Network parameter read (request)
65008	FDF0H	Network parameter write (request)
65009	FDF1H	Stop command (request)
65010	FDF2H	Operate command (request)
65011	FDF3H	Read profile (request)
65012	FDF4H	Trigger header
65013	FDF5H	Log read (request)
65014	FDF6H	Log clear (request)
65015	FDF7H	For message return test (request)
65016 to 65202	FDF8H to FEB2H	Reserved
65203	FEB3H	Byte block data read (response)
65204	FEB4H	Byte block data write (response)
65205	FEB5H	Word block data read (response)
65206	FEB6H	Word block data write (response)
65207	FEB7H	Network parameter read (response)
65208	FEB8H	Network parameter write (response)
65209	FEB9H	Stop command (response)
65210	FEBAH	Operate command (response)
65211	FEBBH	Read profile (response)
65212	FEBCH	Reserved
65213	FEBDH	Log read (response)
65214	FEBEH	Log clear (response)
65215	FEBFH	For message return test (response)
65216 to 65399	FEC0H to FF77H	Reserved
65400 to 65535	FF78H to FFFFH	Reserved

POINT

A response transaction code is a "request transaction code + 200".

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(4) Virtual address space and physical address

When a virtual address space is specified in word block read/write for a Q series FL-net module, an access is made to the CPU module and MELSECNET/H remote I/O station devices on the target node.
Accessible CPU module and MELSECNET/H remote I/O station devices and their device number ranges are shown below.

(a) Comparison between the virtual addresses and physical address

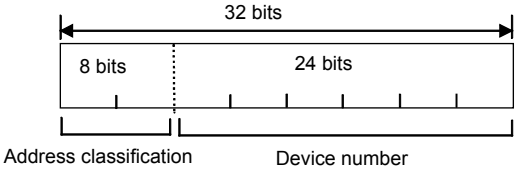
1) CPU module

Category	Device name		Device type		Address classification		Device number range (During default allotment)		Expression		Remark
			Bit	Word	Physical	Virtual	Q02/Q02H/Q06H/ Q12H/Q25H/Q12P H/Q25PHCPU	Q00J/Q00/ Q01CPU	Decimal	Hexa-decimal	
Internal system	Special relay		○		SM	91	000000 to 002047	000000 to 001023	○		—
	Special register			○	SD	A9	000000 to 002047	000000 to 001023	○		—
Internal user	Input relay		○		X	9C	000000 to 001FFF	000000 to 0007FF		○	Q00J/Q00/Q01CPU are variable within a total of 16.4 k words. Q02/Q02H/Q06H/ Q12H/Q25H/Q12P H/Q25PHCPU are variable within a total of 28.75 k words. (1 device is 32 k point maximum) When changing allocations, it is possible to access to the maximum device number after changing. Local devices cannot be accessed.
	Output relay		○		Y	9D	000000 to 001FFF	000000 to 0007FF		○	
	Internal relay		○		M	90	000000 to 008191	000000 to 008191	○		
	Latch relay		○		L	92	000000 to 008191	000000 to 002047	○		
	Annunciator		○		F	93	000000 to 002047	000000 to 001023	○		
	Edge relay		○		V	94	000000 to 002047	000000 to 001023	○		
	Link relay		○		B	A0	000000 to 001FFF	000000 to 0007FF		○	
	Data register			○	D	A8	000000 to 012287	000000 to 011135	○		
	Link register			○	W	B4	000000 to 001FFF	000000 to 0007FF		○	
	Timer	Contact point	○		TS	C1	000000 to 002047	000000 to 000511	○		
		Coil	○		TC	C0					
		Current value		○	TN	C2					
	Accumulated timer	Contact point	○		SS	C7					
		Coil	○		SC	C6					
		Current value		○	SN	C8					
	Counter	Contact point	○		CS	C4	000000 to 001023	000000 to 000511	○		
		Coil	○		CC	C3					
		Current value		○	CN	C5					
	Link special relay		○		SB	A1	000000 to 0007FF	000000 to 0003FF		○	
	Link special register			○	SW	B5	000000 to 0007FF	000000 to 0003FF		○	
	Step relay		○		S	98	000000 to 008191	000000 to 002047	○		Q00J/Q00/ Q01CPU cannot be accessed.
	Direct input		○		DX	A2	000000 to 001FFF	000000 to 0007FF		○	Input relay, output relay are the same. (For direct access)
	Direct output		○		DY	A3	000000 to 001FFF	000000 to 0007FF		○	
	Index register			○	Z	CC	000000 to 000015	000000 to 000009	○		—
—	Normal file register			○	R	AF	000000 to 032767	000000 to 032767	○		—
	Serial number file register			○	ZR	B0	000000 to 0FE7FF	000000 to 007FFF		○	—

2) MELSECNET/H remote I/O station

Device name	Device type		Address classification		Device number range	Expression		Remark
	Bit	Word	Physical	Virtual	QJ72LP25-25, QJ72LP25G, QJ72LP25GE, QJ72BR15	Decimal	Hexa-decimal	
Special relay	○		SM	91	000000 to 002047	○		—
Special register		○	SD	A9	000000 to 002047	○		
Input relay	○		X	9C	000000 to 001FFF		○	Cannot change the allocation
Output relay	○		Y	9D	000000 to 001FFF		○	
Internal relay	○		M	90	000000 to 008191	○		
Link relay	○		B	A0	000000 to 003FFF		○	
Data register		○	D	A8	000000 to 012287	○		
Link register		○	W	B4	000000 to 003FFF		○	
Link special relay	○		SB	A1	000000 to 0001FF		○	
Link special register		○	SW	B5	000000 to 0001FF		○	

*: A virtual address is expressed as a 32-bit address as shown below.



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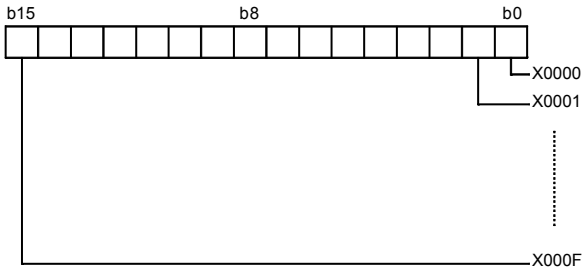
(b) Virtual address specification (Word block)

1) Device classification: bit

<table>
<tr><th>Item</th><th>Contents</th></tr>
<tr><td>Area name</td><td>(Example) Input relay (X)</td></tr>
<tr><td>Area size</td><td>512 words</td></tr>
<tr><td>Access attributes</td><td>Read</td></tr>
<tr><td>Comparison with virtual address
(Word block)</td><td>
<table>
<tr><th>Natural notation
(Device name)</th><th>Virtual address</th></tr>
<tr><td>X0000</td><td>9C000000H</td></tr>
<tr><td>X0010</td><td>9C000001H</td></tr>
<tr><td>X0020</td><td>9C000002H</td></tr>
<tr><td>:
:</td><td>:
:</td></tr>
<tr><td>X1FF0</td><td>9C0001FFH</td></tr>
</table>
</td></tr>
<tr><td>Data alignment</td><td>Corresponds to 1-word word block at device 16 bit
(When set from X0000)
 
</td></tr>
</table>

2) Device classification : word

<table>
<tr><th>Item</th><th>Contents</th></tr>
<tr><td>Area name</td><td>(Example) Data register (D)</td></tr>
<tr><td>Area size</td><td>12288 words</td></tr>
<tr><td>Access attributes</td><td>Read/Write</td></tr>
<tr><td>Comparison with virtual address
(Word block)</td><td>
<table>
<tr><th>Natural notation
(Device name)</th><th>Virtual address</th></tr>
<tr><td>D0000</td><td>A8000000H</td></tr>
<tr><td>D0001</td><td>A8000001H</td></tr>
<tr><td>D0002</td><td>A8000002H</td></tr>
<tr><td>:
:</td><td>:
:</td></tr>
<tr><td>D12287</td><td>A8002FFFH</td></tr>
</table>
</td></tr>
<tr><td>Data alignment</td><td>Device 1 word corresponds to word block 1-word.</td></tr>
</table>

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(5) Support message details (Server function)

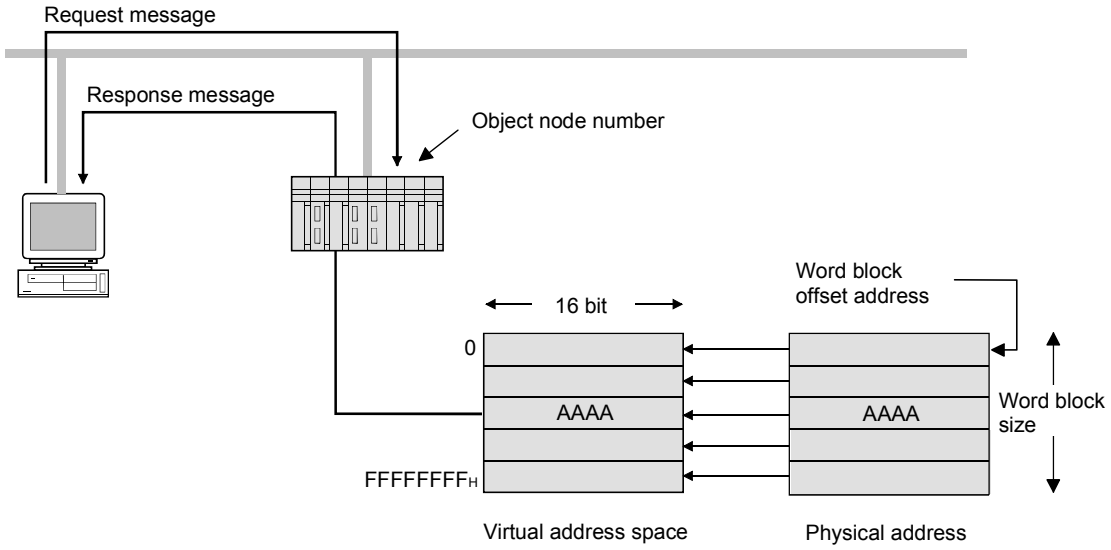
The server function of the support messages is explained in this section.

(a) Word block read

This function reads messages in word units (1 address 16 bit units) for the virtual address space (32 bit address space) that the corresponding node holds from the network.

The virtual address spaces of the Q series FL-net module are assigned to respective devices (physical addresses) of the CPU module and MELSECNET/H remote I/O station. (Refer to (4).)

Item	Request	Response
Transaction code	65005	65205
Parameter	• Object node number • Virtual address space data size • Virtual address space first address	—
User data	—	Read data (1024 byte space)

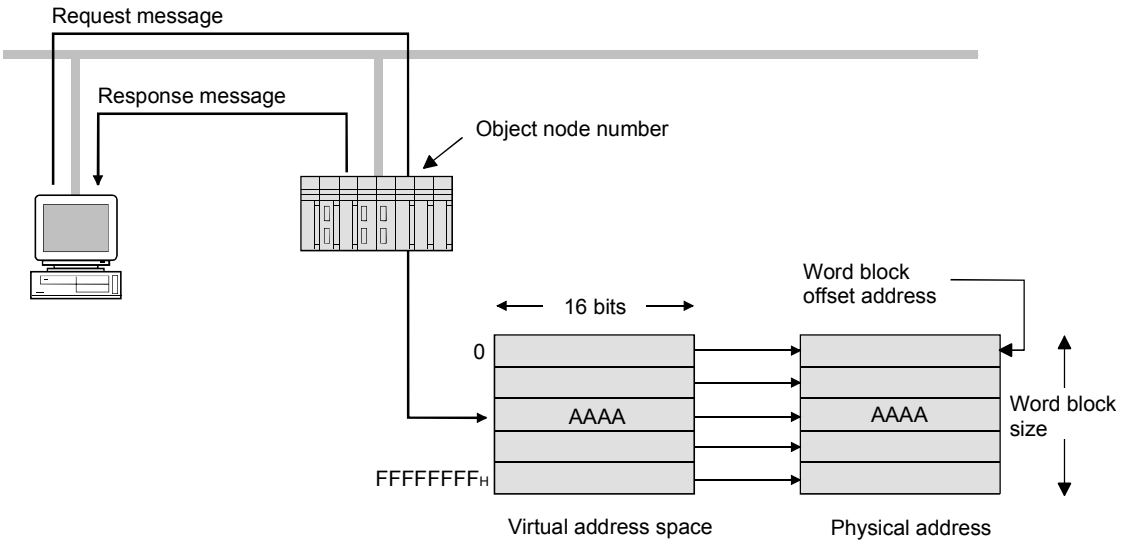


(b) Word block write

This function writes messages in word units (1 address 16 bit units) for the virtual address space (32 bit address space) that the corresponding node holds from the network.

The virtual address spaces of the Q series FL-net module are assigned to respective devices (physical addresses) of the CPU module and MELSECNET/H remote I/O station. (Refer to (4).)

Item	Request	Response
Transaction code	65006	65206
Parameter	• Object node number • Virtual address space data size • Virtual address space first address	—
User data	Write data (1024 byte space)	—



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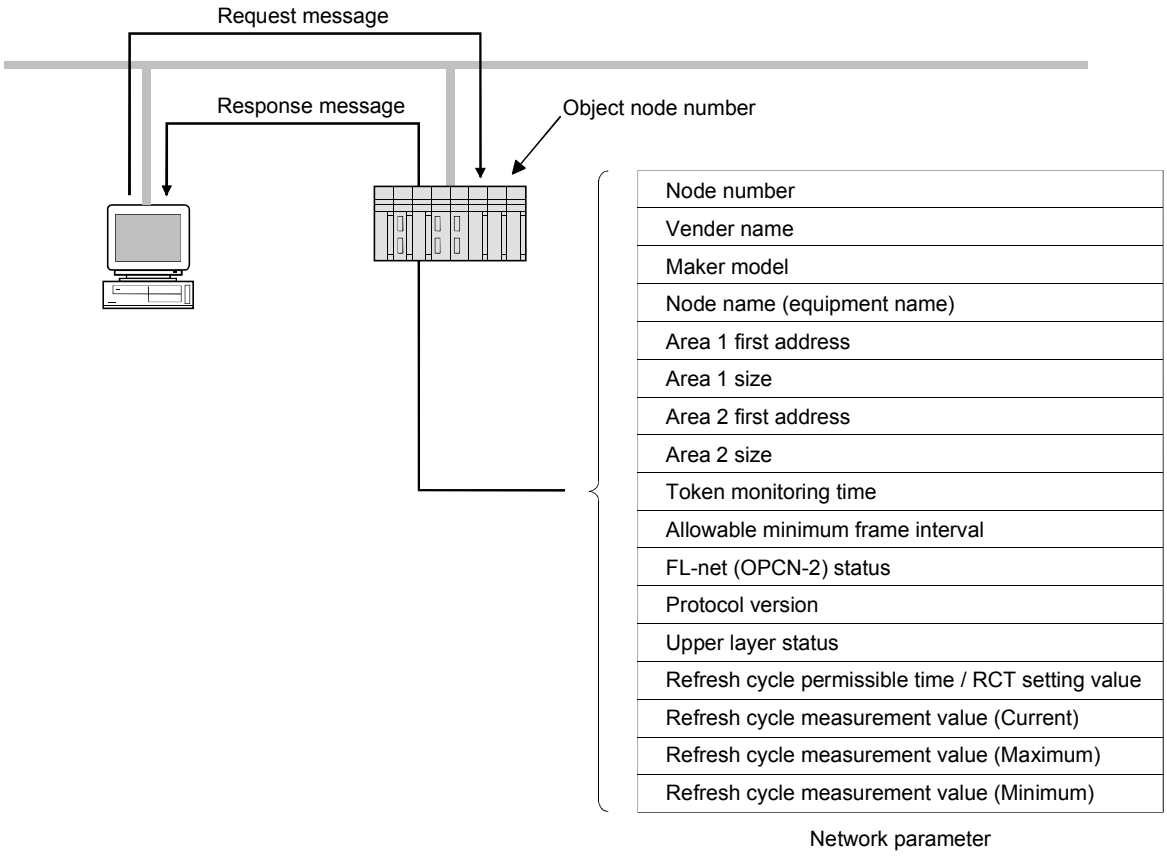
(c) Read network parameters

This function reads the corresponding node network parameter data from the network.

Item	Request	Response
Transaction code	65007	65207
Parameter	• Object node number	—
User data	—	• Node number • Vender name • Maker model • Node name (equipment name) • Address and size of common memory • Token monitoring time • Allowable refresh cycle time • Refresh cycle measurement time (actual value) • Allowable minimum frame interval • Upper layer status • FL-net (OPCN-2) status • Protocol version



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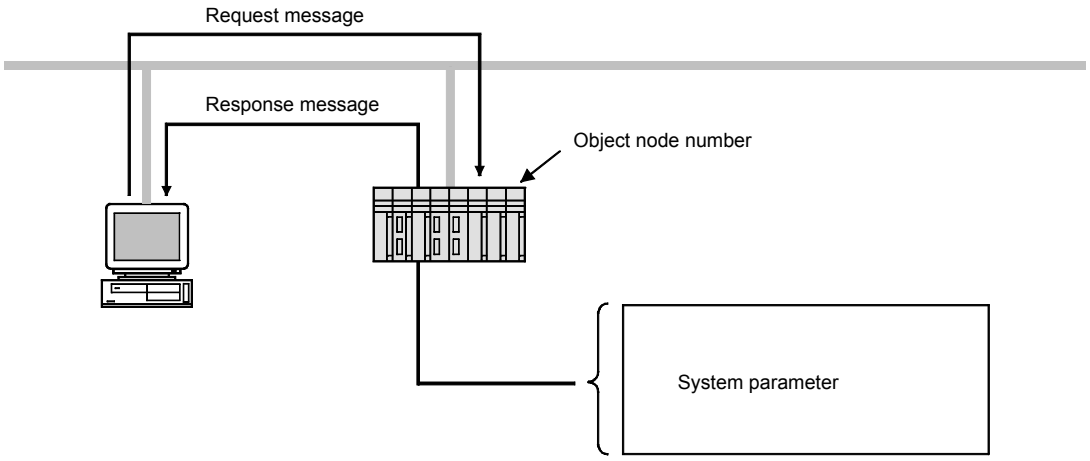
(d) Device protocol read

This function reads the device profile data that is the data for the corresponding node from the network. The data format for the device profile data is based on ASNI.1 "Abstract Syntax Notation One" conversion rules for transmission encoding as stipulated in ASNI.1 "Basic Encoding Rules (ISO/IEC 8825).

Item	Request	Response
Transaction code	65011	65211
Parameter	• Object node number	—
User data	—	• System parameters

<Device profile data>

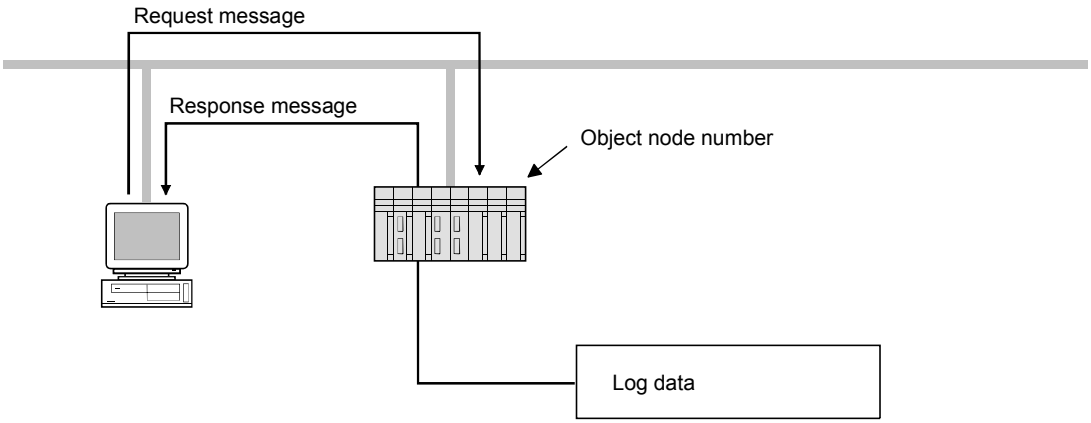
System parameter	• Common specifications version • Identifier character string • Revision number • Revision data • Device classification • Vendor name • Product number



(e) Log data read

Message function for reading corresponding node log data from the network.

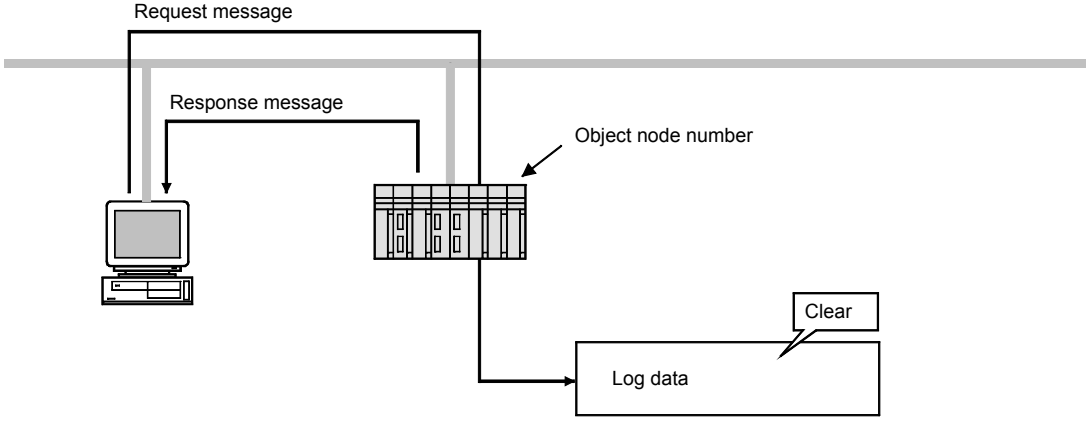
Item	Request	Response
Transaction code	65013	65213
Parameter	• Object node number	—
User data	—	• Send and Receive log • Frame log • Cyclic transmission error log • Message transmission error log • ACK error log • Token error log • Status data • Participation node list



(f) Log data clear

Message function for clearing corresponding node log data from the network.

Item	Request	Response
Transaction code	65014	65214
Parameter	• Object node number	—
User data	—	—

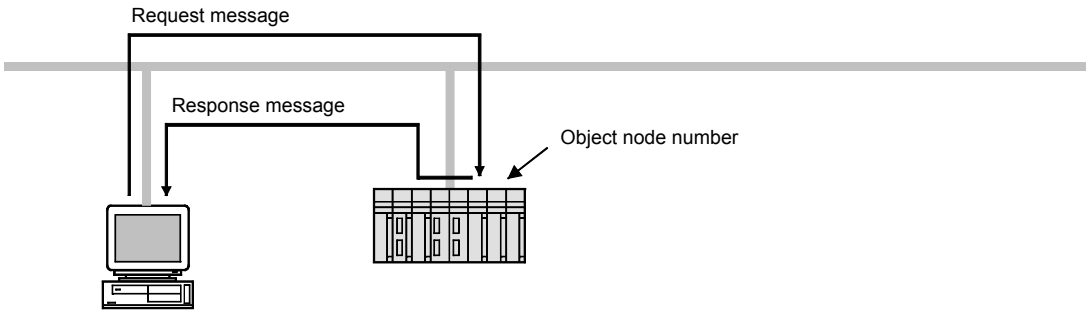


(g) Message return

This function returns the received message.

The returning is performed automatically within the FL-net module.

Item	Request	Response
Transaction code	65015	65215
Parameter	• Object node number	—
User data	Test data (1024 bytes)	Test data (1024 bytes)

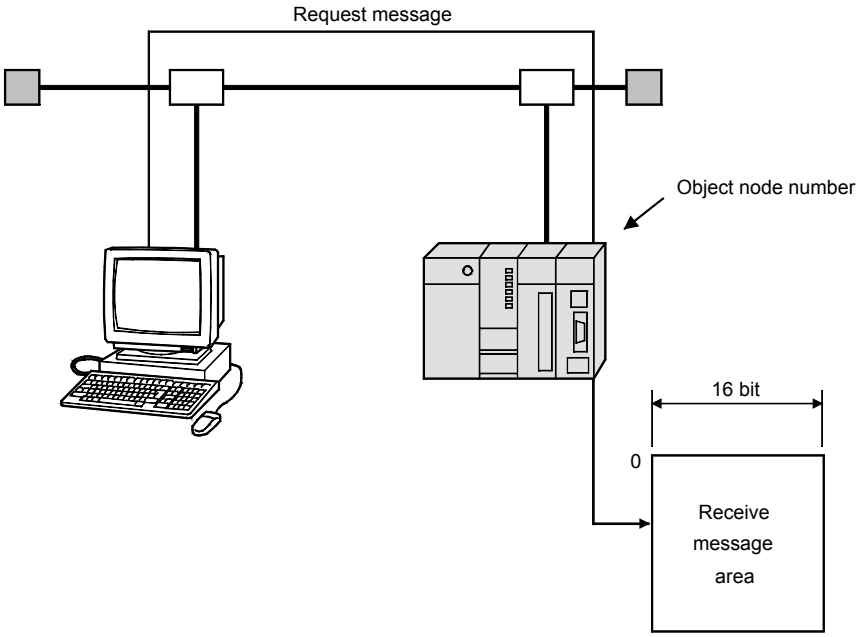


(h) Transparent type message transmission

This function writes messages to the corresponding node received message area from the network.

In addition, response message creation by the sequence program is required if a response message for not returning the response message as a FL-net module. Designation of the response message classification and virtual address space can be performed.

Item	Request	Response
Transaction code	0 to 59599 65000 to 65535 ∗1 (Function version A : 0 to 9999)	—
Parameter	• Object number • Data size (word/byte unit)∗3 ∗4 • Response message classification • Virtual address space • Address • Size (word/byte unit) ∗5	—
User data	Data (1024 byte space)	—



POINT

∗1 : Refer to Section 6.2.8 (3) "Transaction codes" for information on codes used by the system.

∗2 : Since there is no discrimination of transaction codes for the request frame and response frame, the use must define them.

∗3 : For the data size, the data unit is switched according to "Message Data Unit Select" of the network parameter.

∗4 : If the object destination is using Version A, use word units. (Version A is not compatible with byte units.)

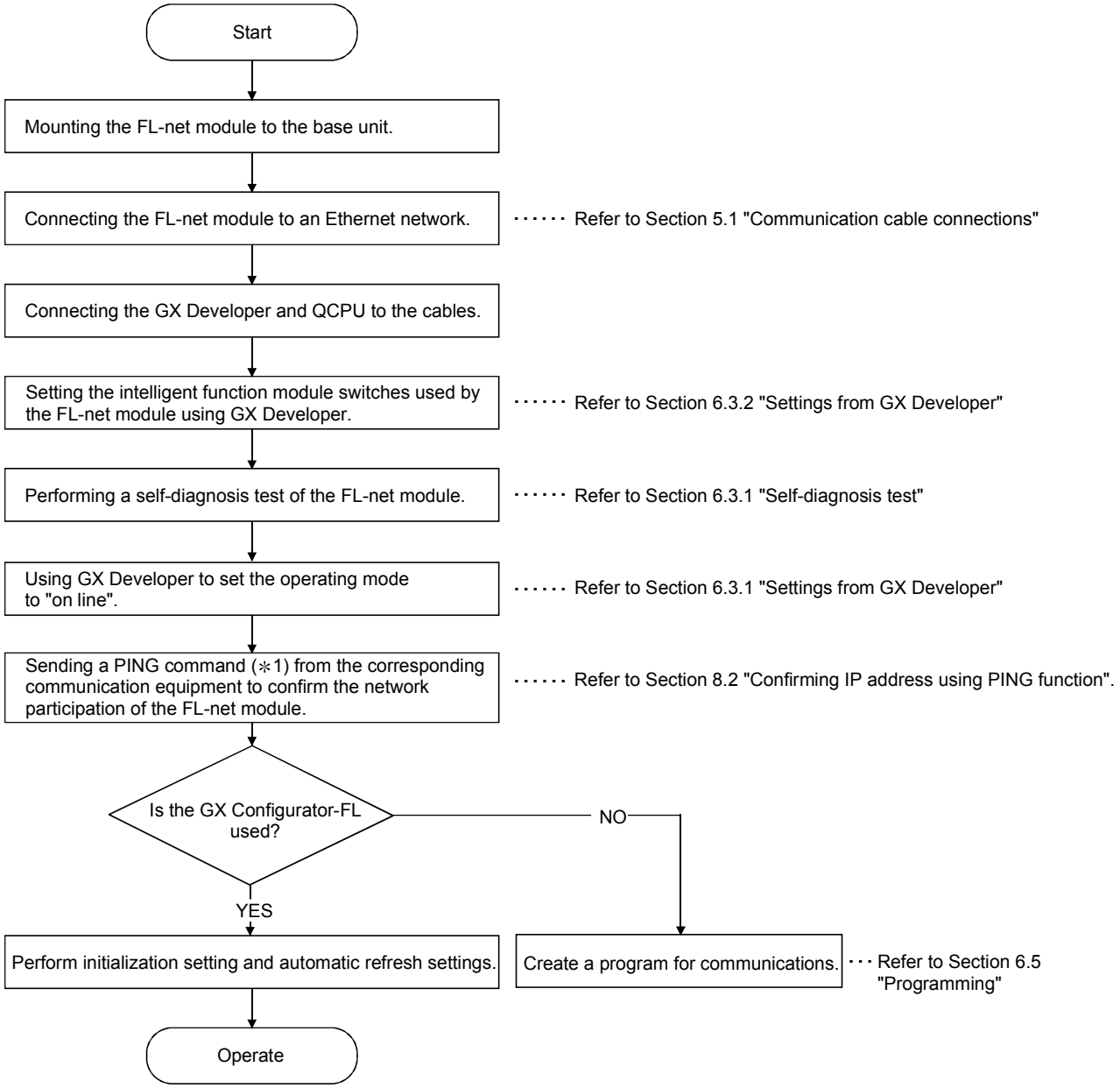
∗5 : Exists in the transaction code.

6.3 Setting the FL-net Module

This section explains the procedures and setting methods up to the operation of the FL-net module.

6.3.1 Procedures up to operation

The following is a summary of the procedures up to operation.



∗1 : Note that the PING command cannot be sent from the FL-net module.

(1) Self-diagnosis test

This section explains the self-diagnosis test used for checking the send/receive functions and hardware components of the FL-net module.

(a) Self-loopback test

This section explains the self-loopback test for checking the hardware including the send/receive circuits of FL-net module.

A self-loopback test is one that check whether or not the FL-net module can receive the same message when an local station address transmission is sent to the line and received via the network.

Next, the procedure for the self-loopback test is explained. This test is performed in approximately 5 seconds. The test results are evaluated by using the LED on the front of the FL-net module.

Step	Operation		LED Status		
			[RUN]	[LNK]	[PER]
1	Connect the FL-net module to the line. (Refer to Section 5.1)		—	—	—
2	Stop the CPU module.		—	—	—
3	Use GX Developer to change the FL-net module operating mode to "2. Loopback test" and write the parameters to the CPU module. (Refer to Section 6.3.2)		—	—	—
4	Reset the CPU module.		●	●	○
5	After five (5) seconds, check the status of the LEDs.	When normal	●	○	○
		When error	●	○	●
6	Use GX Developer to change the FL-net module operating mode to "Online" or other test mode. (Refer to Section 6.3.2)		—	—	—
7	Reset the CPU module.		—	—	—

● : On ○ : Off

The following are possible causes of errors.

- FL-net module hardware error.
- FL-net (OPCN-2) line error
- External power supply 12 V DC error (10BASE5 only)

POINT

There is no hardware-type blockage by the corresponding equipment on line, even when the self-loopback test is performed. When the packets are crowding the line, packet collision may cause the test to take more than five seconds to complete. It such cases, perform this test after stopping the data communication among other equipment.

(b) Hardware test

This introduces the RAM and ROM tests for the FL-net module.
The following are the steps for performing the hardware tests.
The test results are evaluated by using the LED on the front of the FL-net module.

Step	Operation		LED Status		
			[RUN]	[LNK]	[PER]
1	Stop the CPU module.		—	—	—
2	Use GX Developer to change the FL-net module operating mode to "3. Hardware test" and write the parameters to the CPU module. (Refer to Section 6.3.2)		—	—	—
3	Reset the CPU module.		●	●	○
4	After five (5) seconds, check the status of the LEDs	When normal	●	○	○
		When error	●	○	●
5	Use GX Developer to change the FL-net module operating mode to "Online" or other test mode. (Refer to Section 6.3.2)		—	—	—
6	Reset the CPU module.		—	—	—

● : On ○ : Off

The following are possible causes of errors.
• FL-net module RAM/ROM error.

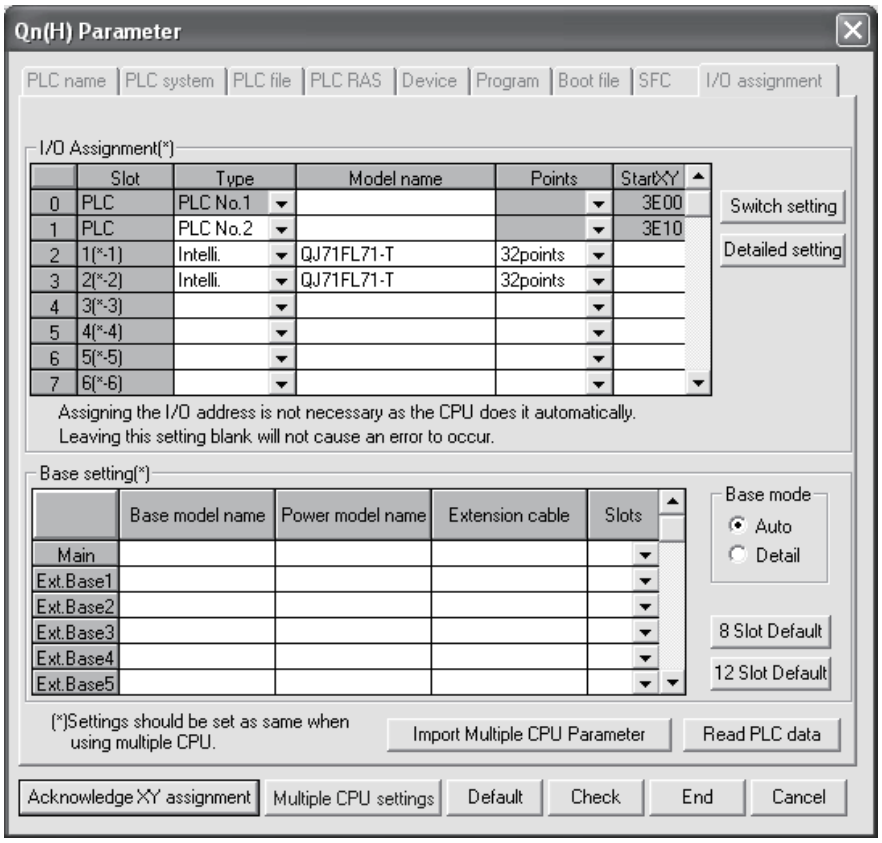
POINT

If the results of the hardware test show an error, perform the test again.
If a repeat of the test shows that there may be an error with the hardware of the FL-net module, make detailed notes of the problem and then contact your nearest representative.

6.3.2 Setting the GX Developer

This section explains using the required settings from the GX Developer for use on the FL-net module.
Refer to the operating manual for the GX Developer for details about the screen displays. For multiple PLC systems, refer to QCPU User's Manual (Multiple CPU System).

(1) I/O assignment (Qn (H) parameter setting screen)



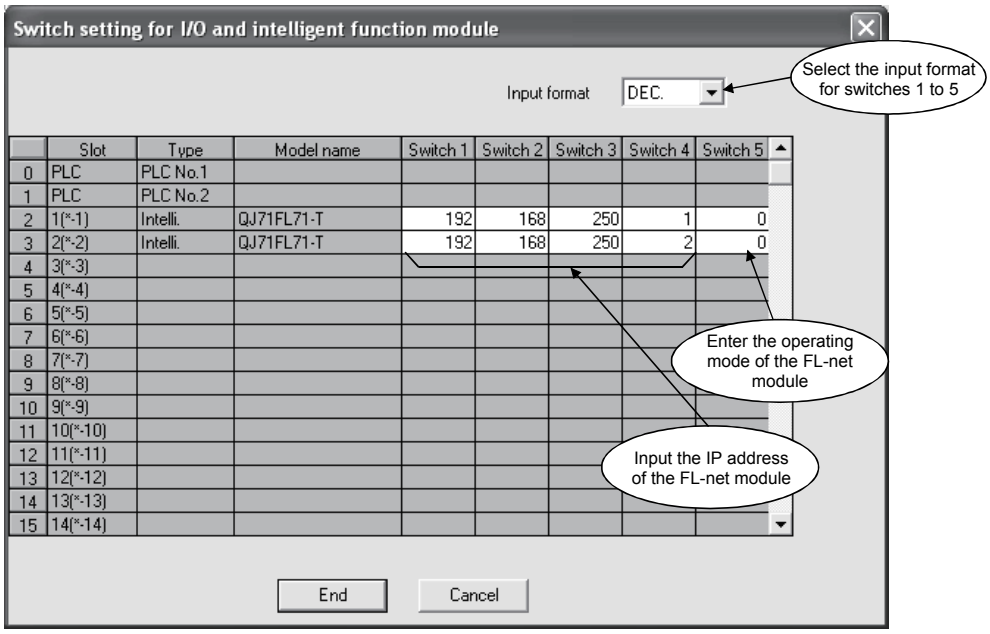
(a) Type
Select the Type of the module.
• Select "intelligent".

(b) Model name
Input the model name of the module.
• QJ71FL71-T
• QJ71FL71-B5
• QJ71FL71-B2

(c) Points
Select the number of I/O points the module has.
• Select "32 points"

(d) Start
If setting/changing the I/O assignments, input the start input/output number of the module.

(2) Intelligent function module switch setting



(a) Switch 1 to switch 4

Sets the IP address of the FL-net module.
Consult with the network manager (the person who plans the network or managers the IP addresses) about the IP address and set so that is no duplication with remote nodes.

1) Switch 1

Sets the first digit of the IP address.
If set to "No setting (Blank)", the default setting is used.
• Default value : 192

POINT
FL-net (OPCN-2) uses Class C IP address. Setting values can be set within a range from 192 to 223.

2) Switch 2

Sets the second digit of the IP address.
If set to "No setting (Blank)", the default setting is used.
• Default value : 168
• Setting range : 0 to 255

3) Switch 3

Sets the third digit of the IP address.
If set to "No setting (Blank)", the default setting is used.
• Default value : 250
• Setting range : 0 to 255

4) Switch 4

Sets the fourth digit of the IP address. (This is the node number.)
If set to "No setting (Blank)", the default setting is used.
• Default value : 1
• Setting range : 1 to 254

(b) Switch 5

This inputs the operating mode of the FL-net module.

0 : "Off line" (Default, communicate with other nodes)
1 : "Off line" (Disconnects local node)
2 : "Loopback test"
3 : "Hardware test"

(c) Input format

Select the input format for the settings.

• Decimal
• Hexadecimal (default)

REMARK

After the settings from the GX Developer have been completed (I/O assignment, switch 1 to switch 4), switch 5 is set to "online" (FL-net module operation mode) and the CPU is reset to complete the preparations for the FL-net module.
Confirmation that preparations have been completed can be performed by using the module ready signal (X1C).

ON : Preparations completed
OFF : Intelligent function module switch setting error

If the module ready signal (X1C) was left off, reset the intelligent function module switches again.

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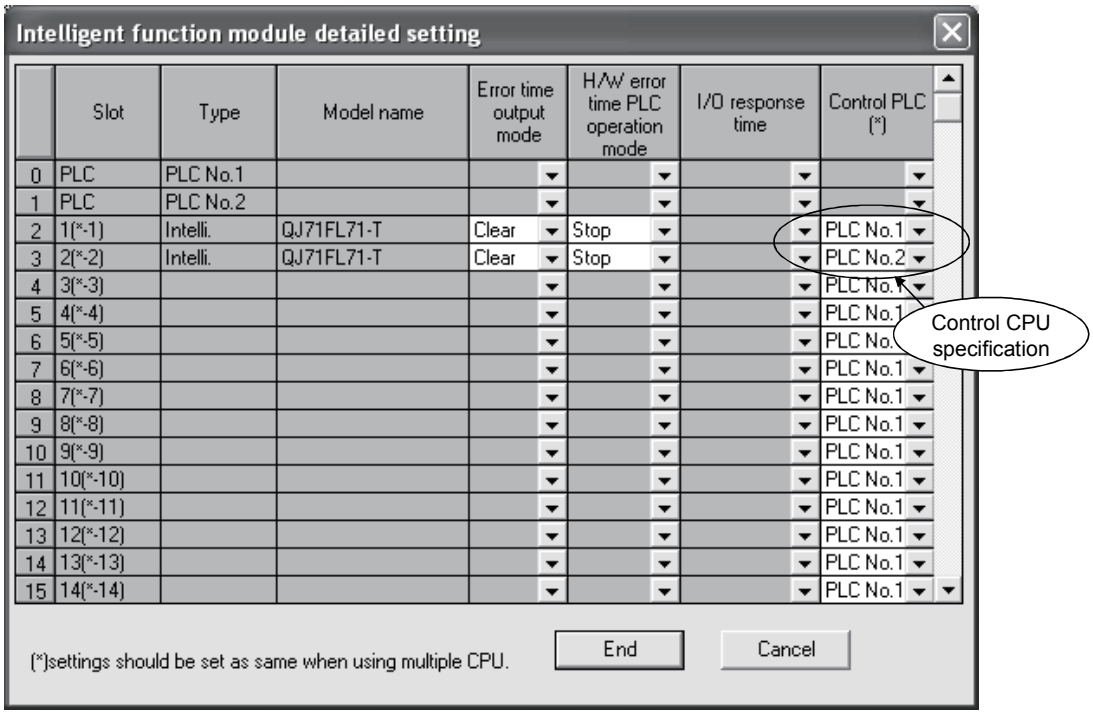
(3) Detailed settings (I/O module, intelligent function module detailed setting screen)



(a) Error time output mode

Select the output mode during errors.

• Default: "Clear"

(b) H/W error time PLC operation mode

Select the CPU operating mode during hardware error.

• Default: "Stop"

(c) Control PLC

Sets the control PLC for FL-net module with multiple PLC system.

• Default: "PLC No. 1"

REMARK

For multiple PLC systems, refer to QCPU User's Manual (Multiple CPU System).

6.4 GX Configurator-FL Package

6.4.1 GX Configurator-FL package functions

Table 6.1 shows the list of GX Configurator-FL functions.

Table 6.1 List of GX Configurator-FL functions

Item	Description	Reference
Initial settings*1	(1) Sets items for the local node network parameter area, which require initial settings. (2) The data that has been initially set is registered in the parameters for the CPU module and when the CPU is set to run status, it is automatically written to the FL-net module.	Section 6.4.8
Automatic refresh setting	(1) Sets the following areas for automatic refresh: status data bit area for the buffer memory of the FL-net module, status data word area and cyclic data area. (2) The buffer memory of the FL-net module that has been set by automatic refresh will automatically read and write to the designated device automatically when the END instruction for the CPU module is executed.	Section 6.4.9
Monitor/test	(1) Monitor - test Monitors and tests the buffer memory or input/output signal of the FL-net module. (2) Status data area Monitors the status data area data. (3) Local/other node network parameter data Monitors local/other node network parameter data.	Section 6.4.10

POINT

*1) Precaution items for initial setting
If new initial settings are performed at the GX Configurator-FL side on a system which had its initial settings performed by sequence program previously, the initial settings by the GX Configurator-FL will not be enabled.

6.4.2 Installing and uninstalling GX Configurator-FL

Refer to the GX Developer operating manual (start up section) for details about installing and uninstalling GX Configurator-FL.

6.4.3 Precautions when using

This section explains the precautions to be taken when using GX Configurator-FL.

(1) Safety first

As the GX Configurator-FL is an add-on software for use with GX Developer, read and understand the basic operating instructions and safety precautions found in the GX Developer operating manual.

(2) Installing

The GX Configurator-FL is added on and started by GX Developer (Version SW4D5-GPPW-E or later). Accordingly, install GX Configurator-FL in peripheral devices that already have GX Developer (Version SW4D5-GPPW-E or later) installed.

(3) Display screen errors with using GX Configurator-FL-net module

Due to insufficient system resources, there may be times when the screen will not be normally displayed when using GX Configurator-FL. If this should happen, close GX Configurator-FL, GX Developer (programs, etc.) and other applications and then start GX Developer and GX Configurator-FL once again.

(4) Starting GX Configurator-FL

(a) In GX Developer, select "QCPU (Q mode)" for the PLC series and set the project.
If anything other than "QCPU (Q mode)" is selected for the PLC series and project settings are not made, GX Configurator-FL will not start.

(b) Multiple operations of GX Configurator-FL can be started
Note that only one operation of GX Configurator-FL can perform the operation of [Open parameter] / [Save parameter] for intelligent function module parameters. The other GX Configurator-FL can only perform [Monitor/Test].

(5) Method for switching the screens when there are two or more GX Configurator-FL operations started

When two or more screens for GX Configurator-FL operations cannot be displayed, display the front-most screen and use the task bar of the GX Configurator-FL to change screens.

(6) About the number of parameters that can be set in GX Configurator-FL

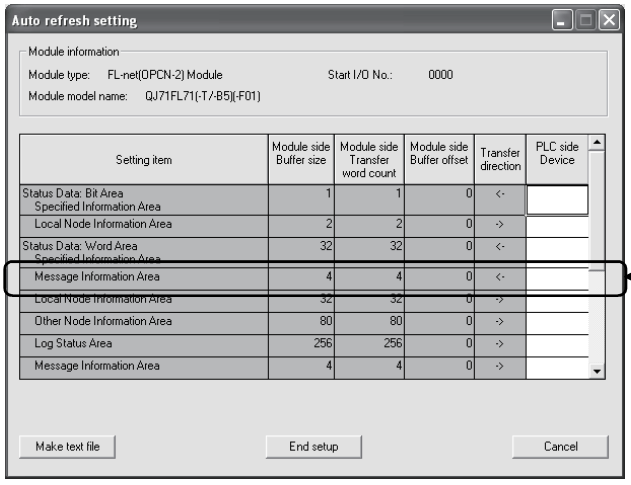
The number of parameters that can be set by the GX Configurator for an intelligent function module installed in the CPU module and in a remote I/O station of the MELSECNET/H network system is limited.

Intelligent function module installation object	Maximum number of parameter settings	
	Initial setting	Automatic refresh setting
Q00J/Q00/Q01CPU	512	256
Q02/Q02H/Q06H/Q12H/Q25HCPU	512	256
Q12PH/Q25PHCPU	512	256
MELSECNET/H remote I/O station	512	256

For example, if multiple intelligent function modules are installed in a remote I/O station, set the GX Configurator so that the number of parameter settings of all the intelligent function modules does not exceed the maximum number of parameter settings.The total number of parameter settings is calculated separately for the initial setting and for the automatic refresh setting.
The number of parameter settings that can be set for one unit in the GX Configurator-FL is as shown below.

Object Module	Initial setting	Automatic refresh setting
FL-net module	2 (Fixed)	14 (Maximum number of settings)

(Example) Counting the number of parameter settings in the automatic refresh setting



The number of settings in this one line is counted as one setting.
The number of settings is not counted by columns. Add up all the setting items in this setting screen, then add them to the total for the other intelligent function modules to get a grand total.

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6.4.4 Operating environment

The operating environment of the personal computer where the GX Configurator-FL is used is explained.

Item		Peripheral devices
Installation (Add-in) destination ＊1		Add-in to GX Developer Version 4 (English version) or later. ＊2
Computer main unit		Personal computer on which Windows® operates.
	CPU	Refer to the following table "Used operating system and performance required for personal computer".
	Required memory	
Hard disk free space	For installation	65 MB or more
	For operation	10 MB or more
Display		800 × 600 dot or more resolution
Operating system		Microsoft® Windows® 95 Operating System (English version) Microsoft® Windows® 98 Operating System (English version) Microsoft® Windows® Millennium Edition Operating System (English version) Microsoft® Windows NT® Workstation Operating System Version 4.0 (English version) Microsoft® Windows® 2000 Professional Operating System (English version) Microsoft® Windows® XP Professional Operating System (English version) Microsoft® Windows® XP Home Edition Operating System (English version)

＊1: Install the GX Configurator-FL in GX Developer Version 4 or higher in the same language.
GX Developer (English version) and GX Configurator-FL (Japanese version) cannot be used in combination, and GX Developer (Japanese version) and GX Configurator-FL (English version) cannot be used in configuration.

＊2: GX Configurator-FL cannot be used as an add-in with GX Developer Version 3 or earlier versions.

Used operating system and performance required for personal computer

Operating system	Performance Required for Personal Computer	
	CPU	Required memory
Windows® 95	Pentium® 133MHz or more	32MB or more
Windows® 98	Pentium® 133MHz or more	32MB or more
Windows® Me	Pentium® 150MHz or more	32MB or more
Windows NT® Workstation 4.0	Pentium® 133MHz or more	32MB or more
Windows® 2000 Professional	Pentium® 133MHz or more	64MB or more
Windows® XP Professional	Pentium® 300MHz or more	128MB or more
Windows® XP Home Edition	Pentium® 300MHz or more	128MB or more

POINT

New functions of Windows® XP

When Microsoft® Windows® XP Professional Operating System or Microsoft® Windows® XP Home Edition Operating System is used, the following new functions cannot be used.

If any of the following new functions is used, this product may not operate normally.

- Start of application in Windows® compatible mode of earlier version
- Fast user switching
- Remote desktop
- Big fonts (Details setting of Screen properties)

6.4.5 Common operations of GX Configurator-FL

(1) Usable control keys

The following shows the special keys and their applications that can be used during the operation of GX Configurator-FL.

Key name	Application
Esc	When entering data to a cell, this key cancels the newly entered value. Closes window.
Tab	Moves the control space within a window.
Ctrl	Used in combination with the mouse to make multiple cell selections in test selection.
Delete	Deletes the character at the position of the cursor. When selecting cells, it clears all the setting contents.
Back Space	Deletes the character at the position of the cursor.
↑ ↓ ← →	Moves the cursor.
Page Up	Moves the cursor 1 page up.
Page Down	Moves the cursor 1 page down.
Enter	Accepts the value entered in the cell.

(2) Creating data with GX Configurator-FL

The data/file shown below created using GX Configurator-FL can also be used for GX Developer operations. Refer to Fig. 6.1 to see the relationship between the data/files and the operations they can be used in.

<Intelligent function module parameters>

(a) The parameters are saved in the intelligent function module parameter file in the project for creating with GX Developer with data created using automatic refresh settings.

Project
- Program
- Parameters
  - PLC parameters
  - Network parameters
  - Intelligent function module parameters

(b) The operations shown in Fig. 6.1 are performed using the following steps.

1) Operation from GX Developer.
[Project] → [Open project] / [Save project] / [Save Project as]

2) Operation from parameter set menu selection screen of GX Configurator-FL.
[Intelligent function module parameter] → [Open parameter] / [Save parameter]

3) Operation from GX Developer
[Online] → [Read from PLC] / [Write to PLC] → "Intelligent function module parameter"
Operation can also be performed from the GX Configurator-FL parameter setting unit selection screen.
[Online] → [Read from PLC] / [Write to PLC]

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<Text file>

(a) Initial settings and automatic refresh settings are text files that can be created using the Text File Creation operation from the monitor/test screen.
These files can be used for creating user documents.

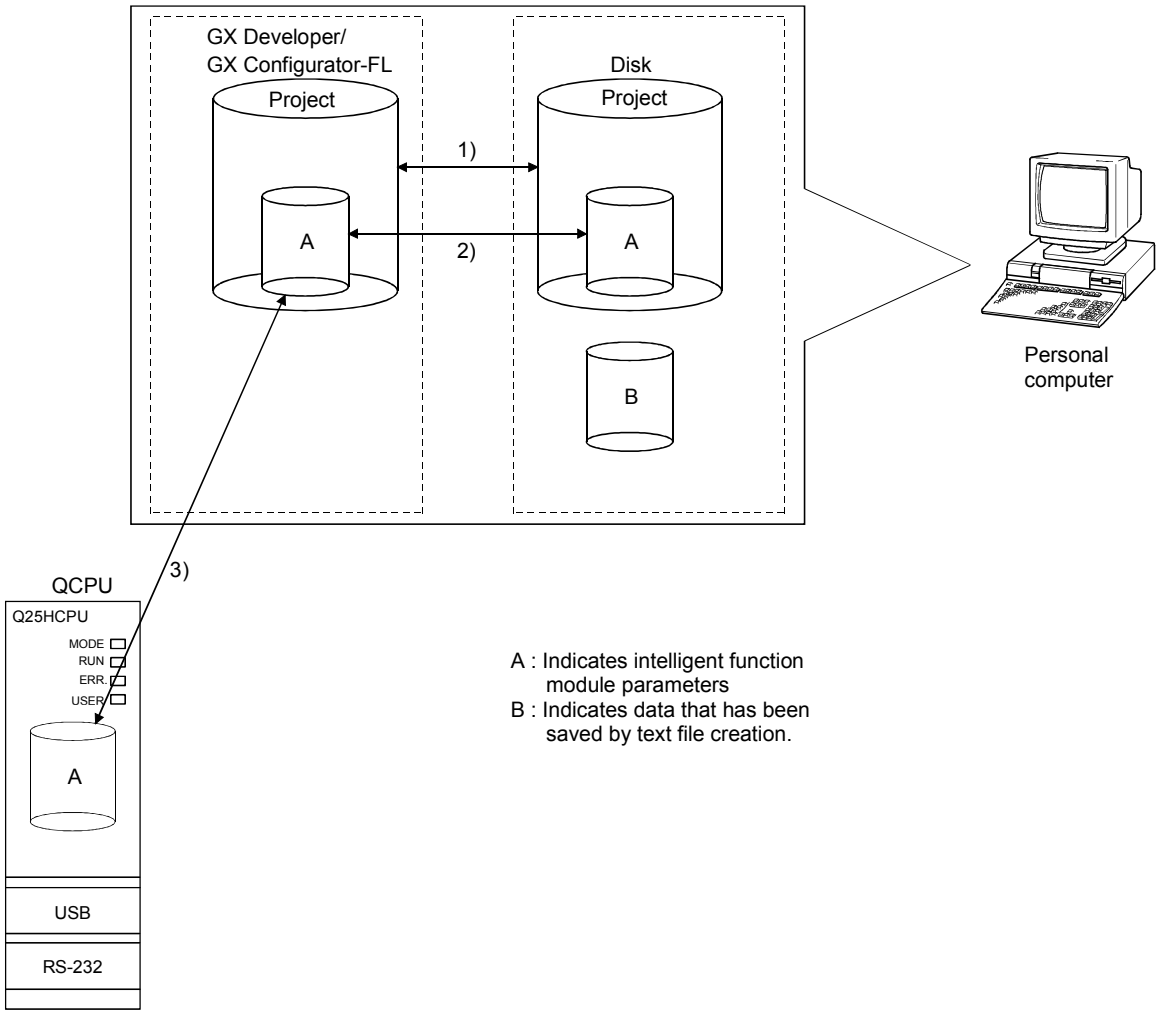

Fig. 6-1 Interrelational drawing of data created by GX Configurator-FL

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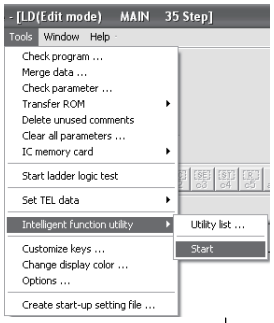
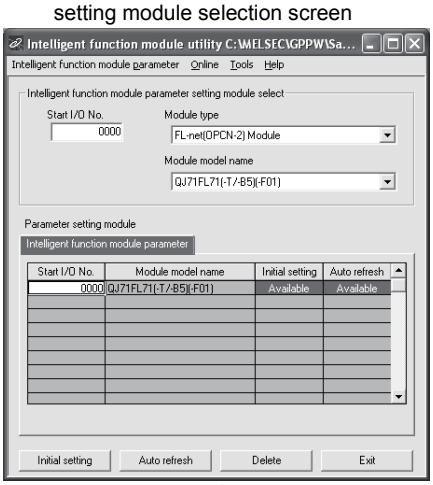
6.4.6 Summary of operations

GX Developer screen



[Tool] - [Intelligent function utility] - [Start]

Intelligent function module parameter setting module selection screen



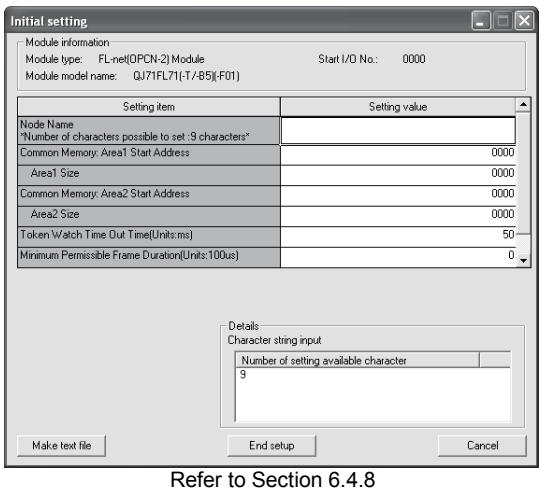
Refer to Section 6.4.7

Enter "Start I/O No.".
Select "Module type" and "Module model name".

1)

Initial settings

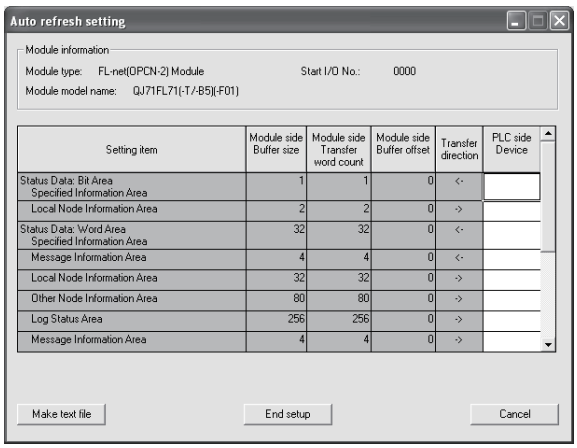
Initial setting screen



Refer to Section 6.4.8

Auto refresh

Auto refresh setting screen

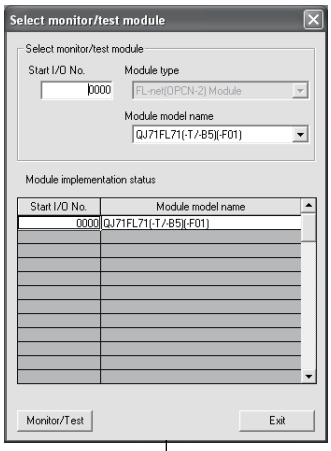


Refer to Section 6.4.9.

1)

[Online] - [Monitor/Test]

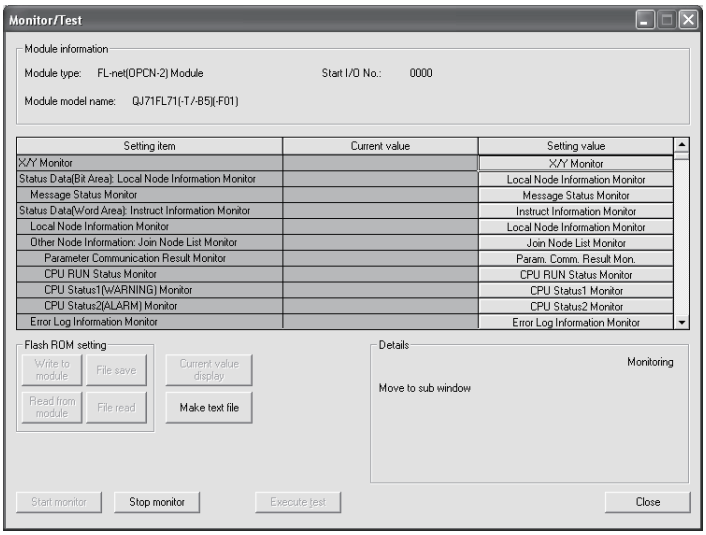
Monitor/test selection screen



Select the parameter setting module for monitor/test.

Monitor/test

Monitor/test screen



Refer to Section 6.4.9

6.4.7 Starting intelligent function module utilities

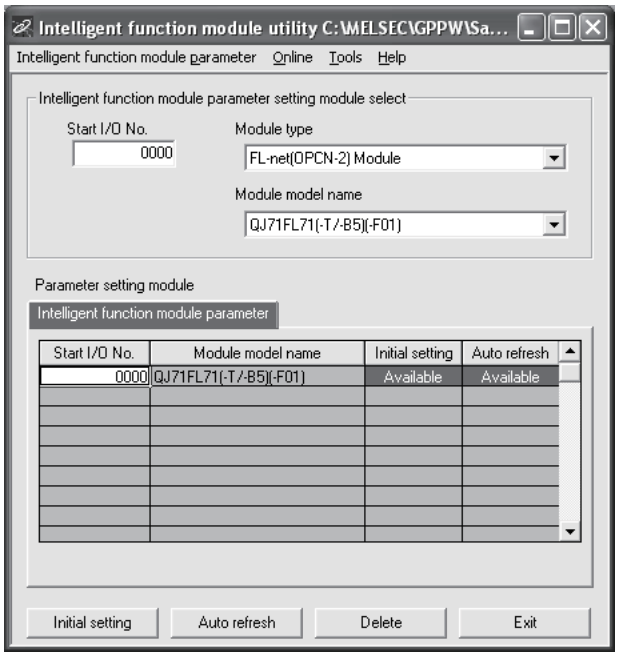
[Purpose of settings]

The intelligent function module utilities are started from GX Developer and the intelligent function module parameter setting module selection screen is displayed. From this screen, selection of the initial setting, automatic refresh setting and monitor/test module (selecting of the modules to perform monitor/test) cab be made and the screens started.

[Startup procedure]

[Tools] → [Intelligent function utilities] → [Start]

[Setting screen]



[Explanation of items]

(1) How to start each screen

(a) Initial setting starting

"Start I/O No.*"→"Module type"→"Module model name"→ Initial setting

(b) Auto refresh setting start

"Start I/O No.*"→"Module type"→"Module model name"→ Auto refresh

(c) Monitor/test module selection screen

[On line] → [Monitor/test]

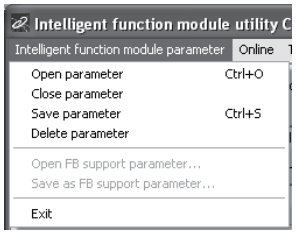
* Enter the first I/O number in hexadecimal.

(2) Introduction of screen command buttons

Delete	Deletes the initial settings for the module and the automatic refresh settings that have been selected.
Exit	Exits the intelligent function module utilities.

(3) Menu bars

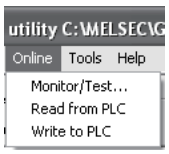
(a) File items



The project intelligent function module parameters opened with GX Developer is the object of the file operations.

[Open parameter] : Reads parameter file.
[Close parameter] : Closes the parameter file. If it has been revised, a dialog box will prompt as to whether or not the revisions are to be saved.
[Save parameter] : Saves the parameter files.
[Delete parameter] : Deletes the parameter file.
[Exit] : Exits intelligent function module utilities.

(b) On line items



[Monitor/test] : Starts the monitor / test module selection screen.
[Read from PLC] : Reads the intelligent function module parameters from the CPU module.
[Write to PLC] : Writes the intelligent function module parameters to the CPU module.

POINT

(1) Saving intelligent function module parameter files

Since files cannot be saved using the project saving operations of GX Developer, use the intelligent function module parameter setting module selection screen referenced above to save files.

(2) Reading from and writing to PLC operations for intelligent function module parameters using GX Developer

(a) After the file for the intelligent function module parameters has been saved, read from and write to PLC operations can be performed.

(b) Set the PLC CPU to be the object with GX Developer [Online] → [Transfer setup].

(c) When mounting an FL-net module to a remote I/O station, use PLC read and PLC write of GX Developer.

(3) Checking the required utility

On the intelligent function module utility setting screen, the head I/O is displayed but the type may be displayed as "*".
This indicates that the required utility has not been installed or that the utility installed cannot be started from GX Developer.
Choose [Tools] - [Intelligent function utility] - [Utility list] of GX Developer, and check and set the required utility.

6.4.8 Initial setting

[Purpose of setting]

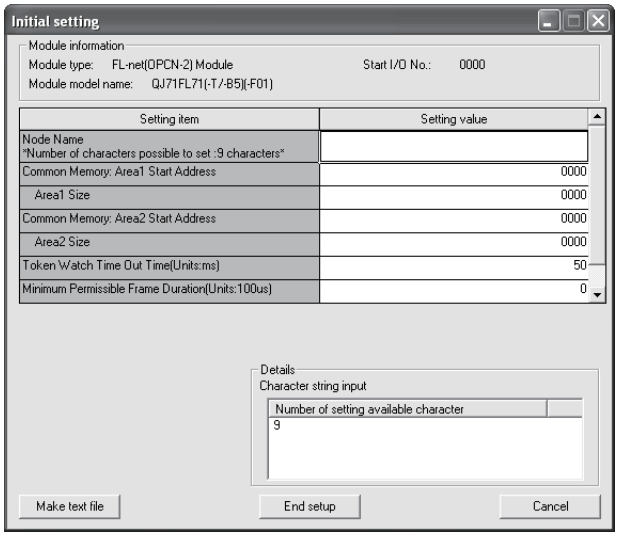
The local node network parameter area is set.
This setting eliminates the need for creating a sequence program shown in Section 6.5.1.

[Startup procedure]

"Start I/O No.*" → "Module type" → "Module model name" → Initial setting

* Enter the first I/O number in hexadecimal.

[Setting screen]



[Explanation of items]

(1) Setting items

Set data formats and allowable setting values for respective items in Setting value fields, and click the End setup button to enter the settings.

Setting item		Buffer memory address	Reference
Node Name		0 to 4H	Section 3.2.5 (3)
Common Memory	Area 1 Start Address	8H	
	Area 1 Size	9H	
	Area 2 Start Address	AH	
	Area 2 Size	BH	
Token Watch Time Out Time (Units: ms)		CH	
Minimum Permissible Frame Duration (Units: 100us)		DH	
Message Data Unit Select		EH	

(2) Introduction of command buttons

Make text file	Creates a file of the contents of the screen in text file format.
End setup	Retains settings made and ends.
Cancel	Eliminates the settings made and ends.

POINT

This initial setting is stored in the intelligent function module parameters.
After being written to the CPU module, the initial settings are enabled by either of the following operation (1) or (2).

(1) Turn the RUN/STOP switch of the CPU module from STOP → RUN → STOP → RUN.

(2) After setting the RUN/STOP switch to RUN, turn the power OFF and then ON or reset the CPU module.

When the contents of the initial settings are written by the sequence program, the values of the initial setting parameters are written when the CPU module changes from STOP status to RUN status. Accordingly, program the sequence program so that the initial settings are re-executed.

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6.4.9 Automatic refresh setting

[Purpose of settings]

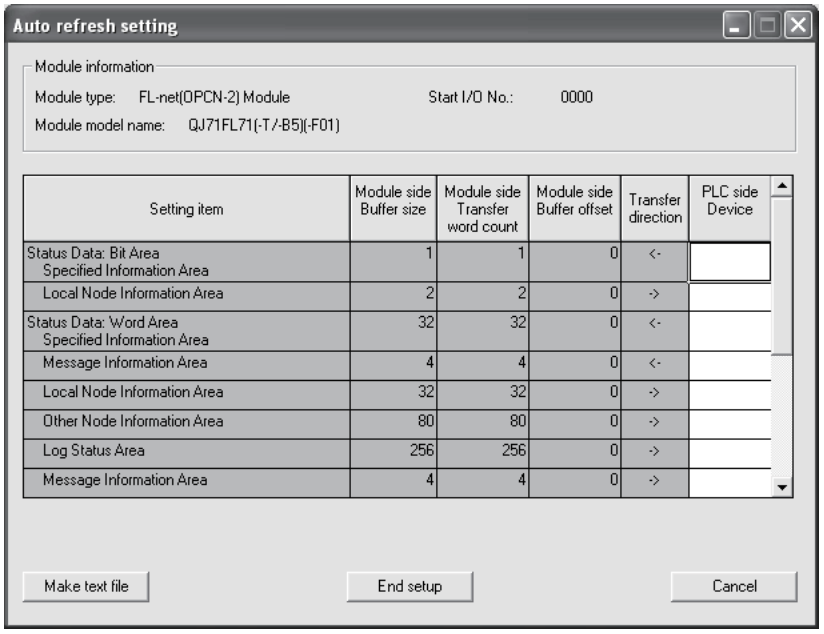
This setting is made for automatic data transfer between the FL-net module buffer memory and the PLC CPU devices.
By this setting, cyclic data can be automatically transferred between the FL-net module and PLC CPU devices.

[Startup procedure]

"Start I/O No.*" → "Module type" → "Module model name" → Auto refresh

* Enter the first I/O number in hexadecimal.

[Setting screen]



[Explanation of items]

(1) Setting items

Setting item		Buffer memory address	Reference
Status Data: Bit Area	Specified Information Area	900H	Section 3.2.6 (1)(a)
	Local Node Information Area	904 to 905H	Section 3.2.6 (1)(b)
Status Data: Word Area	Specified Information Area	980 to 99FH	Section 3.2.6 (2)(a)
	Message Information Area	9A0 to 9A3H	Section 3.2.6 (2)(b)
	Local Node Information Area	9C0 to 9DFH	Section 3.2.6 (2)(c)
	Other Node Information Area	9E0 to A2FH	Section 3.2.6 (2)(d)
	Log Status Area	A80 to B7FH	Section 3.2.6 (2)(e)
	Message Information Area	C00 to C03H	Section 3.2.6 (2)(f)
Cyclic Data: Area 1	Local Node Area	1C00 to 1DFFH	Section 3.2.5 (3)(g) This section (4)
	Other Node Area		
	Other Node Area		
Cyclic Data: Area 2	Local Node Area	2000 to 3FFFH	
	Other Node Area		
	Other Node Area		

(2) Contents of screen display

Item	Description
Module side Buffer size	Displays the buffer memory size for each setting item.
Module side Transfer word count (Input in decimal)	Set the number of data transferred between the module side buffer memory and the CPU side devices in units of words.
Module side Buffer offset (Input in decimal)	Set the transfer destination of the module side buffer memory with an offset value from the start address of each setting item.
Transfer direction	Shows the data transfer direction. [<-] : Module side buffer memory ← PLC side device [->] : Module side buffer memory → PLC side device
PLC side Device	Set the start device on the CPU side to which data are transferred. Available devices are as follows: • CPU module: X, Y, M, L, B, T, C, ST, D, W, R, ZR • MELSECNET/H remote I/O station: X, Y, M, B, D, W When using bit device X, Y, M, L or B, set a number divisible by 16 points (e.g. X10, Y120, M16). Buffer memory data are stored into an area of 16 points starting from the specified device number. For example, if X10 is set, data are stored in X10 to X1F.

(3) Explanation of command buttons

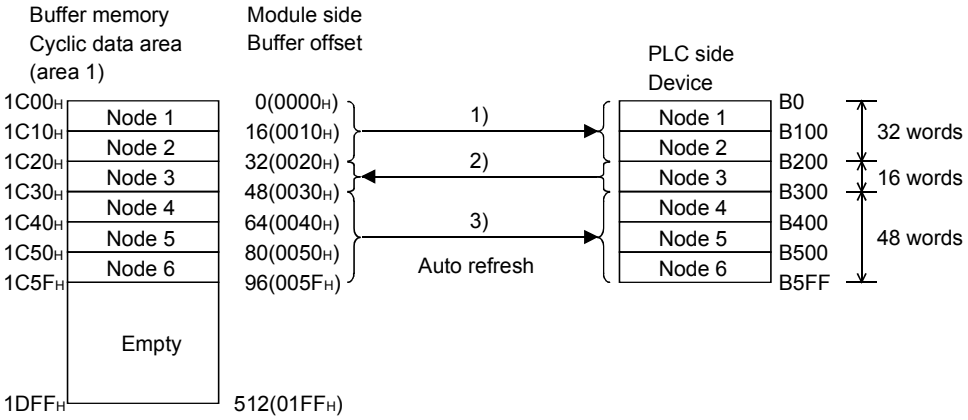
[Make text file]	Creates a file of the contents of the screen in text file format.
[End setup]	Retains settings made and ends.
[Cancel]	Eliminates the settings made and ends.

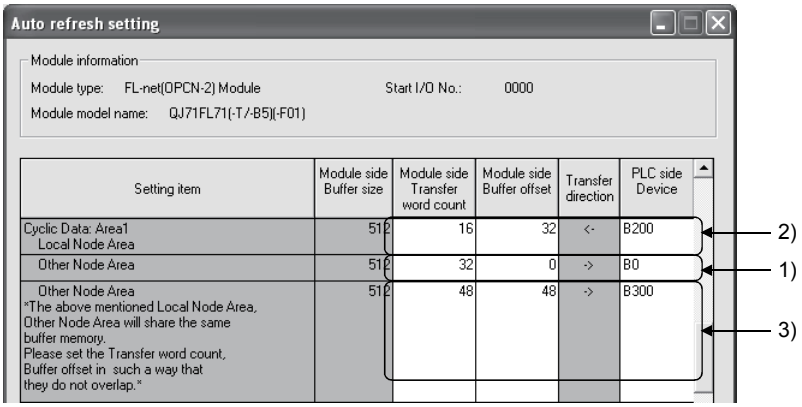
POINT

This automatic refresh setting is stored in the intelligent function module parameters.
After writing the intelligent function module parameter to the CPU module, the automatic refresh settings are enabled by setting the RUN/STOP switch to STOP → RUN → STOP → RUN or by the resetting of the CPU module.
The automatic refresh settings cannot be changed from the sequence program. However, using the FROM/TO instructions of the sequence program can be used to add a process similar to automatic refresh.

(4) Cyclic data area setting example

The following shows a setting example of the cyclic data area (area 1) when the local node is node 3.





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6.4.10 Monitor/test

[Purpose of settings]

The buffer memory monitor/test, input/output signal monitor/test and local/remote node parameter data monitor are started from this screen.

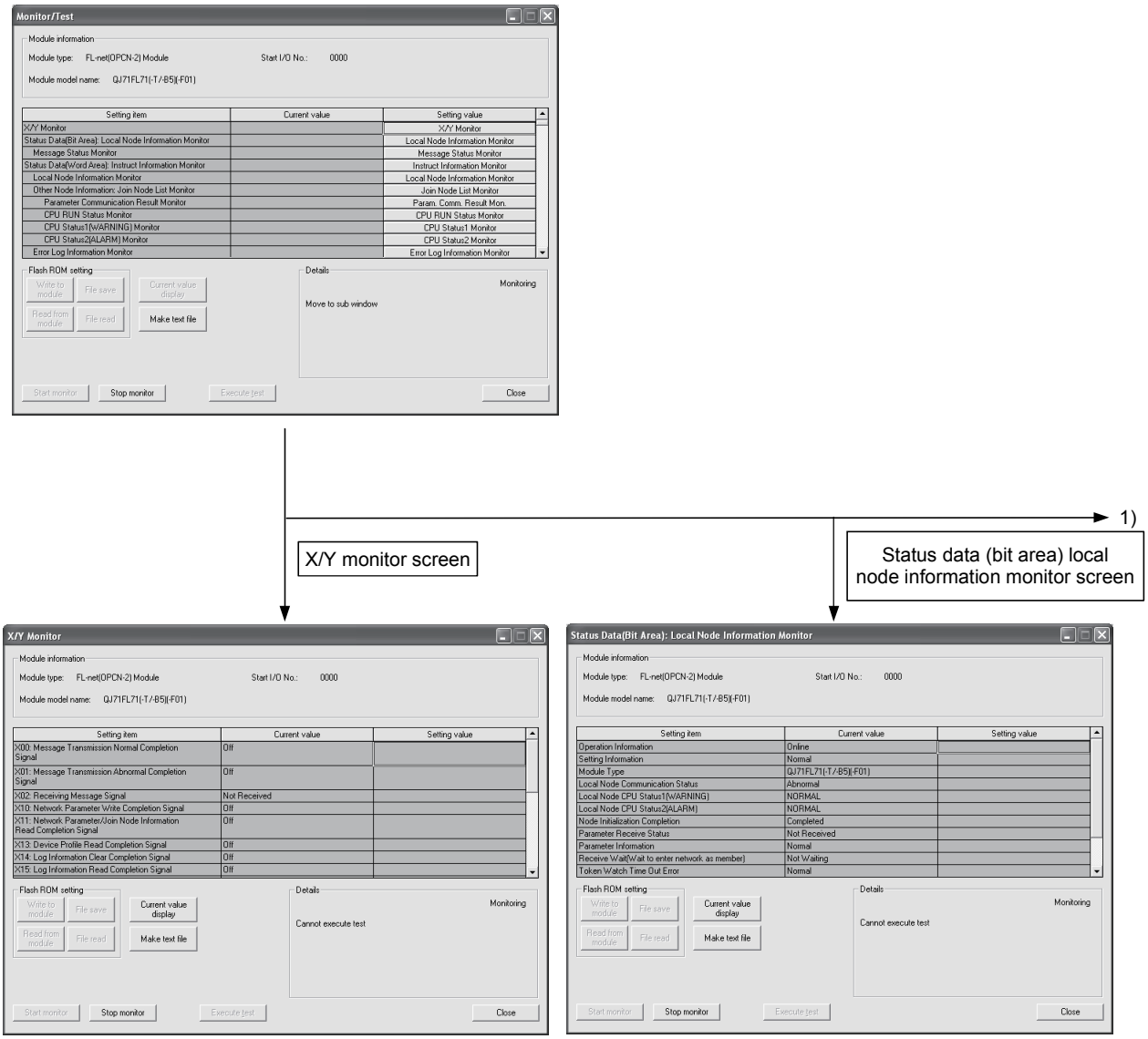
[Startup procedure]

Monitor/test module selection screen → "Start I/O No.*" → "Module type" → "Module model name" → Monitor/test

* Enter the first I/O number in hexadecimal.

This screen can be activated from System monitor of GX Developer Version6 or later. (Refer to the GX Developer Operating Manual.)

[Setting screen]



Refer to Section 3.2.4

Refer to Section 3.2.6(1)(b)

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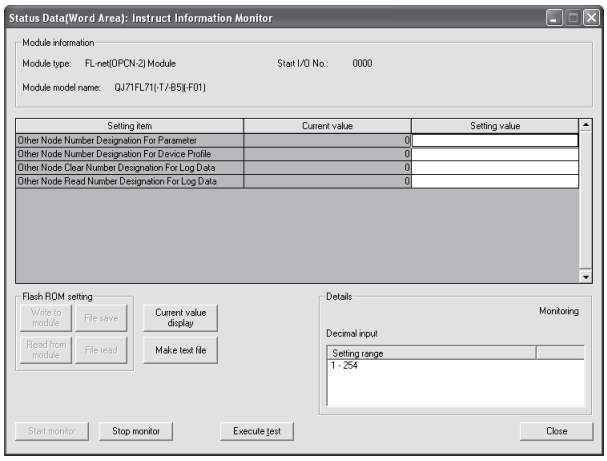
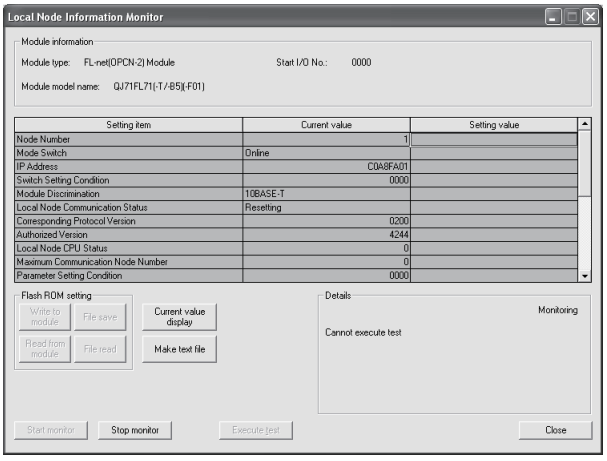
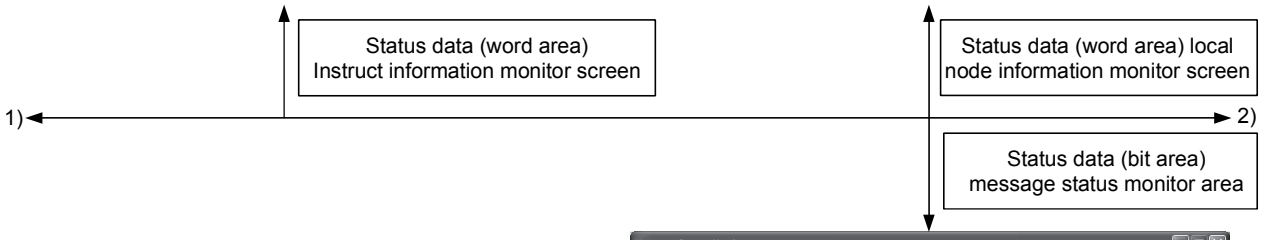
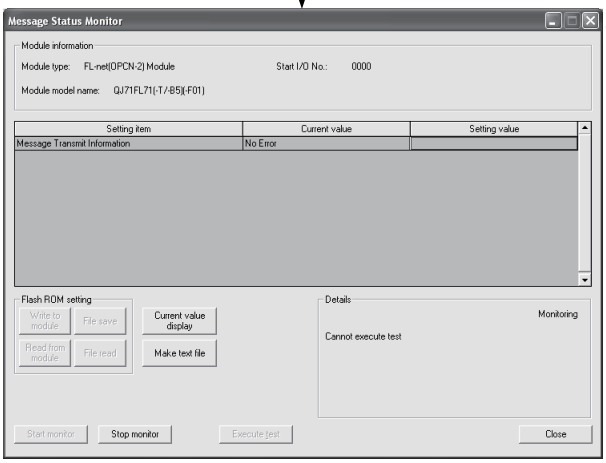


Refer to Section 3.2.6(2)(a)

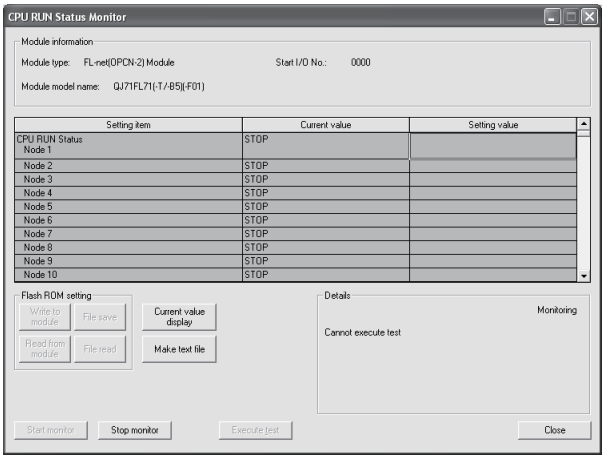


Refer to Section 3.2.6(2)(c)

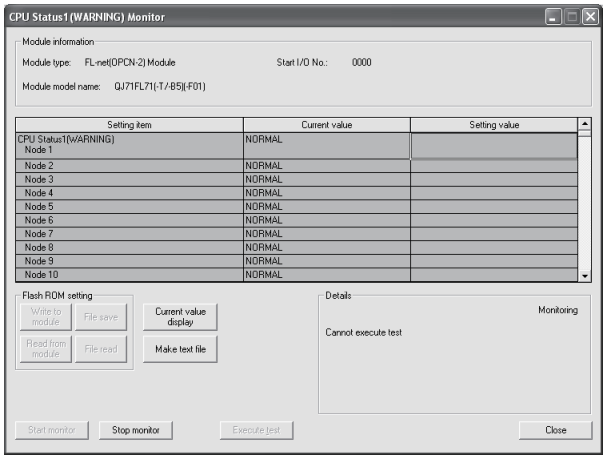




Refer to Section 3.2.6(1)(b)



Refer to Section 3.2.6(2)(b)



Refer to Section 3.2.6(2)(b)

Status data (word area)
other node data :
CPU RUN status monitor screen

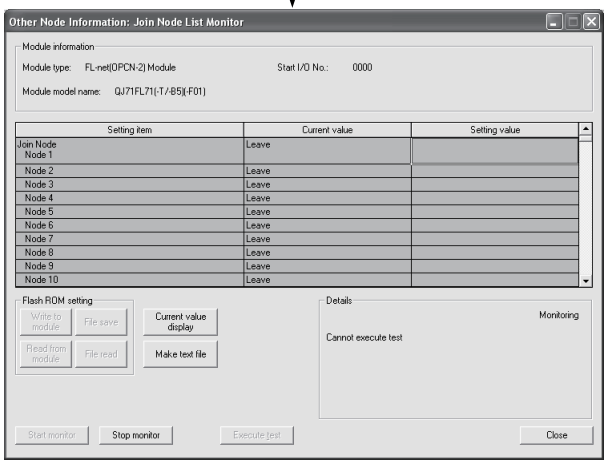
Status data (word area)
other node data : CPU status 1
(WARNING) monitoring screen

2)

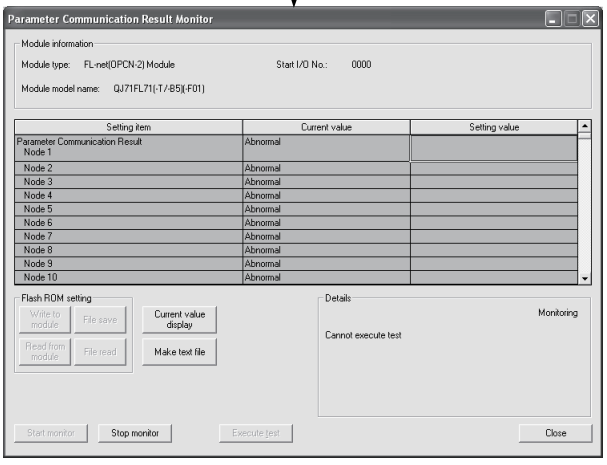
3)

Status data (word area)
other node data :
Join node list monitor screen

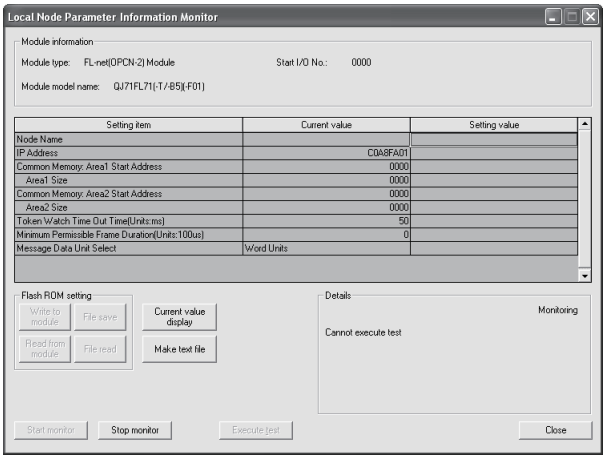
Status data (word area)
other node data : parameter
communication result monitor screen



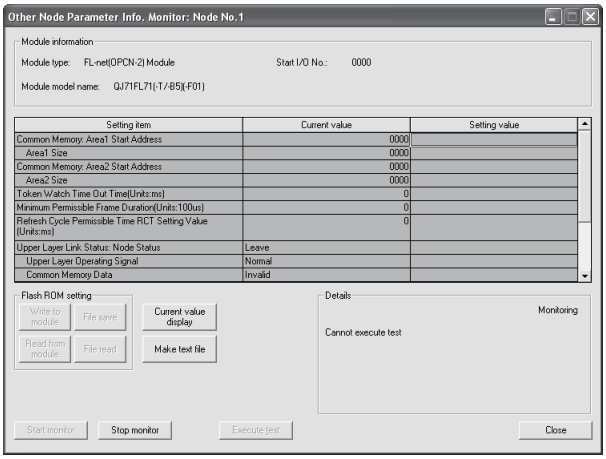
Refer to Section 3.2.6(2)(b)



Refer to Section 3.2.6(2)(b)



Refer to Section 3.2.5(3)(a)



Refer to Section 3.2.5(3)(b)

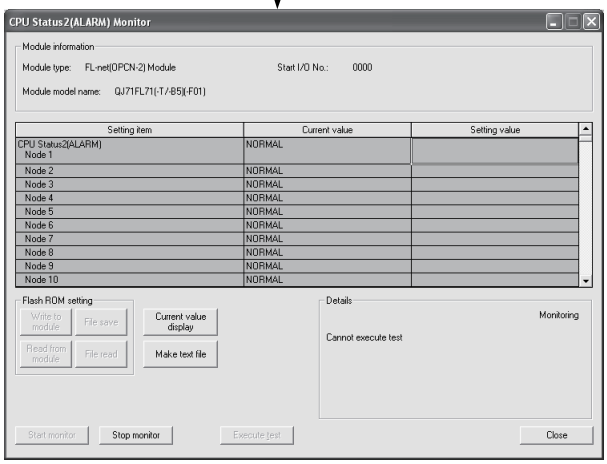
3)

Local node parameter information monitor screen

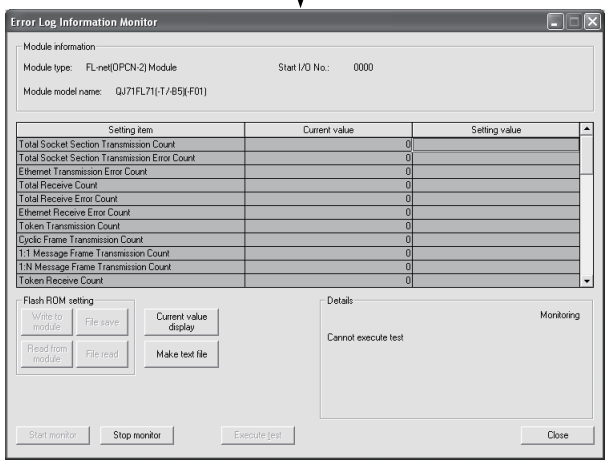
Other node parameter info. monitor screen

Status data (word area) other node data : CPU status 2 (ALARM) monitor screen

Status data (word area) error log data monitor screen



Refer to Section 3.2.6(2)(d)



Refer to Section 3.2.6(2)(e)

[Explanation of items]

(1) Contents of screen display

Setting items : Shows the input/output signal or buffer memory names.
Current value : Monitors the input/output signal status or the current value of the buffer memory.
Setting value : Input or selection of write data in test operations.

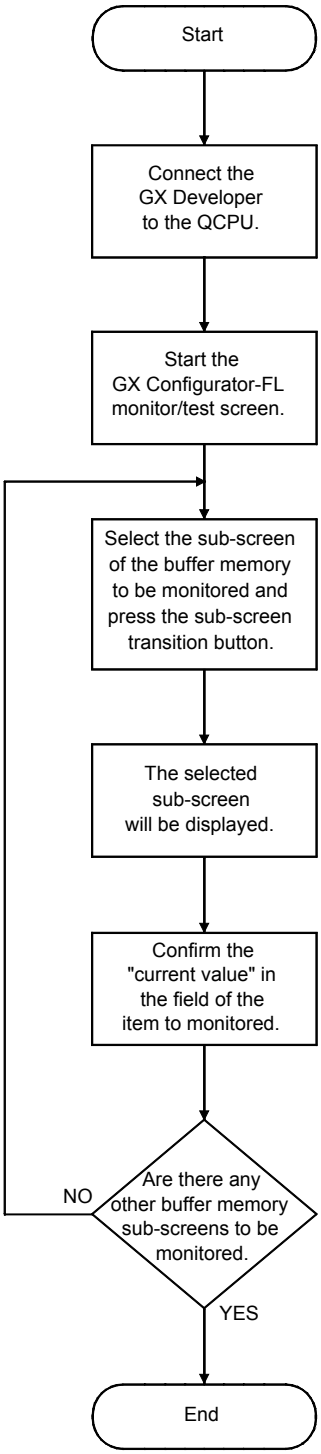
(2) Explanation of command buttons

Current value display	Displays the current value of the item selected. (This would be used to confirm characters that could not be displayed in the current value field. However, there are no items in this package that cannot be shown in the display field.)
Make text file	Creates a file of the contents of the screen in text file format.
Start monitor / Stop monitor	Select whether or not to monitor the current value field.
Execute test	Performs a test of the items that have been selected. Select multiple items by using the CTRL key during the selection.
Close	Closes the current screen and returns to the previous screen.

POINT

If test selection operations are performed on a setting that has been deleted (blank setting value) using the Delete key, "Finished" will appear but writing is not performed.

(3) Steps for monitoring the buffer memory



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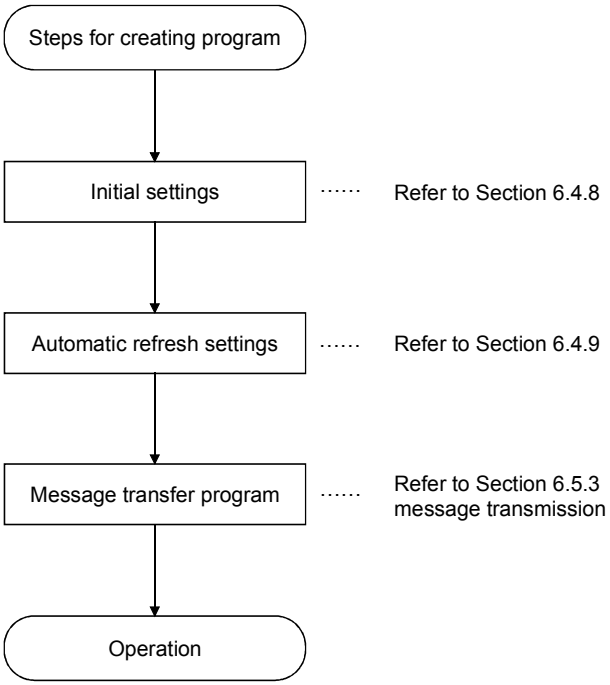
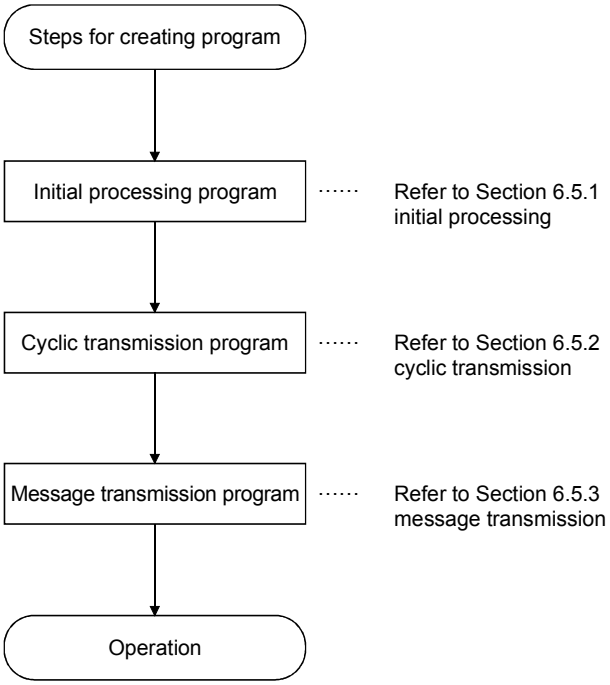
6.5 Programming

This section explains the programming for communicating using the FL-net module. When applying the following program examples to the actual system, make sure to examine the applicability and confirm that it will not cause system control problems.

(1) If using GX Configurator-FL



(2) If not using GX Configurator-FL

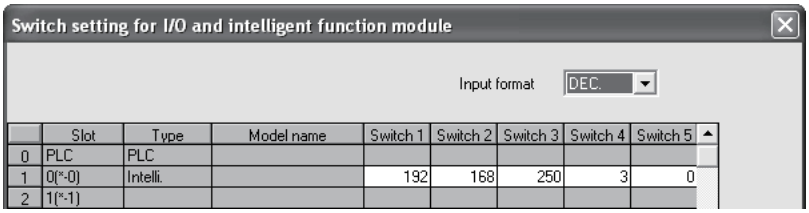


POINT

Also refer to Appendix 10 for programming performed when the FL-net module is mounted on the MELSECNET/H remote I/O station.

REMARK

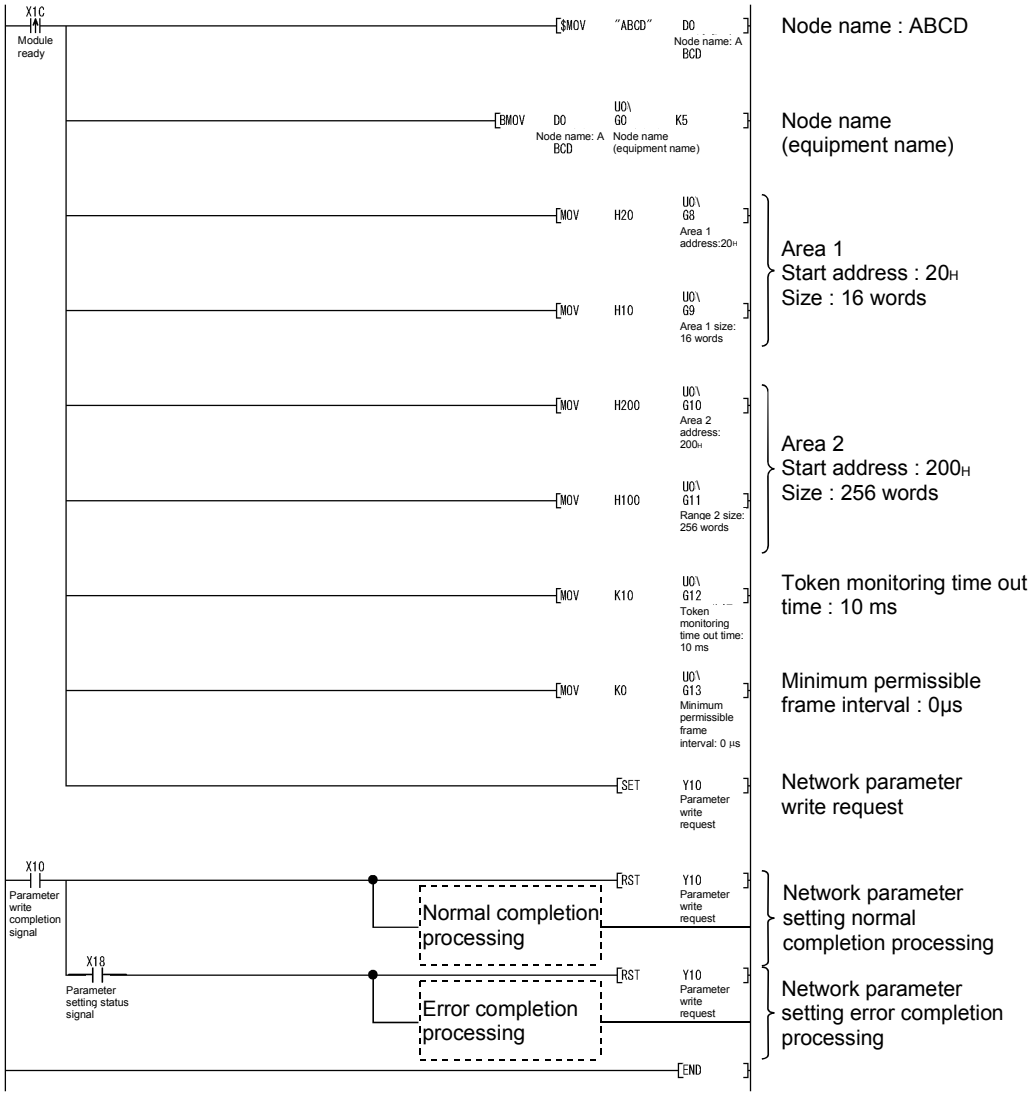
This item presents the environment for executing the program.
Local node number : Node 03
I/O assignment (Qn (H) parameter setting screen)
Classification : Intelligent
Model name : QJ71FL71-T
Number of points : 32 points
First XY : 0 (Occupies X/Y00 to X/Y01F)
Intelligent function module switch setting
Switch 1 : 192
Switch 2 : 168
Switch 3 : 250
Switch 4 : 3
Switch 5 : 0



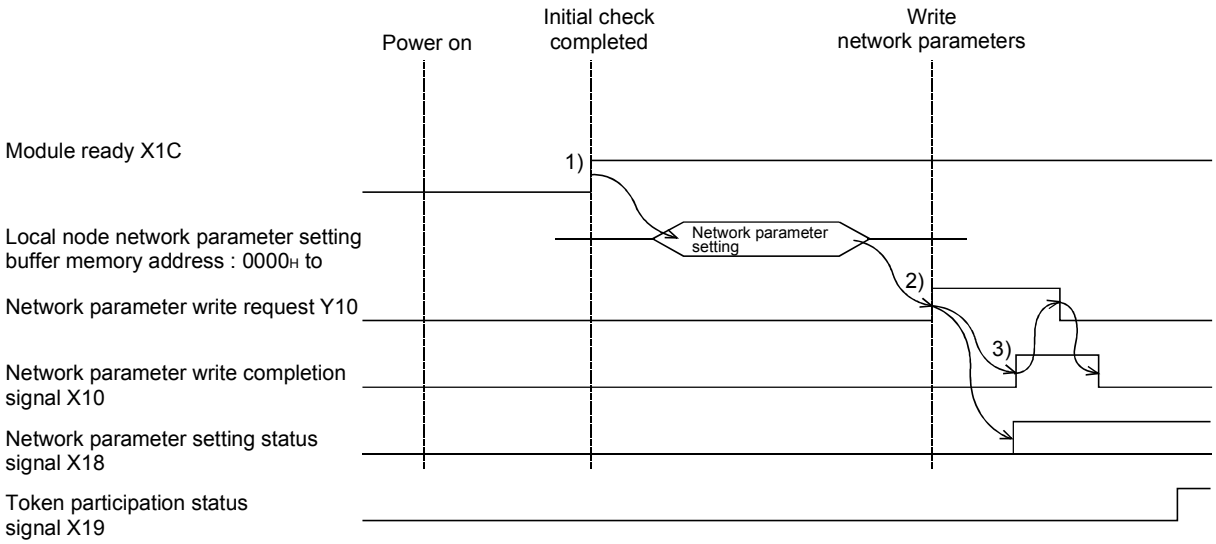
6.5.1 Initial processing

This section explains the initial processing of the FL-net module.
The local node network parameter area is set.

<<Initial processing>>



POINT
The local node network parameter area can be set in Initial setting of GX Configurator-FL. (Refer to Section 6.4.8.) The initial setting on GX Configurator-FL eliminates the need for creating the sequence program shown here.


Power on
Initial check completed
Write network parameters
Module ready X1C
1)
Local node network parameter setting buffer memory address : 0000H to
Network parameter setting
2)
Network parameter write request Y10
3)
Network parameter write completion signal X10
Network parameter setting status signal X18
Token participation status signal X19

1) After turning the power on, confirm that the initial check of the FL-net module has completed normally.
<Normal completion>
• Module ready (X1C) :ON
<Error completion>
• Module ready (X1C) :OFF
If there is an error completion, the settings for the FL-net module switches have to be reset.
(Refer to Section 6.3.2.(2))

2) After setting the local node network parameter area data into the buffer memory (Address: 0000_H to …), turn ON the network parameter write request (Y10).

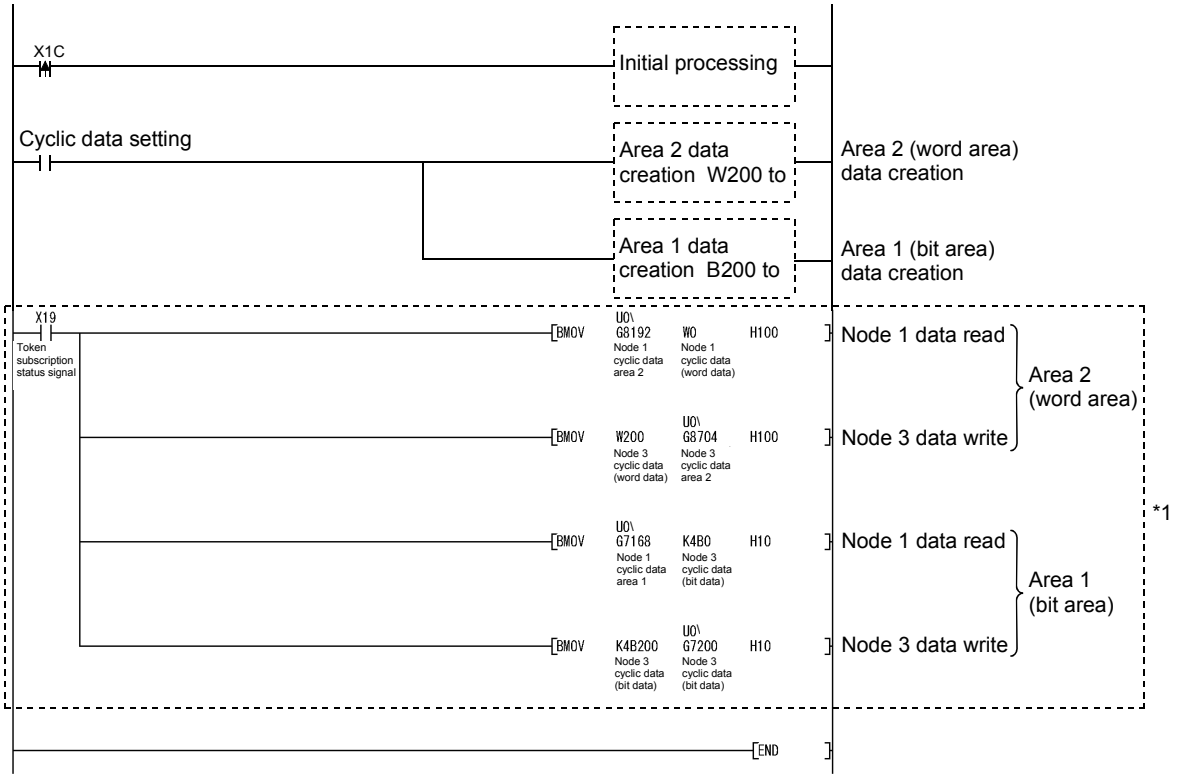
3) Confirm network parameter write completion.
<Normal completion>
• Network parameter write completion signal (X10) : ON
• Network parameter setting status signal (X18) : OFF
• Network parameter setting status : 0
(Buffer memory address: $9D2_H$)
The FL-net module is participating in the token.
(Token participation status signal (X19) : ON)
<Error completion>
• Network parameter write completion signal (X10) : ON
• Network parameter setting status signal (X18) : ON
• Network parameter setting status : Other than 0
(Buffer memory address : $9D2_H$)
During error ending, after revising the network parameter by using the error code that is stored in the network parameter setting status, perform the initial processing once again. Refer to Section 8.5.2 for more information about the error codes.

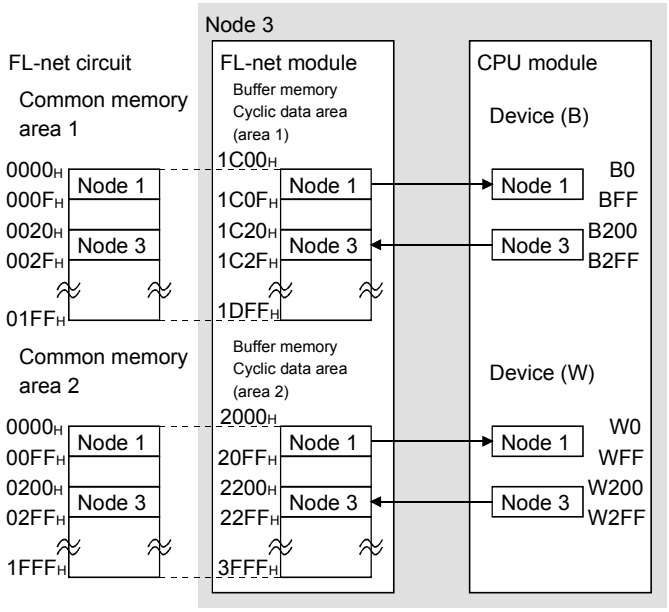
After confirming that the network parameter write completion signal (X10) is ON, the network parameter write request (Y10) is set to OFF.

POINT
Since the node name is set optionally, there will be no problems if the initial processing is performed without it.

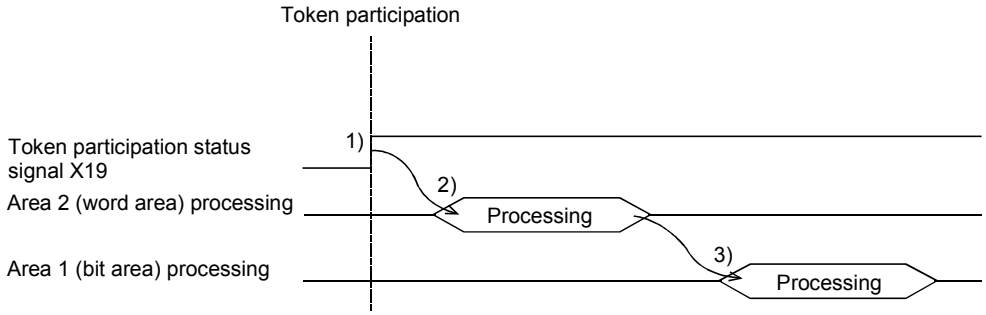
6.5.2 Cyclic transmission

This section explains communication using the cyclic transmission of the FL-net module.





POINT
The auto refresh setting on GX Configurator-FL eliminates the need for creating the section marked with *1 of the above sequence program. (Refer to Section 6.4.9.)



1) Confirms that the FL-net module token participation status signal (X19) is ON.

2) Data processing for area 2 (word area).

3) Data processing for area 1 (bit area).

POINT

(1) Perform the data processing in the following sequence : area 2 (word area) → area 1 (bit area).

(2) Arrange so that node unit assurance for area 2 (word area) is interlocked by bit from area 1 (bit area).
For an interlock program example, refer to Section 6.2.7 (4) (c).

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6.5.3 Message transmission

This section explains communication using the FL-net module message transmission.

(1) Network parameter/participation node data read

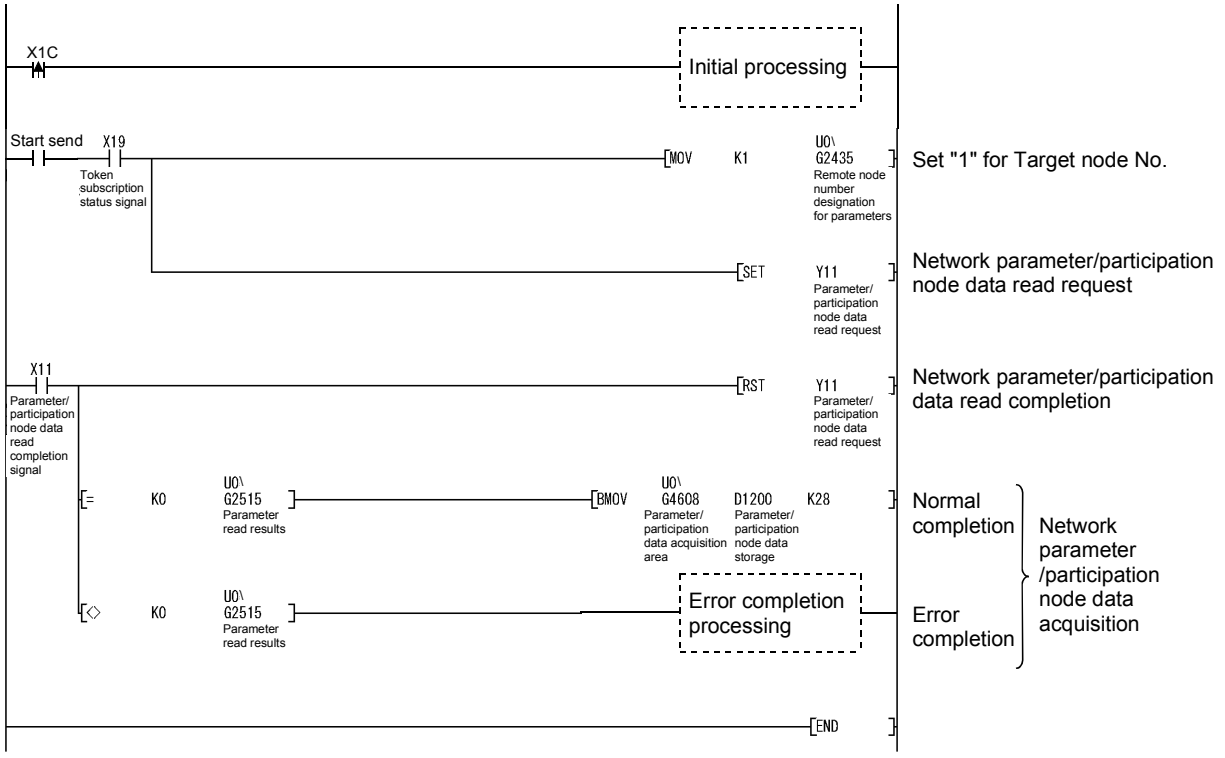
The following explains the network parameter/participation node data read command.

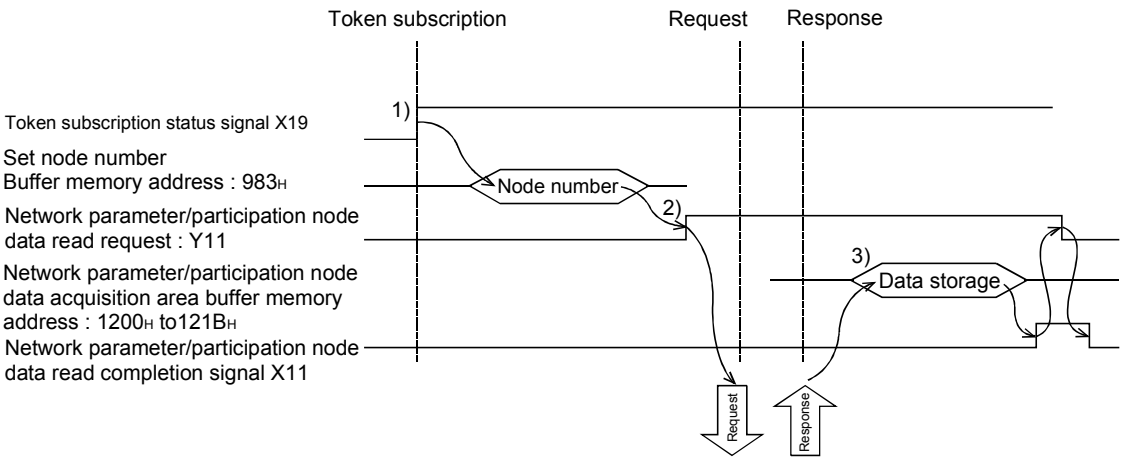
POINT

The switching of Network parameter/participation node data read is determined by buffer memory address 983H . . . b15. (Refer to Section 3.2.6.(2))

0 : Network parameter data read

1 : Participation node data read





1) Confirms that the FL-net module token participation status signal (X19) is ON.

2) After setting the object node number to the buffer memory (address : 983_H), the network parameter/participation node data read request (Y11) is set to ON.
The FL-net module reads the network parameter for the object node.

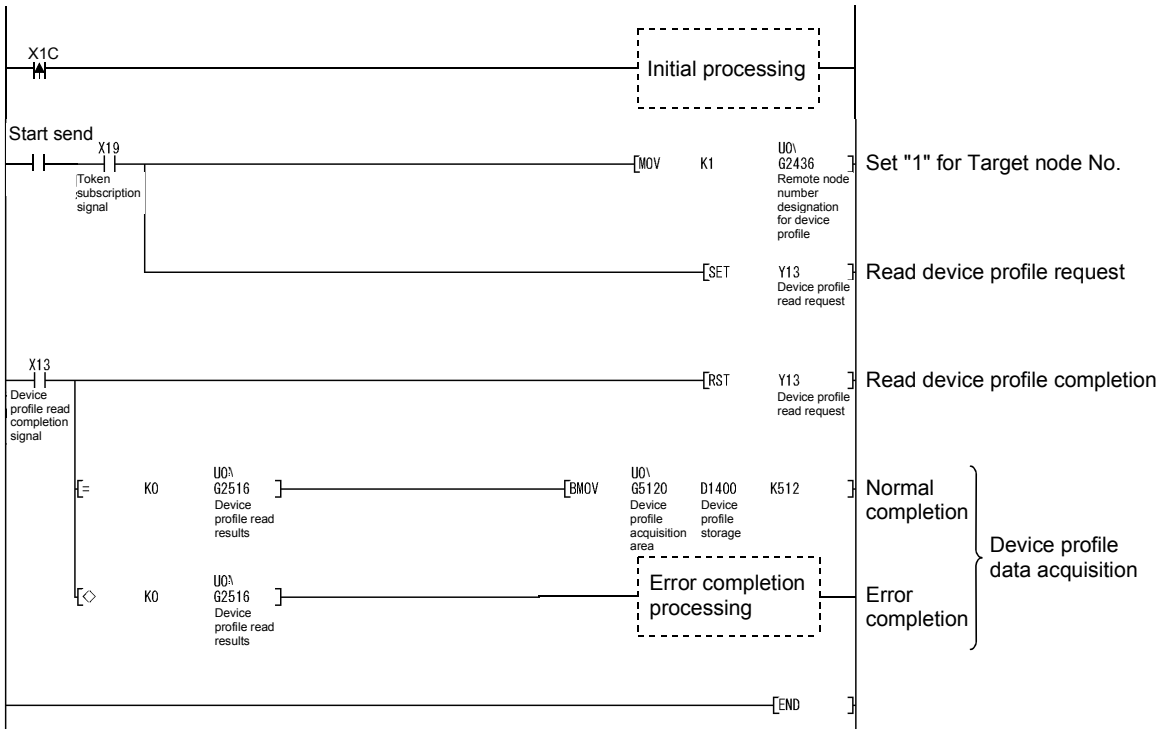
3) The FL-net module stores the network parameter data for the object node in the buffer memory (address : 1200_H to $121B_H$).

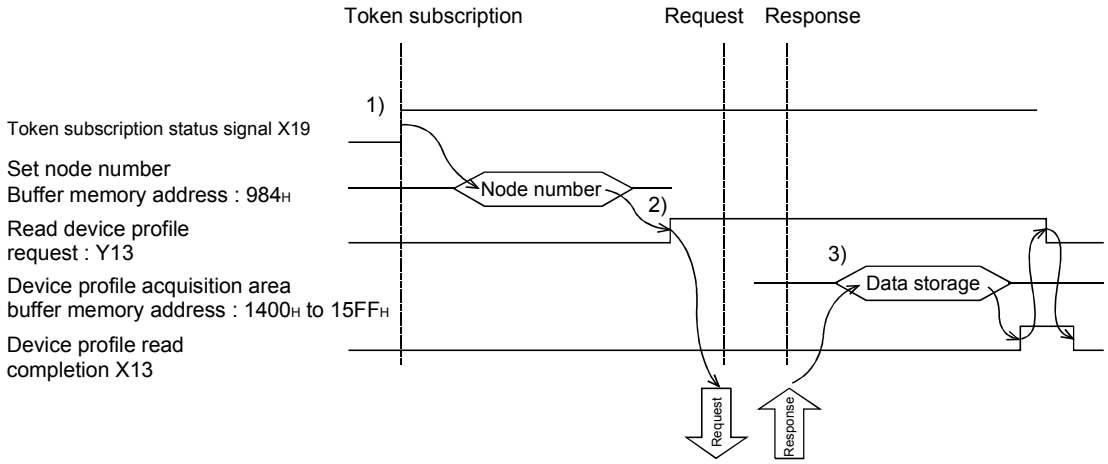
4) Confirms network parameter read completion.
<Normal completion>
• Network parameter/participation node data read completion signal (X11) : ON
• Network parameter read results : 0
(Buffer memory address : $9D3_H$)
<Error completion>
• Network parameter/participation node data read completion signal (X11) : ON
• Network parameter read results : Other than 0
(Buffer memory address : $9D3_H$)
When there is an error completion, after revising the network parameter/program using the error code that is stored in the network parameter read results, execute the network parameter read command once again. Refer to Section 8.5.2 for information about error codes.

After confirming that the network parameter/participation node data read completion signal (X11) is ON, the network parameter/participation node data read request (Y11) is set to OFF.

(2) Device profile read

The following explains the device profile read command.





1) Confirms that the FL-net module token participation status signal (X19) is ON.

2) After setting the object node number to the buffer memory (address : 984_H), the device profile read request (Y13) is set to ON. The FL-net module reads the parameters for the object node.

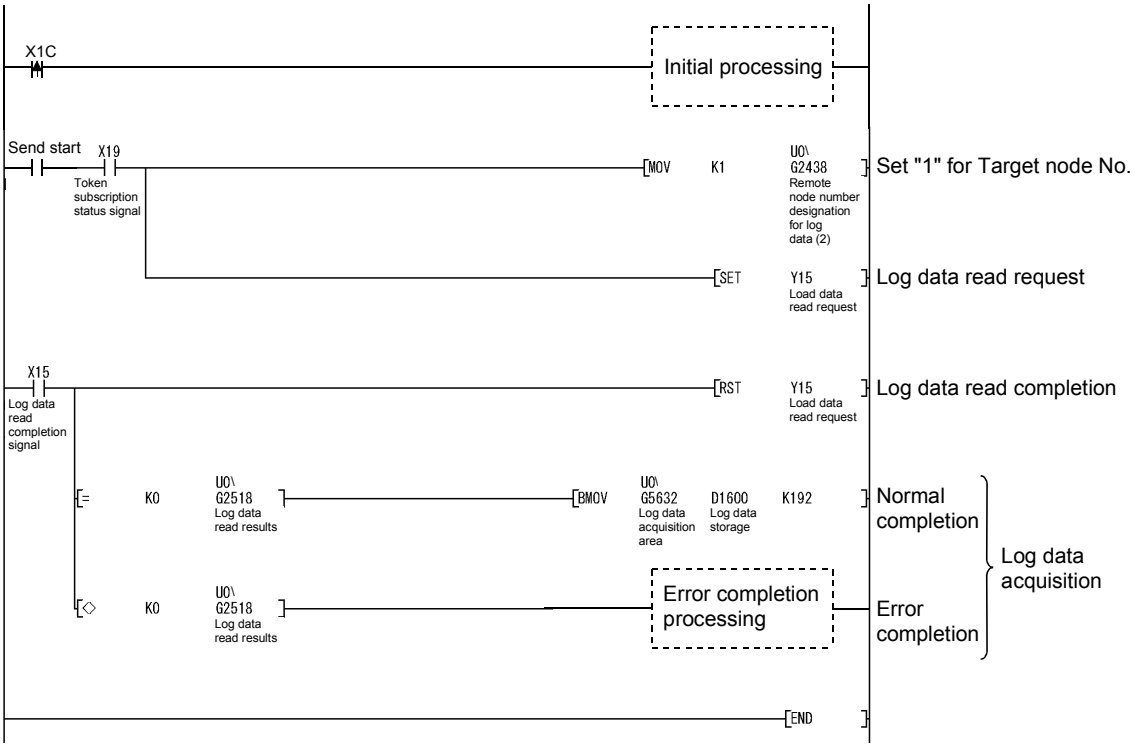
3) The FL-net module stores the device profile data for the object node in the buffer memory (address : 1400_H to $15FF_H$).

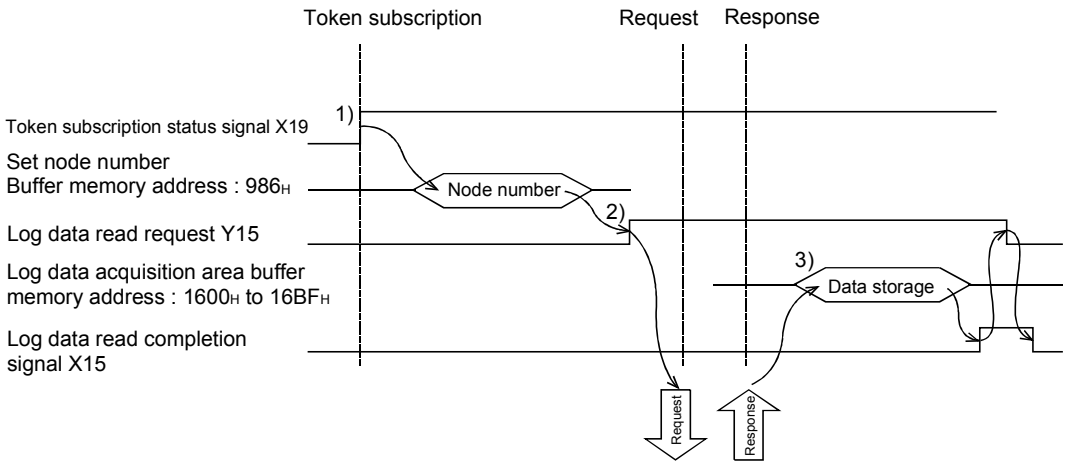
4) Confirms device profile read completion.
<Normal completion>
• Device profile read completion signal (X13) : ON
• Device profile read results : 0
(Buffer memory address : $9D4_H$)
<Error completion>
• Device profile read completion signal (X13) : ON
• Device profile read results : Other than 0
(Buffer memory address : $9D4_H$)
When there is an error completion, after revising the parameter/program using the error codes that are stored in the device profile read results, execute the device profile read command once again. Refer to Section 8.5.2 for information about error codes.

After confirming that the device profile read completion signal (X13) is ON, the device profile read request (Y13) is set to OFF.

(3) Log data read

The following explains the log data read command.





1) Confirms that the FL-net module token participation status signal (X19) is ON.

2) After setting the object node number to the buffer memory (address: 986_H), the log data read request (Y15) is set to ON. The FL-net module reads the parameters for the object node

3) The FL-net module stores the log data for the object node in the buffer memory (address; 1600_H to $16BF_H$).

4) Confirms log data read completion.

<Normal completion>

- Log data read completion signal (X15) : ON
- Log data read results : 0
  (Buffer memory address : $9D6_H$)

<Error completion>

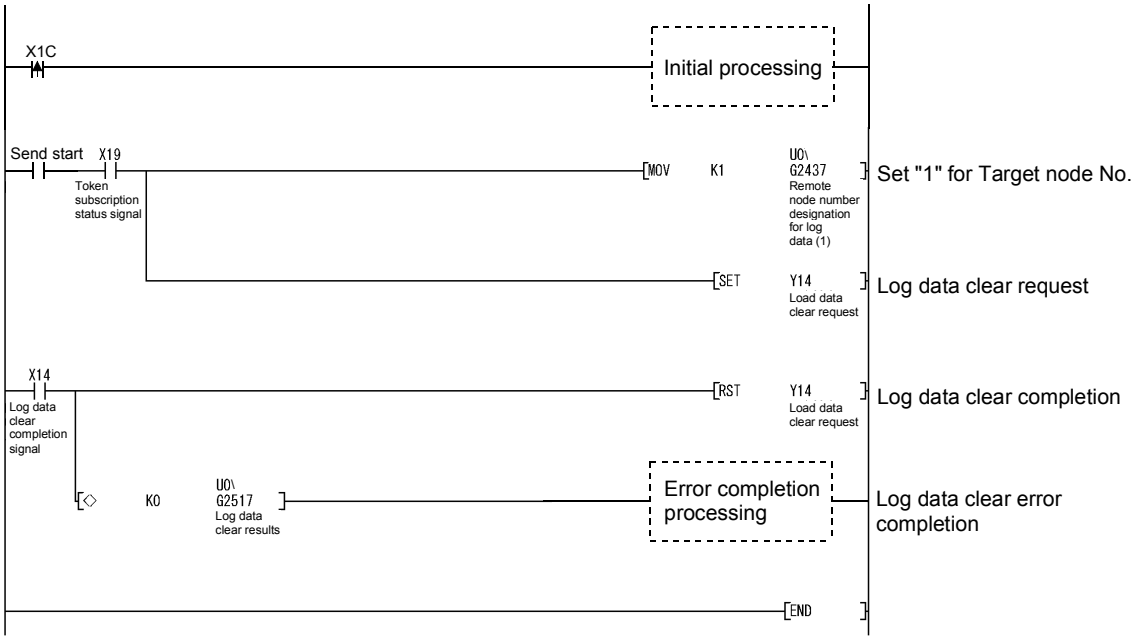
- Log data read completion signal (X15) : ON
- Log data read results : Other than 0
  (Buffer memory address : $9D6_H$)

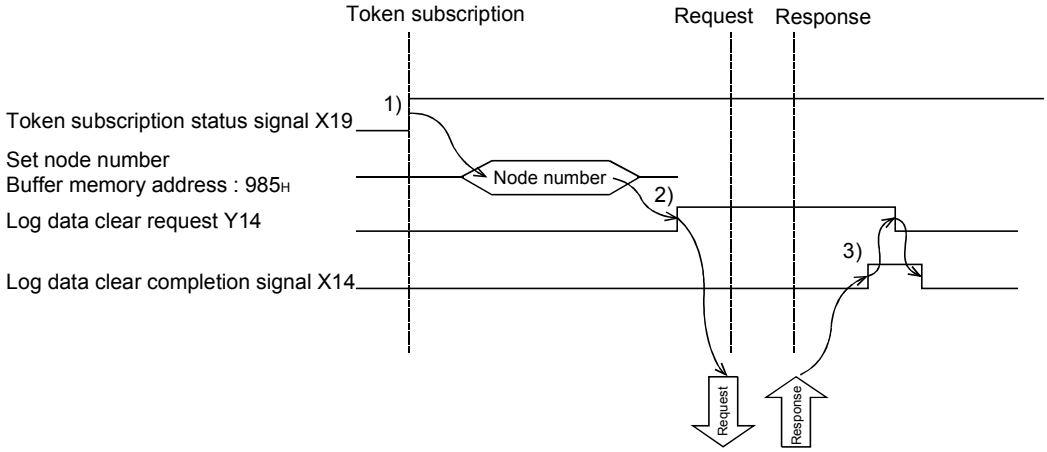
When there is an error completion, after revising the parameter/program using the error codes that are stored in the log data read results, execute the log data read command once again. Refer to Section 8.5.2 for information about error codes.

After confirming that the log data read completion signal (X15) is ON, the log data read request (Y15) is set to OFF.

(4) Log data clear

The following explains the log data clear command.





1) Confirms that the FL-net module token participation status signal (X19) is ON.

2) After setting the object node number to the buffer memory (address: 985_H), the log data clear request (Y14) is set to ON. The FL-net module performs log data clear for the object node.

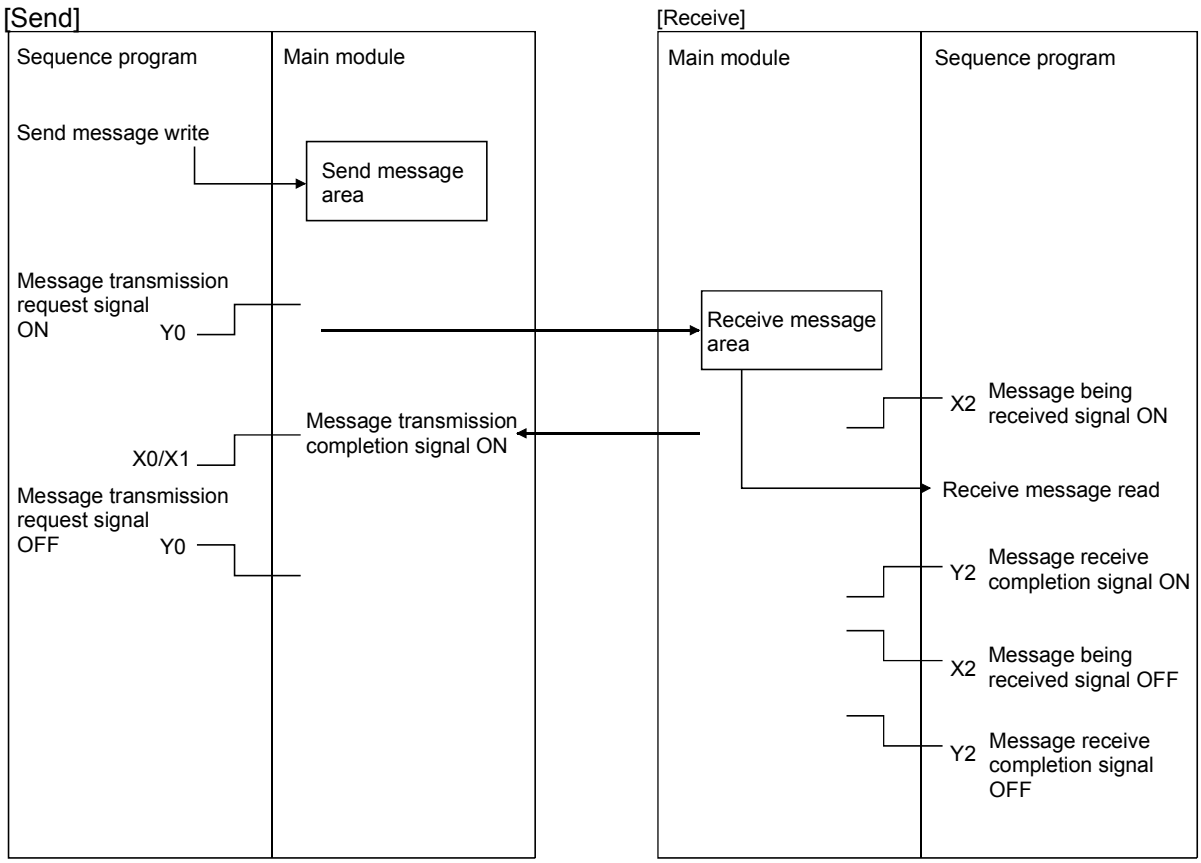
3) Confirms log data clear completion.
<Normal completion>
• Log data clear completion signal (X14) : ON
• Log data clear results : 0
(Buffer memory address : $9D5_H$)
<Error completion>
• Log data clear completion signal (X14) : ON
• Log data clear results : Other than 0
(Buffer memory address : $9D5_H$)

When there is an error completion, after revising the parameter/program using the error codes that are stored in the log data clear results, execute the log data clear command once again. Refer to Section 8.5.2 for information about error codes.

After confirming that the log data clear completion signal (X14) is ON, the log data clear request (Y14) is set to OFF.

(5) Transparent type message

The following explains the send/receive commands for the transparent type message.



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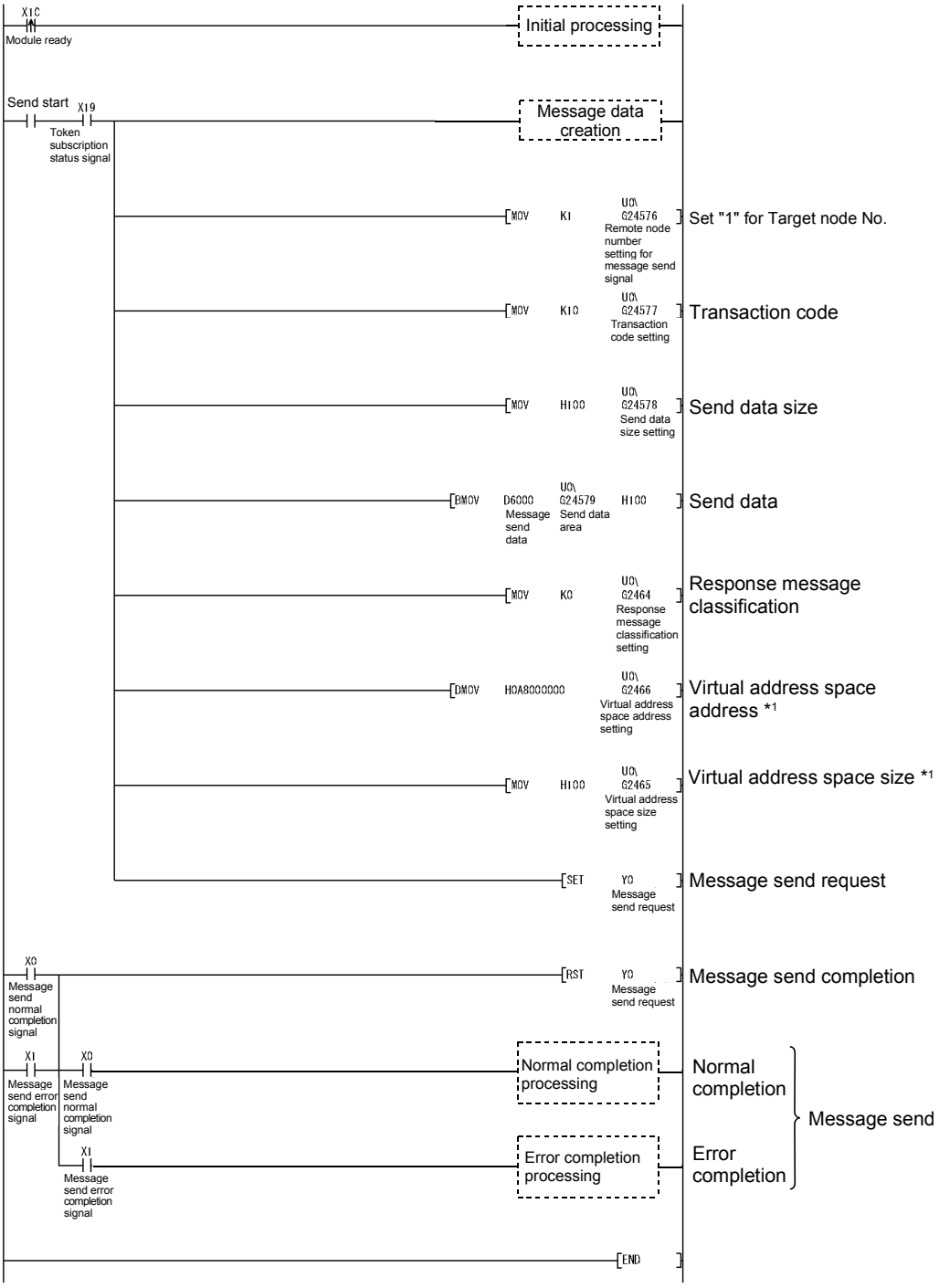
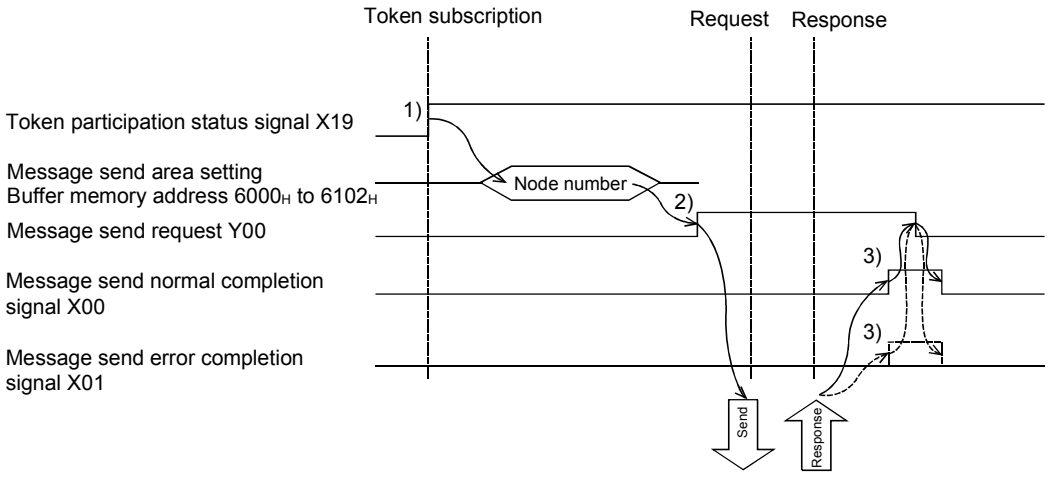
(a) Message send

The following explains the message transmission command.



*1 When the target node is a Q series FL-net module, specify 0H.



1) Confirms that the FL-net module token participation status signal (X19) is ON.

2) After setting the data shown below to the buffer memory (address : 6000_H to 6102_H, $9A0_H$ to $9A3_H$), message send request (Y00) is set to ON.
   - Object node number
   - Transaction code
   - Send data size
   - Send data
   - Response message classification
   - Virtual address space address
   - Virtual address space size

3) Confirm the send complete of the message.

   <Normal completion>
   - Message send normal completion signal (X00) : ON
   - Message send error completion signal (X01) : OFF
   - Transparent message send result : 0
     (Buffer memory address : $9D7_H$)

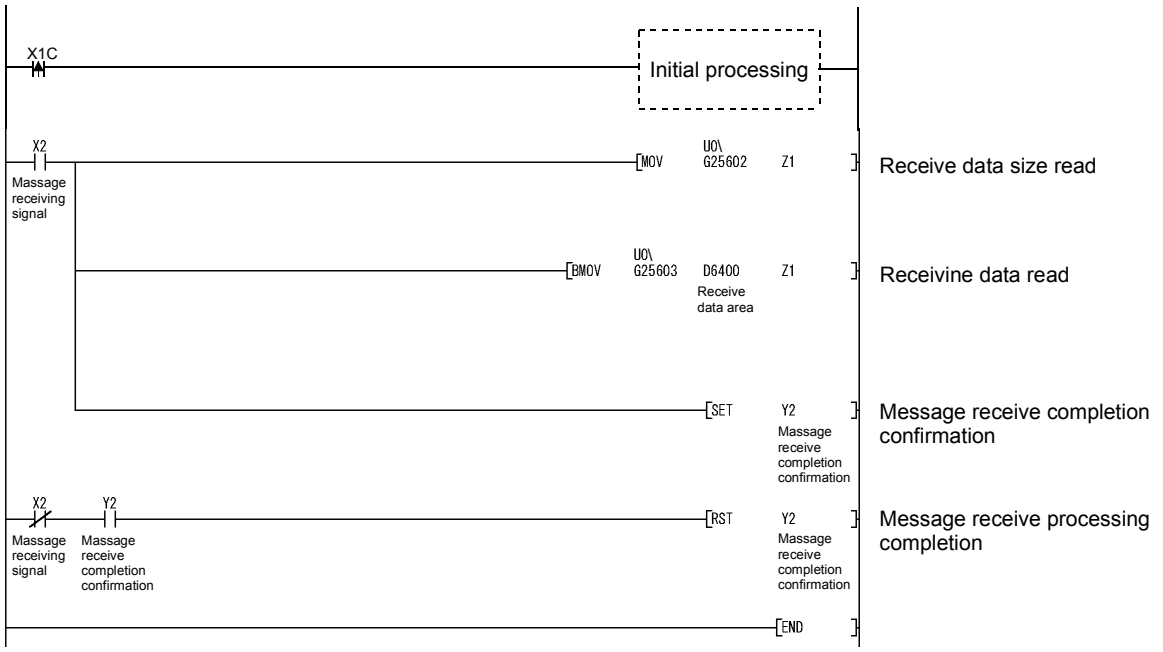
   <Error completion>
   - Message send normal completion signal (X00) : OFF
   - Message send error completion signal (X01) : ON
   - Transparent message send results : Other than 0
     (Buffer memory address : $9D7_H$)

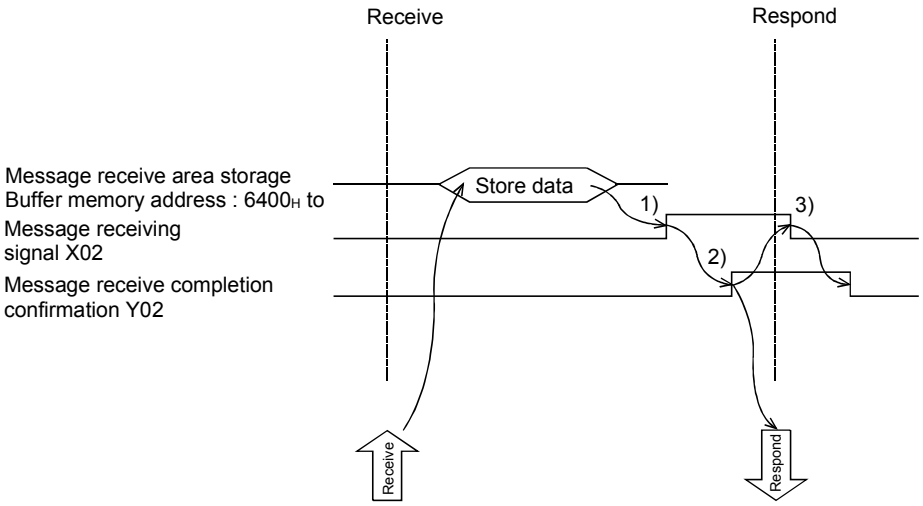
   If the transmission has completed in error, correct the parameters or program according to the error code stored in the transparent type message transmission result area, and execute the transparent type message transmission. Refer to Section 8.5.2 for information about error codes.

   After confirming that the message send normal completion signal (X00)/message send error completion signal (X01) is ON, the message send request (Y00) is set to OFF.

(b) Message receive

The following explains the message receive command.





1) Once the data receive completion is in the FL-net module buffer memory message data receive area (address: 6400_H to), the message receiving signal (X02) is set to ON.
2) After the message data has been transferred to the device (read), the message receive completion signal (Y02) is set to ON.
3) After confirming that the message receiving signal (X02) is OFF, the message receive completion signal (Y02) is set to OFF.

POINT
When a response is needed for message data receive, create a sequence program for the response.

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(6) Other messages (Transparent type messages)

For messages other than (1) to (5), the transparent type message transmission realizes the client function.
To realize the client function of each message, a request message transmission program and a response message reception program are required.
For program examples, refer to (5).
This section provides the items for which the settings are required for each request message transmission and those for which values are stored at the time of response message reception.

POINT

Completion of each message processing must be recognized by completion of request message transmission and response message reception.

(a) Byte block read

1) Setting items required for request message transmission

Buffer memory address	Name	Setting value (Decimal)
9A0H	Response message classification	Not needed (0)
9A1H	Visual address space data size	Read data size (1 to 1024 bytes)
9A2H to 9A3H	Visual address space first address	Visual address space first address
6000H	Object node number	1 to 254
6001H	Transaction code	65003
6002H	Send data size (byte/word length)	Not needed (0)
6003H to 6202H	Send data area (512 words)	Not needed (0)

2) Items for which values are stored at response message reception

Buffer memory address	Name	Stored value (Decimal)
C00H	Response message classification	0: Normal response 1: Error response 2: Not supported
C01H	Visual address space data size	Value same as in request message
C02H to C03H	Visual address space first address	Value same as in request message
6400H	Send source node number	Value same as in request message
6401H	Transaction code	65203
6402H	Receive data size (byte/word length)	Read data size (1 to 1024 bytes/512 words)
6403H to 6602H	Receive data area (512 words)	Read data

(b) Byte block write

1) Setting items required for request message transmission

Buffer memory address	Name	Setting value (Decimal)
9A0H	Response message classification	Not needed (0)
9A1H	Visual address space data size	Write data size (1 to 1024 bytes)
9A2H to 9A3H	Visual address space first address	Visual address space first address
6000H	Object node number	1 to 254
6001H	Transaction code	65004
6002H	Send data size (byte/word length)	Write data size (1 to 1024 bytes/512 words)
6003H to 6202H	Send data area (512 words)	Write data

2) Items for which values are stored at response message reception

Buffer memory address	Name	Stored value (Decimal)
C00H	Response message classification	0: Normal response 1: Error response 2: Not supported
C01H	Visual address space data size	Value same as in request message
C02H to C03H	Visual address space first address	Value same as in request message
6400H	Send source node number	Value same as in request message
6401H	Transaction code	65204
6402H	Receive data size (byte/word length)	0
6403H to 6602H	Receive data area (512 words)	0

(c) Word block read

1) Setting items required for request message transmission

Buffer memory address	Name	Setting value (Decimal)
9A0H	Response message classification	Not needed (0)
9A1H	Visual address space data size	Read data size (1 to 512 words)
9A2H to 9A3H	Visual address space first address	Visual address space first address
6000H	Object node number	1 to 254
6001H	Transaction code	65005
6002H	Send data size (byte/word length)	Not needed (0)
6003H to 6202H	Send data area (512 words)	Not needed (0)

2) Items for which values are stored at response message reception

Buffer memory address	Name	Stored value (Decimal)
C00H	Response message classification	0: Normal response 1: Error response 2: Not supported
C01H	Visual address space data size	Value same as in request message
C02H to C03H	Visual address space first address	Value same as in request message
6400H	Send source node number	Value same as in request message
6401H	Transaction code	65205
6402H	Receive data size (byte/word length)	Read data size (1 to 1024 bytes/512 words)
6403H to 6602H	Receive data area (512 words)	Read data

(d) Word block write

1) Setting items required for request message transmission

Buffer memory address	Name	Setting value (Decimal)
9A0H	Response message classification	Not needed (0)
9A1H	Visual address space data size	Write data size (1 to 512 words)
9A2H to 9A3H	Visual address space first address	Visual address space first address
6000H	Object node number	1 to 254
6001H	Transaction code	65006
6002H	Send data size (byte/word length)	Write data size (1 to 1024 bytes/512 words)
6003H to 6202H	Send data area (512 words)	Write data

2) Items for which values are stored at response message reception

Buffer memory address	Name	Stored value (Decimal)
C00H	Response message classification	0: Normal response 1: Error response 2: Not supported
C01H	Visual address space data size	Value same as in request message
C02H to C03H	Visual address space first address	Value same as in request message
6400H	Send source node number	Value same as in request message
6401H	Transaction code	65206
6402H	Receive data size (byte/word length)	0
6403H to 6602H	Receive data area (512 words)	0

(e) Network parameter write

1) Setting items required for request message transmission

Buffer memory address	Name	Setting value (Decimal)
9A0H	Response message classification	Not needed (0)
9A1H	Visual address space data size	Not needed (0)
9A2H to 9A3H	Visual address space first address	Not needed (0)
6000H	Object node number	1 to 254
6001H	Transaction code	65008
6002H	Send data size (byte/word length)	20 bytes/10 words
6003H	Setting parameter flag	1: Set address and size only 2: Set node name only 3: Set address, size and node name
6004H	Area 1 first address	0 to 511
6005H	Area 1 size	0 to 512
6006H	Area 2 first address	0 to 8191
6007H	Area 2 size	0 to 8192
6008H to 600CH	Node name	Character string (10 bytes or less)

2) Items for which values are stored at response message reception

Buffer memory address	Name	Stored value (Decimal)
C00H	Response message classification	0: Normal response 1: Error response 2: Not supported
C01H	Visual address space data size	0
C02H to C03H	Visual address space first address	0
6400H	Send source node number	Value same as in request message
6401H	Transaction code	65208
6402H	Receive data size (byte/word length)	0
6403H to 6602H	Receive data area (512 words)	0

(f) Operate command

1) Setting items required for request message transmission

Buffer memory address	Name	Setting value (Decimal)
9A0H	Response message classification	Not needed (0)
9A1H	Visual address space data size	Not needed (0)
9A2H to 9A3H	Visual address space first address	Not needed (0)
6000H	Object node number	1 to 254
6001H	Transaction code	65010
6002H	Send data size (byte/word length)	Not needed (0)
6003H to 6202H	Send data area (512 words)	Not needed (0)

2) Items for which values are stored at response message reception

Buffer memory address	Name	Stored value (Decimal)
C00H	Response message classification	0: Normal response 1: Error response 2: Not supported
C01H	Visual address space data size	0
C02H to C03H	Visual address space first address	0
6400H	Send source node number	Value same as in request message
6401H	Transaction code	65210
6402H	Receive data size (byte/word length)	0
6403H to 6602H	Receive data area (512 words)	0

(g) Stop command

1) Setting items required for request message transmission

Buffer memory address	Name	Setting value (Decimal)
9A0H	Response message classification	Not needed (0)
9A1H	Visual address space data size	Not needed (0)
9A2H to 9A3H	Visual address space first address	Not needed (0)
6000H	Object node number	1 to 254
6001H	Transaction code	65009
6002H	Send data size (byte/word length)	Not needed (0)
6003H to 6202H	Send data area (512 words)	Not needed (0)

2) Items for which values are stored at response message reception

Buffer memory address	Name	Stored value (Decimal)
C00H	Response message classification	0: Normal response 1: Error response 2: Not supported
C01H	Visual address space data size	0
C02H to C03H	Visual address space first address	0
6400H	Send source node number	Value same as in request message
6401H	Transaction code	65209
6402H	Receive data size (byte/word length)	0
6403H to 6602H	Receive data area (512 words)	0

(h) Message return

1) Setting items required for request message transmission

Buffer memory address	Name	Setting value (Decimal)
9A0H	Response message classification	Not needed (0)
9A1H	Visual address space data size	Not needed (0)
9A2H to 9A3H	Visual address space first address	Not needed (0)
6000H	Object node number	1 to 254
6001H	Transaction code	65015
6002H	Send data size (byte/word length)	Return data size (1 to 1024 bytes/512 words)
6003H to 6202H	Send data area (512 words)	Return data

2) Items for which values are stored at response message reception

Buffer memory address	Name	Stored value (Decimal)
C00H	Response message classification	0: Normal response 1: Error response 2: Not supported
C01H	Visual address space data size	0
C02H to C03H	Visual address space first address	0
6400H	Send source node number	Value same as in request message
6401H	Transaction code	65215
6402H	Receive data size (byte/word length)	Value same as in request message
6403H to 6602H	Receive data area (512 words)	Value same as in request message

6.5.4 Sample program

The following sample programs are provided relating to cyclic transmission and transparent type message transmission.

• Programs using GX Configurator-FL

• Programs not using GX Configurator-FL.

(1) Execution environment of program examples

(a) Node 1 side

1) FL-net module mounting station CPU : Q25HCPU

2) FL-net module input/output number : X/Y000 to X/Y01F

3) FL-net module IP address : 192.168.250.1
(Set these in GX Developer's intelligent function module switch setting. (Refer to Section 6.3.2.))

(b) Node 3 side

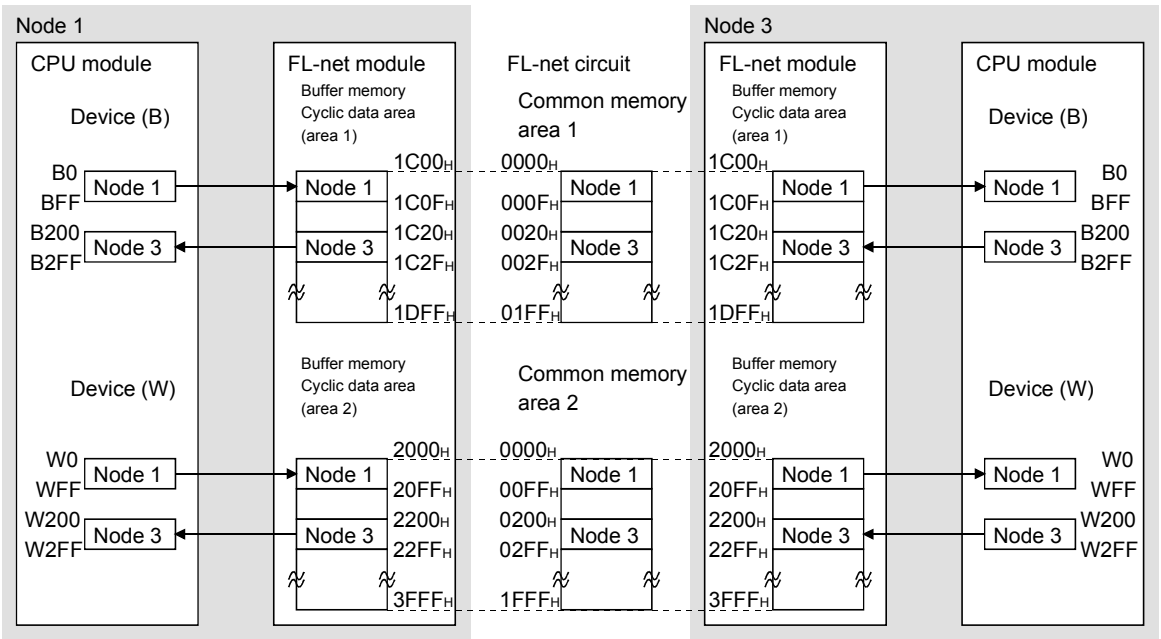
1) FL-net module mounting station CPU : Q06HCPU

2) FL-net module input/output number : X/Y000 to X/Y01F

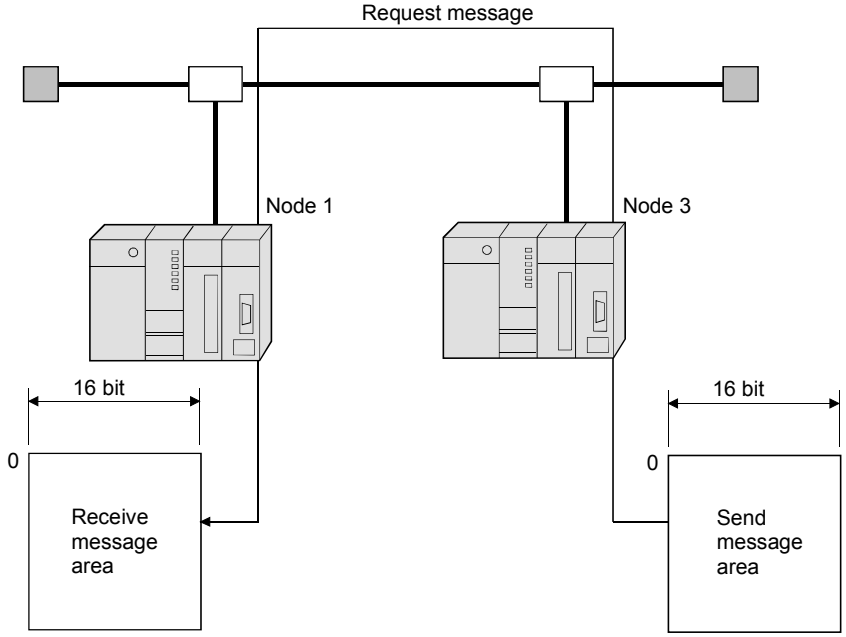
3) FL-net module IP address : 192.168.250.3
(Set these in GX Developer's intelligent function module switch setting. (Refer to Section 6.3.2.))

(2) Summary of program

(a) Cyclic transmission
Cyclic transmission program for node 1 ← → node 3.



(b) Transparent type message transmission
Transparent type message transmission node 1 ← node 3.



REMARK

The cyclic data area assignment sheet is provided in this manual. (Refer to Appendix 11.)
Please utilize the sheet for check of the cyclic data area assignment.
The following is an example for how to fill out the form in the case of this sample program.

(1) Area 1 (bit area)

Node No.	FL-net circuit	FL-net module			CPU module	Remark
	Common memory address (0000 to 01FFH)	Buffer memory address (1C00 to 1DFFH)	Data size (Word units)	Buffer offset	PLC side device	
1	0000 to 000FH	1C00 to 1C0FH	16	0	B0 to BFF	
3	0020 to 002FH	1C20 to 1C2FH	16	32	B200 to B2FF	Local node

(2) Area 2 (word area)

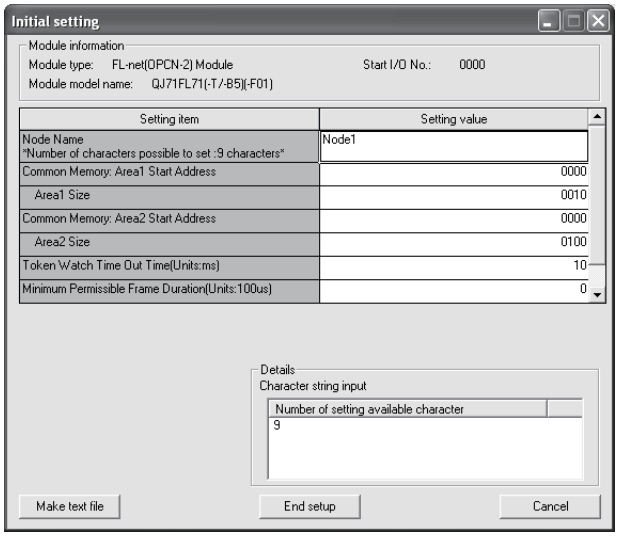
Node No.	FL-net circuit	FL-net module			CPU module	Remark
	Common memory address (0000 to 1FFFH)	Buffer memory address (2000 to 3FFFH)	Data size (Word units)	Buffer offset	PLC side device	
1	0000 to 00FFH	2000 to 20FFH	256	0	W0 to WFF	
3	0200 to 02FFH	2200 to 22FFH	256	512	W200 to W2FF	Local node

(3) Example of program that used GX Configurator-FL

(a) Node 1

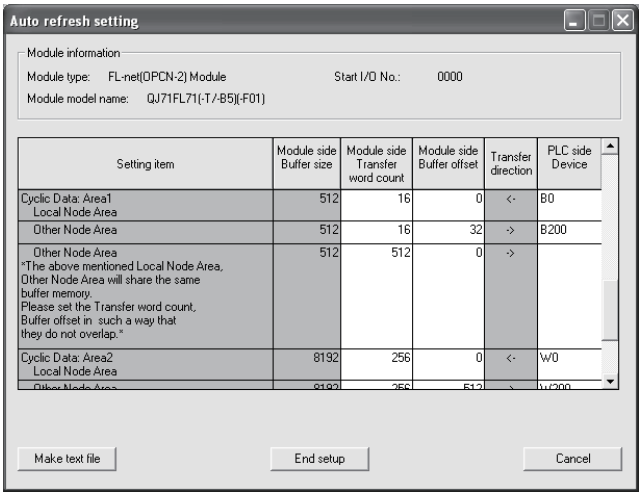
1) GX Configurator-FL operation

- Initial settings (Refer to Section 6.4.8)
  Set as follows: node name to node 1, area 1 first address to 0000H, area 1 size to 10H, area 2 first address to 0000H, area 2 size to 100H.



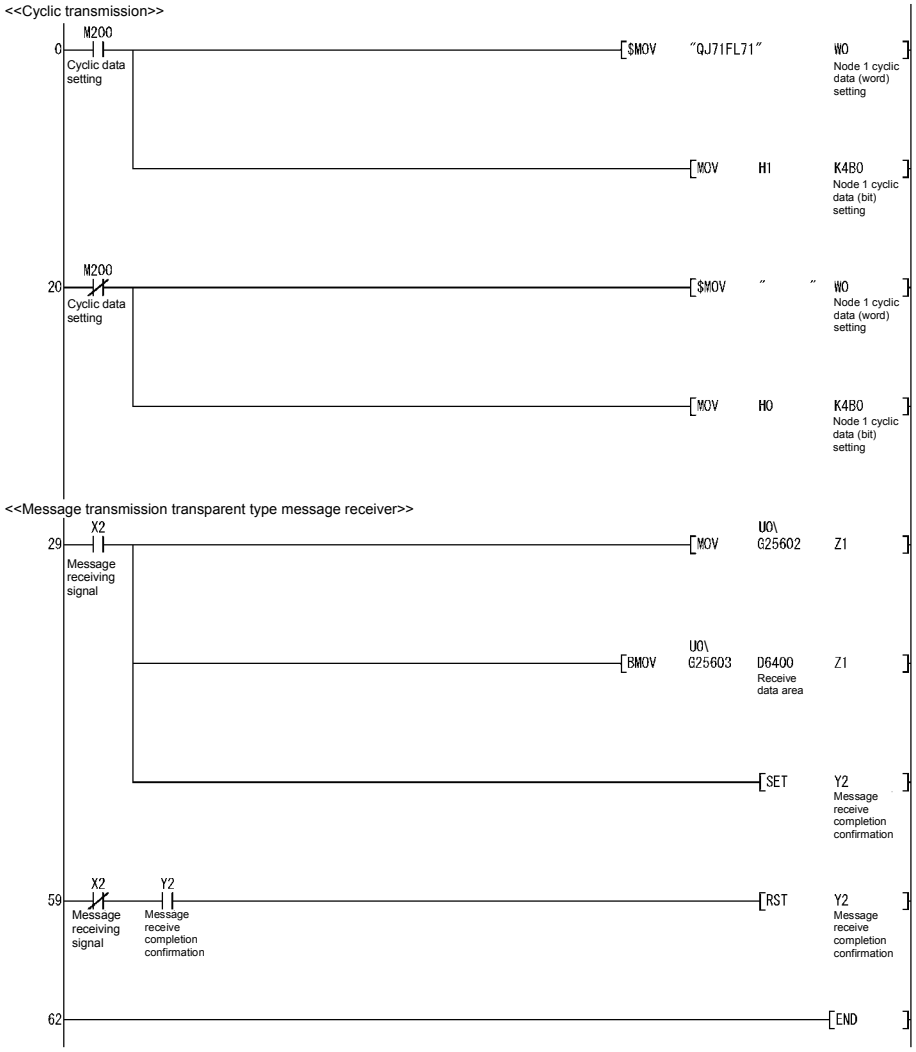
- Auto refresh setting (Refer to Section 6.4.9)

Setting item		Module side Transfer word count	Module side Buffer offset	PLC side Device
Cyclic Data: Area 1	Local Node Area	16	0	B0
	Other Node Area	16	32	B200
Cyclic Data: Area 2	Local Node Area	256	0	W0
	Other Node Area	256	512	W200



- Writing of intelligent function module parameters (Refer to Section 6.4.7)
  The intelligent function module parameters are written to the CPU module. Operations are performed using the parameter setting module selection screen.

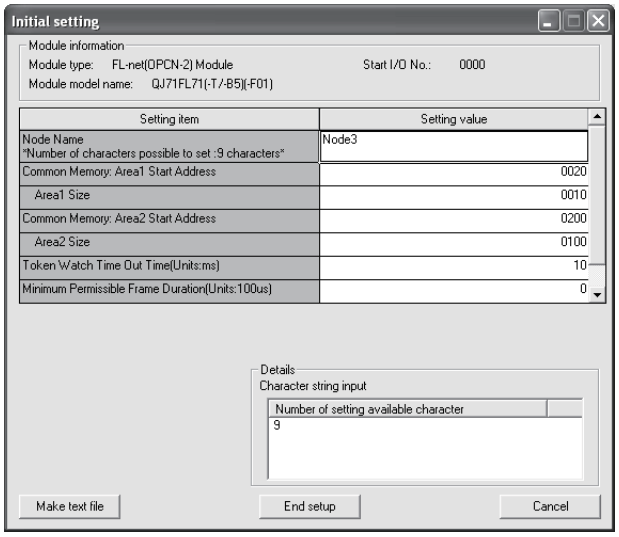
2) Program example



(b) Node 3

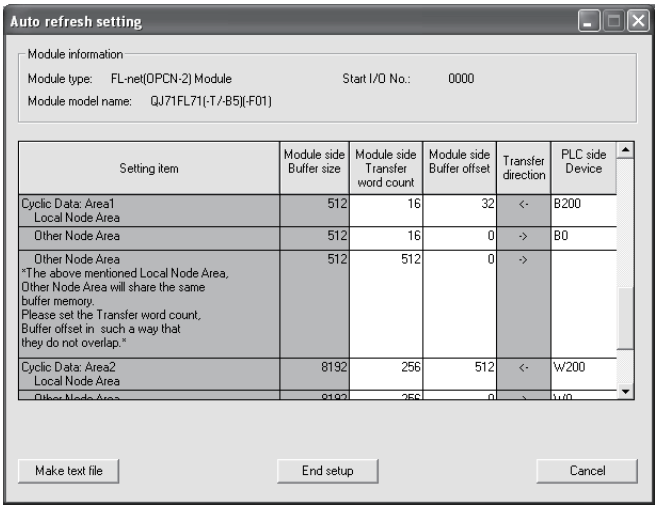
1) GX Configurator-FL operations

• Initial settings (Refer to Section 6.4.8)
Set as follows: node name to node 3, area 1 first address to 0020H, area 1 size to 10H, area 2 first address to 0200H, area 2 size to 100H.



• Auto refresh setting (Refer to Section 6.4.9)

Setting item		Module side Transfer word count	Module side Buffer offset	PLC side Device
Cyclic Data: Area 1	Local Node Area	16	32	B200
	Other Node Area	16	0	B0
Cyclic Data: Area 2	Local Node Area	256	512	W200
	Other Node Area	256	0	W0



• Writing of intelligent function module parameters (Refer to Section 6.4.7)
The intelligent function module parameters are written to the CPU module. Operations are performed using the parameter setting module selection screen.

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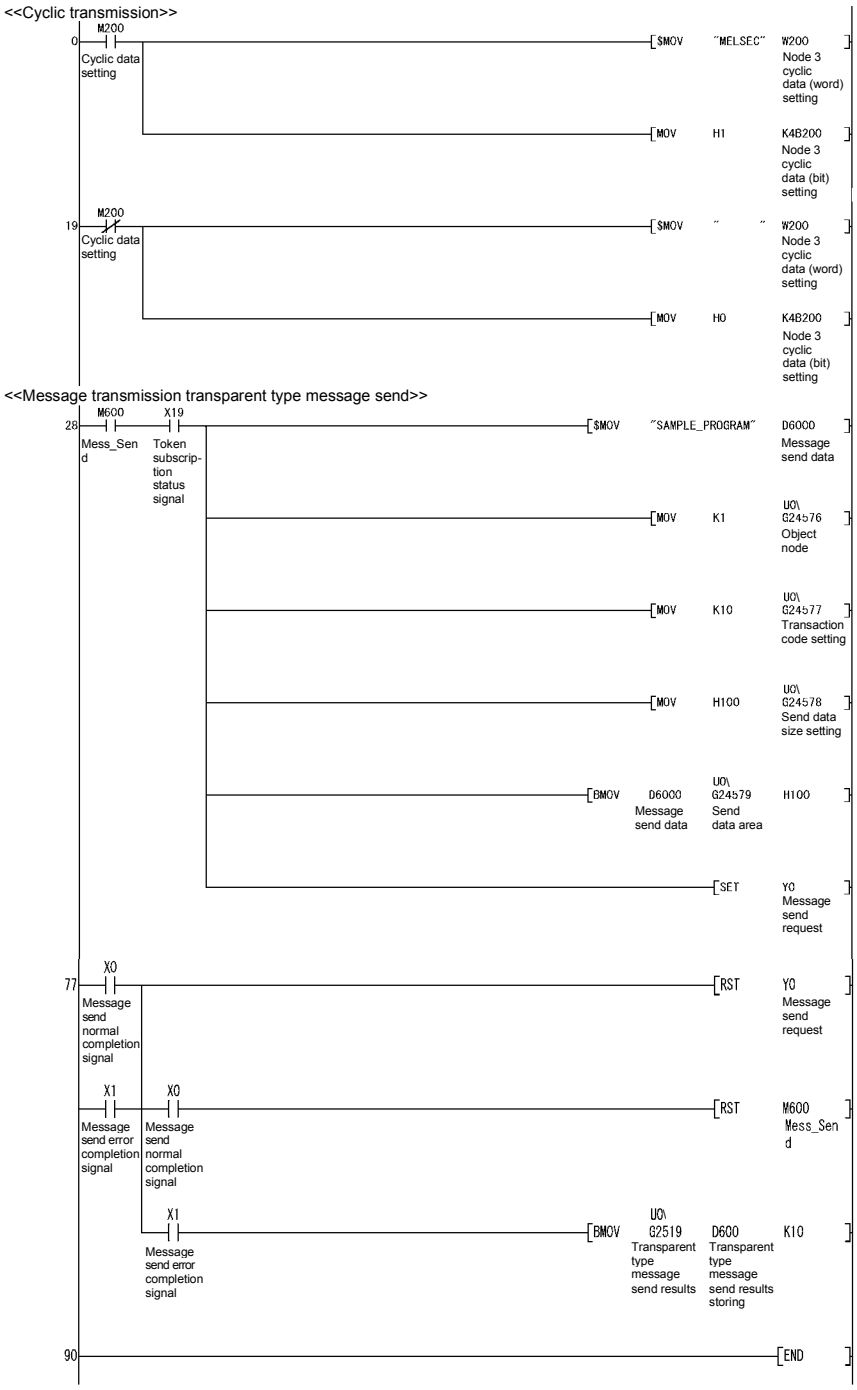
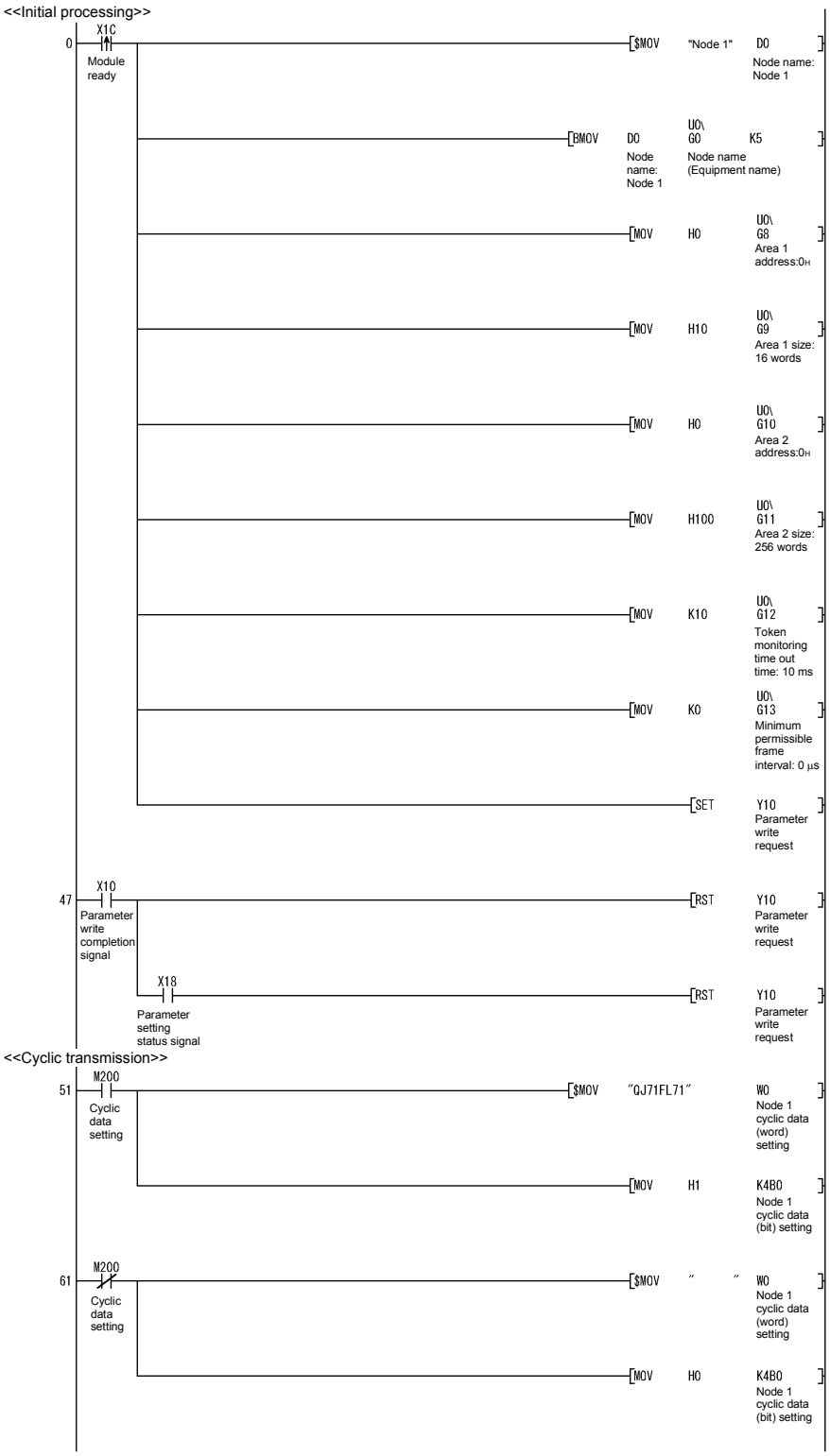
2) Program example



(4) Example of program not using GX Configurator-FL

(a) Node 1 side



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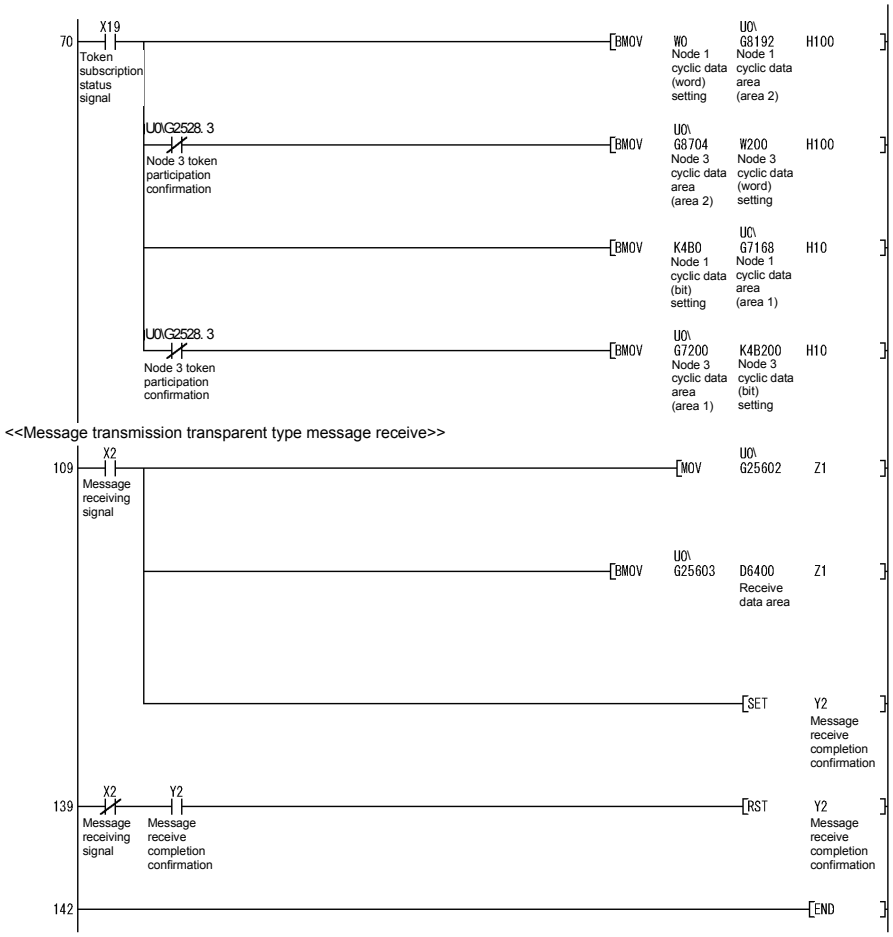
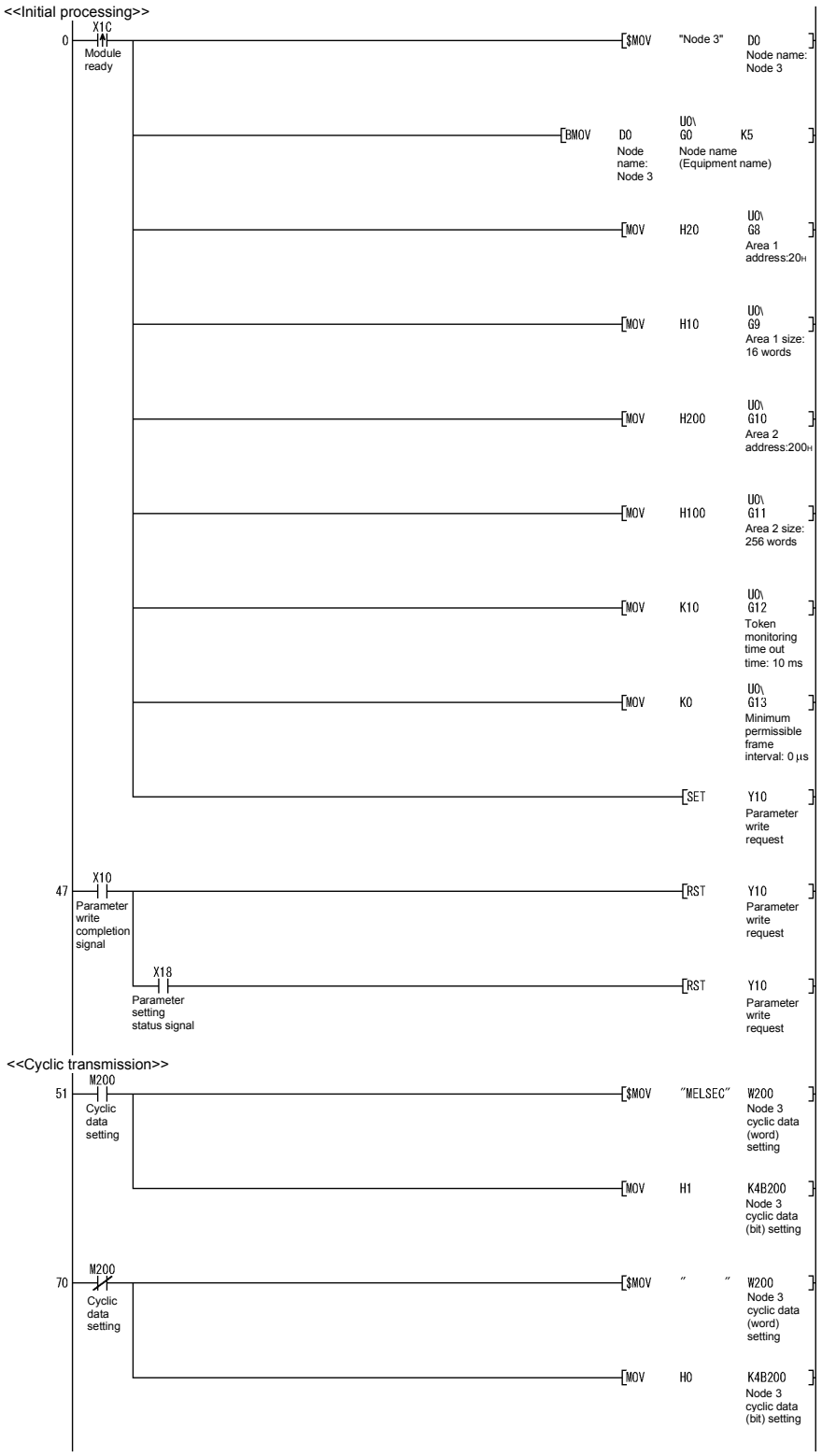
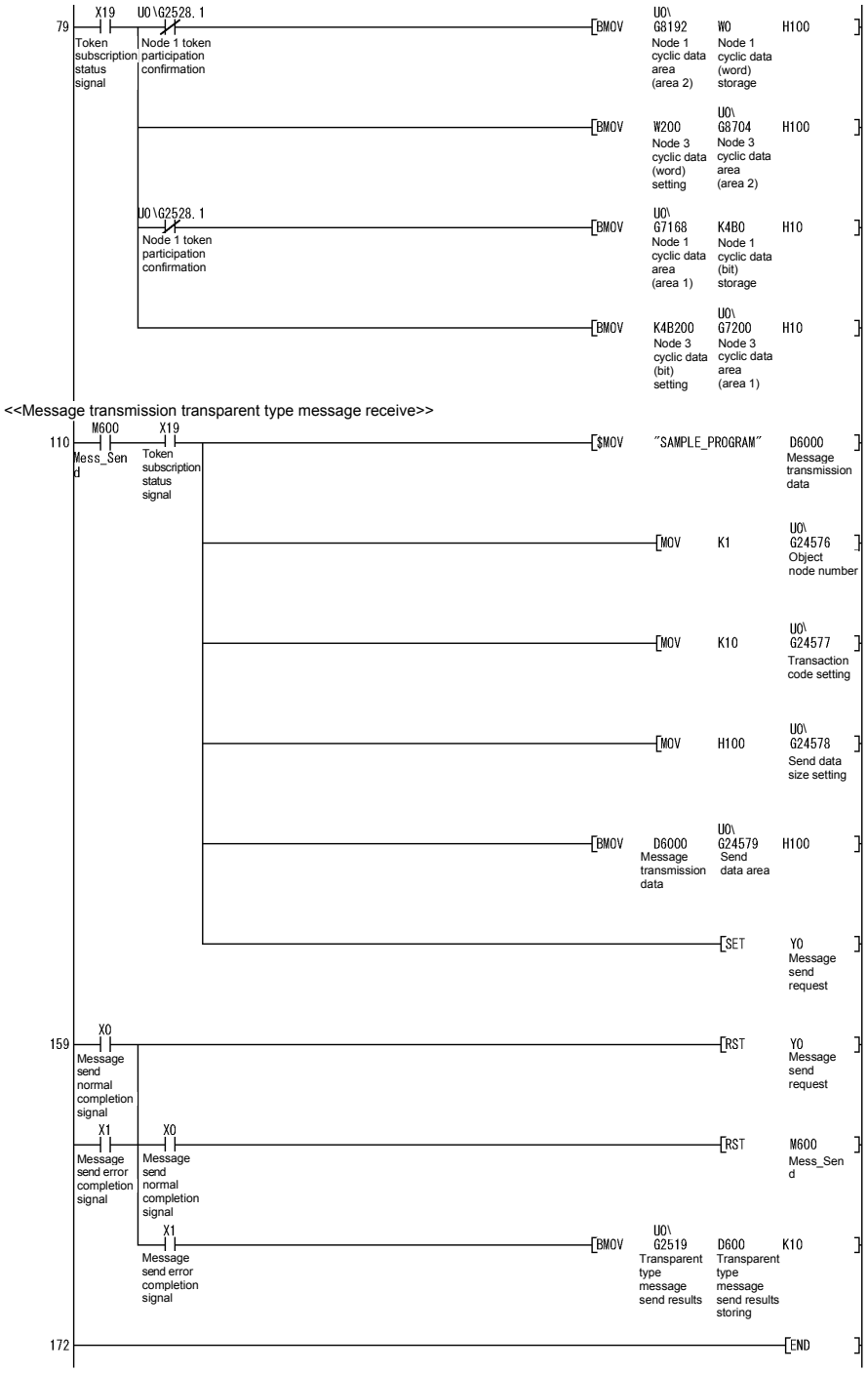

70
X19
Token subscription status signal
BMOV
W0
Node 1 cyclic data (word) setting
U0\G8192
Node 1 cyclic data area (area 2)
H100
U0\G2528.3
Node 3 token participation confirmation
BMOV
U0\G8704
Node 3 cyclic data area (area 2)
W200
Node 3 cyclic data (word) setting
H100
BMOV
K4B0
Node 1 cyclic data (bit) setting
U0\G7168
Node 1 cyclic data area (area 1)
H10
U0\G2528.3
Node 3 token participation confirmation
BMOV
U0\G7200
Node 3 cyclic data area (area 1)
K4B200
Node 3 cyclic data (bit) setting
H10
<<Message transmission transparent type message receive>>
109
X2
Message receiving signal
MOV
U0\G25602
Z1
BMOV
U0\G25603
D6400
Receive data area
Z1
SET
Y2
Message receive completion confirmation
139
X2
Message receiving signal
Y2
Message receive completion confirmation
RST
Y2
Message receive completion confirmation
142
END

(b) Node 3


<<Initial processing>>
0
X1C
Module ready
$MOV "Node 3" D0 Node name: Node 3
BMOV D0 Node name: Node 3 U0\G0 Node name (Equipment name) K5
MOV H20 U0\G8 Area 1 address:20H
MOV H10 U0\G9 Area 1 size: 16 words
MOV H200 U0\G10 Area 2 address:200H
MOV H100 U0\G11 Area 2 size: 256 words
MOV K10 U0\G12 Token monitoring time out time: 10 ms
MOV K0 U0\G13 Minimum permissible frame interval: 0 μs
SET Y10 Parameter write request
47
X10
Parameter write completion signal
RST Y10 Parameter write request
X18
Parameter setting status signal
RST Y10 Parameter write request
<<Cyclic transmission>>
51
M200
Cyclic data setting
$MOV "MELSEC" W200 Node 3 cyclic data (word) setting
MOV H1 K4B200 Node 3 cyclic data (bit) setting
70
M200
Cyclic data setting
$MOV " " W200 Node 3 cyclic data (word) setting
MOV H0 K4B200 Node 3 cyclic data (bit) setting


79
X19
Token subscription status signal
U0\G2528.1
Node 1 token participation confirmation
BMOV
U0\G8192
Node 1 cyclic data area (area 2)
W0
Node 1 cyclic data (word) storage
H100
BMOV
W200
Node 3 cyclic data (word) setting
U0\G8704
Node 3 cyclic data area (area 2)
H100
U0\G2528.1
Node 1 token participation confirmation
BMOV
U0\G7168
Node 1 cyclic data area (area 1)
K4B0
Node 1 cyclic data (bit) storage
H10
BMOV
K4B200
Node 3 cyclic data (bit) setting
U0\G7200
Node 3 cyclic data area (area 1)
H10
<<Message transmission transparent type message receive>>
110
M600
Mess_Send
X19
Token subscription status signal
$MOV
"SAMPLE_PROGRAM"
D6000
Message transmission data
MOV
K1
U0\G24576
Object node number
MOV
K10
U0\G24577
Transaction code setting
MOV
H100
U0\G24578
Send data size setting
BMOV
D6000
Message transmission data
U0\G24579
Send data area
H100
SET
Y0
Message send request
159
X0
Message send normal completion signal
RST
Y0
Message send request
X1
Message send error completion signal
X0
Message send normal completion signal
RST
M600
Mess_Send
X1
Message send error completion signal
BMOV
U0\G2519
Transparent type message send results
D600
Transparent type message send results storing
K10
172
END

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7 MAINTENANCE AND INSPECTION

This chapter explains the procedures for maintaining, inspecting and removing the FL-net module.

7.1 Maintenance and Inspection

Other than checking the terminator and cable connections are not loose, there are no specific inspection items for the FL-net module. For the other areas, implement the inspection procedures found in the user's manual for the PLC CPU module for to ensure the proper operation of the system.

DANGER

- Never touch the terminals or connectors while the power is on. Electrical shock or malfunctioning could result.
- Never touch the connectors inside the covered area at the top of the module. Damage or malfunctioning of the module could result.
- Always turn off all phases of the power supply for the PLC and FL-net system at an external location before cleaning or tightening screws on the module.
  If all phases are not turned off, damage or malfunctioning of the module could occur.
  If the screws are loose, it could result in a short, malfunction or cause the module to fall off of its mounting. Conversely, if the screws are too tight, the resulting damage to the screw or module could result in a short, malfunction or cause the module to fall off its mounting.
- Always make sure to touch the grounded metal to discharge the electricity charged in the body, etc., before touching the module.
  Failure to do so may cause a failure or malfunctions of the module.

CAUTION

- Never allow foreign material, such as metal particles or small pieces of wire, to enter the module. It could cause malfunctioning, damage or fire.
- Never disassemble or modify the module. It could cause malfunctioning, damage, injury or fire.

7 - 1

7.2 Removing the Module

Before performing the following operations, read and understand Section 4.2 "Safety precautions during operation." Always keep safety top priority during operation.
The following is the procedure for removing the FL-net module.

<Operating procedure when changing the FL-net module>

(Step 1) Turn the power for the station to which the FL-net module is mounted to OFF.
(Step 2) Remove the network cable and FL-net module.
(Step 3) Follow the instructions in Section 6.3.1 "Operations up to operation" and start the FL-net module.

<Procedure when changing the CPU>

(Step 1) Use GX Developer to write and save settings related to the FL-net module (I/O tables, IP addresses) and sequence program. (∗1)
(Step 2) Replace the CPU module. (Refer to the user's manual for the CPU module.)
(Step 3) Write the settings for the FL-net module and sequence program that were saved in GX Developer to the CPU module.

∗1: This procedure is not limited to replacing the CPU module. It is recommended that the parameters should be recorded and saved whenever there have been changes or settings made that are related to the FL-net module.

8 TROUBLESHOOTING

This chapter explains the errors that can occur with the FL-net module and the troubleshooting procedures.

8.1 Is It Really an Error?

Inspect the following items first whenever the FL-net module does not operate properly.

	Contents
1	Is the module properly mounted?
2	Have the settings from the GX Developer been properly set for the module?
3	Has the common memory area been properly set?
4	Is there any looseness or other abnormalities with the connections for the module?
5	Are the communication cables properly connected?
6	Is the termianal resistance for the 10BASE5/10BASE2 cable connected?
7	Is the ground for the 10BASE5/10BASE2 cable connected?
8	Is a cross cable being used for 10BASE-T cable?
9	Does the cable meet Category 5 specifications?
10	Is the power on for the Ethernet hub and repeater?

8.2 Solutions to General Network Problems

(1) When there is no communication

Check and inspect the following items when there is no communication with the FL-net module.

Location	Item to check	Solution
Power supply	Is the [Power] LED for the power supply for the PLC on?	Check the power supply, voltage and if the power supply cable has been pulled out.
	Is the [RUN] LED for the FL-net module on?	Check the power supply, voltage and if the power supply cable has been pulled out.
	Is the power supply lamp for the AUI power supply module on?	Check the power supply, voltage and if the power supply cable has been pulled out.
	Is the output of the power supply for the AUI power supply module the specified voltage (12V)?	Check the power supply, voltage and if the power supply cable has been pulled out.
	Is the power supply lamp for the HUB on?	Check the power supply, voltage and if the power supply cable has been pulled out.
	Is the power supply cable for AUI properly connected to the equipment?	Check the power supply, voltage and if the power supply cable has been pulled out.
Communication cable and transceiver connection	Are any of the mountings for the transceiver unsteady?	Reinstall.
	Is there an error in the equipment used for checking the installation status of the transceiver?	Adjust until normal. If the problem persists, install in a different location.
	Is the transceiver properly insulated?	Reinstall.
	Is the transceiver properly mounted to the markers of the communication cable?	Reevaluate the installation location.
Transceiver cable and transceiver connection	Are any of the mountings for the transceiver cable unsteady?	Reexamine. Tighten as necessary.
	Is there an error in the equipment used for checking the installation status of the transceiver?	Follow the procedures in the operating manual for the inspection equipment and check the installation.
	Is the transceiver properly locked?	Properly lock.
	Do the LEDs for the transceiver indicate normal operation?	Check the power supply, voltage and if the power supply cable has been pulled out.
Transceiver cable and equipment connection	Are any of the mountings for the transceiver cable unsteady?	Reexamine. Tighten as necessary.
	Do the [TX] (send) and [RX] (receive) LEDs indicate normal operation?	Check the description of the error.
	Have the media selection switches (SQE, etc.) been properly set?	Reexamine the settings.

(2) When communication is unsteady

Check and inspect the following items when the communication by the FL-net module is unsteady.

Location	Item to check	Solution
Transmission route confirmation	Is one point of the outer conductor of the coaxial cable grounded?	Properly ground.
	Is the shield wire of the AUI cable properly grounded?	Ground according to procedure shown in manufacturer's operation manual.
	Does each station properly respond to the PING command?	Check the power supply and cables for each station that does not respond.
	Does the collision lamp come on frequently?	Check the connections of the cable and connectors. Check the errors with an analyzer.
	Are the repeaters four stages or less?	Reevaluate the design.
	Is each segment within the specified length?	Reevaluate the design.
	Are two terminal registers used at both ends?	Reevaluate the design.
	Is the number of equipment connected in a segment within the specified limits?	Reevaluate the design.
	Are there three segments or less connecting the equipment?	Reevaluate the design.
	Is the power on for the repeaters?	Check the power supply, voltage and if the power supply cable has been pulled out.
Confirmation of equipment settings for stations participating in communication	Is the network IP address properly set?	Reconfirm the IP address that has been set using support tool and analyzers.
	Is the station number for the equipment properly set?	Reconfirm the station number that has been set using support tool and analyzers.
	Are the parameters for the equipment properly set?	Reconfirm the equipment that has been set using support tool and analyzers.
	Does the [TX](Send) LED come on continuously or intermittently?	Reconfirm the settings of the equipment.
	Does the [LNK] (Link) LED come on continuously?	Reconfirm the parameter settings of the equipment.

(3) Checking for completion of the initial processing by "PING function"

The following is an example of confirming that initial processing has been completed by issuing a PING command from the corresponding equipment (personal computer, etc.) connected to the FL-net (OPCN-2) network to the own node FL-net module.

\> ping IP address

The following is an example of a program.
(Example) FL-net module IP address: 192.0.1.254

Normal screen

```
C:\>ping 192.0.1.254    · · · ping command execution

Pinging 192.0.1.254 with 32 bytes of data:

Reply from 192.0.1.254: bytes=32 time=1ms TTL=128
Reply from 192.0.1.254: bytes=32 time<10ms TTL=128
Reply from 192.0.1.254: bytes=32 time<10ms TTL=128
Reply from 192.0.1.254: bytes=32 time<10ms TTL=128

Ping statistics for 192.0.1.254:
        Packets: Sent = 4, Received = 4, Lost = 0 (0 % loss)
Approximate round trip times in milli-seconds:
        Minimum = 0 ms, Maximum = 1ms, Average = 0 ms

C:\>_
```

Error screen

```
C:\>ping 192.0.1.254    · · · ping command execution

Pinging 192.0.1.254 with 32 bytes of data:

Request timed out:
Request timed out:
Request timed out:
Request timed out:

Ping statistics for 192.0.1.254:
        Packets: Sent = 4, Received = 0, Lost = 4 (100 % loss)
Approximate round trip times in milli-seconds:
        Minimum = 0 ms, Maximum = 0 ms, Average = 0 ms

C:\>_
```

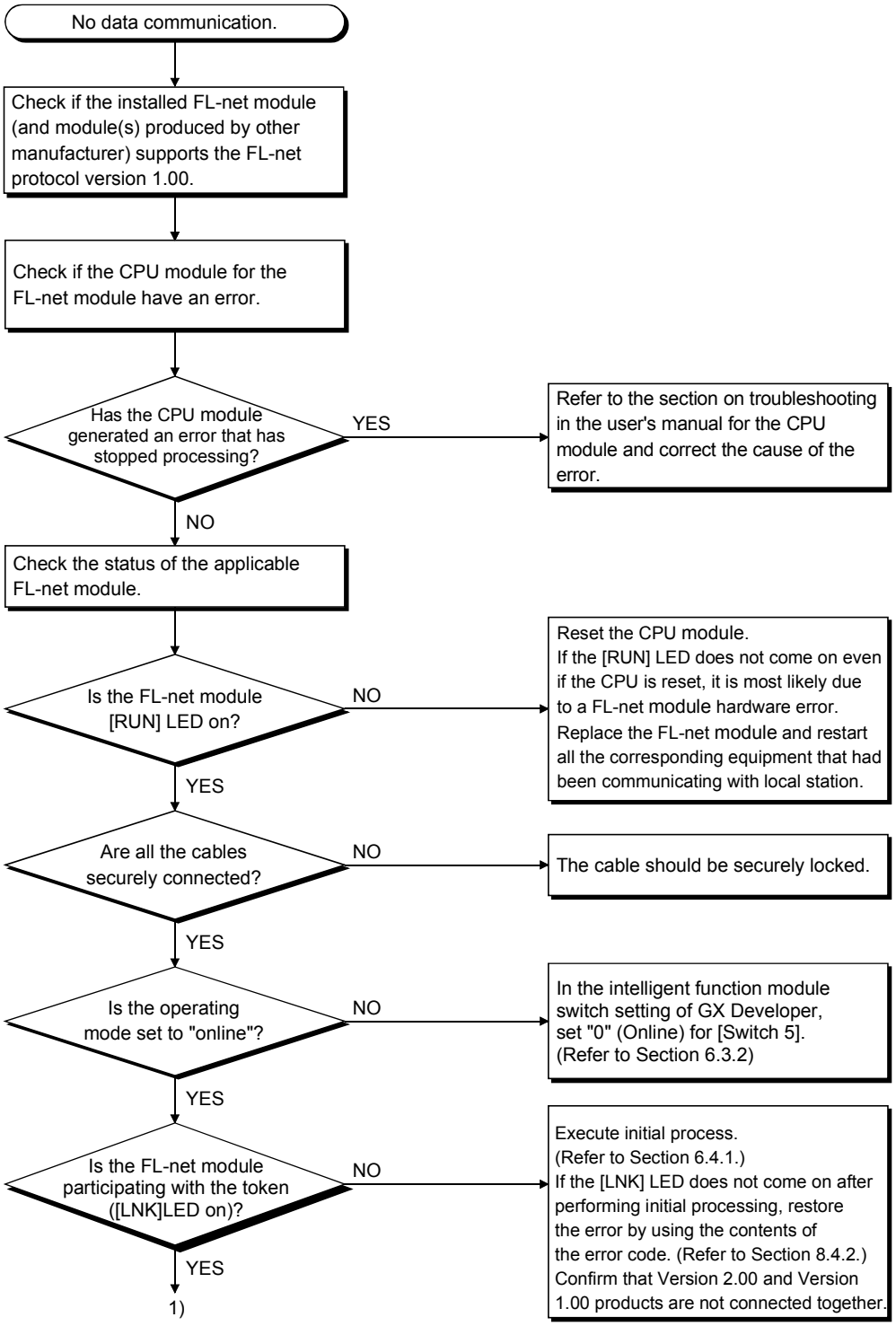
8.3 FL-net (OPCN-2) General Precautions

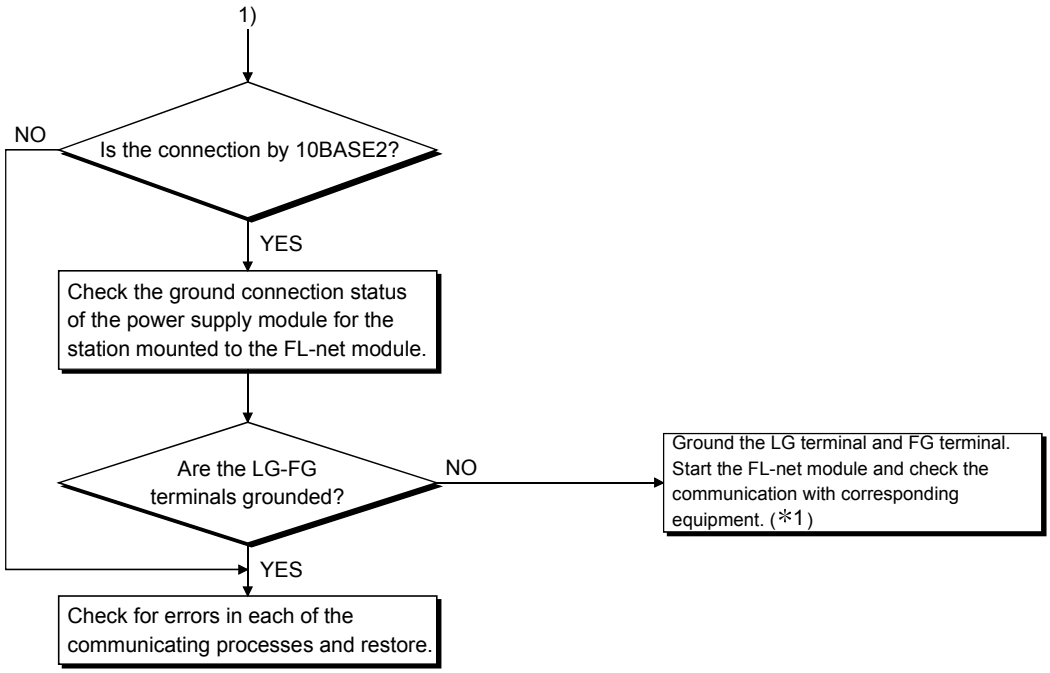
Refer to IEEE802.3 for the specifications relating to the transmission route of the FL-net (OPCN-2).
In addition to these, the following are restrictions and precautions unique to the FL-net (OPCN-2).

<table>
<tr><th></th><th>Contents</th></tr>
<tr><td>1</td><td>Other Ethernet data shall not be handled on communication cables for the FL-net (OPCN-2).</td></tr>
<tr><td>2</td><td>Do not connect FL-net (OPCN-2) to a router.</td></tr>
<tr><td>3</td><td>A switching HUB will not have any effect even if used for FL-net (OPCN-2).</td></tr>
<tr><td>4</td><td>The real-time characteristics of the communication will be dramatically reduced if infrared or other types of wireless media are used.</td></tr>
<tr><td>5</td><td>If a personal computer is used, the performance of the personal computer and its operating system and application software will dramatically change the real-time characteristics.</td></tr>
<tr><td>6</td><td>Use the preset IP address.
There is a need to group network addresses. (Standard network is: 192.168.250)
There is the recommended input range for the node number (station number) of the IP address.
<table>
<tr><th>Network address</th><th>Node Number</th></tr>
<tr><td>192.168.250</td><td>1 to 249</td></tr>
</table>
A check for duplicate node numbers cannot be performed during the initial settings. Use care during setting as the first duplicate node number error will occur during communication.</td></tr>
<tr><td>7</td><td>Always provide a proper ground. Be sure to use a heavy gauge ground wire.</td></tr>
<tr><td>8</td><td>Always install away from sources of electrical noise. Avoid routing cables alongside power cords.</td></tr>
<tr><td>9</td><td>When cyclic data communication and message data communication are performed simultaneously, the real-time characteristics will be adversely affected by the volume of the data and other factors.</td></tr>
<tr><td>10</td><td>There is no need to continue and keep the cyclic data communication area (common memory area).</td></tr>
<tr><td>11</td><td>If there is SQE switch mounted to the transceiver, follow the operator's manual for properly setting it.</td></tr>
<tr><td>12</td><td>The fixed time communication characteristics of the overall system will be affected by the processing performance of the equipment connected to it. The communication processing speed of all equipment on the network is adjusted to match the communication performance (minimum permissible frame interval) of the slowest equipment. Accordingly, the overall real-time characteristics of the overall system can be dramatically reduced by connection or addition of one module.</td></tr>
<tr><td>13</td><td>The message data communication header section is big endian but the data section is little endian. However, on system paarmeter that have a profile read data section, it is big endian. (Big endian indicates the method that initially dispatches the MSB.)</td></tr>
</table>

8.4 Troubleshooting Flowchart

The following is a simple flowchart for troubleshooting when communication cannot be performed with an FL-net module.





*1 When the LG terminal and FG terminal for the power supply module for the station to which the FL-net module is mounted have not been set, the communication line may close because of noise stopping communication with corresponding equipment. Turn off the power supply to the station for the FL-net module and refer to the section on wiring in the user's manual for the CPU module for grounding terminals LG and FG on the power supply module.

8.5 Errors and Their Solutions

This section explains FL-net module errors and their solutions.

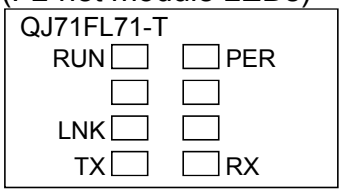
REMARK

If line errors occur when equipment from different manufacturers are connected, have the user use a line analyzer or similar equipment and sort out the locations of the problems.

8.5.1 Confirming errors using the LEDs

The following explains how to confirm errors using the LEDs on the front of the FL-net module.
The following can be confirmed by using the LEDs on the front of the FL-net module.

(FL-net module LEDs)



	LED name	Confirmation status	Cause/solution
1	[RUN]	Goes off after power supply for PLC is turned on.	1) Watchdog timer error • The watchdog timer error detection signal (X1F) is set to on by the self-diagnosis function of the FL-net module when there has been a watchdog timer error (approx. 500 ms). 2) FL-net module mounting defect • Confirm that there is sufficient power supply capacity (5 V DC). • Turn the power off and mount the module.
2	[PER]	Goes on after power supply for PLC is turned on.	1) FL-net module setting error Check the following settings. • Mode • Node number • Common memory first address / size setting 2) FL-net module error (∗1)
3	[TX]	[TX] LED is not flashing during [LNK] LED is on.	1) [PER] LED on • Remove the cause of the [PER] LED coming on. 2) Reevaluate the program • Reexamine the network parameter settings.

∗1: Perform a hardware test to determine whether or not the FL-net module is operating normally.(Refer to Section 6.3.1 (1).)

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	LED name	Confirmation status	Cause/solution
4	[RX]	[RX] LED is off and cannot receive data	1) [PER] LED on • Remove the cause of the [PER] LED coming on. 2) Defective cable connection • Check the cable connections.(∗2) 3) Local station IP address error • If no problem was found with the cable connection, reexamine the IP address settings for the FL-net module.

∗2: Perform a loopback test to determine if there is a problem with the cable connections or the Ethernet line. (Refer to Section 6.3.1.(1))

8.5.2 Confirming errors using error code

The following introduces the processes the FL-net module uses for communicating data and the error codes and their contents generated during processing requests from the local node CPU.
Error code can be confirmed with the system monitor for the GX Developer. (Refer to Section 8.6.)

(1) Error code list

Error code	Contents
0H	Normal
3E8H to 4FFFH	CPU module detecting error number
C000H to CFFFH	FL-net module detection error number

(2) Error codes stored in buffer memory

The following introduces the errors in the processes used by the FL-net module for communicating data and the contents and corrective action for the error codes stored when they have been stored in the buffer memory.
The "storage destination" column of the error code table shows the buffer memory where the applicable error code has been stored. The relationship between the descriptive name used for the "storage destination" column and the buffer memory area is shown below. (Error codes that do have the destination marked are error codes to be returned to the corresponding equipment.)

Descriptive name	Buffer memory	Buffer memory address
Switch	Intelligent function module switch setting status	9C6H
Parameter setting	Network parameter setting status	9D2H
Parameter results	Network parameter read results	9D3H
Profile results	Device profile read results	9D4H
Log clear results	Log data clear results	9D5H
Log data results	Log data read results	9D6H
Message results	Transparent message transmission results	9D7H

Error code	Description of error	Corrective action	Storage destination						
			Switch 9C6H	Parameter settings 9D2H	Parameter settings 9D3H	Profile results 9D4H	Log clear results 9D5H	Log data results 9D6H	Message results 9D7H
3E8H to 3FFFH	(Error detected by CPU module)	• Refer to the troubleshooting section of the CPU user's manual and take the appropriate action.							
4000H to 4FFFH	(Error detected by CPU module)	• Refer to the Appendix of the QCPU user's manual and take the appropriate action.							
C001H	FL-net module's OS error	• Replace the FL-net module.							
C003H	Wrong IP address (network address) setting	• Correct the IP address.	○						
C004H	Wrong IP address (host address) setting	• Correct the IP address.	○						

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Error code	Description of error	Corrective action	Storage destination						
			Switch 9C6H	Parameter settings 9D2H	Parameter settings 9D3H	Profile results 9D4H	Log clear results 9D5H	Log data results 9D6H	Message results 9D7H
C005H	Wrong mode number setting	• Correct the mode number.	○						
C021H	Wrong IP address (network address) setting	• Correct the IP address.		○					
C022H	Wrong IP address (host address) setting	• Correct the IP address.		○					
C023H	Wrong setting value for common memory area 1 first address	• Correct setting value for common memory area 1 first address and perform initial process again.		○					
C024H	Wrong setting value for common memory area 1 size	• Correct setting value for common memory area 1 size and perform initial process again.		○					
C025H	Setting value for common memory area 1 first address and size outside permissible range	• Correct setting value for common memory area 1 first address and size and perform initial process again.		○					
C026H	Wrong setting value for common memory area 2 first address	• Correct setting value for common memory area 2 first address and perform initial process again.		○					
C027H	Wrong setting value for common memory area 2 size	• Correct setting value for common memory area 2 size and perform initial process again.		○					
C028H	Setting value for common memory area 2 first address and size outside permissible range	• Correct setting value for common memory area 2 first address and size and perform initial process again.		○					
C029H	Wrong setting value for token monitoring time out time	• Correct setting value for token monitoring time out time and perform initial process again.		○					
C02AH	Wrong setting value for minimum permissible frame interval	• Correct setting value for minimum permissible frame interval and perform initial process again.		○					
C02CH	Setting for common memory area overlaps other node setting range	• Correct setting value for common memory.		○					
C02DH	Wrong message data unit selection	• Correct selection for message data unit.		○					
C104H	Multiple PLC system No.1 to 4 error	• Confirm the error code of the PLC No.1 to 4, and remove the factor of the error.							
C105H	Error occurred in he interface with the multiple PLC system No.1	• Confirm the error code of the PLC No.1, and remove the factor of the error.							
C106H	Error occurred in he interface with the multiple PLC system No.2	• Confirm the error code of the PLC No.2, and remove the factor of the error.							

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Error code	Description of error	Corrective action	Storage destination						
			Switch 9C6H	Parameter settings 9D2H	Parameter settings 9D3H	Profile results 9D4H	Log clear results 9D5H	Log data results 9D6H	Message results 9D7H
C107H	Error occurred in he interface with the multiple PLC system No.3	• Confirm the error code of the PLC No.3, and remove the factor of the error.							
C108H	Error occurred in he interface with the multiple PLC system No.4	• Confirm the error code of the PLC No.4, and remove the factor of the error.							
C112H	Error occurred in the interface with the multiple PLC system's control PLC.	• Confirm the error code of the control PLC, and remove the factor of the error.							
C321H	Setting value for object node number outside permissible range	• Correct setting value for applicable object node number.			○	○	○	○	○
C322H	Object node does not exist	• Correct setting value for applicable object node number. • Confirm operation of corresponding equipment.			○	○	○	○	○
C323H	No response from object node for 10 seconds or more	• Correct setting value for applicable object node number. • Confirm operation of corresponding equipment.			○	○	○	○	○
C324H	Error in send data	• Correct send data.							○
C325H	FL-net module does not support process indicated in transaction code	• Correct transaction code.							○
C326H	No empty capacity in object node buffer	• Create space and re-execute.			○	○	○	○	○
C327H	Request is broadcast message	• Correct the node number.				○			
C328H	Not participating in token	• Check the status of the PLC and wire status. • Re-evaluate the settings for the initial process.			○	○	○	○	○
C329H	Transaction code is X/Y handshake specification	• Correct the transaction code.							○
C421H	Setting value for virtual address space word length outside permissible range	• Re-evaluate the request data.							○
C422H	Address setting value for virtual address space outside permissible range	• Re-evaluate the request data.							○
C423H	Word block read request data size is not "0"	• Re-evaluate the request data.							○

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(Continued from previous page)

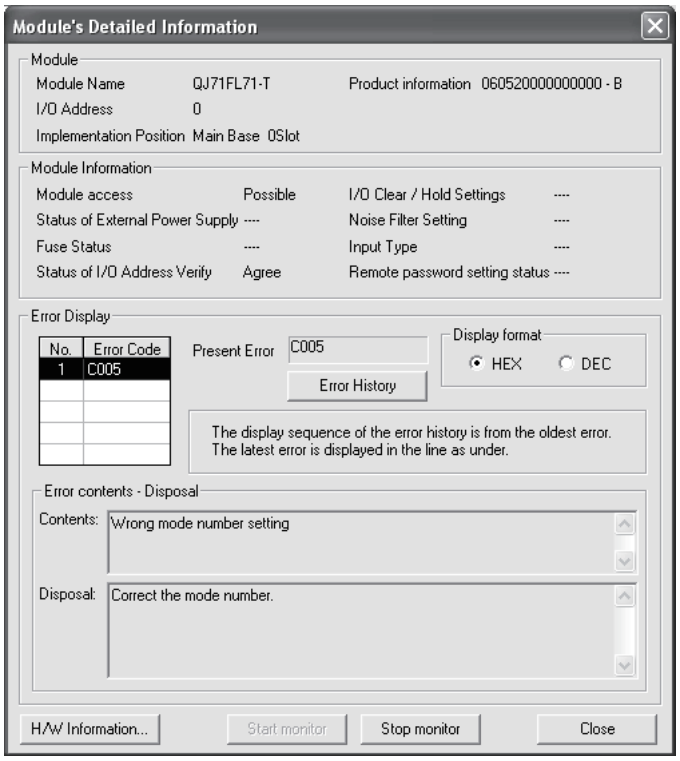
Error code	Description of error	Corrective action	Storage destination						
			Switch 9C6H	Parameter settings 9D2H	Parameter settings 9D3H	Profile results 9D4H	Log clear results 9D5H	Log data results 9D6H	Message results 9D7H
C424H	Byte length for receive message outside permissible range	• Re-evaluate the request data.							○
C425H	Address setting for receive message range outside permissible range	• Re-evaluate the request data.							○
C42BH	No response from other node for 10 seconds or more	• Re-evaluate the source node for the address.							○
C501H	Self-loopback error	• Re-evaluate the cable.							
C502H	Hardware error	• Replace the FL-net module.							
C503H	Hardware error	• Replace the FL-net module.							

8.6 System Monitor

The FL-net module status can be checked from system monitor.

(1) Startup procedure

GX Developer → [Diagnostics] → [System monitor…] → Module's Detailed Information



(2) Display details

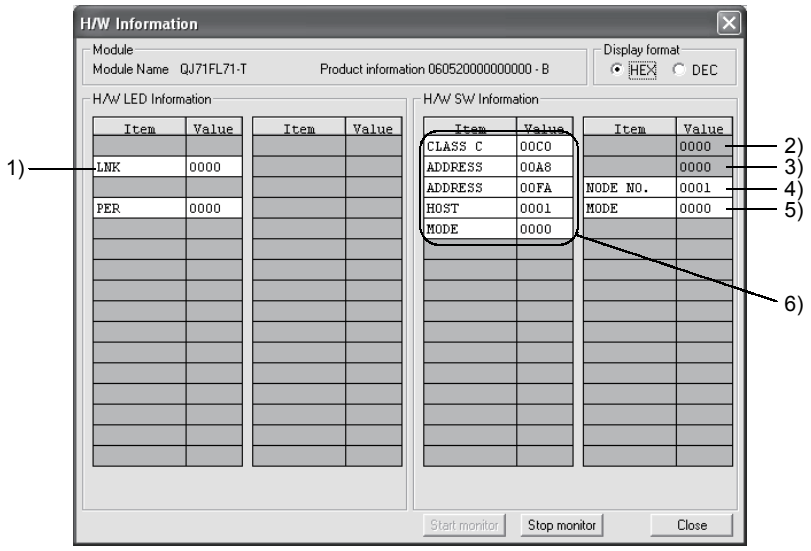
Item		Description
Module	Module Name	Displays the model name of the target module.
	I/O Address	Displays the start I/O No. of the target module.
	Implementation Position	Displays the slot position in which the module is installed.
	Product information	Displays serial No. and function version of the target module. *1
Module Information	Module access	Displays that it is accessible when Module ready (X1C) is ON, or when Watch dog timer error (X1F) is OFF.
	Status of I/O Address Verify	Displays whether the module for which the user has set parameters matches the one installed or not.
Error Display	Present Error	Displays an error code of the latest error. (Refer to Section 8.5.2.)
	Error Display	Displays the latest 16 error codes stored in the buffer memory (Address: 9C6H, 9D2H to 9D7H).
Error contents-Disposal	Contents	For the error code selected at Error Display, displays the error description and its corrective action.
	Disposal	

*1: The suffix of Product information shows the function version of the module.
Example: The suffix of "B" means that the module is function version B.

8.7 H/W Information

Details about FL-net module LED information and switch information can be monitored using H/W information on GX Developer. To display Hardware data, select: Diagnosis → System monitor → Module detailed information and click H/W data .

The H/W information will be shown on the following screen.



The following items are shown.

1) Actul LED information
   Displays information about the LED that are on for the FL-net module.
   • LNK 0000: OFF 0001 : ON
   • PER 0000: OFF 0001 : ON

2), 3) System information
   Displays system information about the FL-net module.

4) Node number switch information
   Displays the node number (4 digits of IP address) that have been set in FL-net module.
   Display range : 1 to 254

5) Mode number switch information
   Displays the mode number that has been set in the FL-net module.
   Display range : 0 to F

6) Intelligent function module switch setting
   Displays the Intelligent function module switch settings that have been set in I/O assignment settings in the parameters for the GX Developer. (No.1 → Intelligent function module switch setting 1)

APPENDIX

Appendix 1 Upgrading the Functions of the FL-net Module

Function version B of the FL-net module contains functions that are revisions of and additions to the current version (version A). This section explains a comparison of the FL-net module functions, program use and incorporating into the existing system along with these additions and revisions.

Appendix 1.1 Comparison of FL-net module functions

(1) Comparison of FL-net module functions

This shows the functions that have been added to or changed in version B.

- Transparent message transmission (Refer to 6.2.8.(6) (h) and 6.5.3.(5) (6))
- Parameter settings using the GX Configurator-FL (Refer to Section 6.4)
- Multiple PLC system (Refer to Section 3.3)

Appendix 1.2 Precautions when replacing from function version A to function version B

This section explains using programs created for FL-net modules with function version A and incorporating them into previous systems.

(1) Using the program

It is possible to use a program for function version A FL-net modules as is on a function version B FL-net module.

(2) Incorporating into existing system

It is possible to use a program created for use on FL-net modules with function version B as is on the cables for used for FL-net modules with function version A.

Appendix 1.3 Precautions when mixing modules with function versions A and B

This section explains the precautions when mixing function version A and function version B FL-net modules.

App

(1) Transparent-type message transmission

Use word units when performing a transparent-type message transmission from a function version B FL-net module to a function A FL-net module. (Refer to Section 6.2.8.(6) (h) and 6.5.3.(5) (6))

(2) GX Configurator-FL

Function version A FL-net modules are not compatible with GX Configurator-FL. Do not use GX Configurator-FL to set the parameters on function version A FL-net modules.

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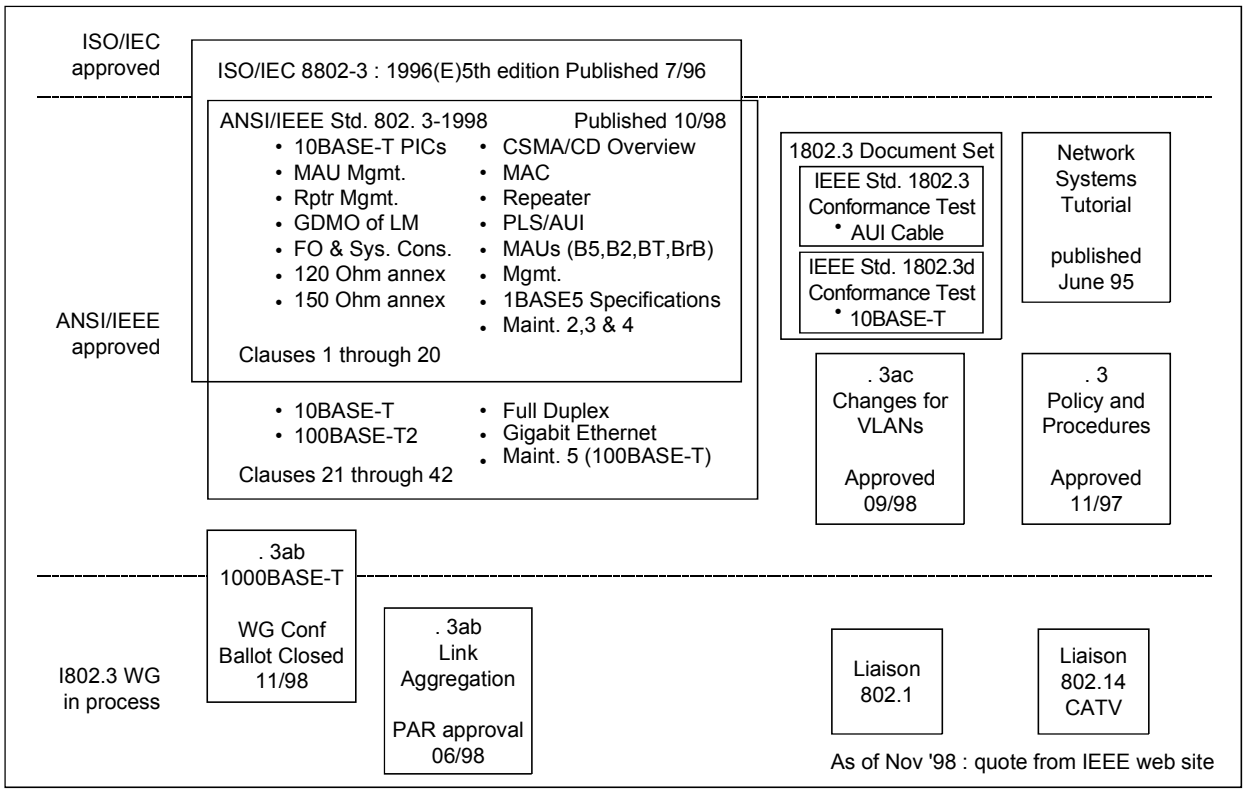
Appendix 2 Guide to System Configuration

Appendix 2.1 Overview of Ethernet

Ethernet is a standard for Local Area Network (LAN) used for communication among computers, printers and other such devices. It sets the standards for formatting the data for communication, the cables, connectors and other components.
The standards for Ethernet are defined by IEEE Ethernet working group: IEEE802.3 and was the standard that defined formats such 10BASE5, 10BASE2 and 10BASE-T up until now. At the present time, there is also research into a standards for new formats such as 1000BASE-T. The following shows the trends in standardization of the IEEE802.3 working group.



App

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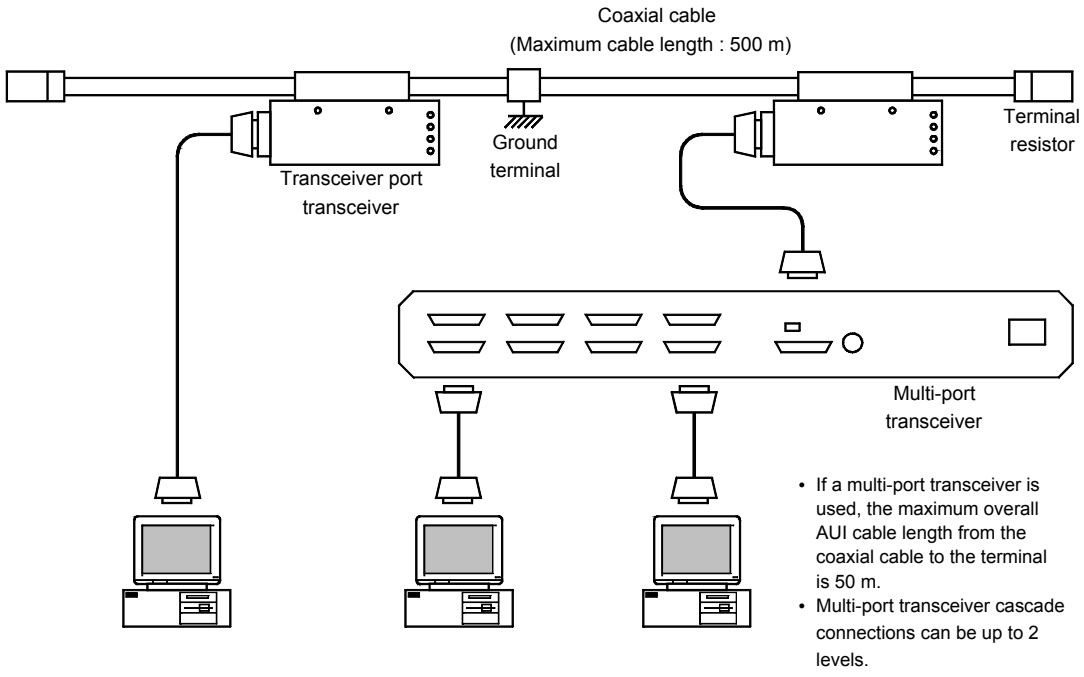
Appendix 2.2 10BASE5 specifications

10BASE5 is a method of connecting an Ethernet system by used a coaxial cable that is approximately 10 mm thick (often called thick cable or yellow cable). The "10" in 10BASE5 indicates that the transmission speed which is 10Mbps. "BASE" indicates the that the transmission method is a base band format while the "5" indicates that the transmission distance of the main cable is 500 m. A transceiver is connected to the coaxial cable when Personal computer and other such equipment is connected to the system. A transceiver cable, commonly called an AUI cable, is used for the connection between the equipment and the transceiver.
Since the thick cables of the 10BASE5 system make it difficult to layout a network, it is not used in offices very often. It is most commonly used as the main line network for applications requiring transmission over long distances.
The following shows the example of 10BASE5 configuration.



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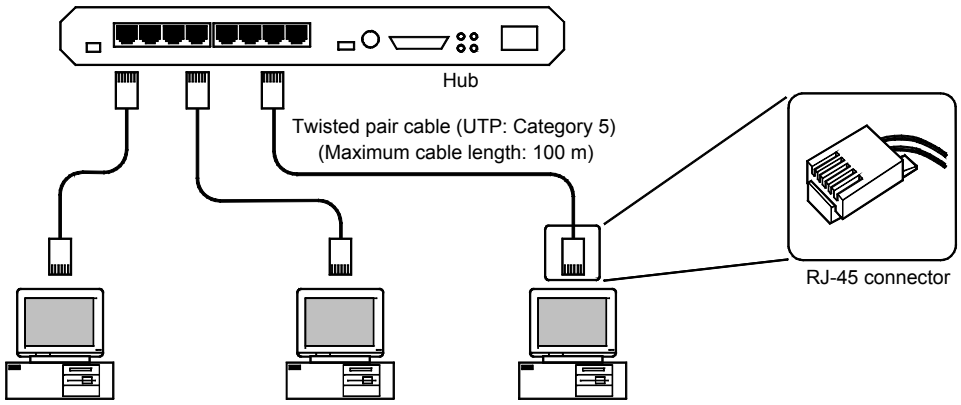
Appendix 2.3 10BASE-T specifications

10BASE-T is method of connecting an Ethernet system by used twisted pair cables. The "10" in 10BASE-T indicates that the transmission speed which is 10Mbps. "BASE" indicates the that the transmission method is a base band method while the "-T" indicates that the twisted pair cable is used as the transmission medium. 10BASE-T networks require a hub in a star configuration for connecting personal computer and other such equipment and the equipment cannot be directly connected to each other. (Note that a special cable, called a cross cable, can be used for direct one-to-one connections, but this is not a common practice.) The cable from the hub to each piece of equipment can be up to 100 m long. Since the cables of the 10BASE-T are thin and relatively easy to route and since each piece of equipment can be connected or disconnected to the network individually, this is a popular network system for office applications.
The following shows the example of a 10BASE-T configuration.



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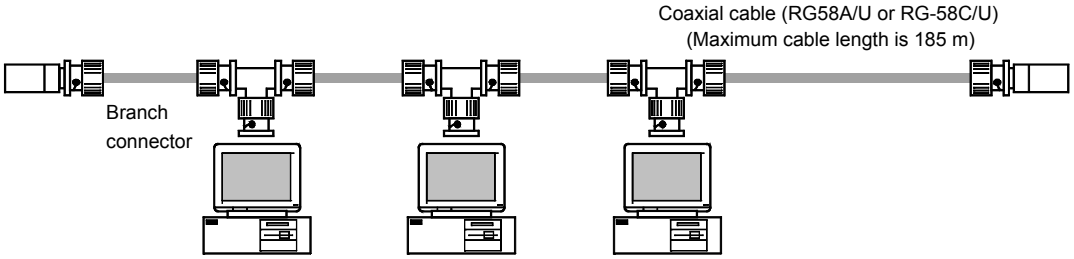
Appendix 2.4 10BASE2 specifications

10BASE2 is a method of connecting an Ethernet system by used a coaxial cable that is approximately 5mm thick (often called the thin cable). The "10" in 10BASE2 indicates that the transmission speed which is 10Mbps. "BASE" indicates the that the transmission method is a base band method while the "2" indicates that the transmission distance of the main cable is 185 m (approximately 200 m). Each personal computer and other equipment is connected by using a T-shaped branch connector on the BNC cable. The coaxial cable is connected to both ends of this T-shaped branch connector.
The following shows the example of a 10BASE2 configuration.



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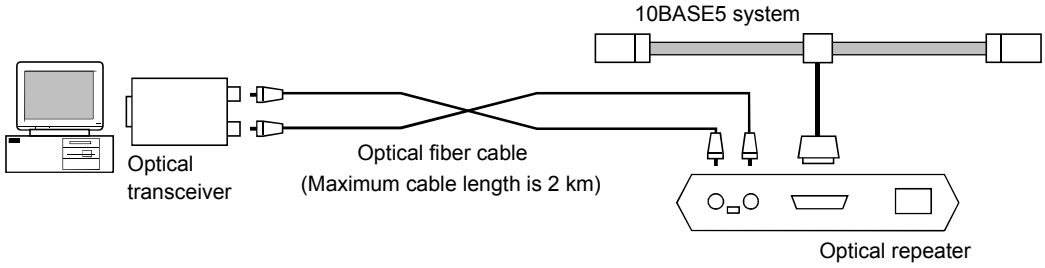
Appendix 2.5 Other Ethernet specifications

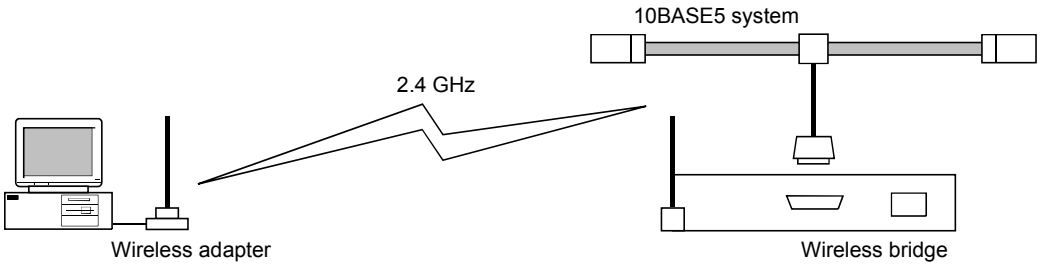
(1) Optical Ethernet

Optical Ethernet uses fiber optics as the medium of transmission. It can transmit to distances exceeding 500 m and is resistant to electrical noise. IEEE802.3 has standardized the optical Ethernet connection method as 10BASE-FP, 10BASE-FB, 10BASE-FL, 100BASE-FX, 1000BASE-LX and 1000BASE-SX.
The following shows the example of an optical Ethernet configuration.



(2) Wireless Ethernet

Wireless LAN uses radio waves or infrared lays as the medium of transmission. It allows portable devices to connected to a LAN system. The standardization process for wireless LAN is proceeding under IEEE wireless LAN working group: IEEE802.11. Wireless LAN has a different MAC layer protocol which necessitates the use of a bridge for interconnection.
The following shows the example of a wireless LAN configuration.



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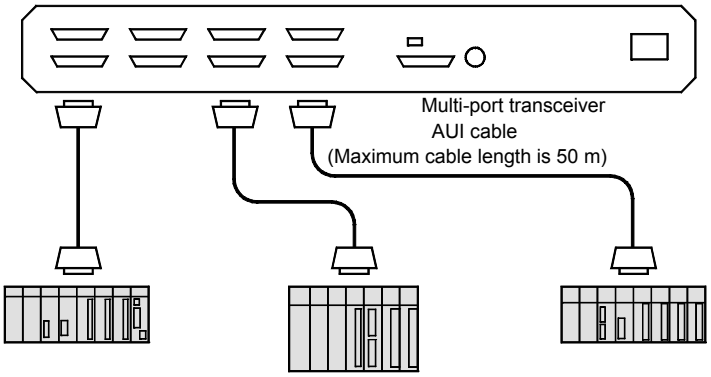
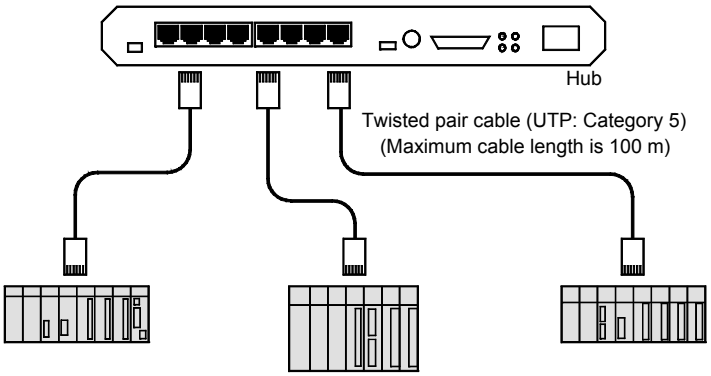
Appendix 3 Examples of System Configuration

Appendix 3.1 Small-scale configuration

A network system can be constructed by connecting equipment to a single multi-port transceiver or HUB.



(a) When using a multi-port transceiver.



(b) When using a HUB

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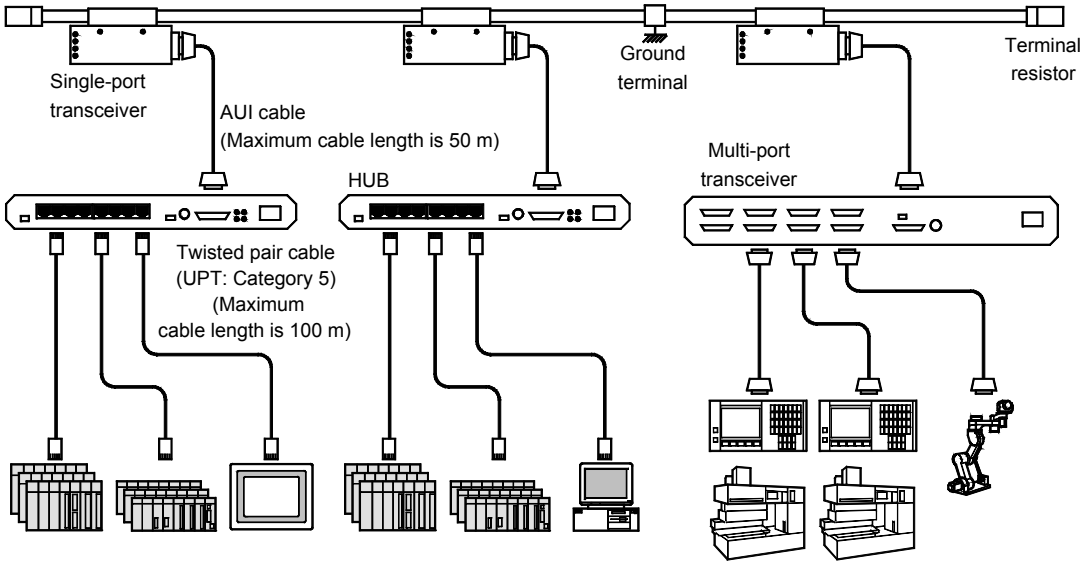
Appendix 3.2 Basic configuration

Several multi-port transceivers or HUBs are connected to one coaxial cable so that the network can consist of a large number of equipment.



- Up to a total of four repeaters or HUBs can be installed between any two given terminals.
- If a multi-port transceiver is used, the maximum overall length of the AUI cable from the coaxial cable to the terminal is 50 m.
- Multi-port transceiver cascade connections can be up to 2 levels.

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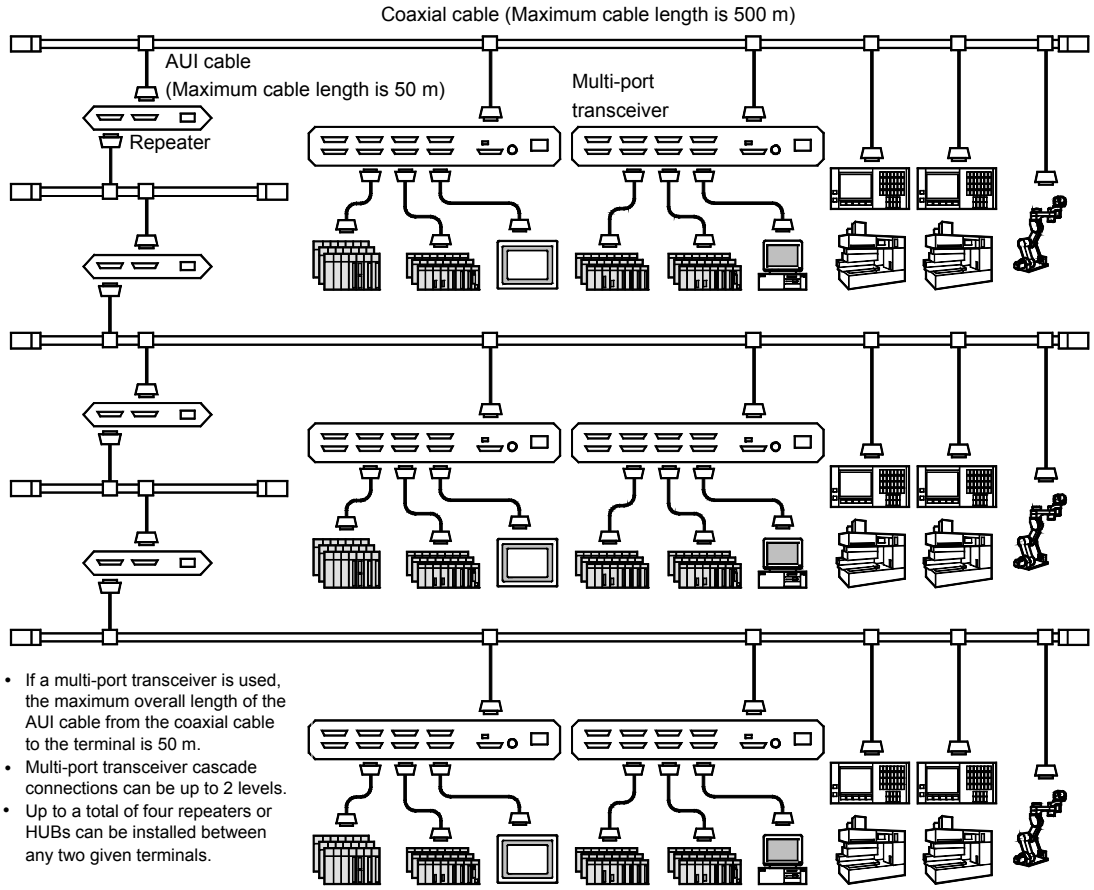
Appendix 3.3 Large-scale configuration

Several 10BASE5 networks sections are connected by repeaters to form a network system that can incorporate several hundred pieces of equipment.



- If a multi-port transceiver is used, the maximum overall length of the AUI cable from the coaxial cable to the terminal is 50 m.
- Multi-port transceiver cascade connections can be up to 2 levels.
- Up to a total of four repeaters or HUBs can be installed between any two given terminals.

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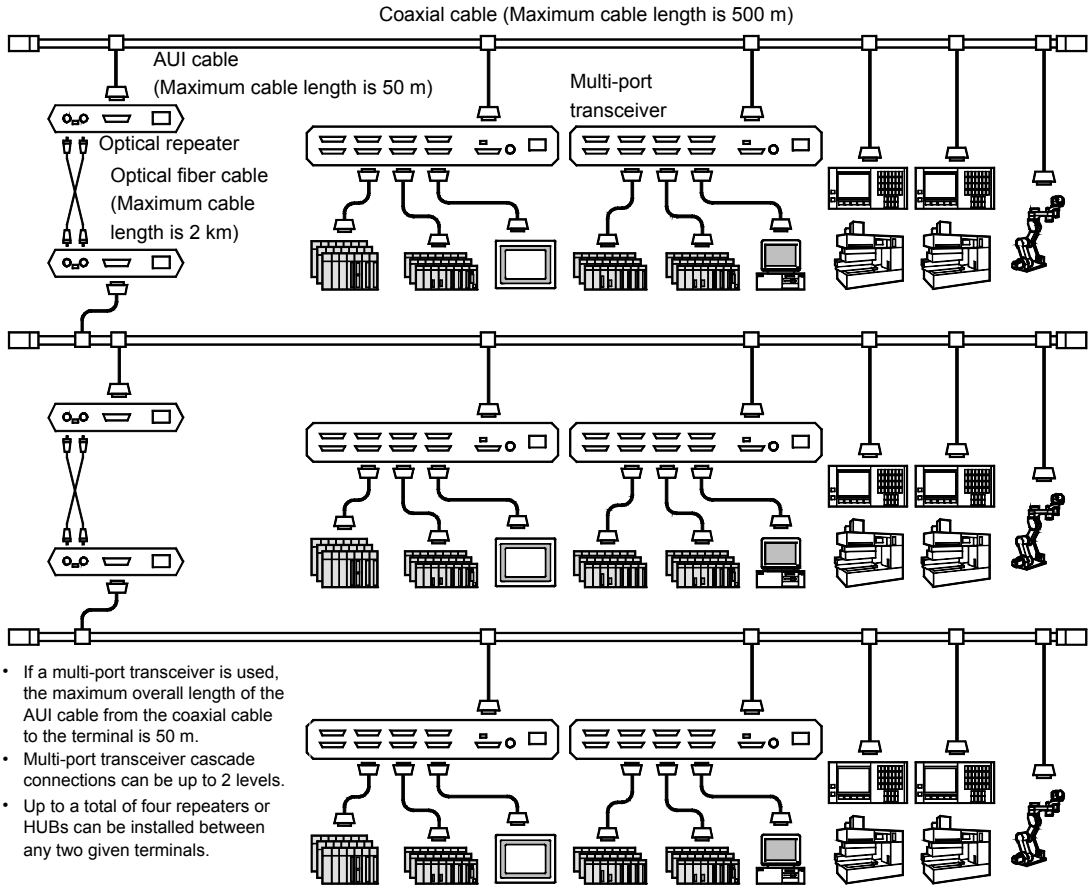
Appendix 3.4 Long-distance distributed configuration

When the distance between the network segments in a large-scale network system exceeds the limitations of the 10BASE5 transmission distance (500 m), the segments of the network can be linked by optical fiber cable that can provide up to 2 km between repeaters.



- If a multi-port transceiver is used, the maximum overall length of the AUI cable from the coaxial cable to the terminal is 50 m.
- Multi-port transceiver cascade connections can be up to 2 levels.
- Up to a total of four repeaters or HUBs can be installed between any two given terminals.

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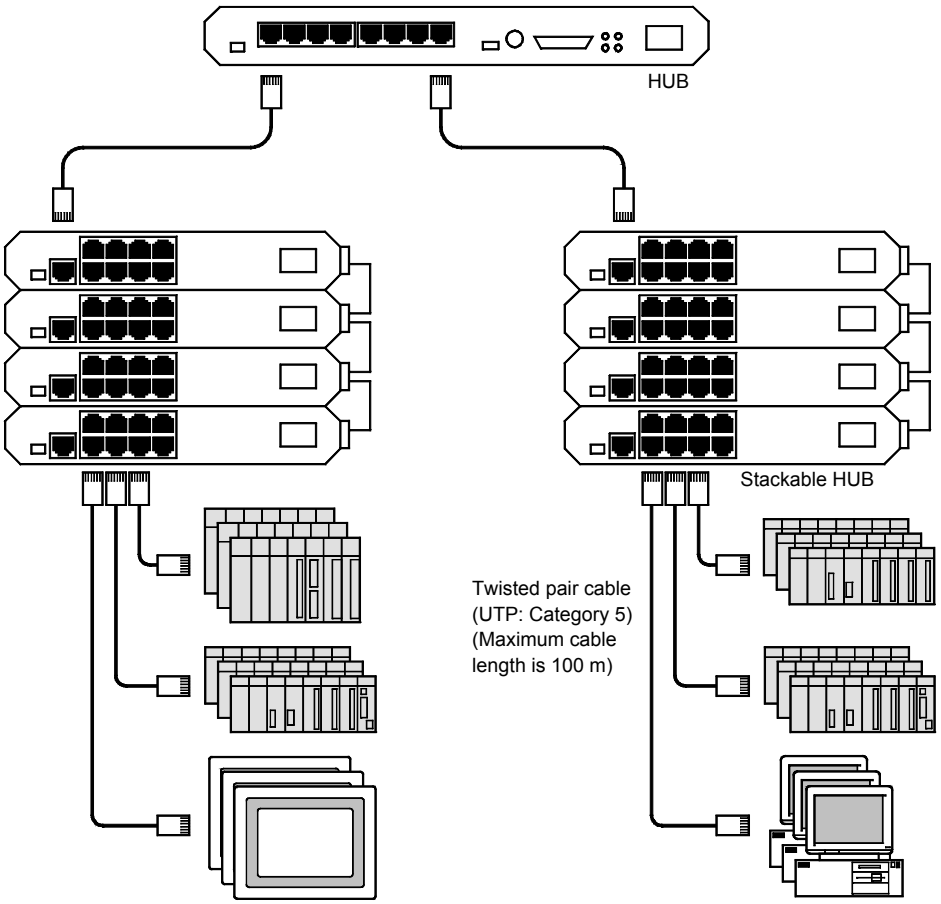
Appendix 3.5 Local centralized configuration

When many pieces of equipment are centralized locally, stackable HUBs can be used when building the network system.



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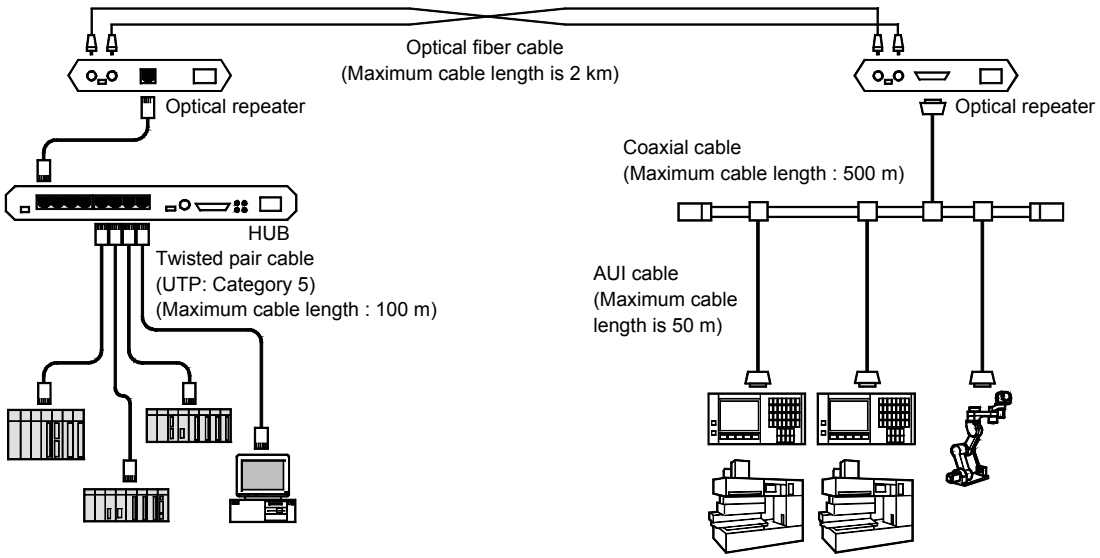
Appendix 3.6 Local and long-distance dispersed configuration

This is a basic network system that has had the network divided into two segments that are connected by optical repeaters for each segment. This design is used when the controller is located far away or when there is a high voltage power source or other sources of electrical noise near the network. The linking of the two segments by optical repeater allows them to be far from each other while offer exceptional resistance to electrical noise.



Appendix 3.7 Basic concepts of the FL-net (OPCN-2) system

The FL-net (OPCN-2) is intended to provide real-time communication among controllers such as the programmable controllers, robot controllers and numerical control devices found in manufacturing systems.
FL-net (OPCN-2) is designed for simultaneous broadcast using a token passing mechanism with upon Ethernet UDP/IP protocol in addition, cyclic communication and message communication can be performed.

Appendix 3.8 Differences between conventional Ethernet and FL-net (OPCN-2)

(1) Since FL-net (OPCN-2) is a network system for use in the factory automation field, not all general purpose Ethernet equipment can be used with it. There is equipment with noise resistance characteristics and environmental resistance characteristics that are not appropriate for use in an FL-net (OPCN-2) system.

(2) Since the FL-net (OPCN-2) is required to provide the response performance that gives it the ability for real-time communication for controller applications, it can be connected to FL-net (OPCN-2) compatible controllers or controller equipment alone.

(3) Since the FL-net (OPCN-2) is a cyclic communication method that uses the simultaneous broadcast functions of UDP/IP communication found in 10BASE5 and 10BASE-T, the following restrictions apply under its current protocol.

(a) Currently compatible equipment can only be used with 10Mbps Ethernet LAN.

(b) It cannot be connected to a conventional Ethernet system.

(c) It does not support the TCP/IP communication functions.

(d) A switching HUB can be used but it will be ineffective.

(e) It may not be possible to use some functions when a router and other such equipment is used.

Appendix 4 Network System Definitions

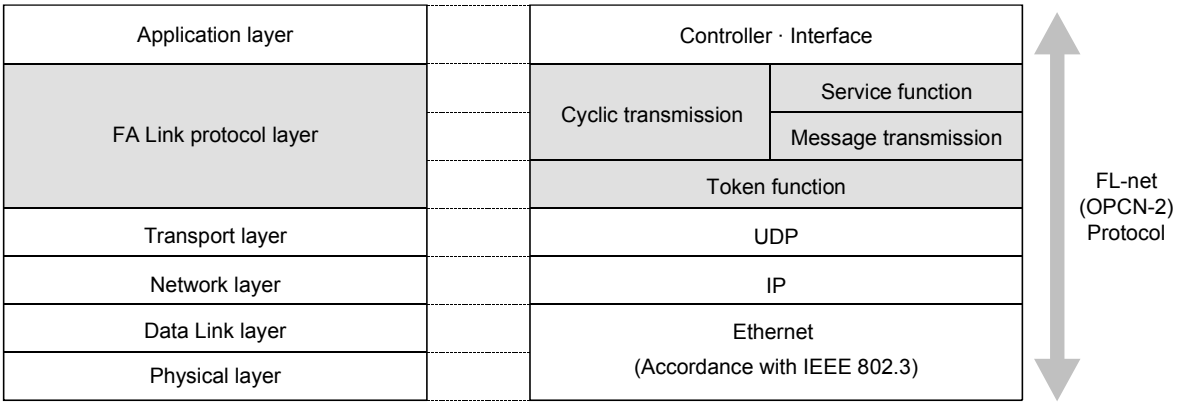
Appendix 4.1 Communication protocol standards

Communication protocol are the rules for one system to exchange data with another system over communication wires. The communication protocol used by FL-net (OPCN-2) conforms to the following standards.

Communication protocol for FL-net (OPCN-2)	Applicable standards
FL-net (OPCN-2)	FA link protocol specifications (Issued by the FA open promotion convention and special committee for FA control networks)
UDP	RFC768
IP, ICMP, etc.	RFC791, 792, 919, 922, 950
ARP, etc.	RFC826, 894
Ethernet	IEEE802.3

Appendix 4.2 Communication protocol layer structure

Communication protocol has been made into a model based on a layered structure and communication processing is divided and organized into several levels for expression and standardization. FL-net (OPCN-2) is comprised on the six protocol layers shown below.



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Appendix 4.3 FL-net (OPCN-2) physical layer

When the transmission speed is 10 Mbps, there are 5 types of transmission methods in the physical layer of the Ethernet. These are: 10BASE5, 10BASE2, 10BASE-T, 10BASE-F and 10BROAD36 (although it is not very popular). There is also a 100 Mbps Ethernet. Of these types, 10BASE5 (recommended), 10BASE2 and 10BASE-T can be used in FL-net (OPCN-2).

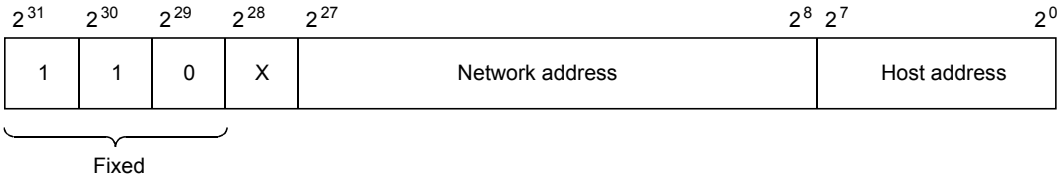
Appendix 4.4 FL-net (OPCN-2) IP address

An address, called an IP address (INET address), is used to identify a specified communication device from among all the communication devices connected to an Ethernet system. Accordingly, a unique IP address must be set for each communication device on the system.
An IP address is comprised of a section that expresses the network address that communication device is connected to and a section that for the host address of that communication device. Depending on the size of the network, it can be classified into one of three network classes, Class A, B or C. (Note that there is also a Class D and a Class E for special purposes.)

	First address octet value	Network address section (*1)	Host address section (*1)
Class A	0 to 127	[xxx.] xxx. xxx. xxx	xxx.[xxx. xxx. xxx]
Class B	128 to 191	[xxx. xxx.] xxx. xxx	xxx. xxx.[xxx. xxx]
Class C	192 to 223	[xxx. xxx. xxx.] xxx	xxx. xxx. xxx.[xxx]

*1: The part enclosed by the rectangular is the section corresponding to each of the address sections.

In one network, the IP addresses of the communication devices that are connected to that network will all have the same network address section and the host address section will be a unique value.
The FL-net (OPCN-2) IP address default value is 192.168.250.n (n is the node number: 1 to 254). It is recommended that IP address class C be used and that the lower position host address and the FL-net (OPCN-2) protocol node number be matched.



Appendix 4.5 FL-net (OPCN-2) sub-net mask

The sub-net mask of FL-net (OPCN-2) is fixed at 255.255.255.0. There is no need for users of FL-net (OPCN-2) to change this setting. This value is the same as segments for the Class C original network address section and host address segments.

Appendix 4.6 TCP/IP, UDP/IP communication protocol

This is the main protocol used in Ethernet, such TCP, UDP or IP. IP is positioned in the network layer of the communication protocol and controls the flow of the communication data.
TCP and UDP are positioned in the transport layer and while both use the IP as the network layer, there are big differences in the service.
TCP provides reliable service that will not recognize the breaks in data for the upper layer.
On the other hand, since the UDP functions for transmitting the data cluster (data diagram) as is to the top layer from IP, there is no assurance as to whether or not the data reaches its destination. It leaves the conformation of reception and resending of data processing to the top layer. In return for the lower reliability UDP offers in comparison to TCP, UDP can offer communication service with low overhead.
FL-net (OPCN-2) uses UDP. This is because the process involved in confirming and resending of questionable TCP data is redundant in the FL-net (OPCN-2). This process is eliminated and instead, high speed data exchange is provided by dividing and composing multiple frames and control of transmission rights through the use of tokens in the top layer of FL-net (OPCN-2) protocol.

Appendix 4.7 FL-net (OPCN-2) port numbers

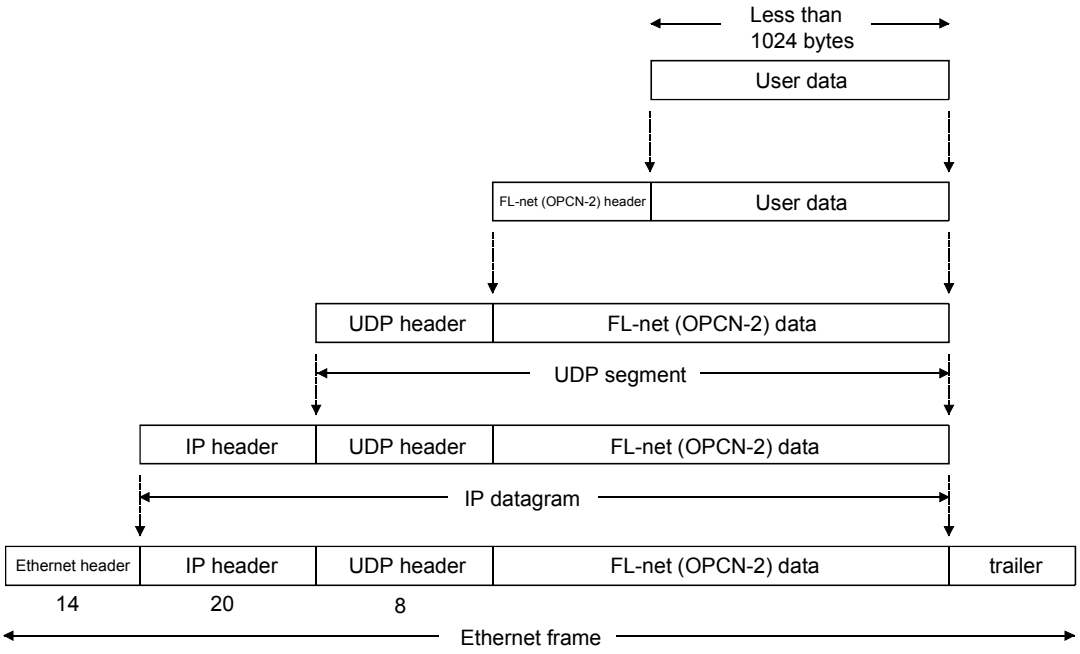
The following port number have been pre-determined for realizing service FL-net (OPCN-2) protocol positioned in the upper transport layer. There is no need for FL-net (OPCN-2) users to set the parameters for these port numbers.

	Name	Port number
1	Port number for cyclic transmission	55000 (Fixed)
2	Port number for message transmission	55001 (Fixed)
3	Port number for participation request frame	55002 (Fixed)
4	Port number for sending	55003 (Fixed)

Appendix 4.8 Data format for FL-net (OPCN-2)

(1) Summary of data format for FL-net (OPCN-2)

The data that is sent by FL-net (OPCN-2) is capsulated in layers of the communication protocol shown below.



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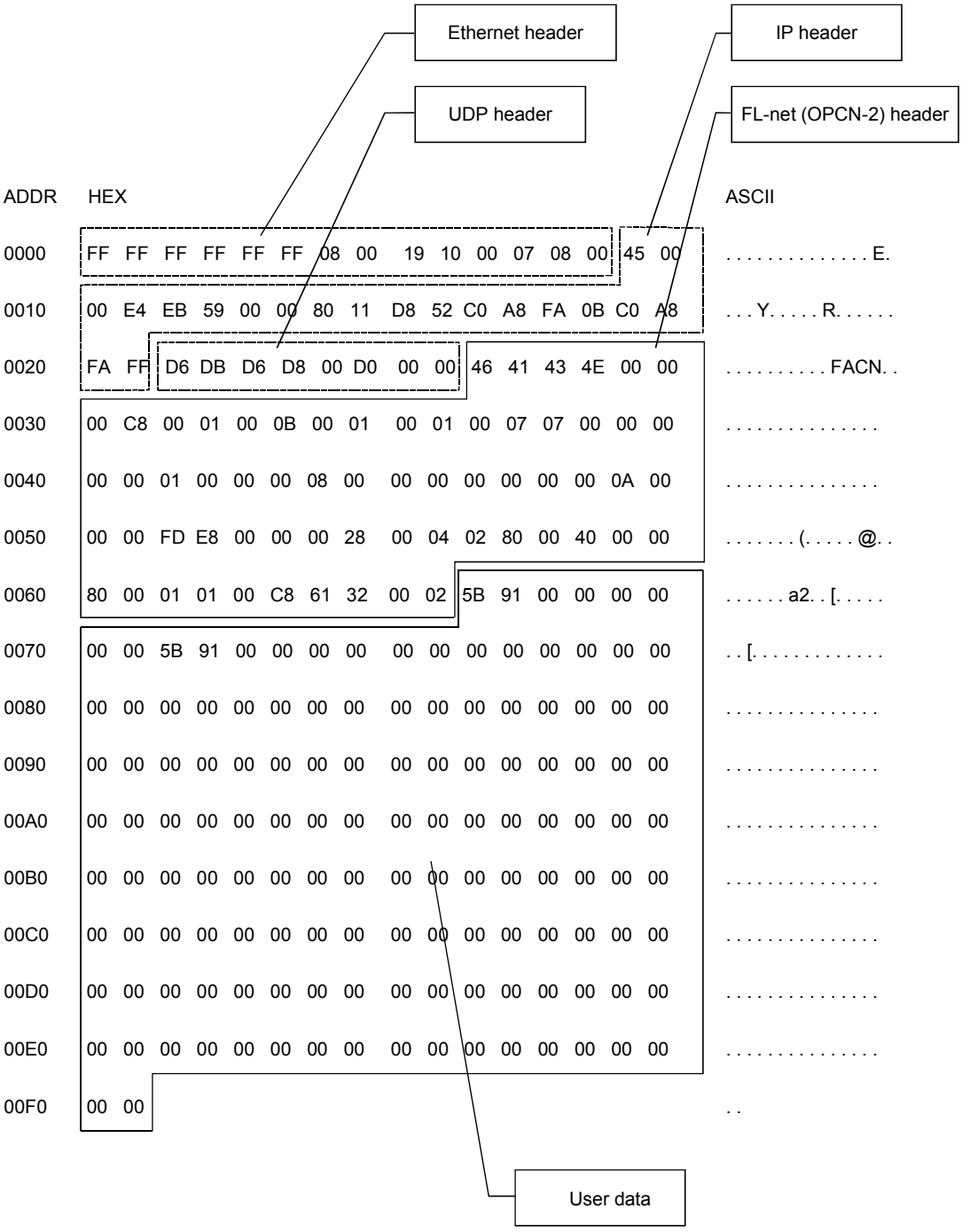
The following shows one frame of FL-net (OPCN-2) data that can be observed on a communication line.
As for example, cyclic data of 128 bytes are transferring.



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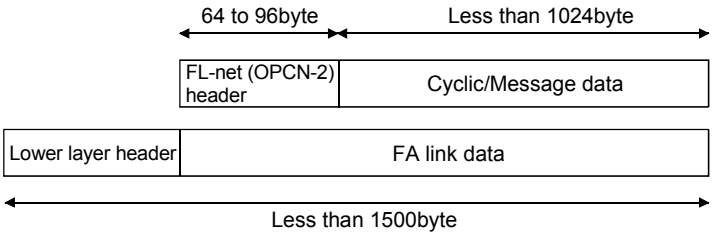
(2) FL-net (OPCN-2) header format

FL-net (OPCN-2) headers can be from 64 to 96 bytes in size. Note that under FL-net (OPCN-2) protocol, FL-net (OPCN-2) headers are attached to the first address of all frames.



Appendix 4.9 FL-net (OPCN-2) transaction code

Refer to Section 6.2.8.(3), (4) for details.

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Appendix 5 FL-net (OPCN-2) Network Control

Appendix 5.1 FL-net (OPCN-2) token control

(1) Token

Basically, the only time a node can transmit is when that node is holding the token. There are only two conditions under which transmission can take place without holding the node: reissuing the token when the token monitoring time has expired and for a participation request when the node is not participating in the network.

(a) In the FL-net (OPCN-2), a single token is circulated among nodes.

(b) A node receiving a token, this node will hold the transmission right until it releases the token to the next node.

(c) The token is circulated among all the nodes joining in the FL-net (OPCN-2)

(d) The token can be transmitted together with cyclic data.

(e) The token can also be circulated without any data.

(f) The token is monitored by the timer of each node. If the token is not sent in the network for a fixed time, another token will be reissued automatically.

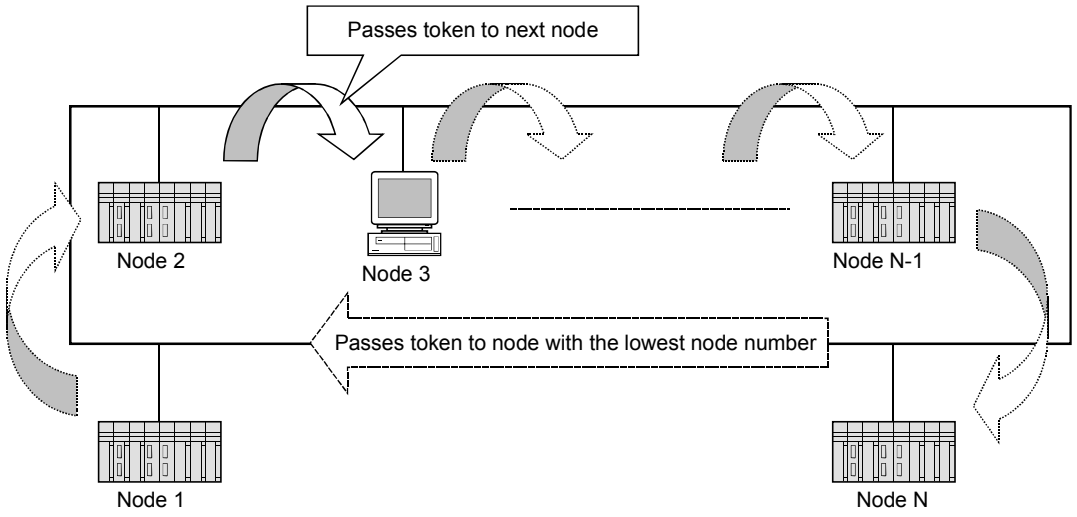
(g) If there are two tokens in the network, they are unified into one.

(2) Token flow

Basically, there is only one token for the network. When there are two or more tokens, the smallest address node number has priority while others are eliminated.

The frame that includes the token (token frame) has a token address node number and a token dispatch node number. When the node matches the token address node number of the token frame received, it becomes the token holding node.

The sequence of the token rotation is determined by the node number. Rotation is performed in ascending order among the nodes that are registered in the participating node control table. The highest node number passes the token to the lowest node number.



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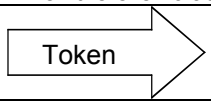
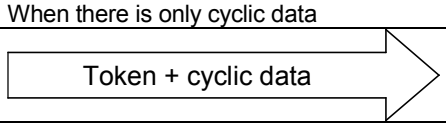
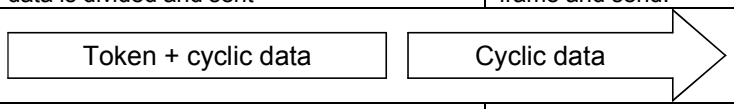
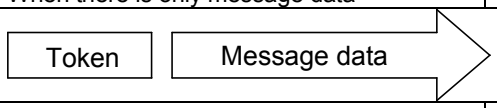
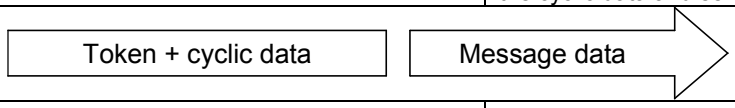
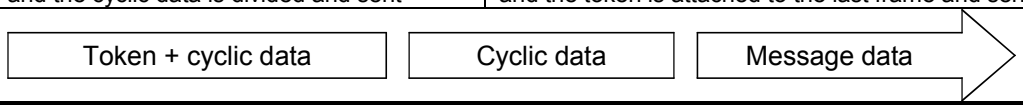
(3) Token and data

There are following 6 types of patterns for the data when sending token.

No.	Item	Contents
1	When there is no accompanying data	Only the token is sent.
		
2	When there is only cyclic data	The token is attached to the cyclic data and send.
		
3	When there is only cyclic data and the cyclic data is divided and sent	Only the cyclic data is sent and the token is attached to the last frame and send.
		
4	When there is only message data	The token is sent after the message data has been sent.
		
5	When there is cyclic data and message data	After the message data has been sent, the token is attached to the cyclic data and sent.
		
6	When there is cyclic data and message data and the cyclic data is divided and sent	After the message data has been sent, only the cyclic data is sent and the token is attached to the last frame and sent.
		

(4) Frame interval (Minimum permissible frame interval)

The frame interval is time from when a local node receives the token until it dispatches a frame. The minimum permissible frame interval is the shortest amount of time a node has to wait before dispatching a frame.
With FL-net (OPCN-2), this minimum permissible frame interval is shared by the network. Each node recalculates and updates the largest value for the minimum permissible frame interval when nodes participate or leave.

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(5) Refresh cycle time

As shown below, the refresh cycle time is the time from when a local node dispatches a token until it is held.

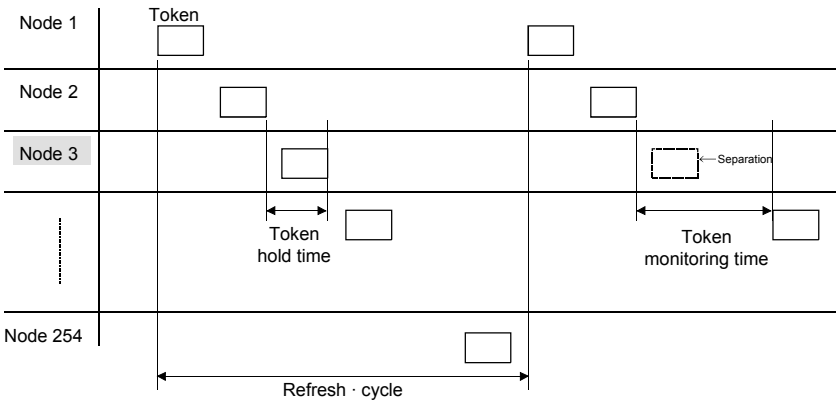
(a) Refresh cycle time (RC)

RC [ms] = Total number of nodes × 1.35 + total number of cyclic data words (∗1) × 0.0032 + (total number of frames (∗2) – the number of nodes) × the minimum frame interval time setting value (∗3)10
+ (number of separating nodes × token monitoring time (∗4)) • • • Add to separation time
+ (1.35 + number of message data words × 0.0016) • • • add to message transmission time

∗1 : Total number of data words	· · · · Total of area 1 (bit area) and area 2 (word area) that have been allocated to each node.
∗2 : Total number of frames	· · · · The total number of frames that have been divided when the size for each node has exceeded 1024 bytes.
∗3 : Minimum frame interval time setting value	· · · · Maximum setting value for all nodes.
∗4 : Token monitoring time	· · · · The token monitoring time that has been set for each node.

(b) Token hold time

Token hold time [ms] = 1.35 + (number of local node transmission cyclic data word × 0.0032) + {(number of frames - 1) × minimum frame interval time setting value/10}



POINT

(1) The above are the calculations when comprised of this module and will become the sum total of token hold time when mixed with equipment from other manufacturers.

(2) When the minimum frame interval time is larger than the token hold time, the following will apply: RC [ms] = total number of frames × minimum frame interval time setting value/10.

(3) Separation is determined as follows. When each node receives a token frame, it checks the node number. If a token frame is not received from a given node for three times continuously, it is considered separated. Note that this also includes when a node holding a token does not dispatch a token even though the token monitoring time has been exceeded.

(6) Refresh time

The transmission time between the cyclic data area and device area.

(a) Automatic refresh

Refresh time [ms] = KM1 + (KM2 × total number of transmitted words)
+ (KM3 × number of parameter setting with automatic refresh setting

KM1, KM2, KM3: Constant

Item		Constant				
		Q00JCPU	Q00CPU	Q01CPU	Q02CPU	Q02HCPU, Q06HCPU, Q12HCPU, Q12PHCPU, Q25HCPU, Q25PHCPU
KM1	Basic base	0.097	0.082	0.070	0.046	0.013
	Extension base	0.180	0.135	0.103	0.056	0.024
KM2	Basic base	0.00099	0.00091	0.00086	0.00054	0.00046
	Extension base	0.00175	0.00168	0.00164	0.00114	0.00106
KM3	Basic base	0.065	0.063	0.044	0.0105	0.006
	Extension base	0.049	0.053	0.042	0.0095	0.005

Note 1) See Section 6.4.3 for the way of counting of the parameter setting with the automatic refresh setting.

(b) During BMOV (FROM/TO)

Number of transmission words	Transmission time [ms]				
	Q00JCPU	Q00CPU	Q01CPU	Q02CPU	Q02HCPU, Q06HCPU, Q12HCPU, Q12PHCPU, Q25HCPU, Q25PHCPU
1 point	0.120	0.101	0.0917	0.048	0.025
1000 points	0.734	0.677	0.642	0.489	0.448

(7) Transmission delay time

The transmission delay time indicates the delay time until the cyclic data is transmitted from the node.

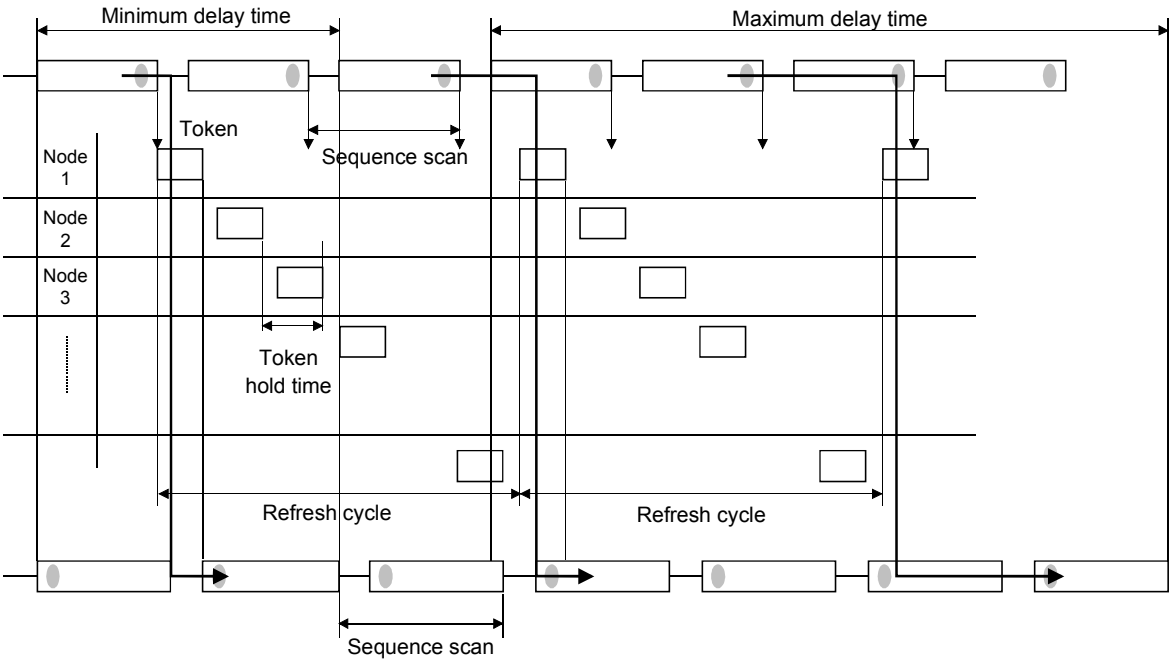
(a) Minimum transmission delay time [ms] = SM1(∗5) + token hold time + SM2 (∗6)

(b) Maximum transmission delay time [ms] = SM1 (∗5) + (refresh cycle time (RC) × 4) + SM2 (∗6)

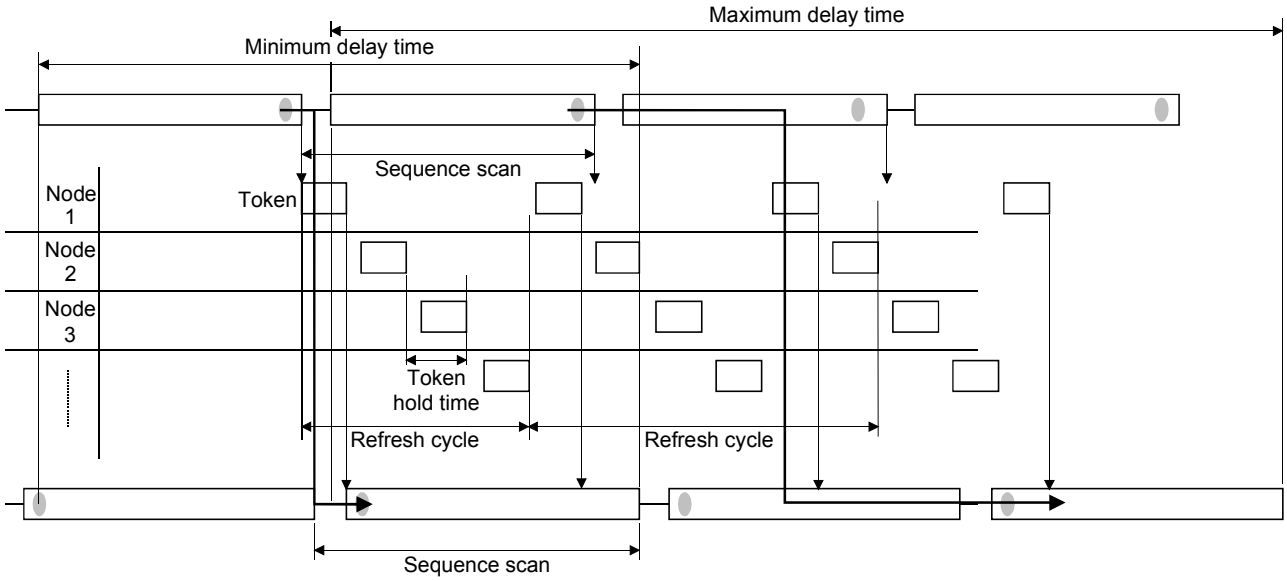
∗5: SM1 · · · · Send side sequence scan (including refresh time)

∗6: SM2 · · · · Receive side sequence scan (including refresh time)

1) When refresh cycle > sequence scan



2) When refresh cycle < sequence scan



POINT

Due to the relationship between the refresh cycle time and sequence scan time, there is a need to also estimate the transmission delay time with the maximum delay time for "when refresh cycle time < the sequence scan".

Appendix 5.2 FL-net (OPCN-2) subscription and separation

(1) Subscription to FL-net (OPCN-2)

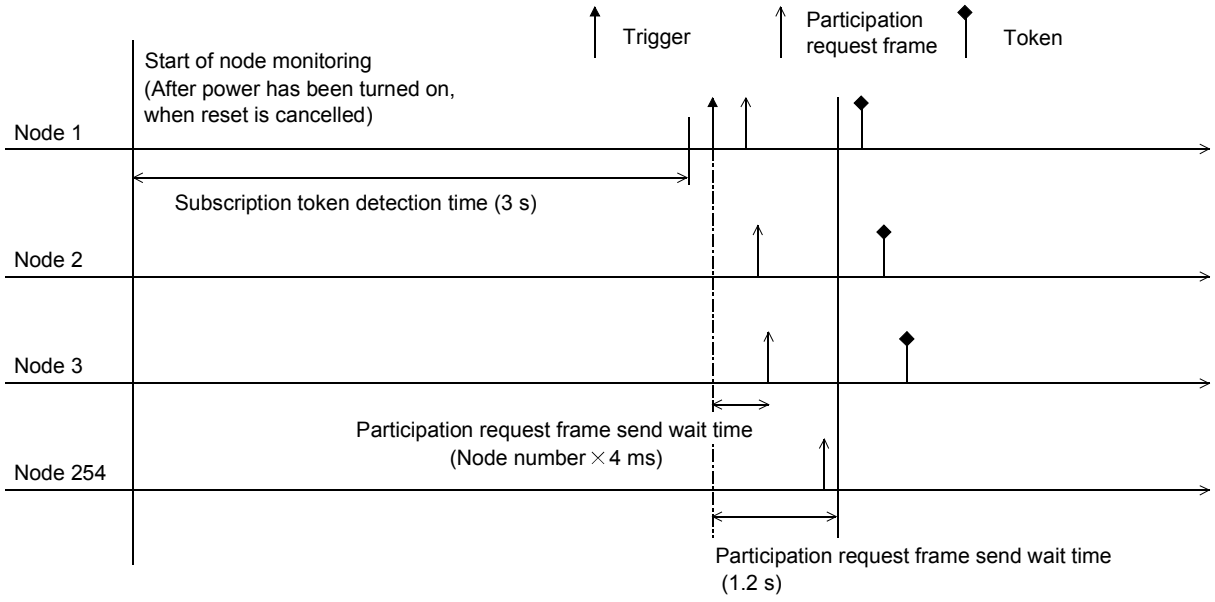
During start-up, each node monitors the transmission line until each of the token detection times have expired. If the node has not received a token at that time, it determines that the network is starting up and makes a new participation with the network. Or, if the node has received the token, it determines that it is in participating mode and performs in-process participating with the network.

(a) New participation

If the token has not been received after the subscription token detection time (*1) has expired, preparations are made for sending a trigger, which is sent approximately (node number/8) × 4 ms later. If a trigger is received before one is sent, the trigger is not sent.

During the participation request frame receive wait time (1200 ms) from when the trigger was received, all nodes wait for sending a participation request frame while checking for duplicate node numbers and addresses and updating participation node control tables. After the participation request frame receive wait time (*3) (node number × 4 ms) from when the trigger was received has expired, the participation request frame is sent. At this time, nodes that recognized duplicate addresses by the participation request frame of other nodes set area 1 (bit area) and area 2 (word area) of the first address of the common memory and the common memory size to zero (0) and do not send cyclic data.

The nodes that recognized duplicate addresses set the duplicate address flag and reset the common memory data validity notification flag. At the time the participation request frame receive wait time has ended, the node with the smallest node number sends the first token in accordance with the participation node control table. All the nodes that recognized node number duplication do not send or receive.



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(b) Participating (In-process participation)

When a token is received within the subscription token detection time (∗1) and a previously established link is recognized, there is a wait in the sending of the participation request frame until the token has completed three cycles. (∗2) During this time, the frame that has been received is used for checking for duplicate addresses and updating the participation node control table. At this time, nodes that recognized duplicate addresses set area 1 (bit area) and area 2 (word area) of the first address of the common memory and the common memory size to zero (0) and do not send cyclic data. The nodes that recognized duplicate addresses set the address multiplexing flag and reset the common memory data validity notification flag.

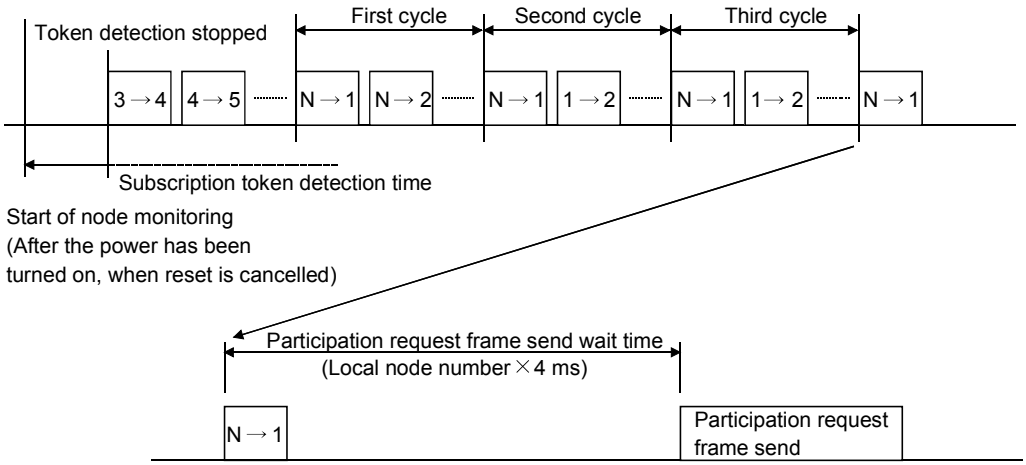
If there is no error with a node number, the node sends the participation request frame after the participation request frame send wait time has expired. (∗3) The participation request frame is sent without any relation to the holding of the token.

The nodes that recognized duplicate node numbers do not send participation request frames and do not participate in the network.

∗1 : Subscription token detection time · · · · Time for checking if the network is in operation mode.

∗2 : Cycle · · · · The standard for a cycle is based on the time at which the token addressed to the smallest node number is received.

∗3 : Participation request frame send wait time · · · · The dispatching of a participation request node is sent after the (node number × 4 ms) has passed so that it does not overlap with another node that is newly participating.



(2) Separation from FL-net (OPCN-2)

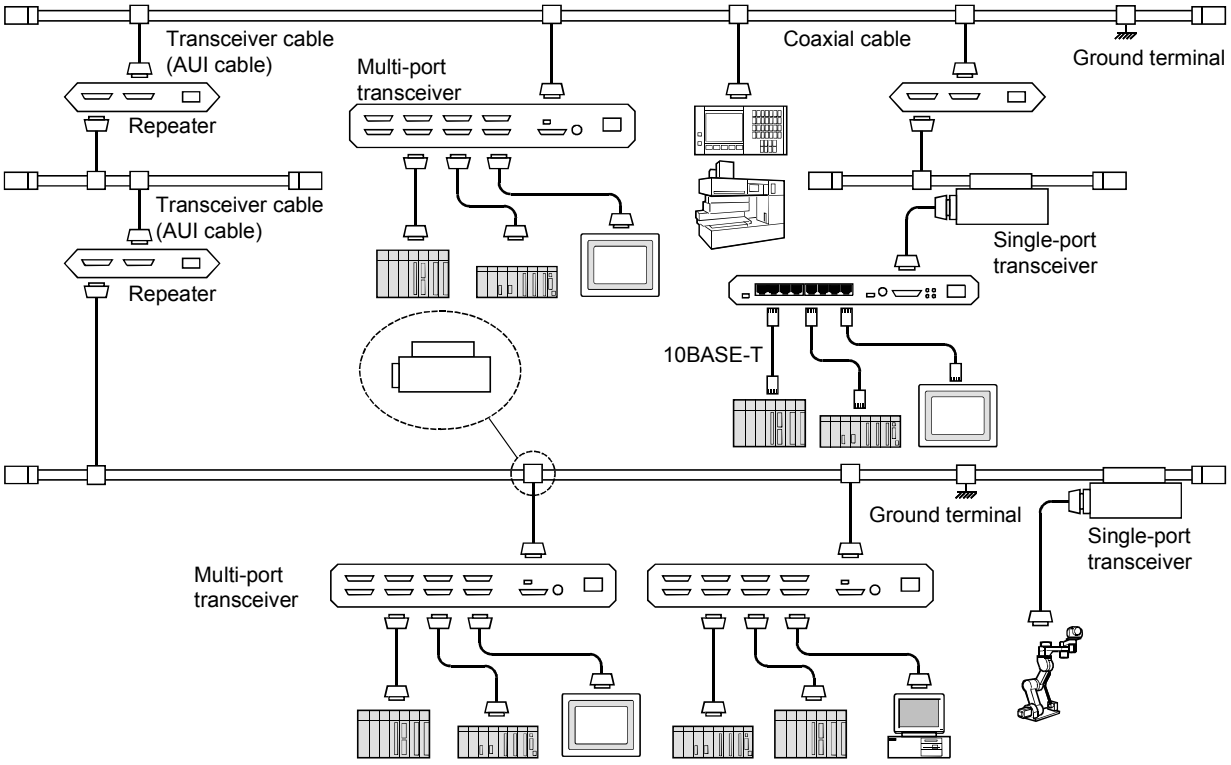
When each node receives a token frame, it checks the node number. If a token frame is not received from a given node for three cycles continuously, it is considered separated. (Note that this also includes when a node holding a token does not dispatch a token even though the token monitoring time has been exceeded.)

When a node is determined to have separated from the network as shown above, the data for that node is deleted from the control table.

Appendix 6 Network Components

Appendix 6.1 List of Ethernet components

The following shows the components to configure Ethernet. Use the network equipment conforming to the IEEE802.3 standard.



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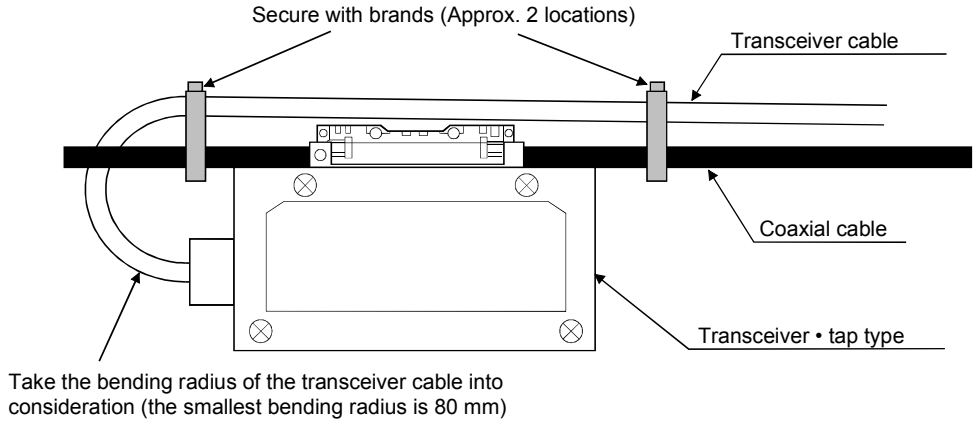
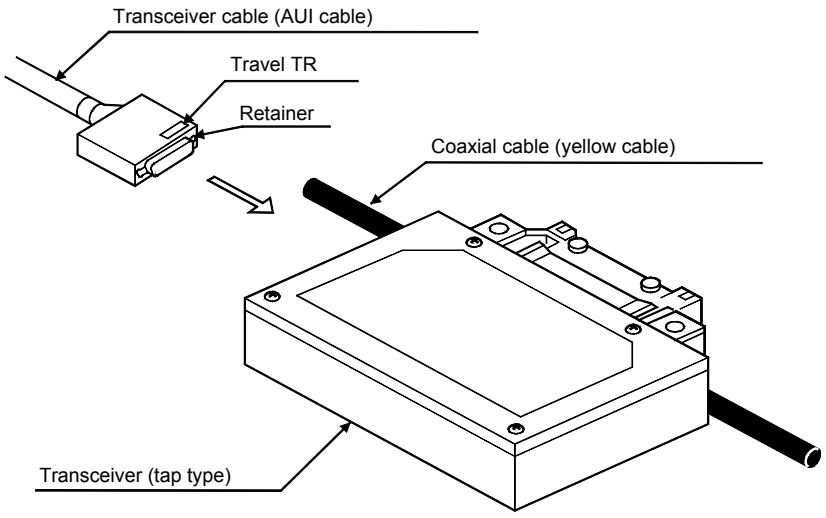
Appendix 6.2 10BASE5 components

(1) Transceiver

The transceiver is the device that converts the signals flowing through the coaxial cable (yellow cable) into the signals the node requires or vice versa.
When connecting a transceiver to a coaxial cable, there is a need to set them at an integral multiple of 2.5 m. Connection is done by following the inscription (jacket mark) on the coaxial cable and installing.
Always turn off the power supply for the node and transceiver when connecting the transceiver to the coaxial cable. Making the connection while the power is on will cause shorting.





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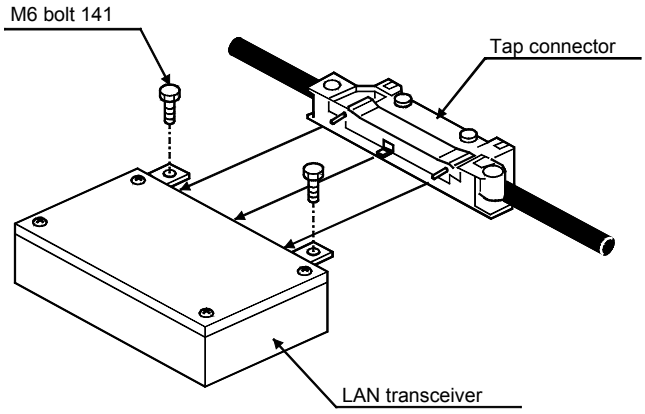


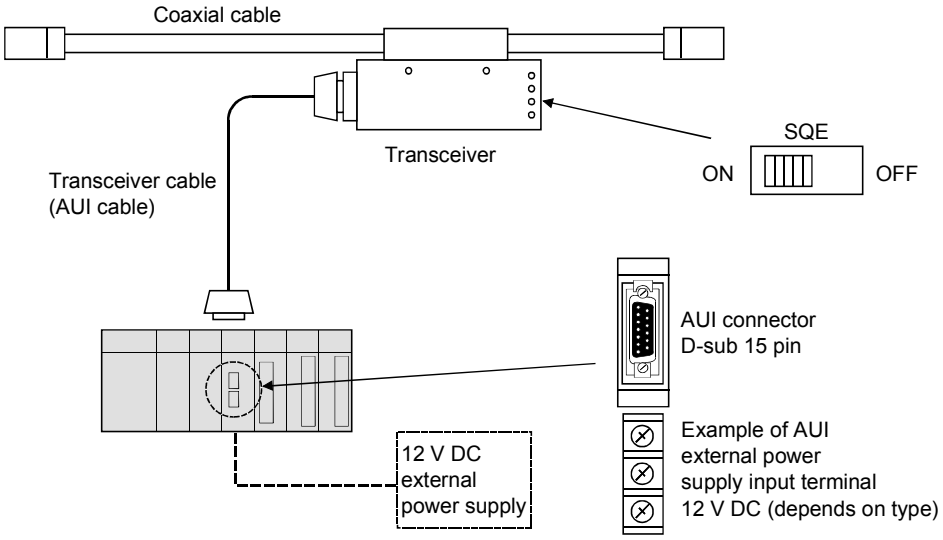
(a) Transceiver (tap type)

To connect a tap-type transceiver, make a hole in the coaxial cable and push in the pin for contacting the center conductor while breaking the insulation jacket on the shielded conductor with the tooth-like tab. Note that special tools are required for insulation.

The transceiver power supply (12 V DC) is supplied from the node via the transceiver cable. Note that some nodes may require 12 V DC power supply when using a transceiver cable. Check the hardware manual for the node for details.

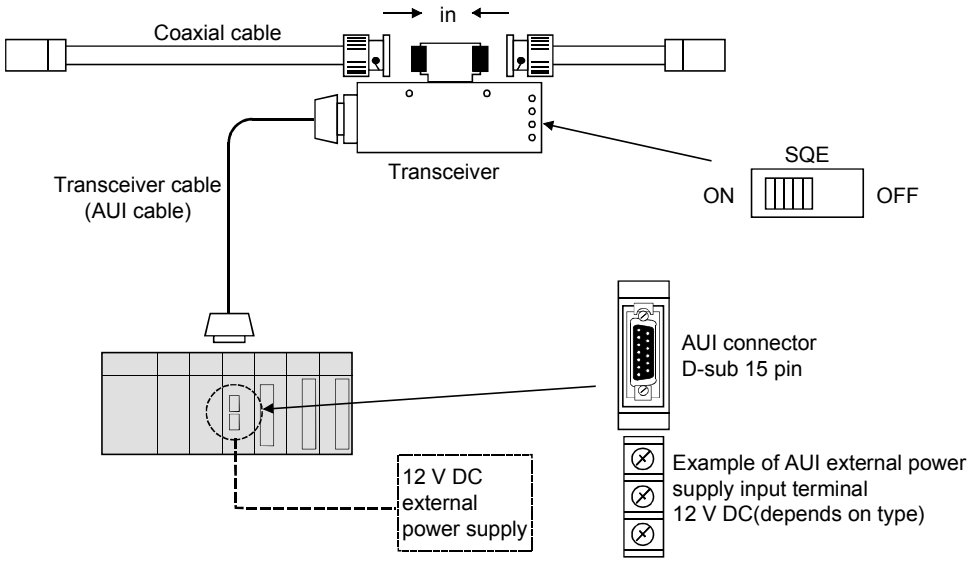
The following are the most common settings for the SQE switch.

1) When connected to node : ON
2) When connected to repeater: OFF



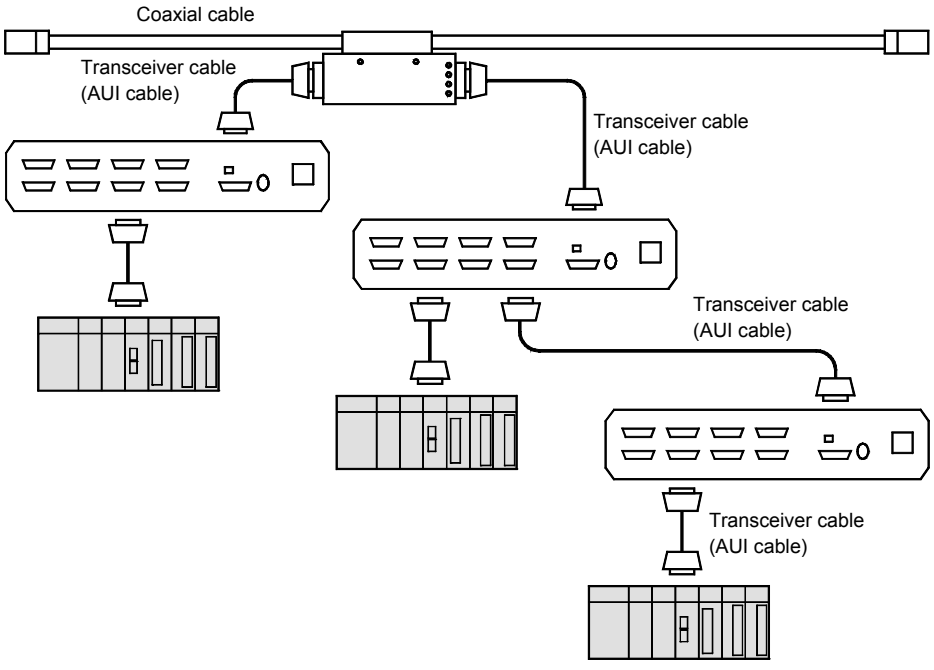
(b) Transceiver (Connector type)

With the connector type transceiver connection, a connector is attached to the coaxial cable and it is connected to the connector on the transceiver. No special tools are required for installation and the connection can be easily removed.



(c) Multi-port transceiver

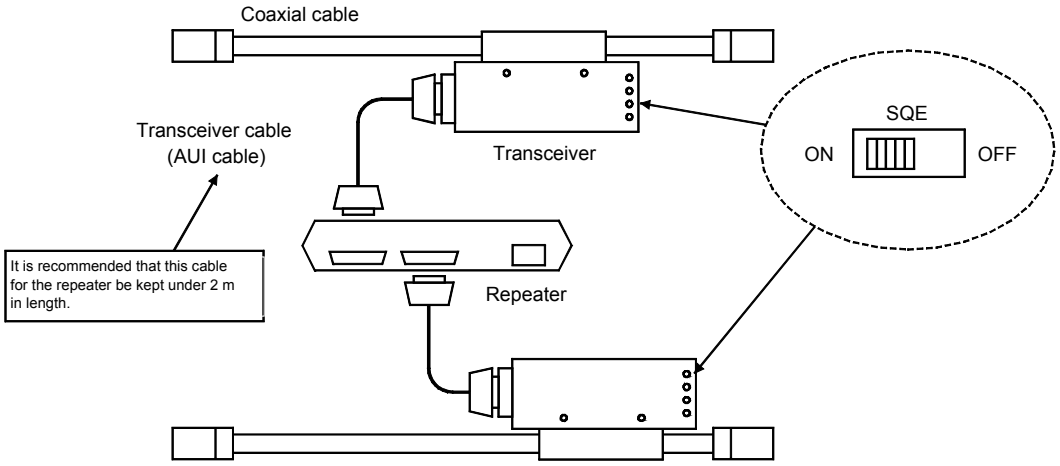
A multi-port transceiver allows terminals to be connected to the tap type transceiver and the connector type transceiver, which normally would only be capable of having one terminal connected to them. 4-port and 8-port transceivers are the most common. Note that the power supply for the transceiver is done by a power cord.



(d) Repeater

A repeater is a device that relays the transmission signal once again. It is used for interconnecting segments that have different media, extending the length of a media segment, increasing the number of terminals connected and converting cable media. A repeater receives the signal from one of the interconnected segments, adjusts the waveform, amplifies it to a predetermined level and sends (or repeats) it to the other segment connected to the repeater.

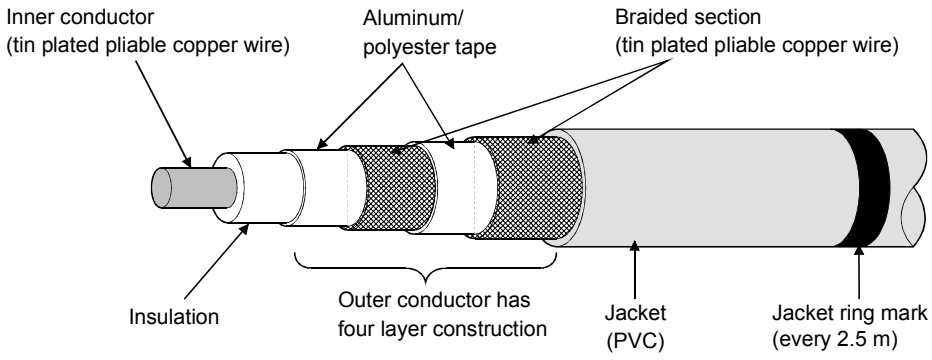
While it is possible to connect a transceiver cable of up to 50 m to the repeater, it is recommended that the length be kept to less that 2 m due to electrical noise and other factors. Also, use care when setting the SQE switch.



(2) Coaxial cable

The coaxial cable is constructed of an inner conductor and an outer conductor that serves as a shield. Coaxial cable used for Ethernet connects has a 50 ohm impedance and there are coaxial cables (yellow cables) for 10BASE2 RG58A/U and 10BASE5.

The 10BASE2 cable has a maximum length of 185 m and the 10BASE5 cable has a maximum length of 500 m. Always ground a coaxial cable to prevent electrical noise. This should be a one-point Type D ground.



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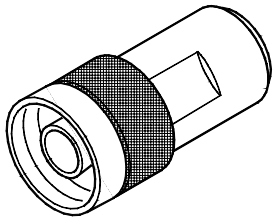
(3) Coaxial cable connector

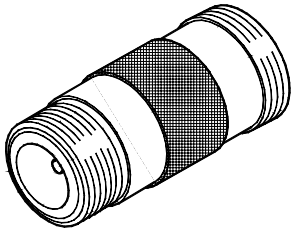
The connector for coaxial cable is commonly called the N-type connector. It is the connector used for connecting the coaxial cable to the final device or for connecting the coaxial cable with a connector type transceiver.



(4) Relay connector

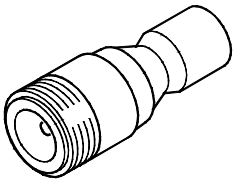
This is the connector used for extending coaxial cable segments. A repeater that is used to extend segments while the relay connector is used to extend the cable for the same segment.

Note that if multiple relay connectors are used, they could change the electrical resistance of the coaxial cable. (The use of relay connectors is not recommended.)



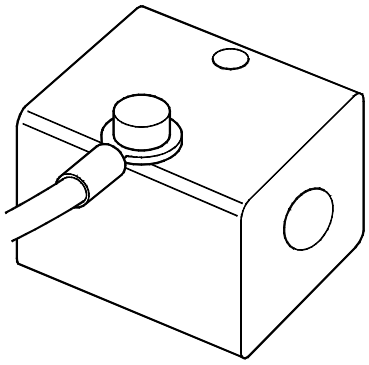
(5) Terminator (Terminal resistor)

A terminator must be connected at the devices at both ends of the cable when a bus type configuration is used in order to prevent the signal from being reflected. If the connection at the final device is not made, the signal is reflected (collides) and shuts the network down. There are two types of terminator, J-type for using with a tap type transceiver and P-type for using with a connector type transceiver. Connect the terminal at the location indicated by the jacket mark on the coaxial cable.



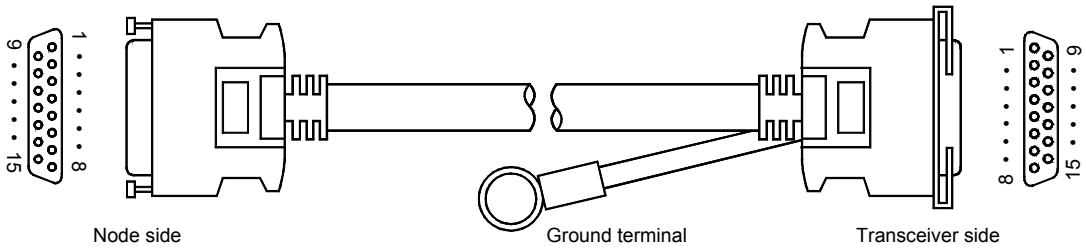
(6) Coaxial cable ground terminal

The coaxial cable ground terminal is a device that prevents electrical noise from causing communication errors. Always ground one point of the coaxial cable using a Type D ground.



(7) Transceiver cable

The transceiver cable is used to connect the transceiver and node. Both ends of the transceiver cable have D-sub 15 pin AUI connectors. A transceiver cable can be up to 50 m long but it is recommended that the length be kept under 15 m in FA applications to reduce the potential for electrical noise. If the transceiver cable has a ground connection, be sure to connect it.



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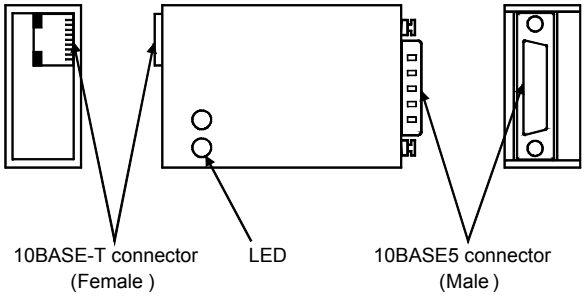
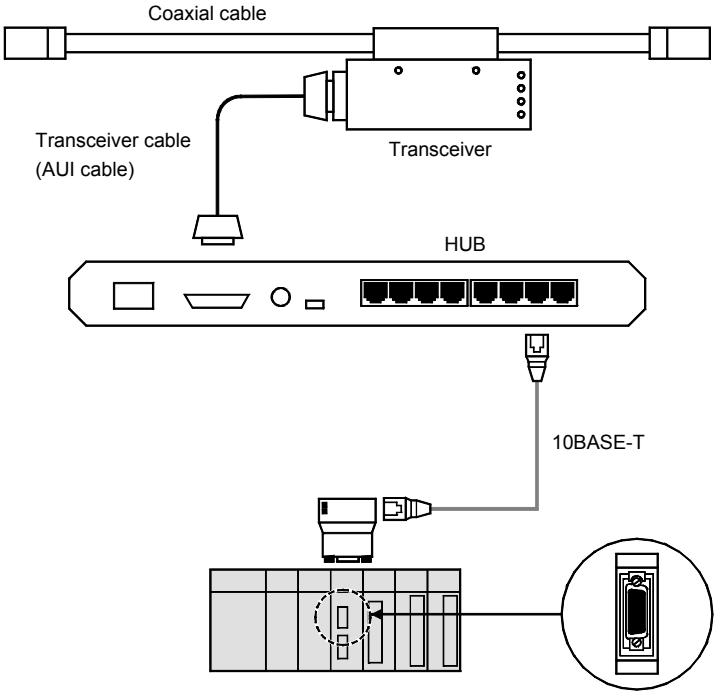
(8) 10BASE5/T converter

This is the converter for connecting a cable with a 10BASE5 interface to a 10BASE-T.





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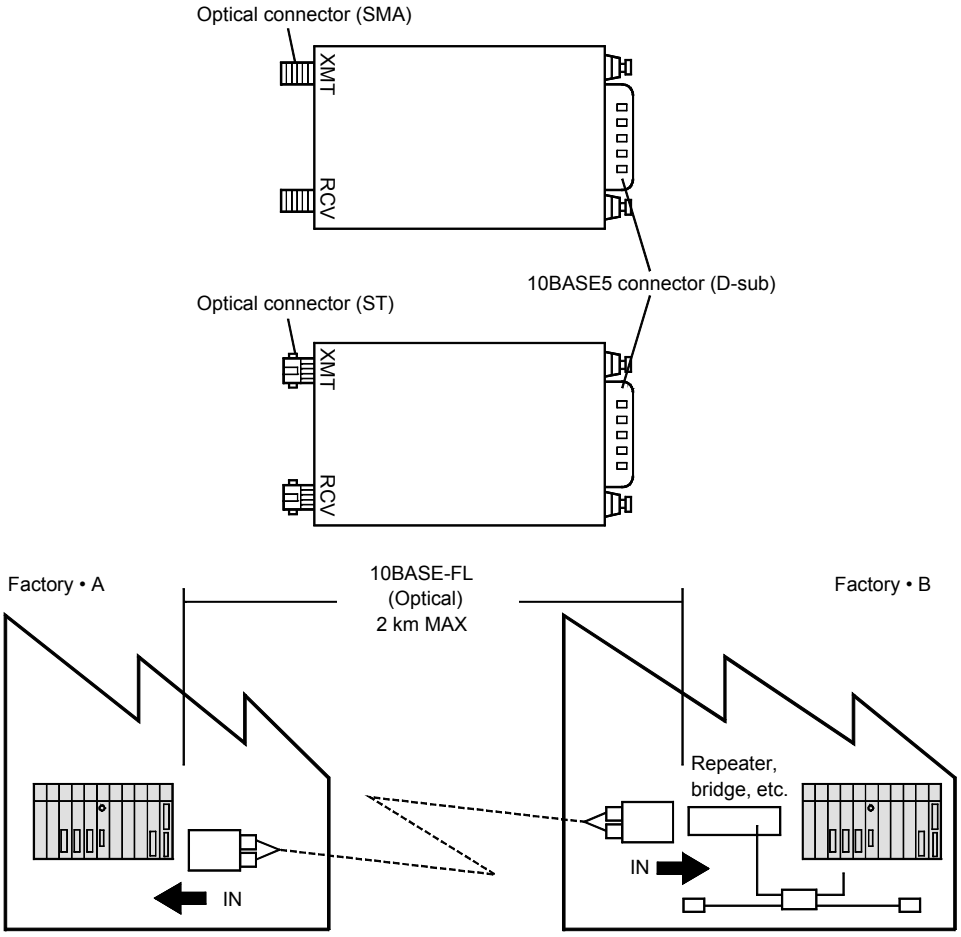
(9) Coaxial cable/optical media converter repeater

The coaxial cable/optical media converter repeater is a device that converts the electrical signals on coaxial cable (10BASE5, 10BASE2) to optical signals. Various types include the fiber optic inter repeater link (FOIRL) for connecting repeater segments and 10BASE-FL for connecting to a terminal. The coaxial cable/optical media converter repeater is used for preventing electrical noise, extending cable length and other applications.



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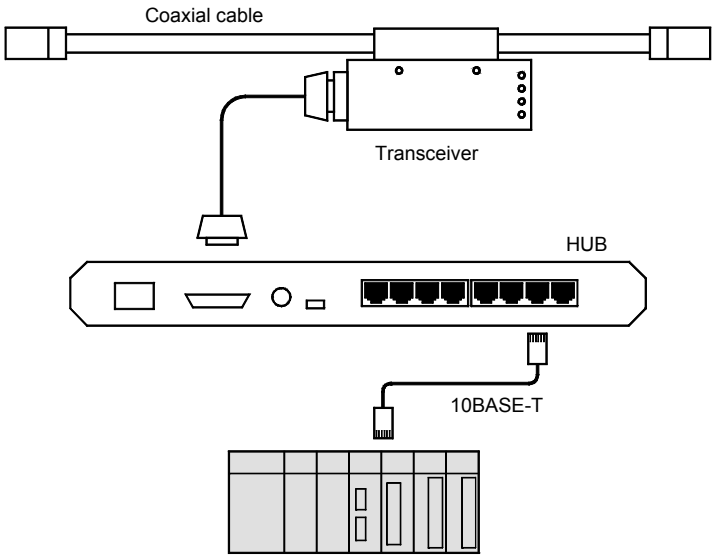
Appendix 6.3 10BASE-T components

(1) HUB

A HUB is a centralized wiring device with repeater functions capable of accommodating the twisted pair cable used by 10BASE-T. Varieties include the HUBs with 10BASE2 interfaces and cascade type (multi-level connections) interfaces. Up to four HUBs can be used for cascading. There are also stackable HUBs that allow several HUBs to be used as one.



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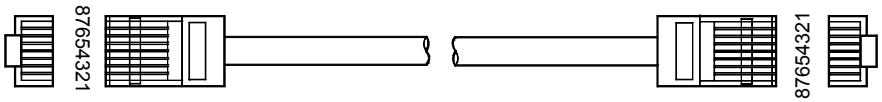
(2) 10BASE-T cable

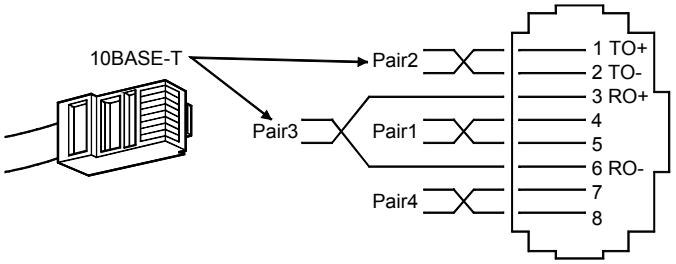
This is a twisted pair cable in which the copper wires are matched into pairs, twisted and covered by a protective outer cover. The following are some of the types available.

(a) The shielded STP cable and unshielded UTP cable

(b) The cross cable used for making connections directly between nodes and the straight cable used for connections through a HUB

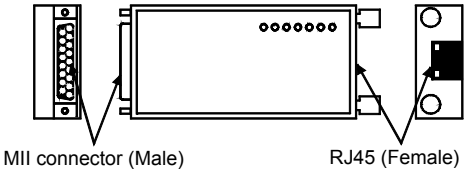
The maximum transmission speed in a 10BASE-T cable is 10 Mbps and it can be up to 100 m long. Both ends of the cable have the 8-point modular connector specified by ISO8877.
Arrange so that Category 5 compliant components are used on 10BASE-T cable.





(3) 10BASE-T /optical media converter repeater

10BASE-T /optical media converter repeater is a device that converts the electrical signals on 10BASE-T cable to optical signals. Various types include the fiber optic inter repeater link (FOIRL) for connecting repeater segments and 10BASE-FL for connecting to a terminal. 10BASE-T /optical media converter repeater is used for preventing electrical noise, extending cable length and other applications.



Appendix 7 Grounding the FL-net (OPCN-2) System

Appendix 7.1 Summary of grounding the FL-net (OPCN-2) system

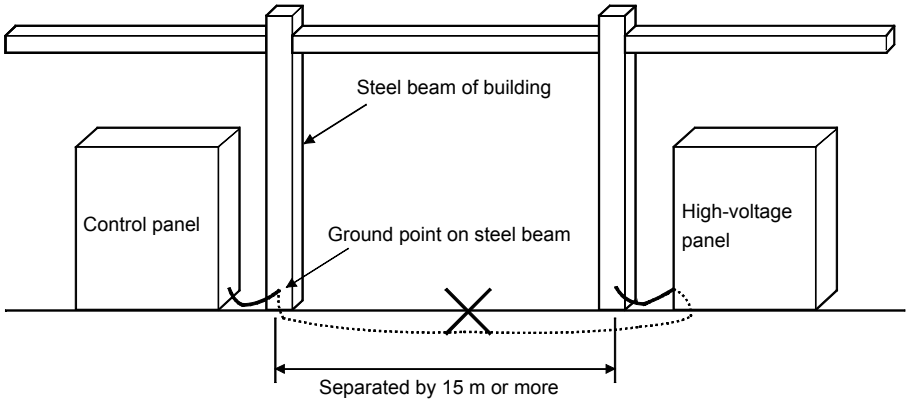
The following shows the method for grounding the control panel for the controller for FL-net (OPCN-2) system and grounding the control panel to the steel beams of a building.
Note that certain conditions must be met when grounding a control panel to the steel beams of a building. If those conditions cannot be met, provide a dedicated ground (Type D ground or higher).

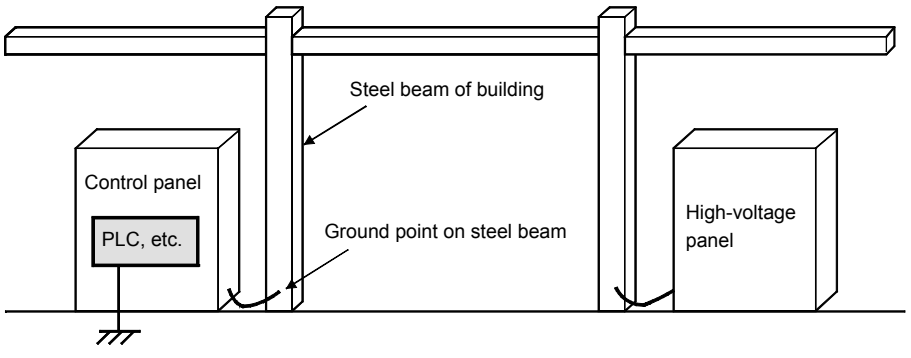
(1) The beams are welded together.

(2) There is Type D grounding between the ground and the beams.

(3) Current from the high-voltage circuit shall not flow into the ground contact point for the control panel.

(4) The ground point for the control panel and the ground point for the high-voltage panel shall be separated by more than 15 m.





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Appendix 7.2 Power supply wires and grounding

The following shows the power supply wiring for the FL-net (OPCN-2) system and the grounding as well and provides an example of the power supply wiring for the panel board and controller panel and the grounding.
Follow the information given below when wiring the power supply and grounding.

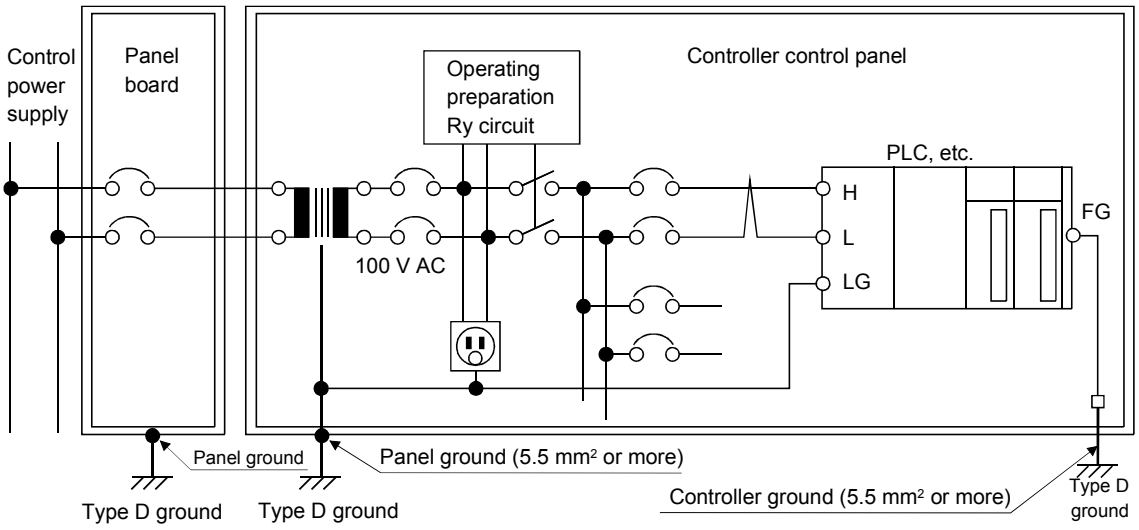
(1) Insulate the area between the control power supply and controller power supply by using an insulated transformer with a static electricity shield.

(2) Ground the frame for the control panel and the control board for the controller with a Type D ground.

(3) Do not connect the frame ground (FG) terminal on the controller to the control panel frame. Use a dedicated ground (Type D or better) for the controller.

(4) Keep the wiring for the input power supply for the controller as short as possible and wire in a twisted configuration.

(5) Connect the line ground (LG) terminal for the controller to the shielded terminal on the insulated transformer and ground the frame of the panel.



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Appendix 7.3 Power supply wiring and grounding for network equipment in the FL-net (OPCN-2) system

The following shows the power supply wiring and grounding for network equipment in the FL-net (OPCN-2) system. Follow the procedure below for examples of the power supply wiring and grounding.

(1) When grounding the coaxial cable, connect it to the dedicated Type D ground for the controller.

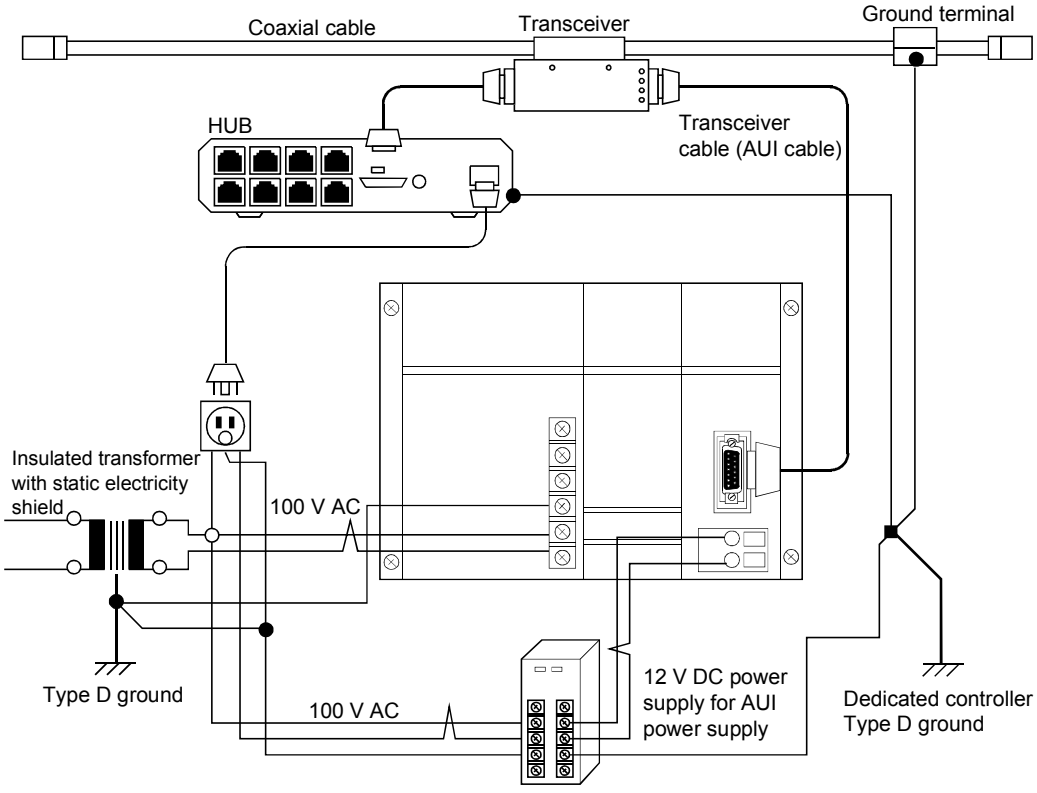
(2) The frame ground for the HUB for 10BASE-T is connected to the dedicated Type D ground for the controller. Supply power from an insulated transformer with a static electricity shield as is used for the power supply for the controller.

(3) Do not connect the frame ground (FG) terminal on the controller to the control panel frame. Use a dedicated ground (Type D or better) for the controller.

(4) Connect the frame ground (FG) terminal for the FL-net module to the frame ground (FG) terminal on the controller.

(5) Connect the shielded earth on the transceiver cable (AUI) to the frame ground (FG) on the FL-net module.

(6) If a direct current power supply (such as 12 V DC) is required by the transceiver (AUI), provide a dedicated stable power supply module for the network and connect that direct current output to the terminal for the FL-net module. Provide the 100 V AC input power supply from an insulated transformer with a static electricity shield as is used for the controller.



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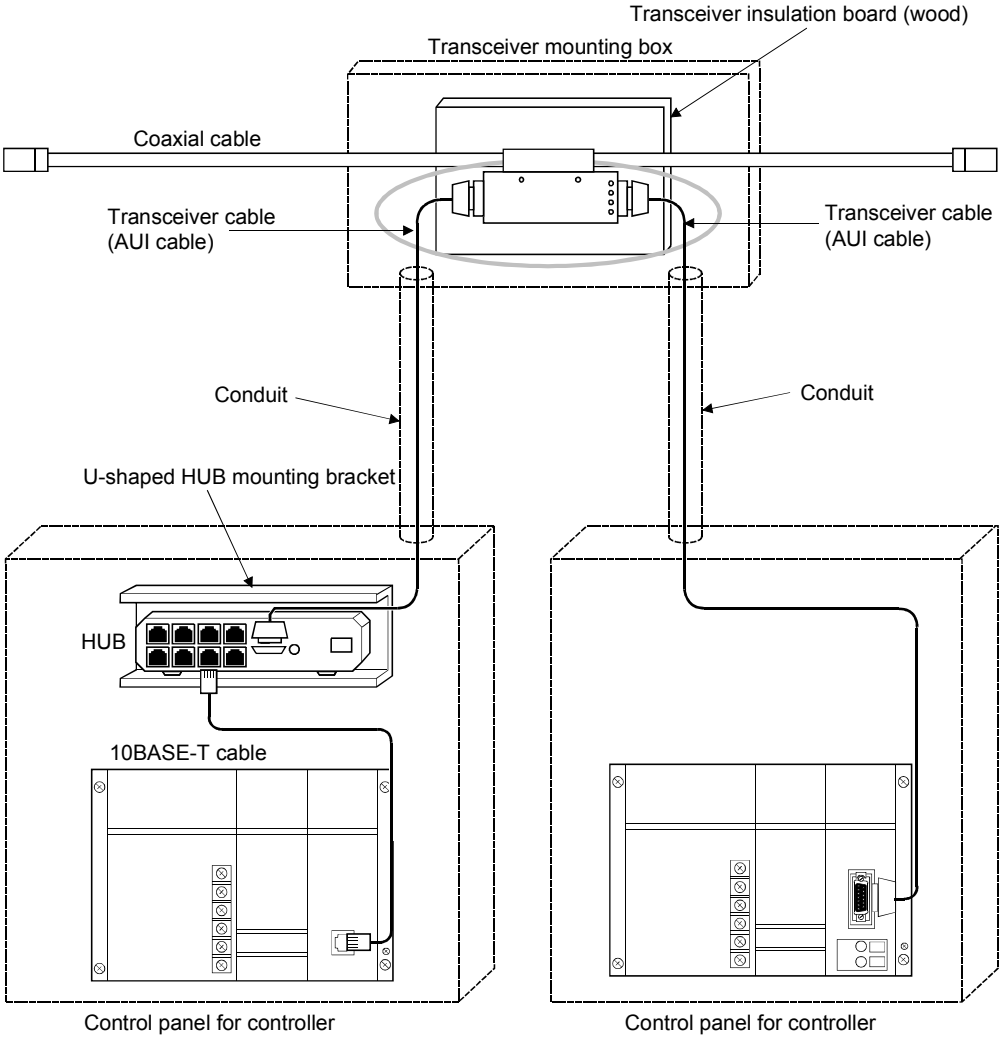
Appendix 7.4 Mounting FL-net (OPCN-2) system network components

The following shows examples for mounting the network components (transceiver, HUB, etc.) to the FL-net (OPCN-2) system.
Follow the procedures below when mounting components.

(1) Mount the transceiver to a wood insulation board inside a steel mounting box. Be sure that the mounting box has a Type D grounding.

(2) Route the transceiver cable through electric conduit to the control panel for the controller. Make sure that the conduit has a Type D grounding.

(3) Use rubber legs or some other type of electric insulation material with the mounting bracket for the HUB. Use a metal U-shaped mounting bracket to connect it to the control panel for the controller. Make sure that the mounting bracket for HUB should be grounded to the control panel for the controller and it has a Type D grounding.



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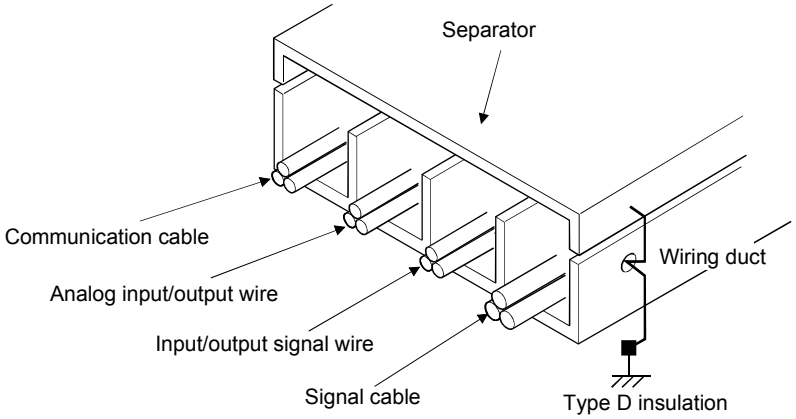
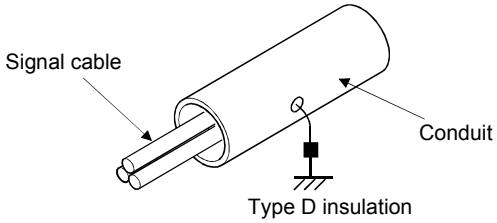
Appendix 7.5 Wiring grounding wiring ducts and conduit

The following shows the grounding of wiring ducts for the FL-net (OPCN-2) system and the wiring and grounding of conduit.
Follow the procedure below for routing the wiring.

(1) If a wiring duct is used for routing the wires, use separators to separate the power wires and signal wires according to their levels. Make sure that the wiring duct (including the cover and separators) have a Type D ground.

(2) If conduit is used for routing the wires, prepare separate conduit according to the levels of the power and signal wires. Always use conduit meeting JIS-C-8305 specifications and ground with Type D ground.





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Appendix 8 FL-net (OPCN-2) Installation Checklist

FL-net (OPCN-2) installation checklist			
Communication line name:	Node no:		
	Inspection data		
Check item	Inspector Company Name		
Cables	Are all connectors securely locked?		
	Are the bend diameter of the cables the established value or greater?		
	Are the connectors protected by jackets, etc.?		
	Have the wires been identified by wire numbers? Are they correct?		
	Are there any heavy objects on the communication cables?		
	Are the communication cables bundled together with other cables, such as the power cables?		
	Is the length of the AUI cable for the repeater less than 2 m? Is the cable for the transceiver less than 50 m?		
	Is the length of the coaxial cable (10BASE5) less than 500 m?		
	Is the coaxial cable properly grounded?		
	Are the shields for the coaxial cable and the transceiver insulated?		
	Are the correct terminal resistor at the ends of the coaxial cable?		
	Is the number of HUBs or repeaters within the specified number?		
	Is the twisted pair cable using a straight cable?		
	Is the twisted pair cable Category 5 and is its length less than 100 m?		
Units	Is the ground terminal on the equipment properly connected?		
	Is each module tightly secured to its base?		
	Is the base unit tightly secured to the control board?		
	Are the AUI cables securely locked?		
	Is excessive force being applied to any of the cable mountings, such as by a door?		
Hubs, etc.	Is the RJ45 connector securely mounted?		
	Are the AUI cable connectors locked?		
	Are the cables marked with wire numbers?		
	Has the transceiver been properly mounted to the marked location?		
	Has the transceiver SQE switch been properly set according to the equipment specifications?		
	Is the HUB tightly secured?		
	Is the HUB/MAU switch for the hub properly set?		
	Is the specified electrical voltage being supplied to the HUB?		

- Fill in and check this list anytime a modification, change or inspection is made.
- Mark as follows: OK = ○, No good = ×. For the setting switch column, fill in the rotary switch number. For DIP switches, fill in ON or OFF.

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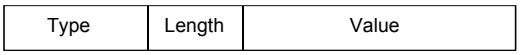
Appendix 9 Profile Supplement

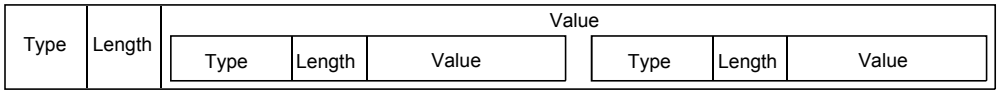
(1) ASN.1 transmission syntax format summary

This summarizes the portions of this specification manual that relate to ISO/IEC 8825 ASN.1 (Abstract Syntax Notation One) basic coding rules.

(a) Primitive ASN.1 type

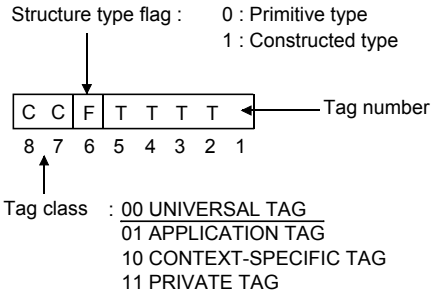


(b) Example of structure type ASN.1 type coding



(c) Type field

1) Structured (1 Octet type)



2) Tag number (UNIVERSAL TAG)

Tag number (Hexadecimal)	Type	Tag number (Hexadecimal)	Type
00	(Reserved)	11	SET & 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 & SEQUENCE OF	1D to 1E	(Reserved)

3) Each data type and structure type flag

ASN. 1 type	Primitive (*1)	Constructed (*1)
BOOLEAN, INTEGER, OBJECT IDENTIFIER, REAL, ENUMERATED	○	—
BIT STRING	○	○
OCTET STRING, NumericString,etc. structured type	○	○
Null (No value field)	○	—
SEQUENCE, SEQUENCE OF, SET, SET OF	—	○
EXTERNAL	—	○
CHOICE	○	○
ANY	○	○
Tagged type	○	○

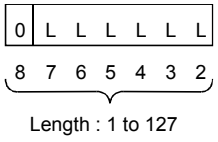
*1 ○ is compatible

4) Printable string

Name	Character	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

(d) Length field

1) Fixed length short format



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2) Fixed length long format

3) Data transmission sequence

The data transmission is the big endian type in which the data with the highest octet gets sent first.

4) Profile reference materials

- Ohgane Hisao, "TCP/IP and OSI Network Management", 1993, Soft Research Center, LTD
- ISO/IEC 8824 Information technology – Open Systems Interconnection – Specification of Abstract Syntax Notation One (ASN. 1), 1990 Second edition, (IS/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)

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(2) Mounting of items that have been read by log data read service

Declaration of mounting/not mounting of the items that have been read by log data read service. (○: Mounting / ×: Not mounting)

Item	Description	Status	Comments
Send/receive	Totaling socket section send count	○	
	Totaling socket section send errors count	○	
	Ethernet send error count	○	
	Totaling socket receive count	○	
	Totaling socket receive error count	○	
	Ethernet receive error count	○	
Frame types	Token send count	○	
	Cyclic frame send count	○	
	1:1 message frame send count	○	
	1:n message send count	○	
	Token receive count	○	
	Cyclic frame receive count	○	
	1:1 message frame receive count	○	
	1:n message receive count	○	
Cyclic transmissions	Cyclic transmission/receive count	○	
	Cyclic address size error count	○	
	Cyclic CBN error count	○	
	Cyclic TBN error count	○	
	Cyclic BSIZE error count	○	
Message transmissions	Message transmission re-send count	○	
	Message transmission re-send over count	○	
	Message transmission /receive error count	○	
	Message transmission serial number count	○	
	Message transmission re-send confirmation count	○	
ACK related	ACK error count	○	
	Serial number version error count	○	
	Serial number error count	○	
	Node number error count	○	
	TCD error count	○	
Token related	Token multiplexing recognition count	○	
	Token destroyed count	○	
	Token reissues count	○	
	Token hold time count		
	Token monitoring time out count		

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Item	Description	Status	Comments
Status 1	Total operating time	○	
	Frame wait status count	○	
	Subscription count	○	
	Self-separation count	○	
	Separation by skip count	○	
	Other node separation recognition count	○	
Status 2	Participation recognition node list	○	

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Appendix 10 Programming for Use of FL-net Module on MELSECNET/H Remote I/O Station

When using the FL-net module on the MELSECNET/H remote I/O station, take into account the following for programming.
This section provides the precautions for reading/writing the buffer memory data of the FL-net module using the REMFR/REMTO instruction in programs for initial processing, cyclic transmission, message transmission, etc.
Refer to Section 6.5 for programs for the initial processing, cyclic transmission and message transmission.

(1) REMFR/REMTO instruction

(a) Make programming so that the next instruction is executed after completion of the REMFR/REMTO instruction execution.
Several scans are required from when the REMFR/REMTO instruction is executed until read/write of the actual data is completed.
Whether the REMFR/REMTO instruction is completed or not can be checked by the completion device.

(b) When reading/writing data larger than 960 words, execute the REMFR/REMTO instruction several times.
In that case, make programming to provide an interlock for exclusive processing.
Note that one REMFR/REMTO instruction is executed once (read/write of up to 960 words) for the same module.

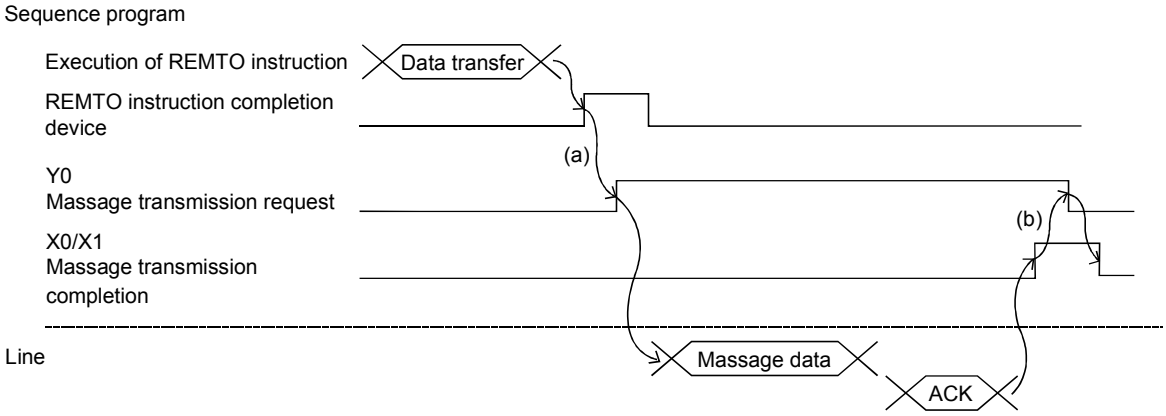
(2) REMFR/REMTO instruction and output signal Y

When turning ON/OFF the output signal Y after completion of the read/ write of data by the REMFR/REMTO instruction from/to the FL-net module buffer memory, take into account the following for programming.

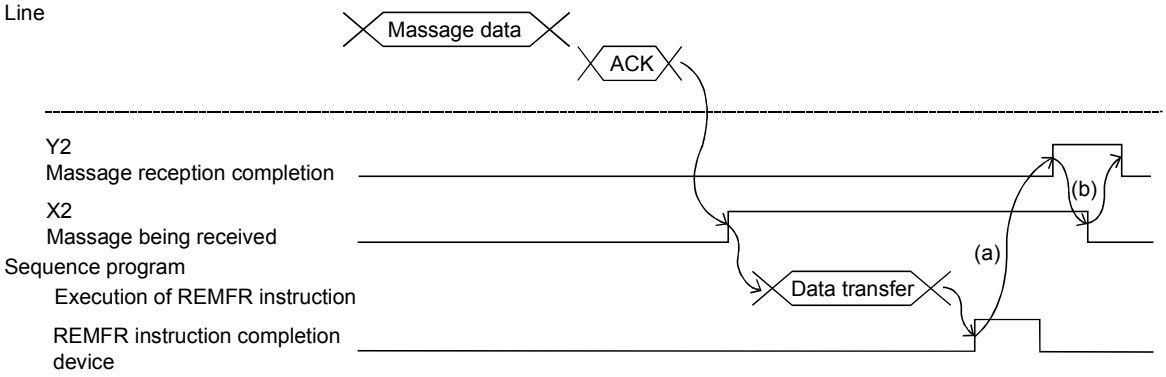
(a) When turning ON output signal Y
Before turning ON the output signal Y, make sure that the completion device is ON after execution of the REMFR/REMTO instruction.

(b) When turning OFF output signal Y after turning it ON
Before turning OFF the output signal Y, make sure that the input signal X corresponding to the output signal Y is ON (X2 is OFF for message reception).
Refer to Section 3.2.4 for details of the I/O signals.

1) Message transmission example



2) Message reception example



POINT
For details of the REMFR/REMTO instruction, refer to the "Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O Network)".

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Appendix 11 Cyclic Data Area Assignment Sheet

(1) Area1 (bit area)

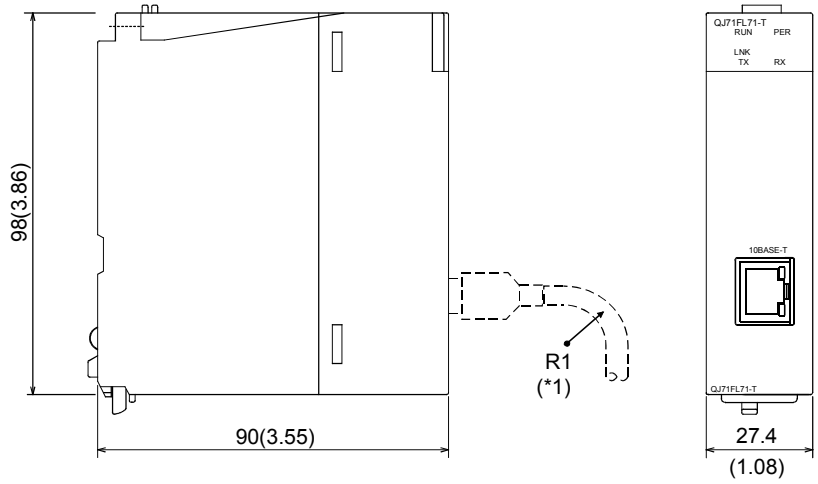
	Node No.	FL-net circuit	FL-net module			CPU module	Remark
		Common memory address (0000 to 01FFH)	Buffer memory address (1C00 to 1DFFH)	Data size (Word units)	Buffer offset	PLC side device	
	□□1						
	□□2						
	□□3						
	□□4						
	□□5						
	□□6						
	□□7						
	□□8						
	□□9						
	□□0						
(example)	□□1	0000 to 000FH	1C00 to 1C0FH	16	0	B0 to BFF	
	□□3	0020 to 002FH	1C20 to 1C2FH	16	32	B200 to B2FF	Local node

(2) Area2 (word area)

	Node No.	FL-net circuit	FL-net module			CPU module	Remark
		Common memory address (0000 to 1FFFH)	Buffer memory address (2000 to 3FFFH)	Data size (Word units)	Buffer offset	PLC side device	
	□□1						
	□□2						
	□□3						
	□□4						
	□□5						
	□□6						
	□□7						
	□□8						
	□□9						
	□□0						
(example)	□□1	0000 to 00FFH	2000 to 20FFH	256	0	W0 to WFF	
	□□3	0200 to 02FFH	2200 to 22FFH	256	512	W200 to W2FF	Local node

Appendix 12 External Dimensions

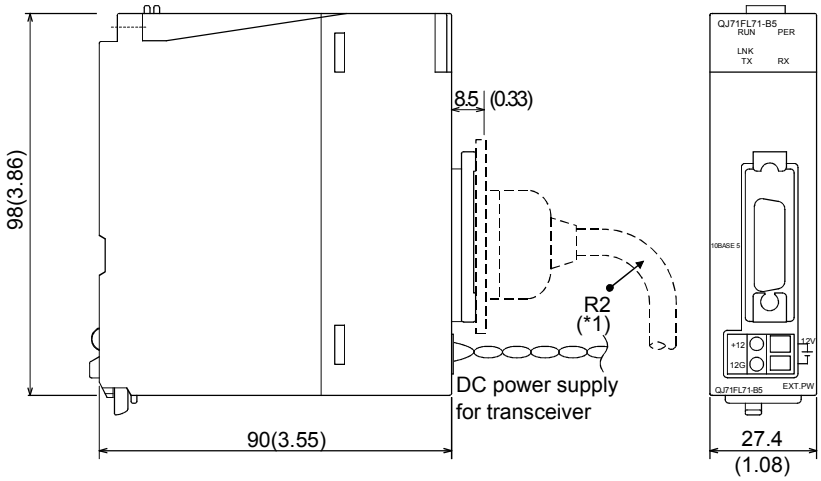
(1) QJ71FL71-T



(units : mm (in.))

*1 When connecting the twisted pair cable, set the bending radius near the connector (reference value: R1) as four times the cable's outside diameter or larger.

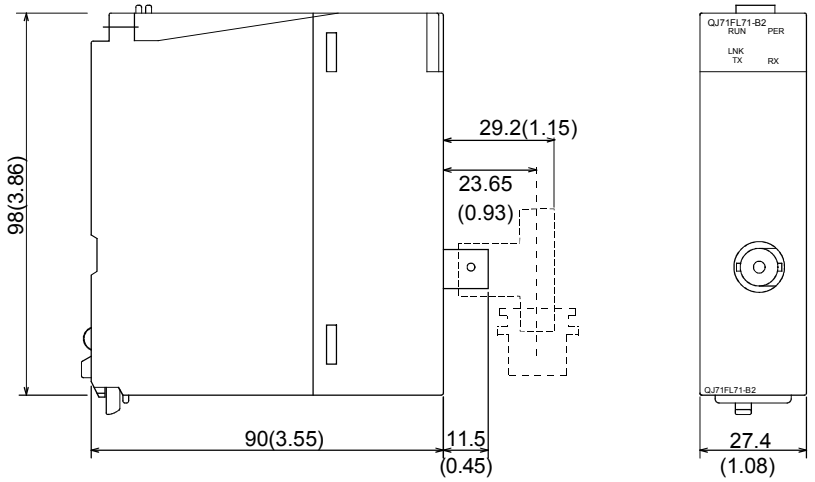
(2) QJ71FL71-B5



(units : mm (in.))

*1 When connecting the AUI cable, set the bending radius near the connector (reference value: R2) as four times the cable's outside diameter or larger.

(3) QJ71FL71-B2



(units : mm (in.))

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WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.
However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place.
Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.
(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.
1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.
(2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation of damages caused by any cause found not to be the responsibility of Mitsubishi, loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products, special damages and secondary damages whether foreseeable or not , compensation for accidents, and compensation for damages to products other than Mitsubishi products, replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

6. Product application

(1) In using the Mitsubishi MELSEC programmable logic controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable logic controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.
(2) The Mitsubishi programmable logic controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for Railway companies or Public service purposes shall be excluded from the programmable logic controller applications.
In addition, applications in which human life or property that could be greatly affected, such as in aircraft, medical applications, incineration and fuel devices, manned transportation, equipment for recreation and amusement, and safety devices, shall also be excluded from the programmable logic controller range of applications.
However, in certain cases, some applications may be possible, providing the user consults their local Mitsubishi representative outlining the special requirements of the project, and providing that all parties concerned agree to the special circumstances, solely at the users discretion.

FL-net(OPCN-2) Interface Module

User's Manual

MODEL	QJ71FL71-U-SHO-E
MODEL CODE	13JR25
SH(NA)-080130-D(0603)MEE	

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : TOKYO BUILDING, 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
NAGOYA WORKS : 1-14 , YADA-MINAMI 5-CHOME , HIGASHI-KU, NAGOYA , JAPAN