FUJI ELECTRIC

MICREX-SX *series*

SPH

USER'S MANUAL

FL-net (OPCN-2) MODULE

FEH234

Preface

This User's Manual explains the system configuration of SPH, the specifications and operation of the modules. Read this manual carefully to ensure correct operation.
When using modules or peripheral devices, be sure to read the corresponding user's manuals listed below.

Title	Manual No.	Contents
User's Manual Instruction, MICREX-SX series SPH	FEH200	Explains the memory, language and system definitions of the MICREX-SX series.
User's Manual Hardware, MICREX-SX series SPH	FEH201	Explains the system configuration, the specifications and operations of modules in the MICREX-SX series.
User's Manual D300win <Introduction>, MICREX-SX series	FEH250	Explains the basic operations of D300win, the programming and monitoring for MICREX-SX series.
User's Manual D300win <Reference>, MICREX-SX series	FEH251	Explains the menu and icon of D300win and all of the operations of D300win.
User's Manual D300winV2 <Reference>, MICREX-SX series	FEH254	Explains the menu and icon of D300winV2 and all of the operations of D300winV2.

Note: In this manual, FL-net (OPCN-2) is referred to as "FL-net".

Notes

1. This manual may not be reproduced in whole or part in any form without prior written approval by the manufacturer.
2. The contents of this manual (including specifications) are subject to change without prior notice.
3. If you find any ambiguous or incorrect descriptions in this manual, please write them down (along with the manual No. shown on the cover) and contact FUJI.

Safety Precautions

Be sure to read the “Safety Precautions” thoroughly before using the module.
Here, the safety precaution items are classified into “Warning” and “Caution.”

Warning : Incorrect handling of the device may result in death or serious injury.

Caution : Incorrect handling of the device may result in minor injury or physical damage.

Even some items indicated by “Caution” may also result in a serious accident.
Both safety instruction categories provide important information. Be sure to strictly observe these instructions.

Warning
◊ Never touch any part of charged circuits as terminals and exposed metal portion while the power is turned ON. It may result in an electric shock to the operator. ◊ Turn OFF the power before mounting, dismounting, wiring, maintaining or checking, otherwise, electric shock, erratic operation or troubles might occur. ◊ Place the emergency stop circuit, interlock circuit or the like for safety outside the PC. A failure of PC might break or cause problems to the machine. ◊ Do not connect in reverse polarity, charge (except rechargeable ones), disassemble, heat, throw in fire or short-circuit the batteries, otherwise, they might burst or take fire. ◊ If batteries have any deformation, spilled fluids, or other abnormality, do not use them. The use of such batteries might cause explosion or firing. ◊ Do not open the FG terminal with the LG-FG short circuited. (It must be grounded, otherwise it might cause electric shock.)

Safety Precautions

⚠ Caution

◊ Do not use one found damaged or deformed when unpacked, otherwise, failure or erratic operation might be caused.
◊ Do not shock the product by dropping or tipping it over, otherwise, it might be damaged or troubled.
◊ Follow the directions of the operating instructions when mounting the product. If mounting is improper, the product might drop or develop problems or erratic operations.
◊ Use the rated voltage and current mentioned in the operating instructions and manual. Use beyond the rated values might cause fire, erratic operation or failure.
◊ Operate (keep) in the environment specified in the operating instructions and manual. High temperature, high humidity, condensation, dust, corrosive gases, oil, organic solvents, excessive vibration or shock might cause electric shock, fire, erratic operation or failure.
◊ Select a wire size to suit the applied voltage and carrying current. Tighten the wire terminals to the specified torque. Inappropriate wiring or tightening might cause fire, malfunction, failure, or might cause the product to drop from its mounting.
◊ Contaminants, wiring chips, iron powder or other foreign matter must not enter the device when installing it, otherwise, erratic operation or failure might occur.
◊ Remove the dust-cover seals of modules after wiring, otherwise, fire, accidents, failure or fault might occur.
◊ Connect the ground terminal to the ground, otherwise, an erratic operation might occur.
◊ Periodically make sure the terminal screws and mounting screws are securely tightened.
Operation at a loosened status might cause fire or erratic operation.
◊ Put the furnished connector covers on unused connectors, otherwise, failure or erratic operation might occur.
◊ Install the furnished terminal cover on the terminal block, otherwise, electric shock or fire might occur.
◊ Sufficiently make sure of safety before program change, forced output, starting, stopping or anything else during a run. The wrong operation might break or cause machine problems.
◊ Engage the loader connector in a correct orientation, otherwise, an erratic operation might occur.
◊ Before touching the PC, discharge any static electricity that may have been collected on your body. To discharge it, touch a grounded metallic object. Static electricity might cause erratic operation or failure of the module.
◊ Be sure to install the electrical wiring correctly and securely, observing the operating instructions and manual. Wrong or loose wiring might cause fire, accidents, or failure.
◊ When disengaging the plug from the outlet, do not pull the cord, otherwiase, break of cable might cause fire or failure.
◊ Do not attempt to change system configurations (such as installing or removing I/O modules) while the power is ON, otherwise, failure or erratic operation might occur.
◊ Do not attemp to repair the module by yourself -- contact your Fuji Electric agent. When replacing the batteries, correctly and securely connect the battery connectors, otherwise, fire, accidents or failure might occure.
◊ To clean the module, turn power off and wipe the module with a cloth moistened with warm water. Do not use thinner or other organic solvents, as the module surface might become deformed or discolored.
◊ Do not remodel or disassemble the product, otherwise, a failure might occur.
◊ Follow the regulations of industrial wastes when the device is to be discarded.
◊ The modules covered in these operating instructions have not been designed or manufactured for use in equipment or systems which, in the event of failure, can lead to loss of human life.
◊ If you intend to use the modules covered in these operating instructions for special applications, such as for nuclear energy control, aerospace, medical, or transportation, please consult your Fuji Electric agent.
◊ Be sure to provide protective measures when using the module covered in these operating instructions in equipment which, in the event of failure, may lead to loss of human life or other grave results.
◊ External power supply (such as 24V DC power supply) which is connected to DC I/O should be strongly isolated from AC power supply.

Revision

***Manual No. is shown on the cover.**

Printed on	*Manual No.	Revision contents
Dec. 2000	FEH234	First edition

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Section 1 Introduction

Section 1 Introduction
1-1 About FL-net

FL-net is the open FA network that was standardized by the Japan FA Open Systems Promotion Grop (JOP) of the Manufacturing Science and Technology Center, an extra-governmental organization of the Ministry of International Trade and Industry.
As shown in the figure below, this network realizes a system control and monitoring environment where programmable controllers (PCs), computerized numerical control (CNC) devices, and other various types of FA controllers and personal computers from different manufacturers are interconnected.

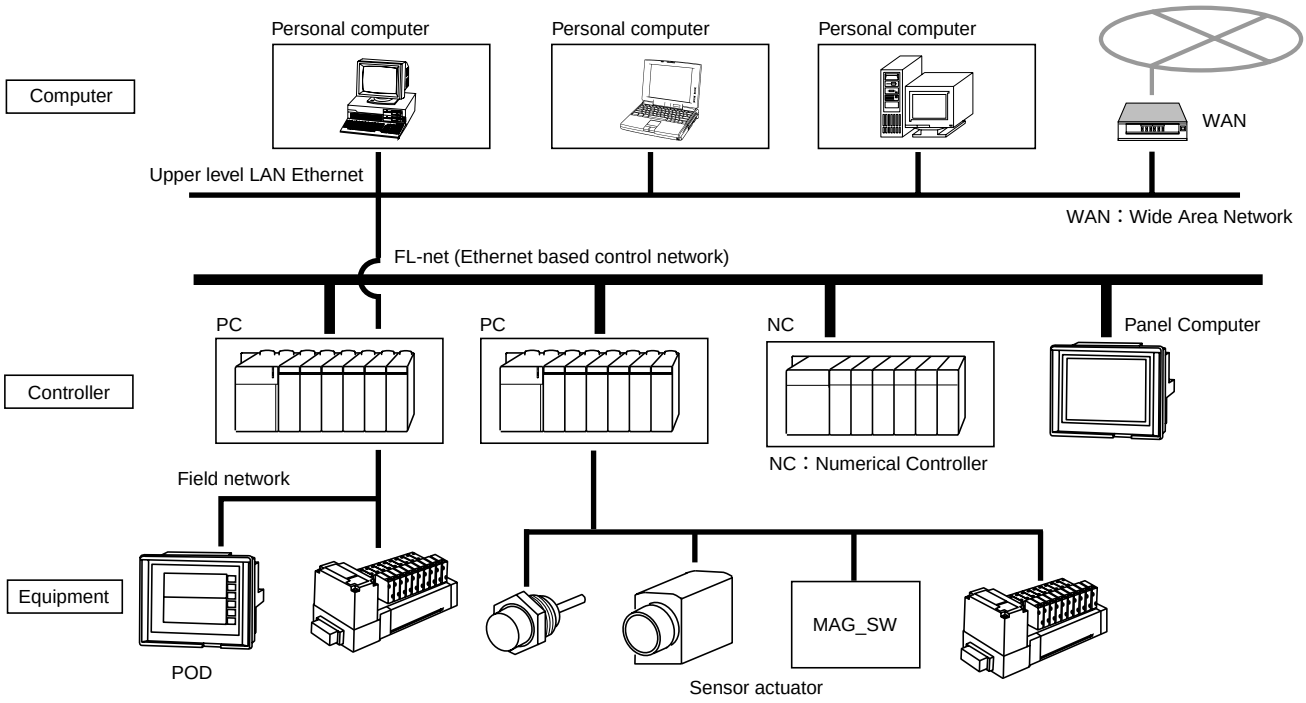


Figure 1-1 (1) Example of FA Control Network Structure

FL-net is the open network that interconnects programmable controllers (PCs), computerized numerical control (CNC) devices, and other controllers and personal computers from different manufacturers to realize the control and monitoring of system.
FL-net has the following features:

1-2-1 Conforming to widely spread standards

FL-net is based on Ethernet, or a widely spread standard in the field of OA, and uses UDP/IP to realize efficient communication.

1) Low cost
Configured with widely spread communication devices, the system can be constructed at low cost.

2) Widely spread network equipment
Transceivers, hubs, cables, LAN card for personal computer, and other network equipment that is widely used for Ethernet are used.

3) Future speedup
Transmission rate can be increased in the future to 10M bps, 100M bps, or 1G bps.

4) Optical communication
By replacing proper part with optical fiber, using the optical repeater that is widely used for Ethernet, you can realize 500 m or longer distance transmission, improve noise immunity, or take measures against lightning surge for outdoor cabling.

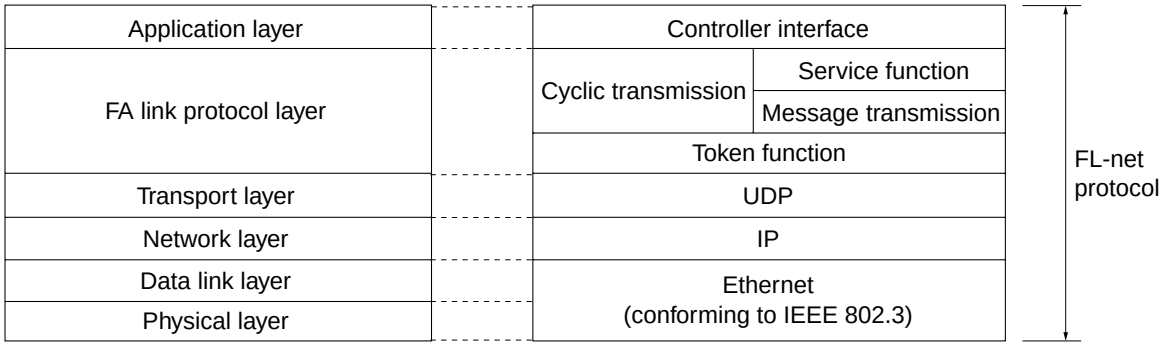


Figure 1-2 (1) FL-net Protocol

1-2-2 Supporting the communication functions necessary between FA controllers

1) Large-scale network
Maximum 254 units of equipment (node) can be connected.

2) Types of communication functions are selectable according to your purpose of use
Common Memory Function, which enables each node to share the same data through cyclic communication, and Message Communication Function, which communicates only necessary data as needed, are supported.

3) Large capacity common memory
The common memory has the capacity of 8K bits + 8K words.

4) High-speed response
High-speed response of 50 ms/32 nodes can be realized.

5) High reliability by masterless system
Because there is no master, individual node can freely participate in or be disconnected from the network without any influence on the communication by other nodes. Therefore, you can freely turn on/off the power of any node. This feature facilitates maintenance to a large extent.

<Table 1-3 (1) FL-net Q&A>

Question		Answer
1	What is Ethernet?	Ethernet is the specification that defines cable type and is used for local area network (LAN). Communication rate of Ethernet is 10 to 100 Mbps. The Ethernet that is most frequently used in offices for OA is 10 Mbps twisted pair cable (UTP). Ethernet can communicate using the software protocols that are supplied from various vendors.
2	What is FL-net?	FL-net is the network that connects FA controllers, such as programmable controllers (PCs) and computerized numerical control (CNC) devices, for mutually exchanging control data between them at high speed. FL-net uses the same network component devices, including cable, as are used for Ethernet.
3	Differences between FL-net and Ethernet	Ethernet is used to connect controllers with upper level computer or personal computer for the purpose of control or data communication, such as production command and result data. FL-net is used to connect between controllers for exchanging control data at high speed. Be careful not to wrongly connect the cables when you install both upper level Ethernet and FL-net for inter-controller communication with one controller.
4	How can FL-net module be used?	FL-net module is installed in FA controller, such as programmable controller (PC) and computerized numerical control (CNC) device, and cyclically communicates data between controllers when you set station numbers (node numbers) and assign links in the common memory, like with “CPU module”. With FL-net, PC does not require special communication program. Also for reading or rewriting PC memory or communication parameters from personal computer, no special communication program is required on the PC side. However, to communicate data between controllers using the message transmission function, individual controller requires the program.
5	What is protocol? What protocol is supported by FL-net?	Protocol is the rules necessary for communication. FL-net supports UDP/IP and FL-net dedicated “FA link protocol” for upper layer.
6	Can ordinary personal computer be connected to FL-net?	Can be connected. FL-net module that is installed in FA controller, such as programmable controller (PC) and computerized numeric control (CNC) device, is an intelligent unit having a processor in the board. Because Ethernet card for personal computer is non-intelligent type as it is called “dumb board”, in general, intelligent FL-net board is commendable, through it depends on the performance and using method of the personal computer.
7	What is topology?	Networking topology means the category of network wiring. There are three major categories: star type (tree type), bus type, and ring type. It is more understandable when you think that they are logical wiring category rather than physical wiring category. 10BASE-T used for FL-net is star type topology. 10BASE5 is bus type topology.
8	Network cable type and length and connectable units	Following are most frequently used Ethernet cable standards and their features and limits: Note: Parenthesized figures are when repeater is used. • 10BASE-T: twisted pair cable (UTP) Maximum transmission distance per segment: 100 m (500 m) Maximum number of connectable units per segment: 254 • 10BASE5: thick coaxial cable (yellow cable) Maximum transmission distance per segment: 500 m (2500 m) Maximum number of connectable units per segment: 100 (254) • 10BASE-FL: optical fiber cable Maximum transmission distance per segment: 2000 m Maximum number of connectable units per segment: 254
9	Is special Ethernet specification necessary for a system that uses FL-net?	No. Ethernet (conforming to IEEE 802.3 standard) is used to construct an FL-net system. No special specification is necessary.
10	How to connect to FL-net	For different types of Ethernet media, Ethernet cables can be interconnected with repeater or media conversion adapter, etc. Such products are supplied from various vendors.

Question		Answer
11	Which cable to use for constructing an FL-net system	General method of use is as follows: • For trunk line: 10BASE5 (thick coaxial cable: yellow cable) • In control panel in office: 10BASE-T (twisted pair cable: UTP Category 5) • Where high-voltage power supply or noise exist: 10BASE-FL (optical fiber cable)
12	How to set IP address for FL-net	IP address for FL-net is as follows: Network address: 192.168.250 Node number (host number): 1 to 254 as standard However, node numbers 250 to 254 are reserved for maintenance tool.
13	How about the compatibility and interconnectability of FL-net adapted equipment?	There is a qualification organization for FL-net, which performs compatibility and interconnectability tests. Certificate is issued for the equipment that passed these tests.

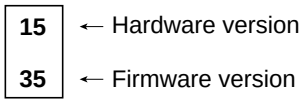
1-4 CPU/D300win Versions That Support NP1L-FL1

FL-net module NP1L-FL1 needs to be used on the system of the following version:

<Table 1-4 (1) Supported versions>

Classification		Type	Adapted version
CPU module	High-performance CPU	NP1PS-32	Firmware version
		NP1PS-74	V35 or newer (See note.)
	Standard CPU	NP1PH-08	Firmware version
		NP1PH-16	V36 or newer (See note.)
D300win			V1.2.1.1 or newer
D300win V2			V2.0.0.0 or newer

Note: You can see the version of CPU module on the right side when you open the battery cover provided on the front of the CPU module.



Section 2 General Precautions

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Section 2 General Precautions
2-1 Safety Precautions

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(1) About the installations

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- ◊ Never touch any part of charged circuits as terminals and exposed metal portion while the power is turned ON. It may result in an electric shock to the operator.
- ◊ Turn OFF the power before mounting, dismounting, wiring, maintaining or checking, otherwise, electric shock, erratic operation or troubles might occur.
- ◊ Place the emergency stop circuit, interlock circuit or the like for safety outside the PC. A failure of PC might break or cause problems to the machine.
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◊ Do not use one found damaged or deformed when unpacked, otherwise, failure or erratic operation might be caused.
◊ Do not shock the product by dropping or tipping it over, otherwise, it might be damaged or troubled.
◊ Follow the directions of the operating instructions when mounting the product. If mounting is improper, the product might drop or develop problems or erratic operations.
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◊ Be sure to provide protective measures when using the module covered in these operating instructions in equipment which, in the event of failure, may lead to loss of human life or other grave results.
◊ External power supply (such as 24V DC power supply) which is connected to DC I/O should be strongly isolated from AC power supply.

2-2 Maintenance Services

2-2-1 Ordering notes

When ordering electrical and control equipment (or requesting price estimates), the following general notes are to be observed, unless otherwise specified in the estimation paper, contract paper, catalogs, or specifications.
When the product is delivered, check the contents of the package as soon as possible. Even before inspection, use caution on storing and using the product safely.

2-2-2 Warranty period and scope of warranty

[Warranty period]

This product is covered by a warranty for a period of one year from the date of delivery to the location specified by the customer.

[Scope of warranty]

During the warranty period, if any failure judged to be the responsibility of the manufacturer occurs, replacement and repair of defective parts are performed under the responsibility of the manufacturer.
This warranty does not cover the following failures:

(1) Failures caused by improper handling or misuse by the customer

(2) Failures caused by something other than the delivered product itself

(3) Failures caused by modification or repair performed by someone other than the manufacturer

(4) Failures caused by natural calamities or environmental disruption

This warranty covers only the product itself; it does not cover any damages resulting from failures of the product.

2-2-3 Service costs

The price of the product does not include maintenance and servicing costs, such as the cost of dispatching an engineer to the customer. The customer will be charged for actual expenses in the following cases.

(1) Guidance for installation and adjustment, and attendance at a test operation

(2) Maintenance, inspection, adjustment, and repair

(3) Technical guidance and technical education

Section 3 FL-net Module Specifications

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Section 3 FL-net Module Specifications

3-1 General Specifications

<Table 3-1 (1) General Specifications>

Item		Specification
Physical environmental conditions	Operating ambient temperature	0 to 55 °C
	Storage temperature	–25 to 70 °C
	Relative humidity	20 to 95 %RH no condensation
	Pollution degree	2 (No condensation)
	Corrosion immunity	Free from corrosive gases.
	Operating altitude	2000 m or less above sea level (Transport condition: 70 kPa or more)
Mechanical service conditions	Vibration	Half amplitude: 0.15 mm, Constant acceleration: 19.6 m/s^2, Two hours for each of three mutually perpendicular axes, total six hours.
	Shock	Acceleration peak: 147 m/s^2 Three times for each of three mutually perpendicular axes.
Electrical service conditions	Electrostatic discharge immunity	Contact discharge: ±6 kV, Aerial discharge: ±8 kV
	Radiated, radio-frequency, electromagnetic field immunity	80 MHz to 1000 MHz: 10 V/m
	Power frequency magnetic field immunity	50 Hz: 30 A/m
	Conduction radio-frequency obstruction immunity	0.15 MHz to 80 MHz: 10 Vrms
	Electrical fast transient/ bust immunity	Cable clamp: 1 kV (the level where system error does not cause stoppage) Power supply-FG: 2 kV
	Square-wave noise immunity	Cable clamp: min. 1.5 kV (the level where no system error occurs) min. 500 V (the level where no transmission error occurs)
Construction		Panel-mounted type
Cooling		Air cooling
Occupied slot		1 slot
Internal current consumption		Described in each module's (unit's) specifications.
External power supply		12 V DC, max. 500 mA (necessary only when 10BASE5 is used)
Mass		Described in each module's (unit's) specifications.
Dimensions		Described in 3-7

One NP1L-FL1 module has two connectors: AUI connector and 10BASE-T connector. You can select either one for use.

<Table 3-2 (1) FL-net Transmission specification>

Item	10BASE5	10BASE-T
Transmission speed	10 Mbps	
Framing method	Ethernet	
Access control	CSMA/CD	
Transmission method (code)	Base band (Manchester coding)	
Transmission line format	Bus configuration (Muiti-drop)	
Max. segment length	500 m (2500 max. with repeater)	100 m : between node and HUB (max. 200 m with repeater)
Min. node interval	2.5m	–
Maximum connectable nodes per FL-net system	254 units. However, because of the electrical limits as explained on the following page, it is necessary to use repeaters to increase the number of segments.	
Maximum connectable nodes per segment	100 unit/segment	2 unit/segment (including hub)
Protocol	FA link protocol UDP/IP, ICMP, ARP	
IP address	Class C	
Data exchange method	• Cyclic transmission system using common memory Data size : Max. 8704 words (512 words + 8192 words) • Message transmission method Data size : Differs depending on what type of message to use. For more information, refer to 6-2-8 (2) " List of supported messages" .	
External power supply	12V DC 500mA or less	Unnecessary

Note 1) For general specifications and detailed specifications, see the FL-net (OPCN-2) Manual (FH234).
Note 2) 10BASE5 and 10BASE-T cannot be used simultaneously.
Be sure to use the external power supply that meets the specifications for transceiver and transceiver cable (AUI cable).

[Reference]
IEEE 802.3 defines the specifications of transceiver and transceiver cable (AUI cable) as follows:

- Transceiver input terminal voltage: 12 $V^{-6\%}$ to 15 $V^{+5\%}$.
- DC resistance of transceiver: 40 Ω/km or less, max. 50m
- Maximum current consumption of transceiver: 500mA

3-3 FL-net Module Operation Definition List

Following parameters are necessary for NP1L-FL1 to participate in and communicate data via FL-net. Individual item is set with FL-net module parameters in the system structure definition (System_Definition) in the project tree.
For more information about the setting procedure, refer to “6-3 FL-net Parameter Setting”.

<Table 3-3 (1) Operation Definition List>

Item	Specification
Model code definition	Sets the model of SX series CPU.
Operating condition setting	Sets the prohibition of access to the following items by message via FL-net (from other node). Default is “permit”. 1) Network parameter writing 2) Byte/word block data writing 3) Run/stop
IP address	Set the IP address of NP1L-FL1 (local node). Default is 192.168.250.□□□. □□□ is the value of the node number setting switch on the front of the module. This cannot be set here.
Token monitoring time	Set the period of time to monitor the duration of cyclic transmission using the common memory area. Default is 50 ms, and setting range is 1 to 255 ms.
Minimum permissible frame interval (See note)	The time till a frame will be output from the local node after a token is received from other node is referred to as “frame interval”. And the minimum time during which you must wait till each node outputs a frame is referred to as “minimum permissible frame interval”. Default is 10x100 μs, and setting range is 0 to 50. Unit is 100 μs. When set to 0 (zero), the system operates at highest speed with no waiting time.
Node name (equipment name)	Set the node name for NP1L-FL1 by 10 single-byte characters (5 double-byte characters). When a name of less than 10 characters is set, space (20h) is set for the remaining digits. Default is 20202020202020202020h.
Local node transmission area setting	Set the local node transmission area in the common memory for cyclic transmission. Set top address and size for each of areas 1 and 2.
Individual structure definition	Register all the node numbers that are connected to FL-net, including the node number of the local module. However, 0 (zero) or 255 cannot be set.
Area 1, 2 sending bank change operation CPU definition	Set the refreshing method (synchronous/asynchronous) of the local node transmission area in the common memory as well as the CPU that issues change command in asynchronous mode.
All area receiving bank change operation CPU definition	Set the refreshing method (synchronous/asynchronous) of the local node receiving area in the common memory as well as the CPU that issues change command in asynchronous mode.

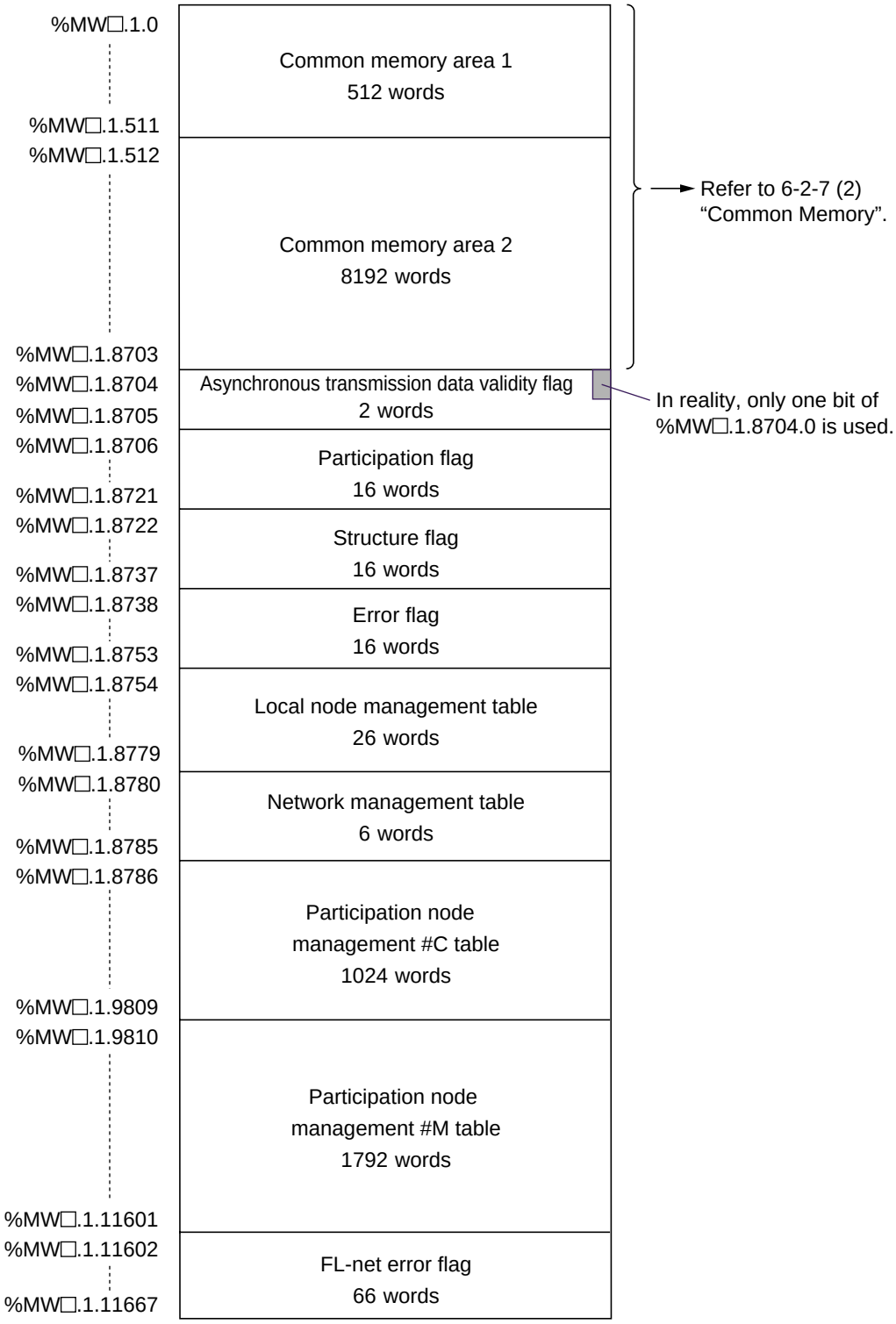
Note: With FL-net, minimum permissible frame interval is common throughout the network. Each node uses the maximum value of the minimum permissible frame interval that are set by the nodes participating in the network. This value is updated each time a node participates in or is disconnected from the network.

<Table 3-4 (1) Cable Specification>

Item	10BASE5	10BASE-T
Transmission medium	Ethernet coaxial cable	UTP (unshielded twisted pair cable) 26-22AWG
Cable diameter	10mm	0.4 to 0.6 mm

Note: For both Ethernet coaxial cable and UTP cable, be sure to use those that conform to IEEE 802.3 standard.

Common memory, participation flag, and structure flag of FL-net module are allocated in the internal memory of the FL-net module, as shown below:



* □ is the CPU number of the FL-net module. The CPU number is set with the CPU number setting switch on the front of the module.

Figure 3-5 (1) Address Map for the Link Data Area in FL-net Module

(1) Asynchronous data enable flag %MX□.1.8704.0

When this flag is turned on by application program, the common memory enable flag (%MX□.1.8771.13) turns on which is prepared in the "FL-net status" register in the local node management table. Depending on the node connected to FL-net, cyclic transmission data from remote node is not received unless the common memory enable flag (%MX□.1.8771.13) in the participation node management #M table is turned on. With MICREX-SX, when bank change FB (BANK_CHG) is used, the FB automatically turns this flag on. Therefore, the operation by application is unnecessary when BANK_CHG FB is used.

(2) Participation flag, structure flag, error flag %MW□.1.8706 to %MW□.1.8753

These flags indicate the status of individual node that is connected to FL-net. The status of individual node is judged from the combination of participation/structure/error flag and the condition of node structure registration in the system structure definition.

<Table 3-5 (1) Change in Flag Status According to Node Condition>

Structure registration	Participation	Structure	Error	Condition of node
No	OFF	OFF	OFF	Unregistered node is not connected.
	ON	OFF	OFF	Unregistered node is connected (participating).
	OFF	OFF	ON	Unregistered node is disconnected.
Yes	OFF	OFF	ON	The corresponding node is not yet connected or is disconnected.
	ON	ON	OFF	The corresponding node is connected normally (participating).

1) Participation flag %MW□.1.8706 to %MW□.1.8721 (read only)

This flag turns on when the corresponding node is participating in the FL-net. In the table, parenthesized figures mean node numbers.

<Table 3-5 (2) Participation Flag for Each Node on FL-net>

Word address ↓

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	← Bit address
%MW□.8706	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1		← Unused
%MW□.8707	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	
%MW□.8708	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	
%MW□.8709	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	
%MW□.8710	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	
%MW□.8711	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	
%MW□.8712	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	
%MW□.8713	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112	
%MW□.8714	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128	
%MW□.8715	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144	
%MW□.8716	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	
%MW□.8717	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	
%MW□.8718	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	
%MW□.8719	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208	
%MW□.8720	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224	
%MW□.8721		254	253	252	251	250	249	248	247	246	245	244	243	242	241	240	

* □ is the CPU number of the FL-net module. The CPU number is set with the CPU number setting switch on the front of the module.

2) Structure flag %MW□.1.8722 to %MW□.1.8737 (read only)

This flag turns on when system structure is registered for the node on FL-net and the node is actually participating in the FL-net.

<Table 3-5 (3) Structure Flag for Each Node on FL-net>

Word address ↓	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	← Bit address															
%MW□.8722	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	← Unused
%MW□.8723	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
%MW□.8724	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
%MW□.8725	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
%MW□.8726	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
%MW□.8727	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
%MW□.8728	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
%MW□.8729	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112
%MW□.8730	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
%MW□.8731	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
%MW□.8732	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160
%MW□.8733	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176
%MW□.8734	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192
%MW□.8735	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
%MW□.8736	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224
%MW□.8737		254	253	252	251	250	249	248	247	246	245	244	243	242	241	240

3) Error flag %MW□.1.8738 to %MW□.1.8753 (read only)

This flag turns on when the node is disconnected from or does not participate in the FL-net.

<Table 3-5 (4) Error Flag for Each Node on FL-net>

Word address ↓	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	← Bit address															
%MW□.8738	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	← Unused
%MW□.8739	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
%MW□.8740	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
%MW□.8741	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
%MW□.8742	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
%MW□.8743	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
%MW□.8744	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
%MW□.8745	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112
%MW□.8746	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
%MW□.8747	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
%MW□.8748	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160
%MW□.8749	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176
%MW□.8750	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192
%MW□.8751	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
%MW□.8752	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224
%MW□.8753		254	253	252	251	250	249	248	247	246	245	244	243	242	241	240

* □ is the CPU number of the FL-net module. The CPU number is set with the CPU number setting switch on the front of the module.

(3) Local node management table %MW□.1.8754 to %MW□.1.8779

This table manages the data related to the setting of local node. Individual setting data is assigned as shown below:

%MW□.1.8754	Node No. (1 byte)	Unused
%MW□.1.8755 ⋮ %MW□.1.8759	Node name (10 bytes)	
%MW□.1.8760 ⋮ %MW□.1.8764	Vendor name (10 bytes)	
%MW□.1.8765 ⋮ %MW□.1.8769	Maker type (10 bytes)	
%MW□.1.8770	Status of local node (1 byte)	Unused
%MW□.1.8771	Status of FL-net (1 byte)	Unused
%MW□.1.8772	Status of upper level (2 bytes)	
%MW□.1.8773	Common memory area 1, top address of transmission area (2 bytes)	
%MW□.1.8774	Common memory area 1, size of transmission area (2 bytes)	
%MW□.1.8775	Common memory area 2, top address of transmission area (2 bytes)	
%MW□.1.8776	Common memory area 2, size of transmission area (2 bytes)	
%MW□.1.8777	Minimum permissible frame interval (1 byte)	Unused
%MW□.1.8778	Token monitoring time (1 byte)	Unused
%MW□.1.8779	Protocol version (1 byte)	Unused

Figure 3-5 (2) Local Node Management Table

· Node No.

The number that is set with the node setting switch on the front of NP1L-FL1 is indicated by hexadecimal number.

· Node name

The node name that is set by the FL-net parameter in the system structure definition is indicated.
For example, when “FUJI DENKI” is set for node name, it is indicated as follows:

%MW□.1.8755	46 (h)	“F”	55 (h)	“U”
%MW□.1.8756	4A (h)	“J”	49 (h)	“I”
%MW□.1.8757	20 (h)	“ ”	44 (h)	“D”
%MW□.1.8758	45 (h)	“E”	4E (h)	“N”
%MW□.1.8759	4B (h)	“K”	49 (h)	“I”

Figure 3-5 (3) Example of Displayed Node Name

· Vendor name

For NP1L-FL1, vendor name is defined as “FUJI ELEC” and indicated as follows:

%MW□.1.8760	46 (h)	“F”	55 (h)	“U”
%MW□.1.8761	4A (h)	“J”	49 (h)	“I”
%MW□.1.8762	20 (h)	“ ”	45 (h)	“E”
%MW□.1.8763	45 (h)	“L”	45 (h)	“E”
%MW□.1.8764	43 (h)	“C”	2E (h)	“ ”

Figure 3-5 (4) Displayed Vendor Name

* □ is the CPU number of the FL-net module. The CPU number is set with the CPU number setting switch on the front of the module.

· Maker type

For NP1L-FL1, maker type is defined as “NP1L-FL1” and indicated as follows:

%MW□.1.8765	4E (h)	“N”	55 (h)	“P”
%MW□.1.8766	31 (h)	“1”	49 (h)	“L”
%MW□.1.8767	2D (h)	“–”	45 (h)	“F”
%MW□.1.8768	4C (h)	“L”	45 (h)	“1”
%MW□.1.8769	20 (h)	“ ”	2E (h)	“ ”

Figure 3-5 (5) Displayed Maker Type

· Status of local node

Indicates the status of local node (NP1L-FL1).

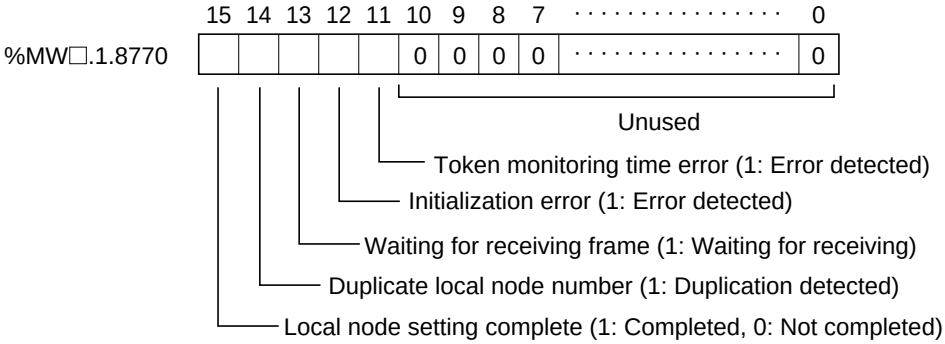


Figure 3-5 (6) Local Node Status Flag

· Status of FL-net

There are two types of FL-net status data: the data shared throughout the network, and the data that individual node manages.

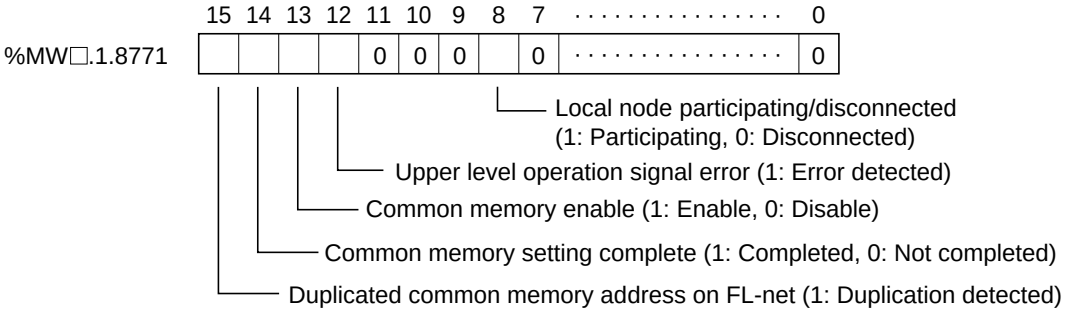


Figure 3-5 (7) FL-net Status Flag

· Status of upper level

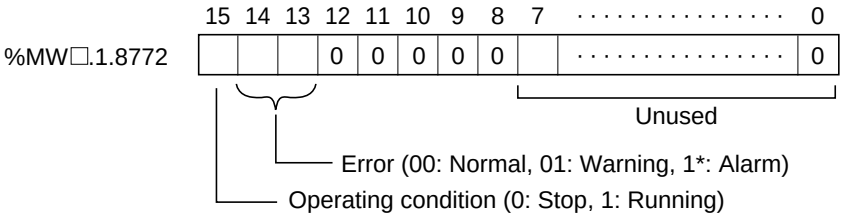


Figure 3-5 (8) Upper Level Status Flag

* □ is the CPU number of the FL-net module. The CPU number is set with the CPU number setting switch on the front of the module.

· Minimum permissible frame interval

The time till a frame will be output from the local node after a token is received from other node is referred to as “frame interval”. And the minimum time during which you must wait till individual node outputs a frame is referred to as “minimum permissible frame interval”.

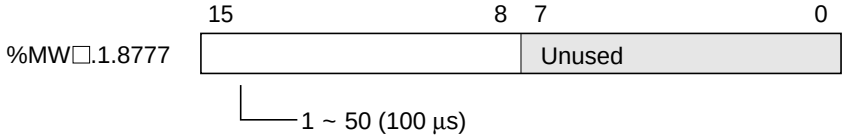


Figure 3-5 (9) Minimum Permissible Frame Interval

· Token monitoring time

The time since the local node (NP1L-FL) received a token from a token retain node till it passes the token to the next retain node is displayed.

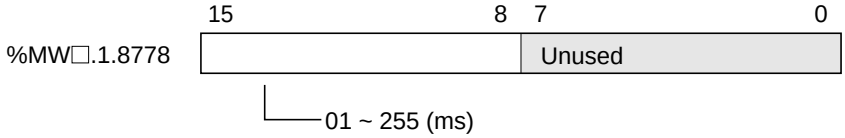


Figure 3-5 (10) Token Monitoring Time

· Protocol version

Protocol version is fixed to 80 hex.

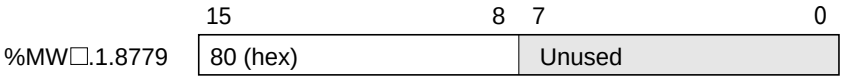


Figure 3-5 (11) Protocol Version

(4) Network management table %MW□.1.8780 to %MW□.1.8785

%MW□.1.8780	Token retain node No. (1 byte)	Unused
%MW□.1.8781	Minimum permissilbe frame interval (1 byte)	Unused
%MW□.1.8782	Refresh cycle allowable time (2 bytes)	
%MW□.1.8783	Refresh cycle measuring time, current value (2 bytes)	
%MW□.1.8784	Refresh cycle measuring time, maximum value (2 bytes)	
%MW□.1.8785	Refresh cycle measuring time, minimum value (2 bytes)	

Figure 3-5 (12) Participation Node Management Table

(5) Participation node management #C table %MW□.1.8786 to %MW□.1.9809

The transmission area for individual node that participates in FL-net is displayed. The data for one node is displayed in 4 words.

%MW□.1.8786 ⋮	⋮
+4x (Node No.)	Common memory area 1, top address of transmission area (2 bytes)
+4x (Node No.) +1	Common memory area 1, size of transmission area (2 bytes)
+4x (Node No.) +2	Common memory area 2, top address of transmission area (2 bytes)
+4x (Node No.) +3	Common memory area 2, size of transmission area (2 bytes)
⋮ %MW□.1.9809	⋮

Figure 3-5 (13) Participation Node Management #C Table

* □ is the CPU number of the FL-net module. The CPU number is set with the CPU number setting switch on the front of the module.

(6) Participation node management #M table %MW□.1.9810 to %MW□.1.11601

The setting of FL-net parameters for individual node that participate in the FL-net is displayed. The data for one node is displayed in 7 words.

%MW□.1.9810	⋮	
+7x (Node No.)	Status of FL-net (1 bytes)	Unused
+7x (Node No.) +1	Status of higher level (2 bytes)	
+7x (Node No.) +2	Token monitoring time (1 byte)	Unused
+7x (Node No.) +3	Minimum permissible frame interval (1 byte)	Unused
+7x (Node No.) +4	Allowable refresh cycle time (2 bytes)	
+7x (Node No.) +5	Unused	
+7x (Node No.) +6	Unused	
⋮	⋮	
%MW□.1.11601		

Figure 3-5 (14) Participation Node Management #M Table

(7) FL-net log %MW□.1.11602 to %MW□.1.11667

FL-net communication log is stored.

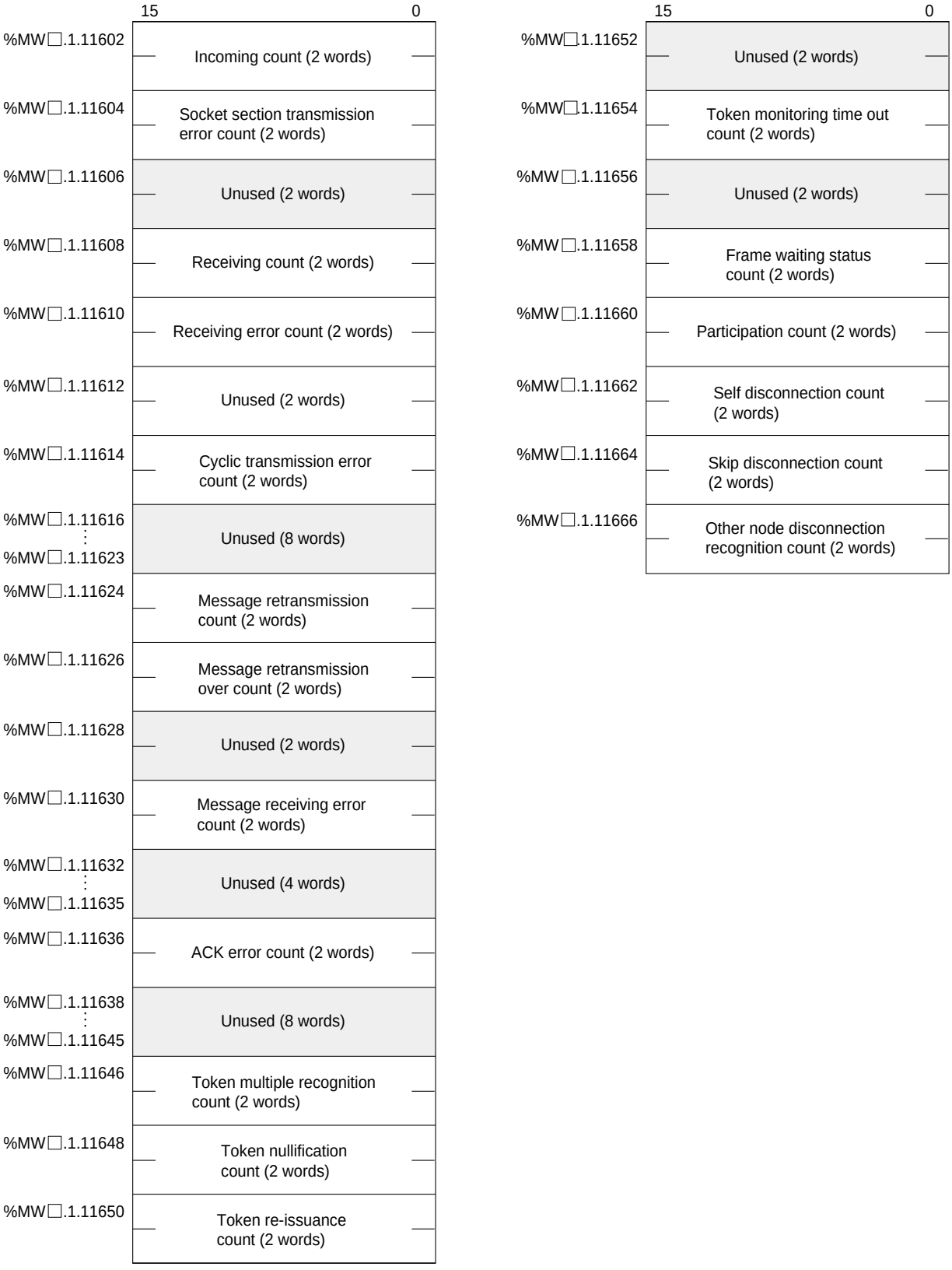


Figure 3-5 (15) FL-net Log

3-6-1 Name of each part

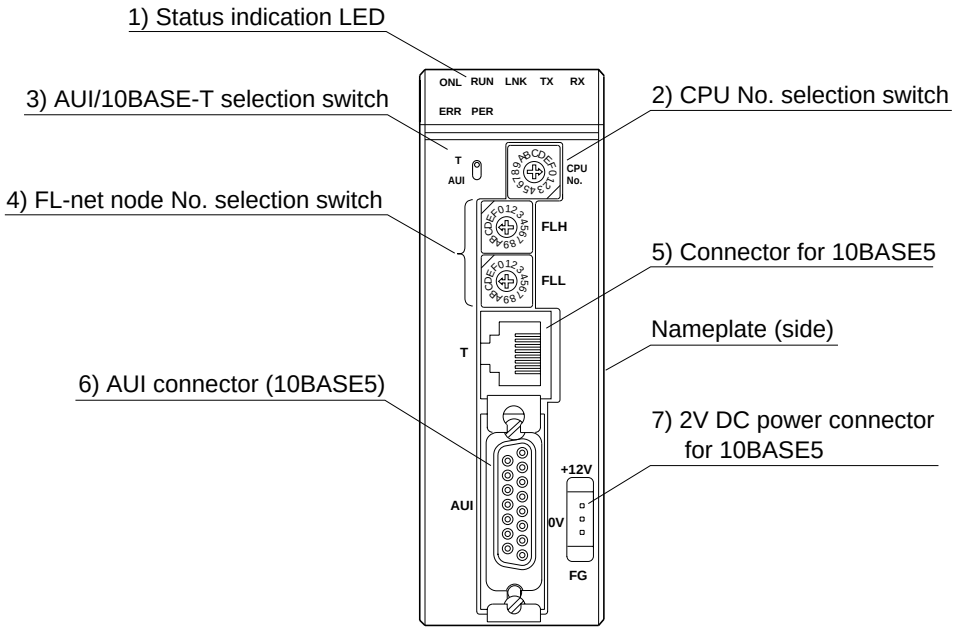


Figure 3-6 (1) NP1L-FL1 Front View

3-6-2 Function of each part

1) Status indication LED

Indicates the status of NP1L-FL1.

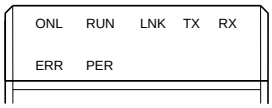


Figure 3-6 (2) LED

<Table 3-6 (1) Status Indication LED>

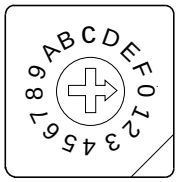
Symbol	Indication color	Lighting condition
ONL	Green	Lights when NP1L-FL1 is normal (flashes till the SX bus is activated after the system power source is turned on.)
RUN	Green	When the local module is operating normally
ERR	Red	Lights if NP1L-FL1 or SX bus is abnormal.
LNK	Green	Lights when participating in FL-net.
TX	Green	Lights while data is being transmitted from NP1L-FL1 to FL-net.
RX	Green	Lights while data is being received from FL-net to NP1L-FL1.
PER	Red	Lights if FL-net parameter that is set for NP1L-FL1 is abnormal. See note.

Note: Detectable setting errors include: CPU number setting error on the module front, node number setting error on the module front, and common memory area 1/2 address/size setting error.

2) CPU number setting switch

With FL-net module, like with CPU module, it is necessary to assign CPU station number (8 or 9). Do not change the setting while the system is running (while the power is turned on). This switch is set to “8” at shipment.

CPU No.



← For FL-net module, this switch is set to “8” or “9”.

Figure 3-6 (3) CPU Number Setting Switch

3) AUI/10BASE-T changeover switch
This switch is used to set the specification of the Ethernet that is connected to the FL-net. Do not change the setting while the system is running (when the power supply is turned on). This switch is set to “T” at shipment.

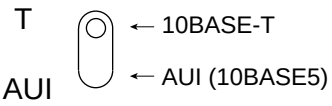


Figure 3-6 (4) AUI/10BASE-T Changeover Switch

4) FL-net node number setting switch
This switch sets the FL-net node number of NP1L-FL1 by hexadecimal number 01 to FE (1 to 254). Do not change the setting while the system is running (when the power supply is turned on). This switch is set to “01” at shipment.

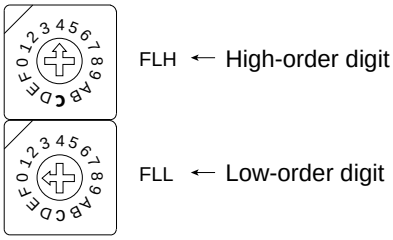


Figure 3-6 (5) FL-net Node Number Setting Switch

5) 10BASE-T connector
To use 10BASE-T, the 10BASE-T cable (UTP cable) is connected here.

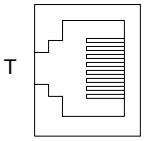


Figure 3-6 (6) 10BASE-T Connector

6) AUI connector
To connect to 10BASE5 using the AUI cable, this connector is used.

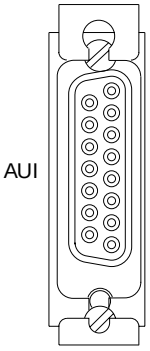


Figure 3-6 (7) AUI Connector

7) 12 VDC Connector for 10BASE5
When AUI cable is used, it is necessary to supply external 12 V DC (500 mA) power to this terminal. For the cable side connector, be sure to use HNC2-2/5S-3 from Hirose. When 10BASE-T is used, this connector is unnecessary.

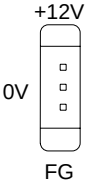


Figure 3-6 (8) 12 V DC Connector for 10BASE5

3-7 Outside Specifications

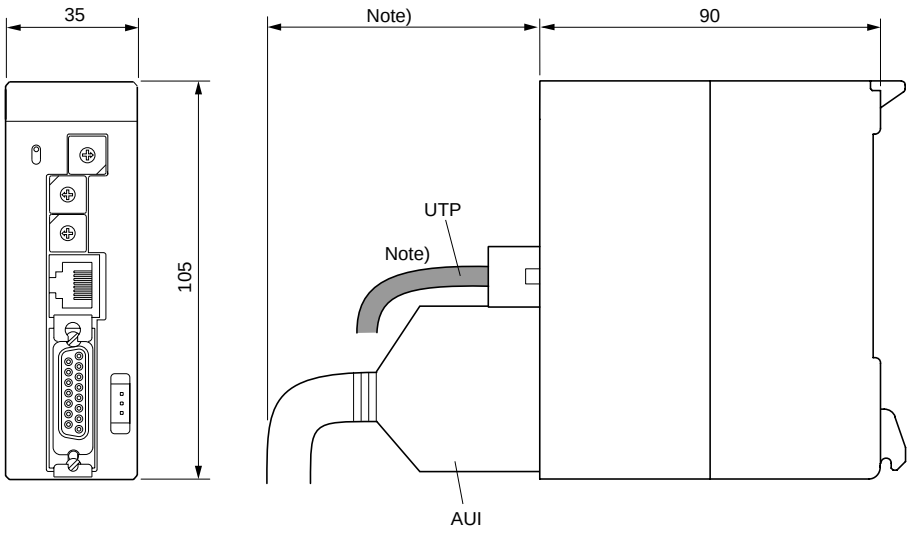


Figure 3-7 (1) Outside Dimensions

Note: To connect signal line to FL-net, either AUI cable (10BASE5) or UTP cable (10BASE-T) is used. The dimensions of the connector for the AUI or UTP cable to be used as well as the bending radius of cable (see the specification for the cable to be used) need to be taken into consideration.

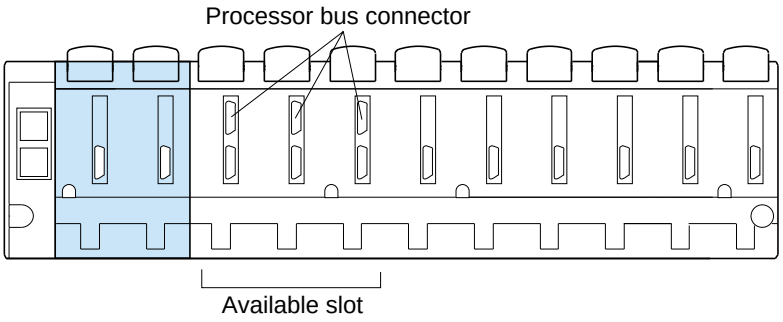
Section 4 Installing the FL-net Module

Section 4 Installing the FL-net Module

4-1 Module Installation Position

NP1L-FL1 is the communication module that is connected to SX bus or processor bus. There are the following limits on the installation position on baseboard.

The module is installed in the slot that has processor bus connector.



* NP1BP-13 has processor bus connectors for 10 slots.

Note: The module cannot be installed on the baseboard that is a slave station of T-link or JPCN-1.

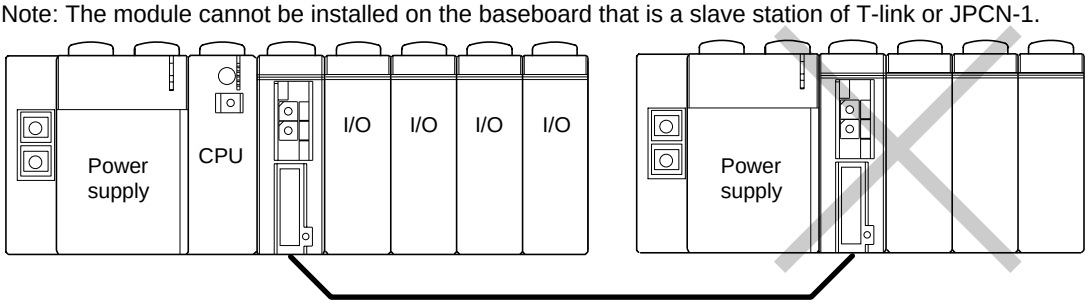


Figure 4-1 (1) Module Installation Position

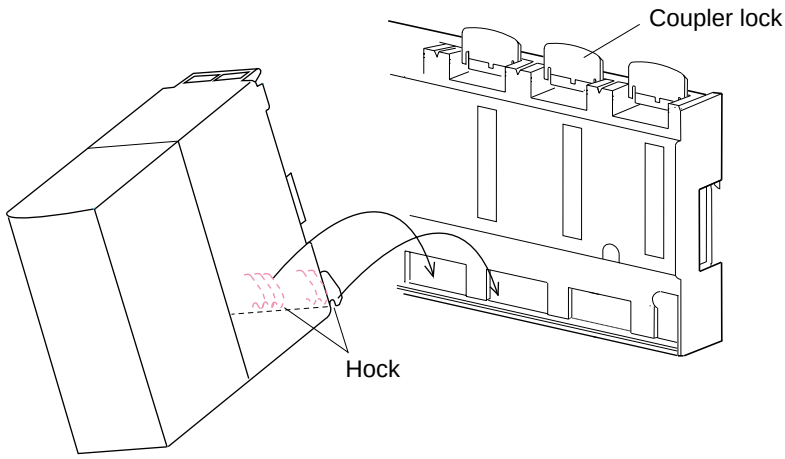
4-2 Number of Installable Modules

Maximum 2 units of NP1L-FL1 can be installed for one configuration. However, according to the classification of modules for MICREX-SX series, NP1L-FL1 belongs to “processor link module”. Therefore, when P-link module or PE-link module that belongs to the same category (processor link module) is installed in the same configuration, the following limit on the number of installable units is applied.

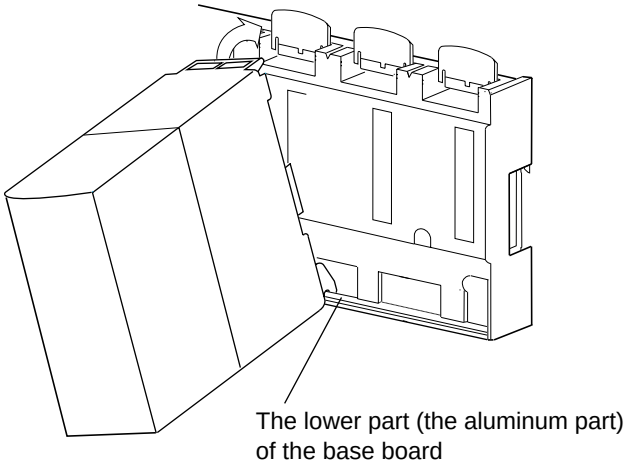
The total number of the modules that belong to “processor link module”: 2 units.

4-3 Mounting Module to the Base Board

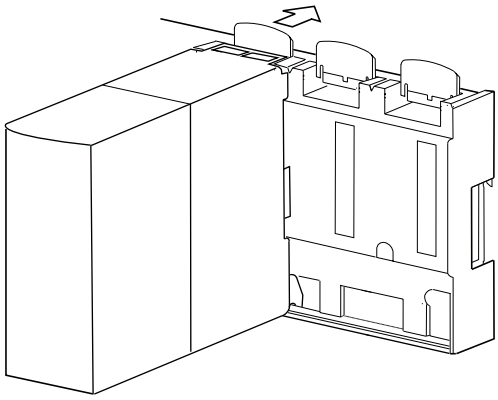
1) Raise the coupler lock which is attached to the slot where the module is inserted. Hang the hock of the module's backside on the lower part (the aluminum part) of the base board.



2) Fix the upper part of the module's backside on the base board.
   * Confirm that the hook of the module is stable on the lower part of the base board and is not sliding left or right. If the module is pushed in a sliding position, the connector may be damaged.



3) Confirm the coupler lock to hang on the hole which is in the upper part of the module's backside. If the module is loose, push the coupler lock to the direction of the arrow.



* Remove the module by the reverse procedure with bending the coupler lock.

Figure 4-3 (1) Mounting procedure to base board

Note: 1) Do not remove a module in which the power is ON. Confirm the ALM LED (Red) of the power supply module is OFF before removing the module.
2) If the module should be mounted with not hanging the hock to the base board, bend the coupler lock to remove the module with pushing the hock to the base board. Removing by force might cause to be broken.

Section 5 Wiring of FL-net Module Communication Cable

Page

Section 5 Wiring of FL-net Module Communication Cable

5-1 Connecting the Communication Cable

For communication, connect the module with either AUI cable (10BASE5 transceiver cable) or UTP cable.

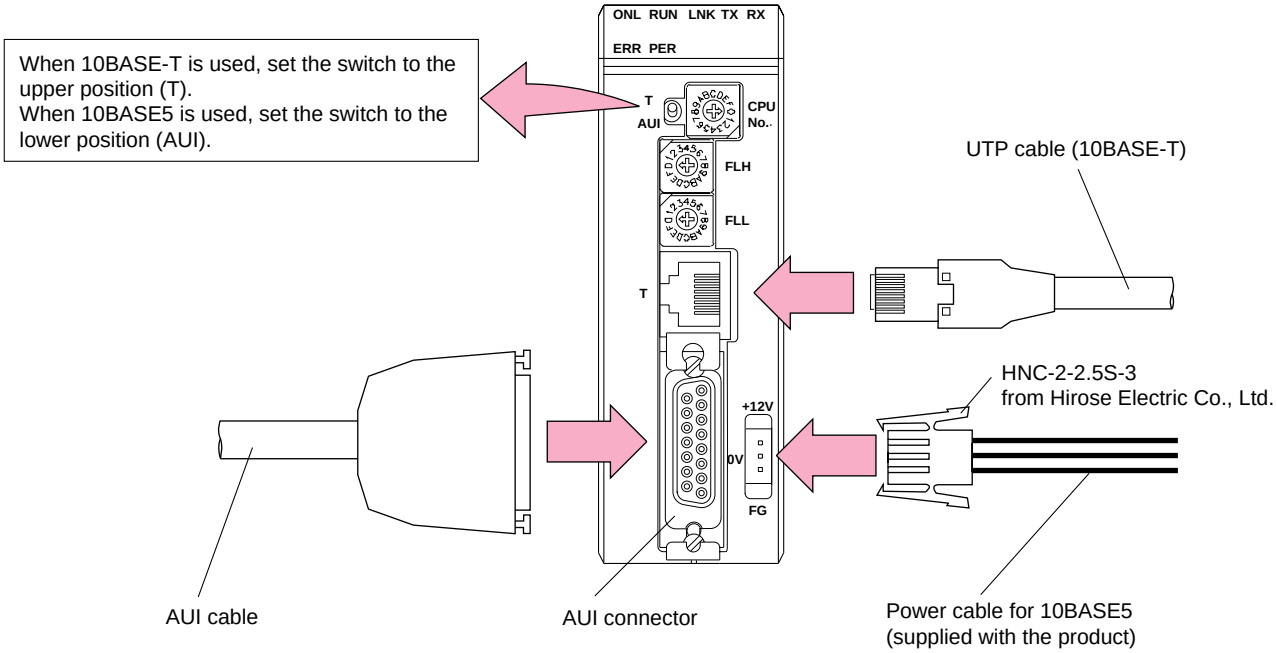


Figure 5-1 (1) Connecting the Communication Cable

(1) When 10BASE5 is used

Connect the 10BASE5 transceiver cable to the AUI connector. 10BASE5 requires the dedicated power supply (12 V DC).
Connect the 10BASE5 power cable supplied with the product.

Note: Connect “FG” of the 10BASE5 power cable not to the control panel frame but to the grounding line dedicated to the controller (type D grounding).

(2) When 10BASE-T is used

Connect the UTP cable to the modular connector.
Set the AUI/10BASE-T changeover switch to “T” (upper side).

Note: Do not change over between 10BASE5 and 10BASE-T while the system is running.

The controlled source of NP1L-FL1 is supplied from the power supply module via bace board.

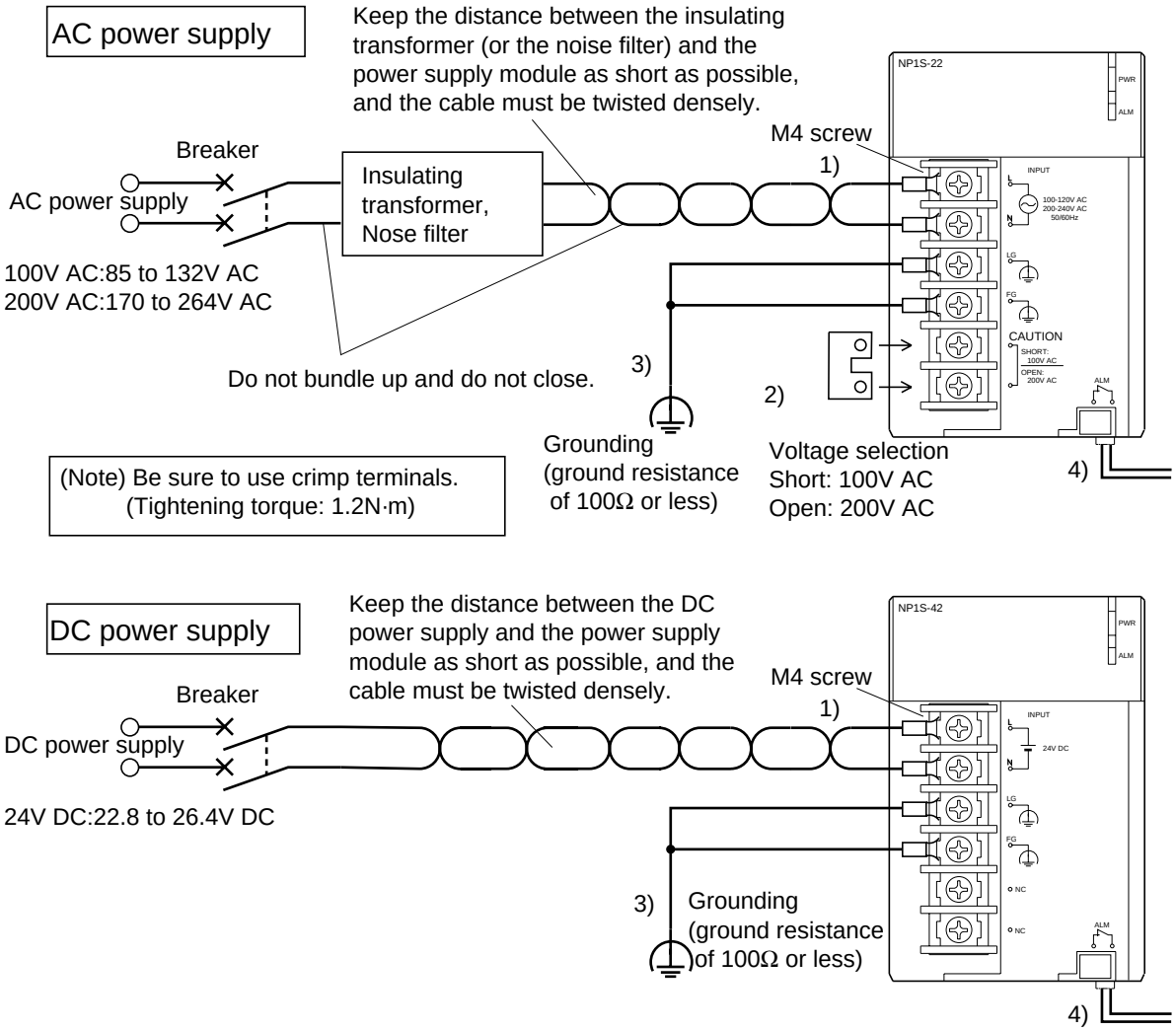


Figure 5-2 (1) Wiring of power supply

(1) Wiring of power supply

• For AC power supply

Wire to a 100 to 200V AC or 200 to 240V AC power supply. The thickness of the wire must be **2mm²**, and the wire must be twisted densely.

• For DC power supply

Wire to a 24V DC power supply (22.8 to 26.4V DC).

[Tips]

The tolerance range of SPH AC power supply is 85 to 132V AC for 100V AC, and 170 to 264V AC for 200V AC. But the voltage is recommended to be as near the rated voltage (100 to 110V AC, 200 to 220V AC) as possible.

In the case of the lower voltage, a small voltage drop will cause a power failure. In the case of the higher voltage, the heating value of the power supply module increases and it reduces the life of the module. If power supply voltage fluctuation exceeds the specified range, connect a voltage stabilizer to the power supply.

For noise reduction of the power supply, an insulating transformer or a noise filter is effective between the breaker and the power supply module. Take care of the following points:

- Do not bundle up or do not close the primary wire and the secondary wire of the insulating transformer or the noise filter.
- Keep the distance between the insulating transformer (or the noise filter) and the power supply module as short as possible, and the cable must be twisted densely.

(2) Voltage selection (for only AC power supply)
100V AC: Short (using a jumper plate)
200V AC : Open

(3) Grounding
For grounding, follow the description below.

- Connect the FG terminal to the integrated ground section of each control panel (FG bus, FG integrated terminal block, or stud) in branch-type configuration. The thickness of the ground wire must be **2mm²**. Allocate the grounding point as near the module as possible, and keep the ground wire as short as possible.
- The integrated ground section of each control panel must be connected to the integrated ground board, which is installed according to the distribution of devices in a branch-type configuration. The thickness of the ground wire must be **5.5mm²** or more.
- Separate the ground wire as far from the lines of high-voltage circuits and main circuit as possible. In addition, keep the distance at which they run in parallel as short as possible.
- For grounding, use an exclusive ground pole and wire which are separated from the ground system of other power circuits.
- The grounding should be exclusive. The grounding resistance is 100Ω or less. Separate the ground pole 10m or more from that of other power circuit.
- When an exclusive grounding is not available, use a common grounding as shown below.
- When installing in a place affected by frequent lighting surges, all the CPU modules and input/output modules should be electrically insulated from the control panel. Also, modules and units should be earthed to the ground individually.

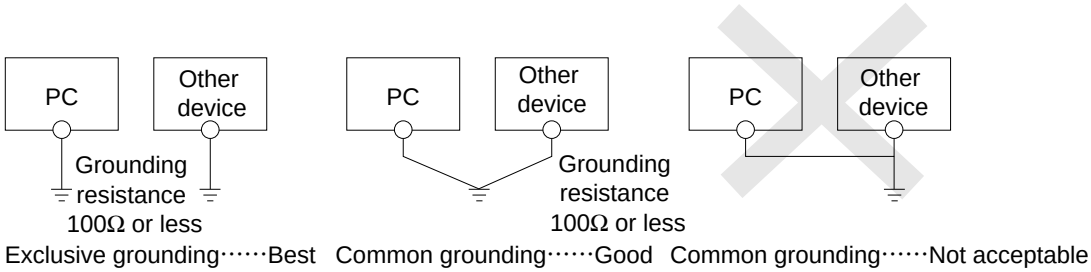


Figure 5-2 (2) Grounding

⚠ Warning
◊ Do not open the FG terminal with the LG-FG short circuited. (It must be grounded, otherwise it might cause electric shock.)

[Tips]
Sufficient measures are applied to SPH against noise and can be used without grounding, except when there is strong noise.
When no quality grounding is available because, for example, its ground wire is shaved by after equipment, connected to a building beam (steelwork), or connected to a grounding line whose purpose is merely to prevent electric shuck, it may rather be desirable to use SPH without grounding.
Even in such a case, the control panel must surely be grounded.

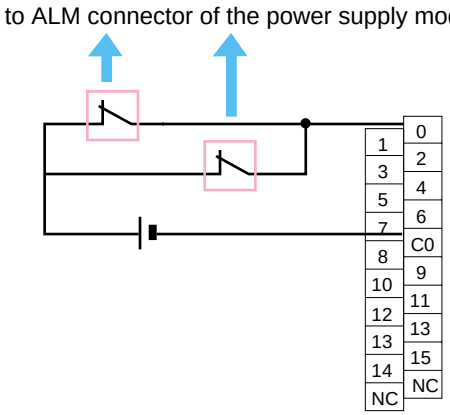
(4) ALM Contact wiring

When two (or three) power supply modules are mounted on one base board for the purpose of redundancy, the ALM contact can be used to detect any fault in power supply modules. The ALM contact should be wired to an input module or an external alarm lamp. The ALM contact is an NC contact. While the power supply module is normal (output voltage is 22.8 to 26.4V), the ALM contact is OFF. If the power supply module is not normal, the ALM contact is ON.

<Examples>

Examples with DC input module (NP1X1606-W) are shown below.

1) To detect a power supply module fault



2) To distinguish a faulty power supply module from a normal one

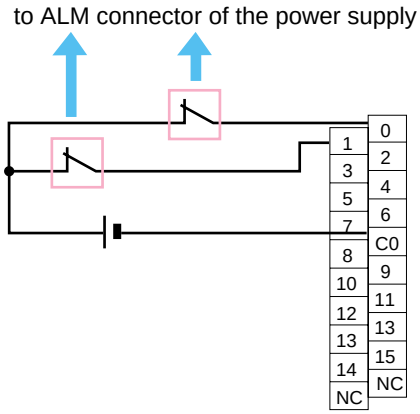


Figure 5-2 (3) ALM contact wiring

(5) Other precautions

For wiring terminal block type module, take the following precautions.

· Use the crimp terminals not to contact with each other and keep a clearance of 3.2mm or more.

· Apply the insulation sheath for the crimp terminal.

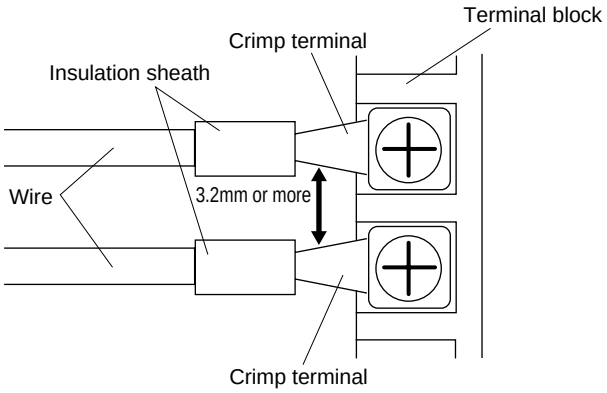


Figure 5-2 (4) Grounding

· Keep the bending of 1.5 times of the sheath for the wire, otherwise, a break might occur.

Section 6 Operation Guide 10BASE5

Page

Section 6 Operation Guide 10BASE5

6-1 About Ethernet

6-1-1 10BASE5 system

(1) Basic structure

10BASE5 system is configured basically with coaxial cable up to 500 m and nodes that are connected to the cable. Nodes are connected to the coaxial cable via AUI cable (transceiver cable) and transceiver. There are two types of transceiver: “single port transceiver” that can connect only one AUI cable and “multiport transceiver” that can connect multiple AUI cables.

This basic structure is referred to as “segment”. Maximum 100 nodes can be connected to one segment.

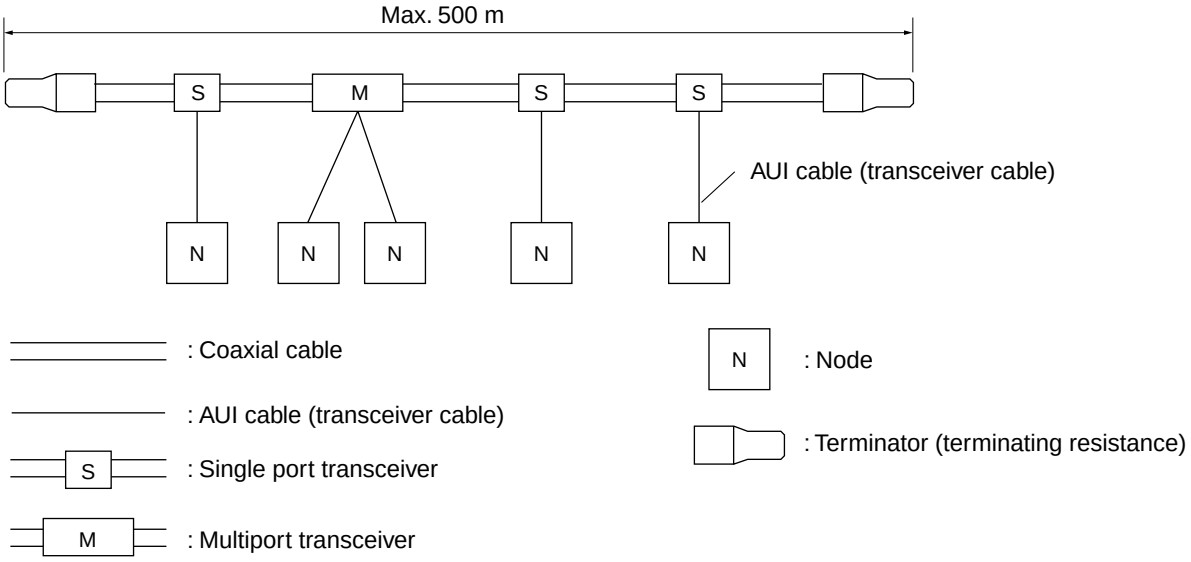


Figure 6-1 (1) Basic Structuren of 10BASE5 System

(2) Structure with repeaters

When the distance between nodes exceeds 500m, you can branch the segment by connecting repeaters and thus increase the number of segments. The figure below shows an example of a system, the distance between nodes of which is 1500 m or less. Be careful that when constructing a system in this way, the number of repeaters that exist in the path between arbitrary two nodes must be two or less.

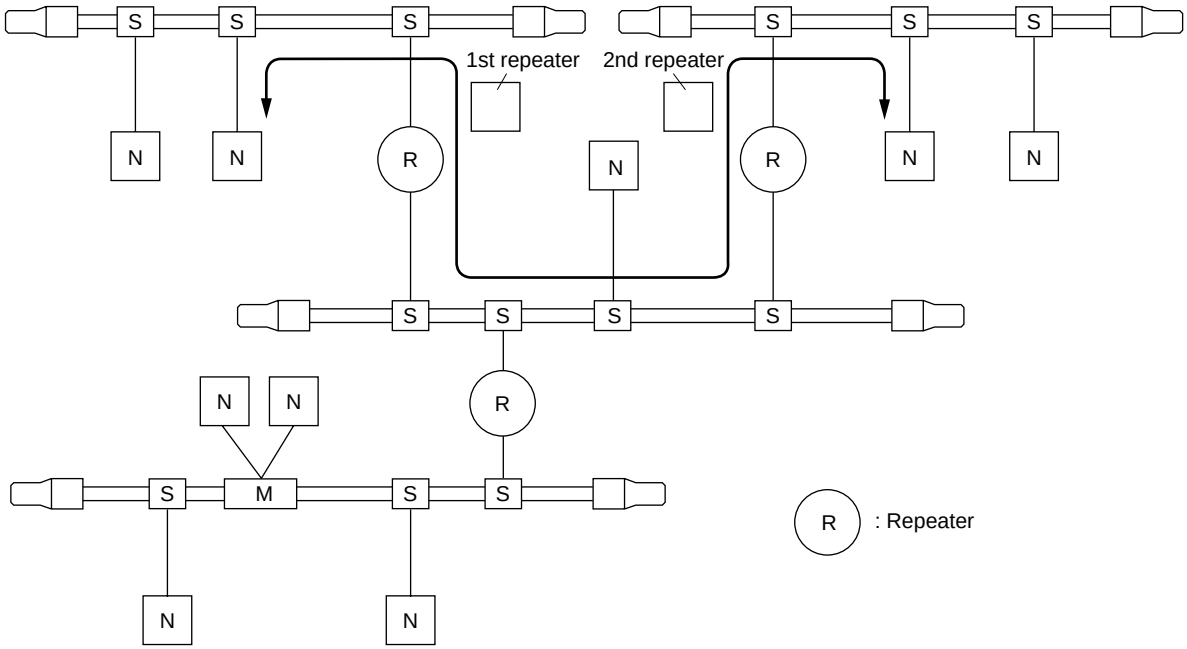


Figure 6-1 (2) Basic Connection (with Repeaters) of 10BASE5 System

Note: 1) Repeaters are connected to the coaxial cable via AUI cable and transceiver.
2) Repeater may be connected to arbitrary transceiver in the same coaxial cable segment.
3) The mounting distance of transceivers must be an integral multiple of 2.5 m.

(3) Structure with link segment

Another example of a system where the distance between nodes is extended to maximum 2500m is shown below. In order to increase transmission distance, “link cable” that is mounted a repeater at both ends (maximum 500 m in the case of coaxial cable) is used, which is referred to as “link segment”.

No node may be connected to the link segment. But the part enclosed by dotted line in the figure, including the repeaters at both ends, is regarded as a single repeater in counting the number of repeaters. Thus the limit on the total number of repeaters between arbitrary nodes can be relieved.

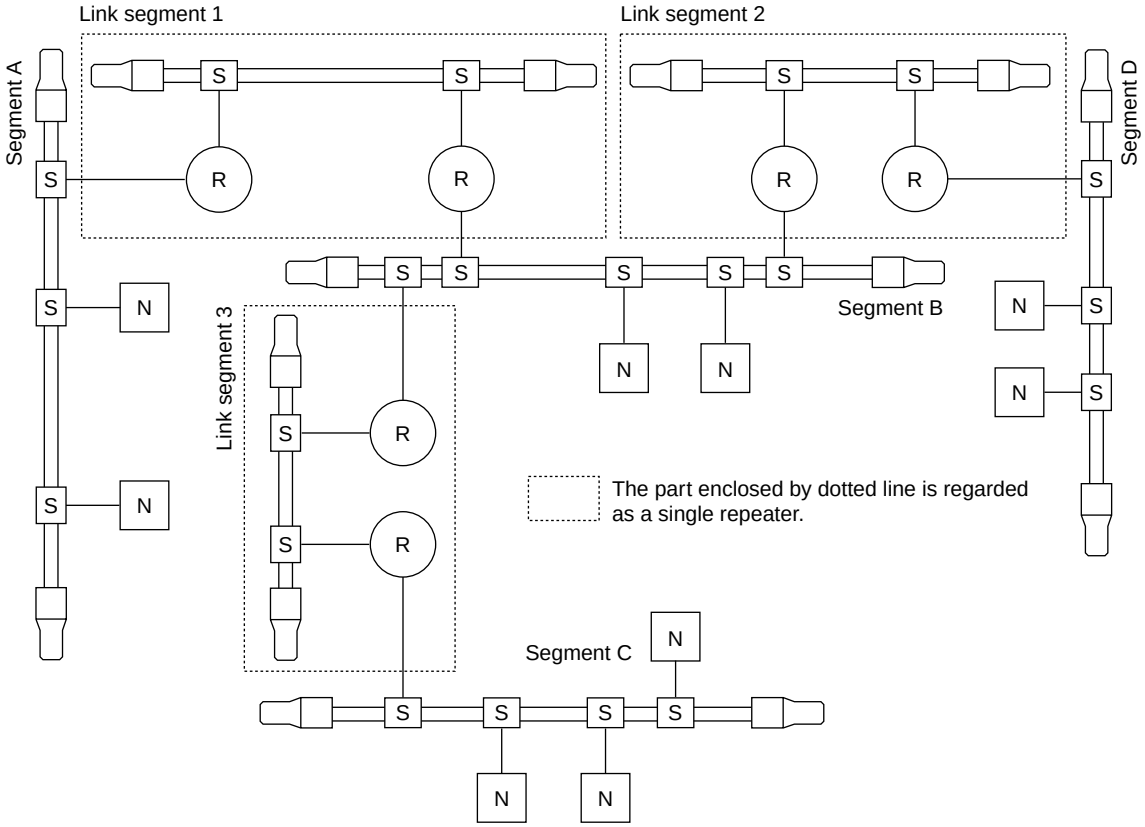


Figure 6-1 (3) Basic Connection of 10BASE5 System (Using Repeater/Link Segment)

Note: 1) Maximum length of a link segment is 500 m.
2) No node may be connected to link segment.
3) The maximum number of repeaters that may exist between arbitrary two nodes is two.
4) The number of the segments in which two or more repeaters are connected must be one (segment B in the above figure).

(4) Specifications for system structure

<Table 6-1 (1) Specifications for Ethernet System Structure>

Item	Specification
Maximum length of segment	500 m
Maximum number of transceivers mounted in a segment	100
Maximum distance between nodes	Max. 2,500 m (excluding AUI cable)
Maximum number of nodes per system	254
Maximum length of AUI cable (transceiver cable)	50m
Cable length between transceiver and repeater	Max. 2 m (recommended)
Maximum number of repeaters in the path between arbitrary two nodes	2 (However, a whole link segment including the repeaters at both ends is regarded as one repeater.)

6-1-2 10BASE-T system

It is possible to connect a hub to a transceiver via AUI cable and to connect multiple nodes to the hub.
UTP cable (10BASE-T) is used for the connection between hub and node.

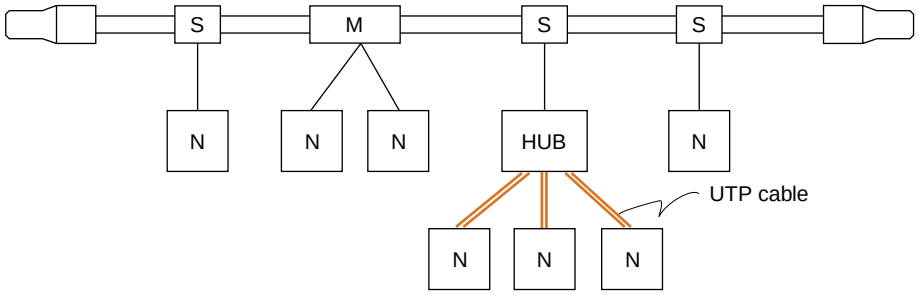


Figure 6-1 (4) Basic Structure of 10BASE-T System

When the distance between nodes is short, it is possible to connect the hub to the node via UTP cable without using coaxial cable or transceiver.

6-1-3 IP address of Ethernet

UDP/IP uses 32-bit logical address called “IP address”. IP address consists of network address and host address. In general, in the field of FA, class C is used.

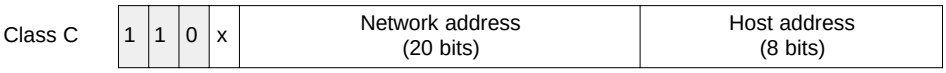


Figure 6-1 (5) Classification of Ethernet IP Address

This address is delimited with period “.” by the 8 bits so as to be expressed by decimal number. For example, for class C, address is expressed as follows:

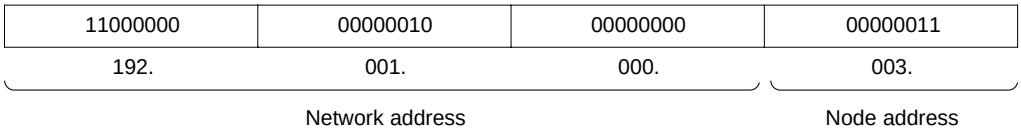


Figure 6-1 (6) Example of Ethernet IP Address for Class C

* For FL-net, default is 192.168.250.N (N: node number 1 to 245).

6-2-1 Overview of FL-net

(1) Concept of FL-net

FL-net is the FA control network based on Ethernet that has the cyclic transmission function as well as the message transmission function.

The basic concept of FL-net is as follows:

1) Use Ethernet as the communication medium (physical level, data link) between FA controllers.
2) Use UDP/IP that is widely used for Ethernet to realize basic means of data transmission.
3) Using the basic means of data communication explained above, manage and control the accesse to the communication medium from individual node on the network (thus to prevent collision), ensuring the transmission within a given period of time.

The object of FL-net is the FA control network for exchanging data among controllers, such as programmable controllers (PCs), robot controllers (RCs) and computerized numerical control (CNC) devices for production system, and personal computers for control.

(2) Protocol for FL-net

FL-net consists of six protocol layers, as shown below.

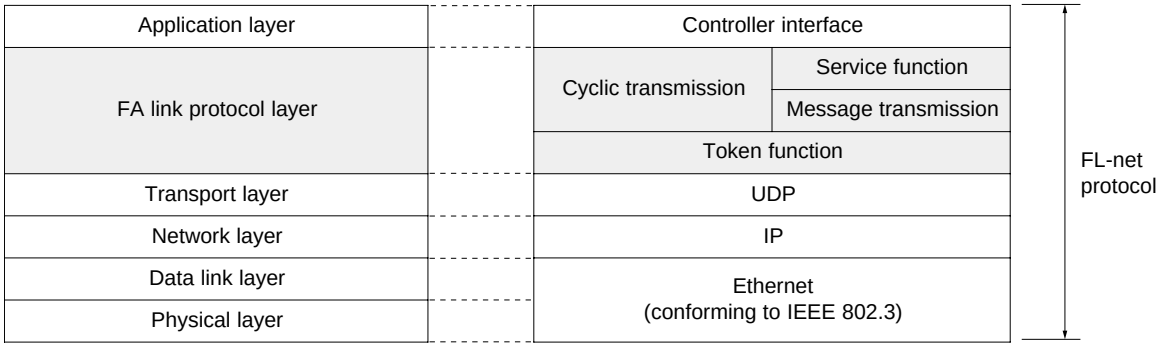


Figure 6-2 (1) FL-net Protocol

* Transport layer and network layer use UDP/IP; data link layer and physical layer use Ethernet.

(3) Features of FL-net transmission method

“FA link protocol layer” of FL-net has the following features:

1) Transmission control by masterless token method to avoid collision.
2) By making the token circulate within a given time, refresh cycle time can be specified.
3) Specified token is sent together with cyclic data.
4) At leading edge, token is sent from a node of the smallest number.
5) When no token is sent for a given time, token is sent from the next node.
6) Due to masterless token system, the network does not stop even when part of the nodes failed.
7) Information control table, including operation mode (RUN/STOP) and hardware error (ALARM), is prepared so that you can reference the operating condition of other nodes.

(4) IP address of FL-net

IP address of each node of FL-net needs to be set individually by Class C. IP address is the address to indicate a specific node for transmission by IP (Internet protocol). Therefore, IP addresses need to be managed carefully so as not to doubly set a same address. FL-net uses Class C IP address. Default IP address for FL-net is 192.168.250.****. **** is node No.

<Table 6-2 (1) IP Address of FL-net>

Network address	Node No. (Host No.)
192.168.250 (default)	n (n: 1 to 254)

6-2-2 Number of connectable units and node numbers

Maximum number of connectable units is 254, node numbers being 1 to 254.

1) Node No. 1 to 249: For ordinary FL-net devices
2) Node No. 250 to 254: For FL-net maintenance
3) Node No. 255: For FL-net internal use. User cannot use this number. (This number is used for broadcast transmission of global address.)
4) Node No. 0: For FL-net internal use. User cannot use this number.

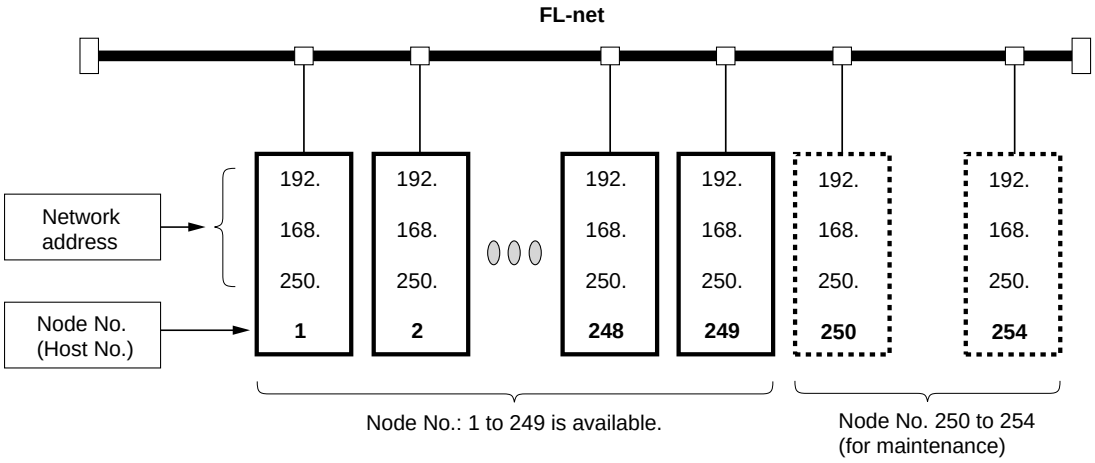
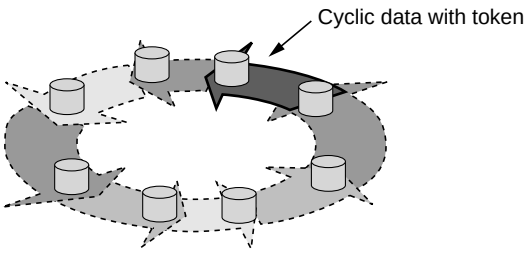


Figure 6-2 (2) Number of Connectable Units and Node Numbers of FL-net

6-2-3 Type of data communication

FL-net data communication supports “cyclic transmission” and “message transmission”.

Cyclic transmission



Cyclic transmission + message transmission

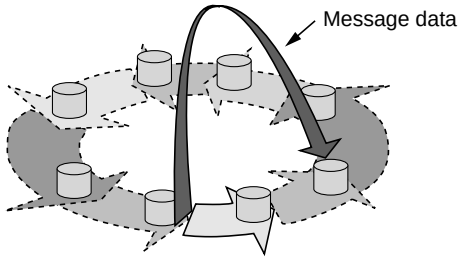


Figure 6-2 (3) FL-net Data Communication Types

(1) Cyclic transmission

The “cyclic transmission” function transmits data cyclically. Individual node can share the data via the common memory.

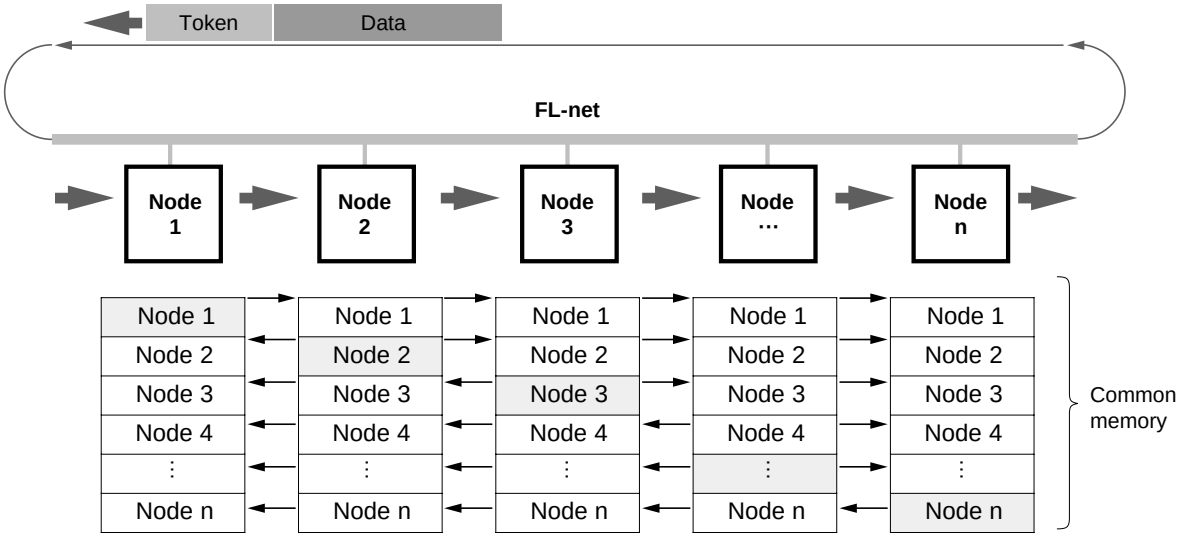


Figure 6-2 (4) Example of Common Memory and Cyclic Transmission

(2) Message transmission

The “message transmission” function transmits data noncyclically.
In general, when there is a request to send and a token is retained, data is transmitted to specified node.

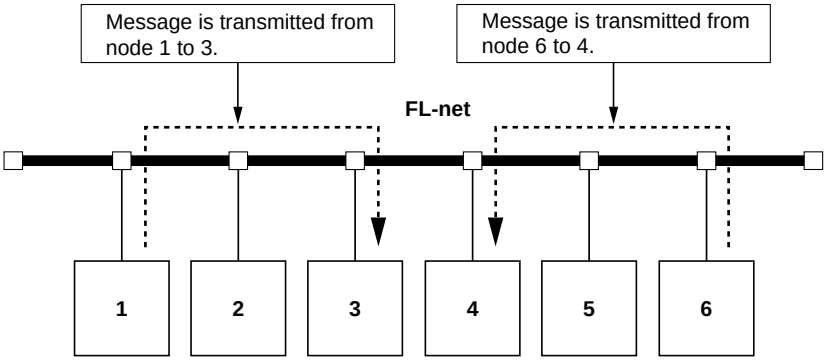


Figure 6-2 (5) Example of Message Transmission

6-2-4 Quantity of transmission data

(1) Cyclic transmission

The entire network has the common memory of 8k bits (512 words) + 8k words.
The maximum quantity of transmission data that can be used per node is 8.5k words (1k = 1024).

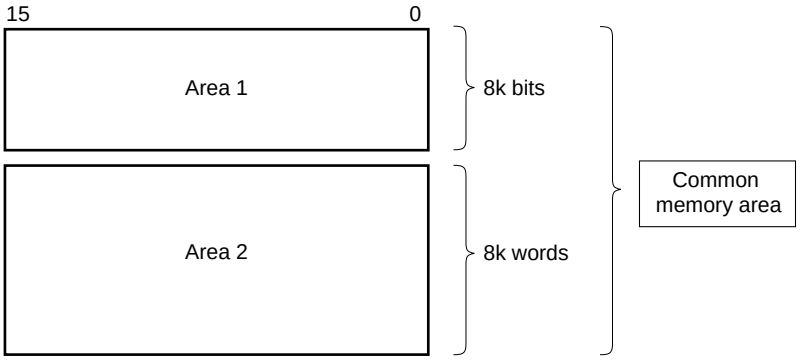


Figure 6-2 (6) Data Quantity for Cyclic Transmission

(2) Message transmission

The maximum quantity of data per message frame is 512 words (1024 bytes) (excluding header).

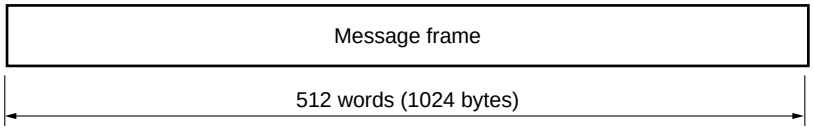


Figure 6-2 (7) Data Quantity for Message Transmission

6-2-5 Transmission period

Cyclic transmission refreshes the common memory at constant intervals. The transmission of message is controlled such that the refresh time of common memory does not exceed the allowable refresh cycle time in individual message transmission cycle.
After receiving a token destined for itself till receiving the next token destined for itself, individual node continuously monitors message frames that flow through the network. When no message frame flows through the network during this period, 120% the period is made the allowable refresh cycle time.
By this monitoring operation, the allowable refresh cycle time is determined dynamically according to the number of nodes connected to the network.

6-2-6 Communication control table

The status of node is managed using Local Node Management Table, Participation Node Table, and Network Management Table.

(1) Local node management table

Local Node Management Table manages the setting of local node.

<Table 6-2 (2) Local Node Management Table>

Name	Length in bytes	Contents and setting range
Node No.	1 byte	1 to 254
Common memory area 1, top address of data	2 bytes	Word address (0 to 1FFhex)
Common memory area 1, data size	2 bytes	Size (0 to 200hex)
Common memory area 2, top address of data	2 bytes	Word address (0 to 1FFFhex)
Common memory area 2, data size	2 bytes	Size (0 to 2000hex)
Status of upper layer	2 bytes	RUN/STOP/ALARM/WARNING/NORMAL
Token monitoring time	1 byte	1 to 255 ms, in units of 1 ms
Minimum permissible frame interval	1 byte	0 to 50 x100 μs, in units of 100 μs
Vendor name	10 bytes	Vendor name “FUJI ELEC.”
Maker type	10 bytes	Maker type, equipment name “NP1L-FL1”
Node name (equipment name)	10 bytes	Node name set by user
Protocol version	1 byte	80hex, fixed
Status of FL-net	1 byte	Participation, disconnection, etc.
Status of local node	1 byte	Detection of duplicated node No., etc.

* For more information about the memory allocation in NP1L-FL1 of Local Node Management Table, refer to 3-5 (3) “Local Node Management Table”.

(2) Participation node management table

Participation Node Management Table manages the data related to the nodes that participate in the network. For more information, refer to the specification for individual node.

<Table 6-2 (3) Participation Node Management Table>

Name	Length in bytes	Contents and setting range
Node No.	1 byte	1 to 254
Status of upper layer	2 bytes	RUN/STOP/ALARM/WARNING/NORMAL
Common memory area 1, top address of data	2 bytes	Word address (0 to 1FFhex)
Common memory area 1, data size	2 bytes	Size (0 to 200hex)
Common memory area 2, top address of data	2 bytes	Word address (0 to 1FFFhex)
Common memory area 2, data size	2 bytes	Size (0 to 2000hex)
Allowable refresh cycle time	2 bytes	Units of 1 ms
Token monitoring time	1 byte	Units of 1 ms
Minimum permissible frame interval	1 byte	Units of 100 μs
Status of FA link	1 byte	Participation, disconnection, etc.

* For more information about the memory allocation in NP1L-FL1 of Participation Node Management Table, refer to 3-5 (6) “Participation Node Management #M Table”.

(3) Network management table

Network Management Table manages the common data of the network.

<Table 6-2 (4) Network Management Table>

Name	Length in bytes	Contents and setting range
Token retain node No.	1 byte	The node number that currently retains the token is stored.
Minimum permissible frame interval	1 byte	Units of 100 μs
Allowable refresh cycle time	2 bytes	Units of 1 ms
Measured refresh cycle time (current value)	2 bytes	Units of 1 ms
Measured refresh cycle time (maximum)	2 bytes	Units of 1 ms
Measured refresh cycle time (minimum)	2 bytes	Units of 1 ms

* For more information about the memory allocation in NP1L-FL1 of Network Management Table, refer to 3-5 (4) “Network Management Table”.

6-2-7 Cyclic transmission and area

(1) Overview of cyclic transmission

Cyclic transmission is the function that supports the periodical exchange of data that takes place between nodes.

1) Realize common memory function.
2) Transmit data when a node retains a token.
3) Permit the nodes that participate in the network but do not perform cyclic transmission.
4) When a node retains a token, all the cyclic data in the transmission area is transmitted.

<Token>

Basically, only one token exists in the network. If more than one token exists in the network, the token of smaller destination node number is given priority, and the other is discarded.

<Token frame>

The frame that includes a token (token frame) contains token destination node number and token source node number. Individual node becomes the token retain node when it coincides with the destination node number of the token in the received token frame.

<Order of token rotation>

The order of token rotation is determined according to node numbers. Individual node rotates the token in the ascending order of the node numbers that are registered in the Participation Node Management Table. A node of the greatest node number passes the token to a node of the smallest node number.

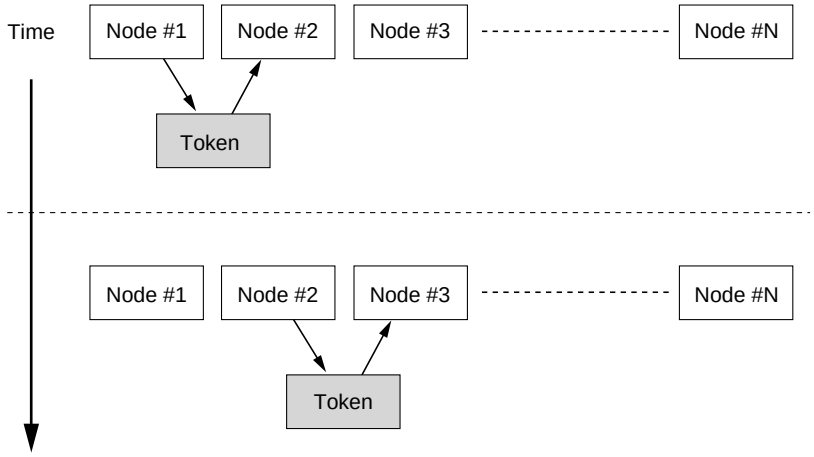


Figure 6-2 (8) Rotation of Token and Cyclic Transmission 1

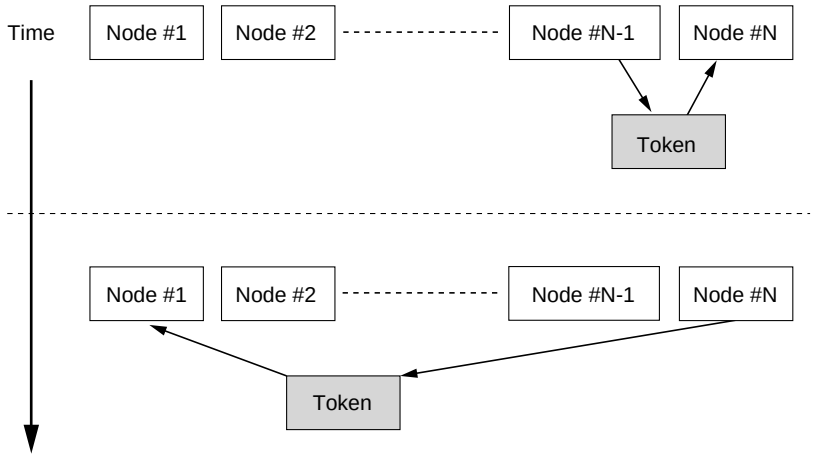


Figure 6-2 (9) Rotation of Token and Cyclic Transmission 2

(2) Common memory

1) Provides the function that can be used as the common memory for the nodes that perform cyclic transmission.
2) Two types areas (area 1 and area 2) can be allocated for one node.
3) When the area for transmission of one node exceeds the transmission size of one frame, or 1024 bytes, data transmission is performed using multiple frames.
4) When receiving the data frames that are divided in above 3), the common memory won't be updated till all the frames sent from one node are received. Namely, the uniqueness (concurrency) of data by the node is assured (see note).
5) Capacity of the common memory prepared by the communication section of a node is fixed to 8.5k words (8k bits + 8k words).
6) In the common memory, area 1 and area 2 as the transmission areas for one node can be set arbitrarily within the maximum of the setting range.
7) By broadcasting data at constant intervals, individual node provides the function to share the data throughout the entire system. Individual node on the FL-net takes charge in a transmission area that does not overlap on other transmission areas to exchange data. Therefore, the transmission area that is allocated to a node becomes the receiving area for other nodes.

Note: With MICREX-SX, in order to assure the uniqueness of data by the node, it is necessary to use "BANK_CHG" function block. For more information, refer to "6-4 How to Use FL-net".

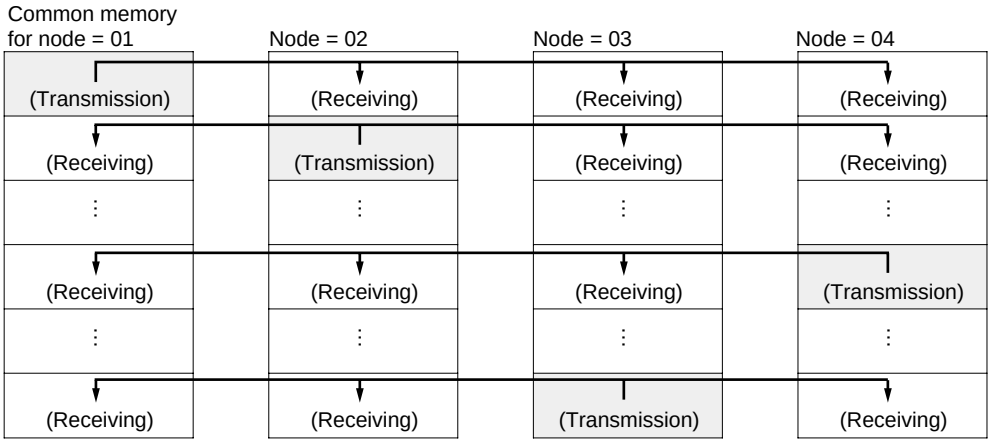


Figure 6-2 (10) Example 1 of Common Memory Area for Cyclic Transmission

It is possible to use common memory only as receiving area.

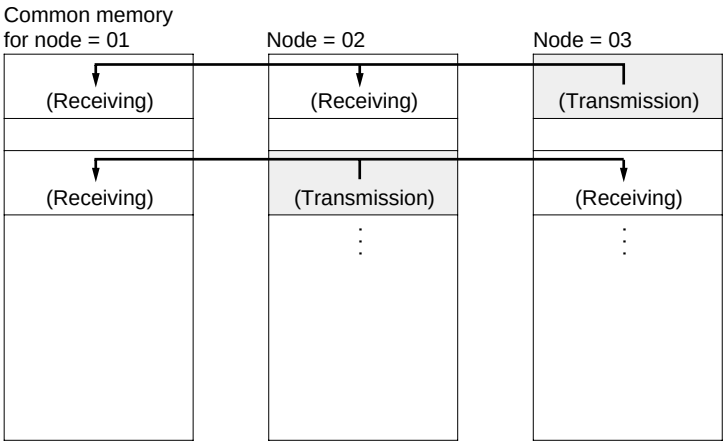


Figure 6-2 (11) Example 2 of Common Memory Area for Cyclic Transmission

(3) Area 1 and area 2

For one node, the two data areas called “area 1” and “area 2” can be allocated in the common area. Transmission area is set by top address and size of the area.

The areas are accessed by word address. Area 1 is 0.5k word; area 2, 8k words (1k = 1024).

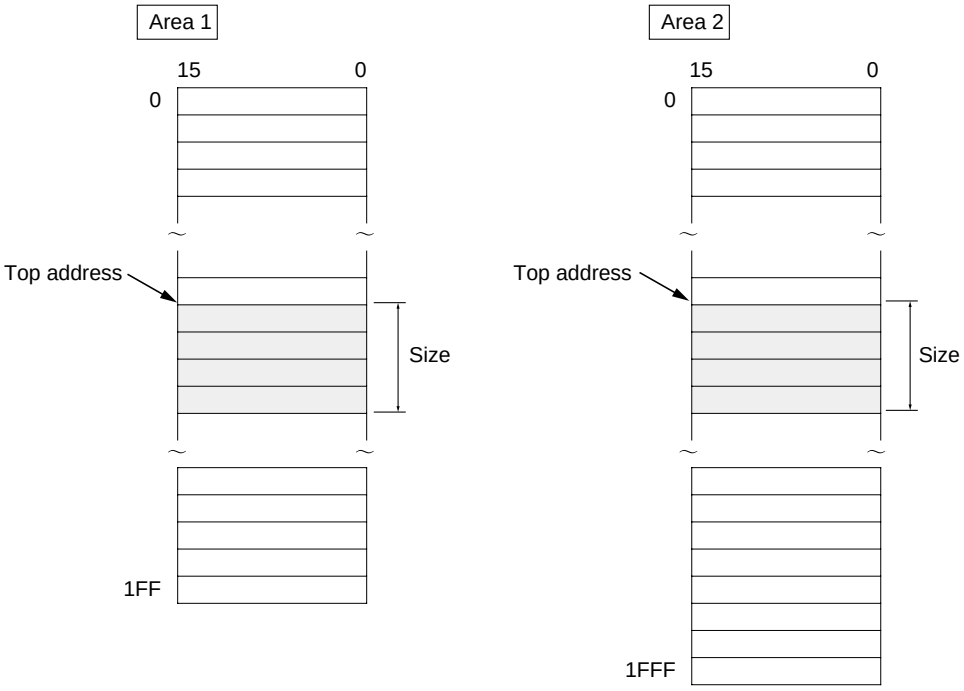


Figure 6-2 (12) Area 1 and Area 2 in Common Memory

(4) Uniqueness (concurrency) of data

For cyclic transmission, depending on the quantity of data to be sent, the data may be divided into multiple frames. In such case, the uniqueness (concurrency) of common memory data by the node is assured in the following manner:

1) Transmission timing

When data transmission is requested from upper layer, the cyclic data of the local node is copied to the buffer to prepare for sending, and thus sent in order. When the data size of a sending node is too large to send by one frame, the buffer data is divided into several frames to be sent.

2) Refresh timing at receiving

When received all the cyclic data sent from one node, the receiving node updates the receiving area (see note). Also in the case of dividing cyclic data into multiple frames for transmission, the area is updated when all the frames sent from one node are received. If all the frames of the divided data sent from one node are not completely received, all the data from the node will be discarded.

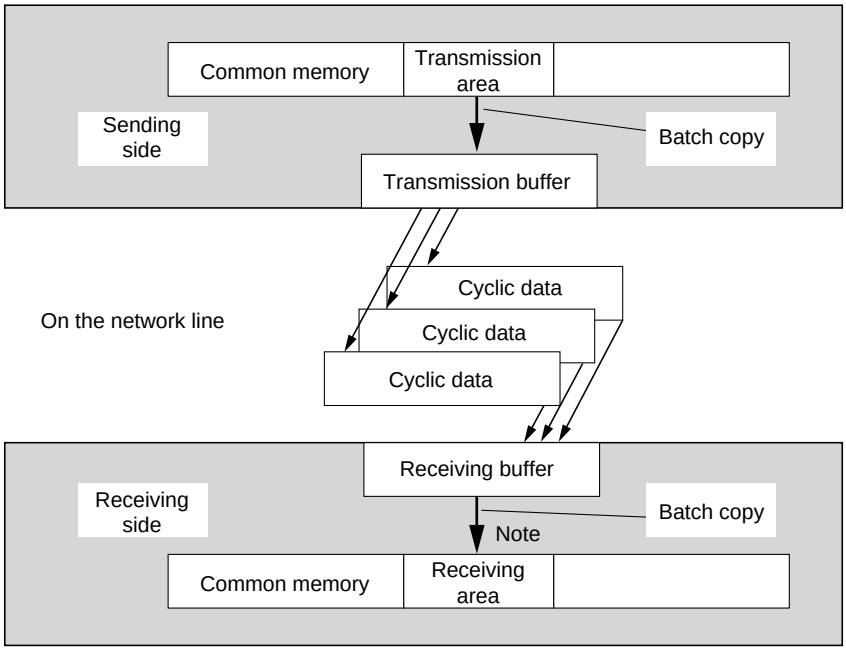


Figure 6-2 (13) Assurance of the Uniqueness of Data

Note: While the data is being copied from the receiving buffer to the receiving area, if the data is accessed from application program, the uniqueness of the data cannot be assured.
When it is necessary to assure the uniqueness of data by the node, “BANK_CHG” function block is used. For more information, refer to “6-4 How to Use FL-net”.

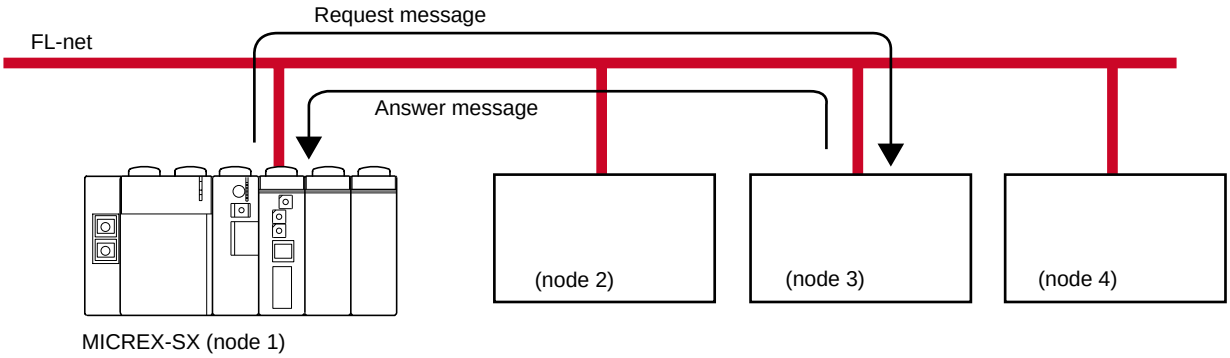
6-2-8 Message transmission

(1) Overview of message transmission

The message transmission function supports asynchronous data exchange between nodes. Basic features of the message transmission function are as follows:

1) When a node receives a token, maximum 1 frame can be transmitted before cyclic frame transmission.
2) The maximum quantity of data that can be transmitted or received by one transmission cycle is 1024 bytes. However, the quantity of transmitted data in one cycle depends on what command (FB) to use. For more information, refer to the Supported Messages List on the following page.
3) There is the algorithm to keep within the allowable refresh cycle time for cyclic transmission.
4) There are two transmission functions: 1:1 transmission function for sending data only to specified destination node; 1:N transmission function for sending data to all nodes.
5) With 1:1 transmission, you can check whether or not the destination node correctly received the data.

<1:1 transmission>



<1:N transmission>

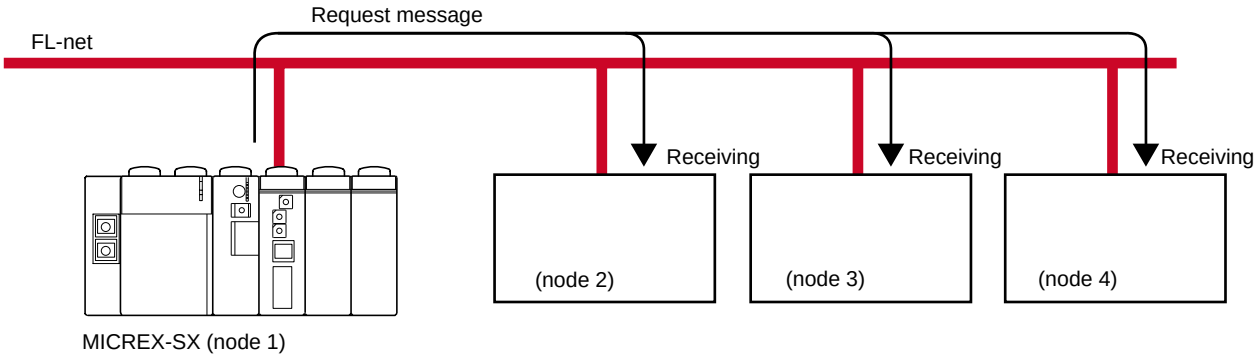


Figure 6-2 (14) Outline of Message Transmission

(2) Supported messages list

<Table 6-2 (5) Supported Messages List>

No.	Type of message		Operation code (TCD code) (see note 1)		Message FB to be used	Message data size
			Request	Answer		
1)	Byte block read (see note 2)		65003 (FDEB)	65203 (FEB3)	R_READ (VAR_TYPE=2)	476 bytes
2)	Byte block write (see note 2)		65004 (FDEC)	65204 (FEB4)	R_WRITE (VAR_TYPE=2)	476 bytes
3)	Word block read		65005 (FDED)	65205 (FEB5)	R_READ (VAR_TYPE=2)	476 bytes
4)	Word block write		65006 (FDEE)	65206 (FEB6)	R_WRITE (VAR_TYPE=2)	476 bytes
5)	Network parameter read		65007 (FDEF)	65207 (FEB7)	R_READ (VAR_TYPE=2)	56 bytes
6)	Network parameter write		65008 (FDF0)	65208 (FEB8)	R_WRITE (VAR_TYPE=2)	20 bytes
7)	Stop		65009 (FDF1)	65209 (FEB9)	R_WRITE (VAR_TYPE=2)	–
	Run		65010 (FDF2)	65210 (FEBA)	R_WRITE (VAR_TYPE=2)	–
8)	Profile read		65011 (FDF3)	65211 (FEBB)	R_READ (VAR_TYPE=2)	480 bytes
9)	Communication log read		65013 (FDF5)	65213 (FEBD)	R_READ (VAR_TYPE=2)	480 bytes
10)	Communication log clear		65014 (FDF6)	65214 (FEBE)	R_WRITE (VAR_TYPE=2)	–
11)	For message loop back test		65015 (FDF7)	65215 (FEBF)	R_WRITE (VAR_TYPE=2)	1024 bytes
12)	Transparent message		00000 to 59999 (0000 to EA5F)		M_SEND/M_RECEIVE	1026 bytes (see note 3)
	Reserved for SX	Address read	100 (64)	150 (96)	R_READ (VAR_TYPE=0)	(see note 4)
		Address write	101 (65)	151 (97)	R_WRITE (VAR_TYPE=0)	(see note 4)
		Loader command	200 (C8)	250 (FA)	–	492 bytes

Note: 1) Parentheses mean hexadecimal expression.
2) MICREX-SX CPU does not support byte data type and therefore cannot accept the request for “byte block read” or “byte block rewrite” from the remote node.
3) Including TCD code
4) The maximum size is the maximum value for the memory area specified by CPU module.

(3) Detail explanation of the supported messages

1) Byte block read

This function reads data by the byte (in units of address, or 8 bits) from the virtual address area (32-bit address space) possessed by the remote node via FL-net. For the address map of virtual address space, refer to the specification for individual node. To request from SX_CPU, remote data read FB “R_READ” is used. (Variables setting is VAR_TYPE=2, and read request is FDEB (hex).)

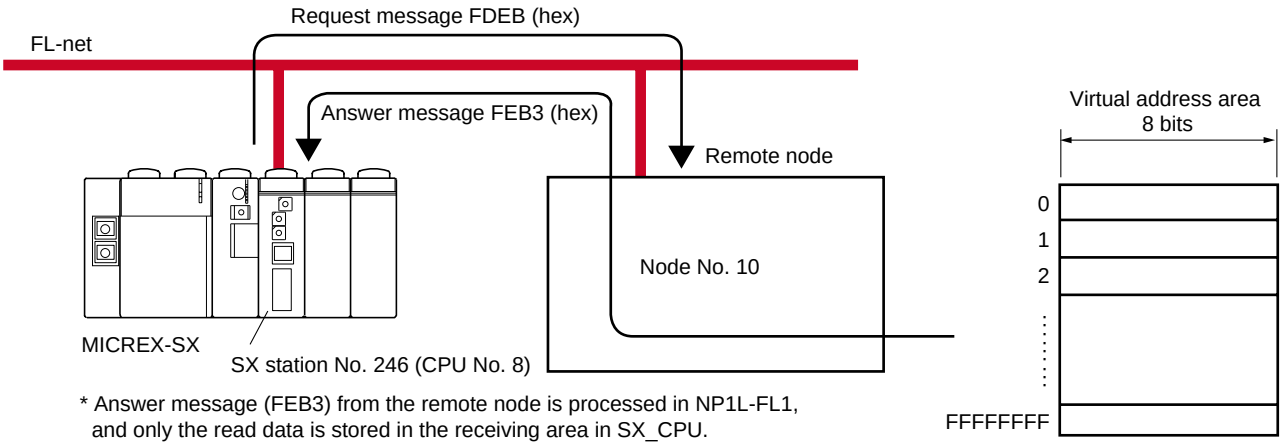


Figure 6-2 (15) Byte Block Read

<Example of byte block reading program>

This program reads the data for 24 bytes from the virtual addresses starting from “00000000” (h) of the CPU that is connected to the FL-net unit of node No. 10.

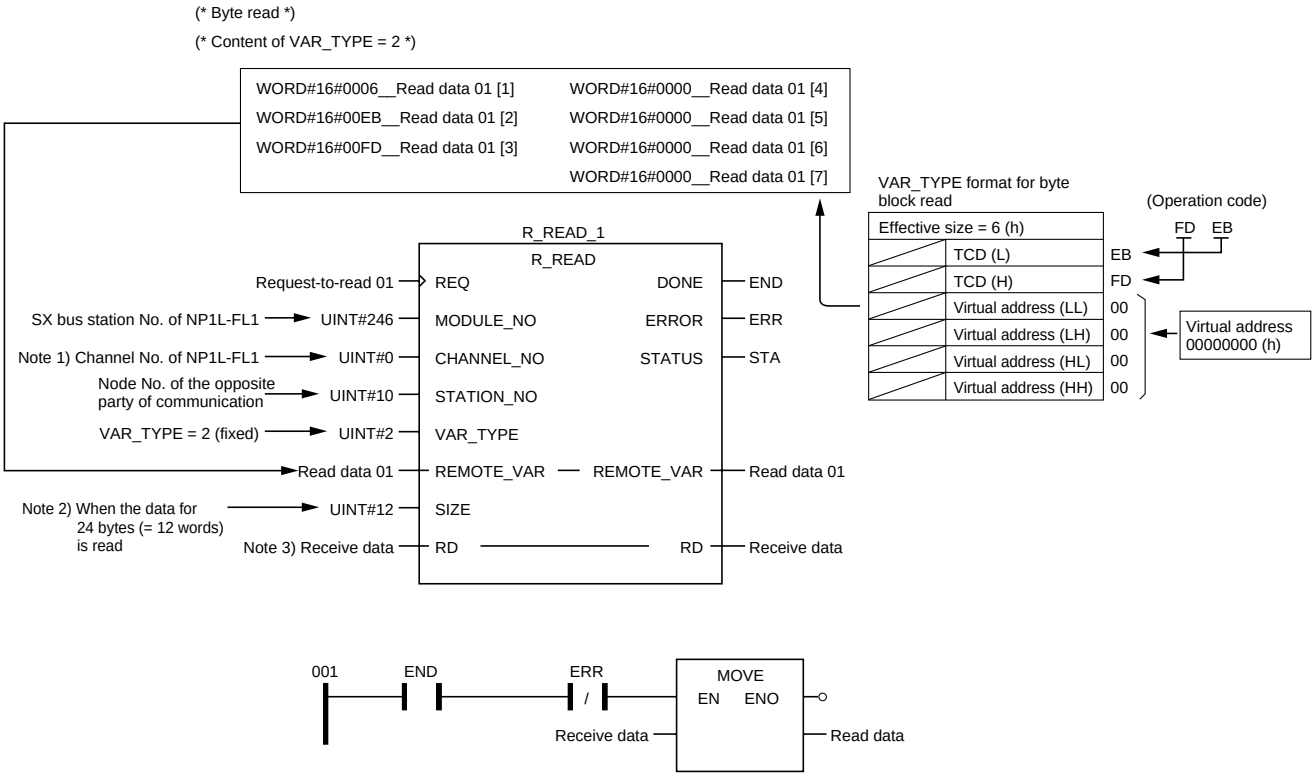


Figure 6-2 (16) Example of Byte Block Reading Program

Note: 1) Specify the channel No. of NP1L-FL1. Fixed to 0 (zero).
2) Because MICREX-SX CPU does not support byte data type , set so that the number of bytes of read data becomes an even number.
3) Determine the size of receive data such that (the quantity (number of words) of read data) ≤ (the size of receive data).

2) Byte block write

This function writes data by the byte (in units of address, or 8 bits) in the virtual address area (32-bit address space) possessed by the remote node via the network. For the address map of virtual address space, refer to the specification for individual node. To request from SX_CPU, remote data write FB “R_WRITE” is used. (Variables setting is VAR_TYPE=2, and write request code is FDEC (hex).)

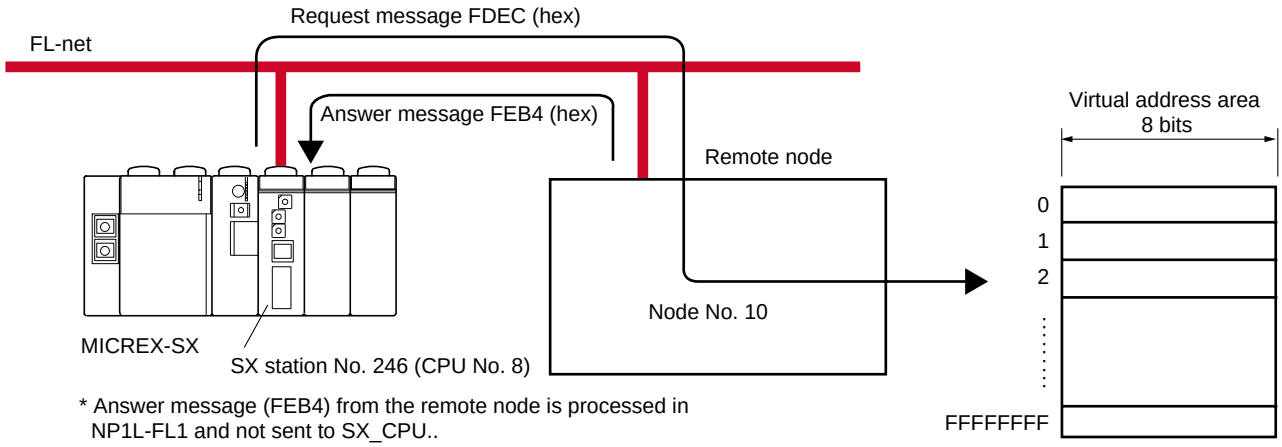


Figure 6-2 (17) Byte Block Write

<Example of byte block writing program>

This program writes the data for 10 bytes in the virtual addresses starting from “64” (h) of the CPU that is connected to the FL-net unit of node No. 10.

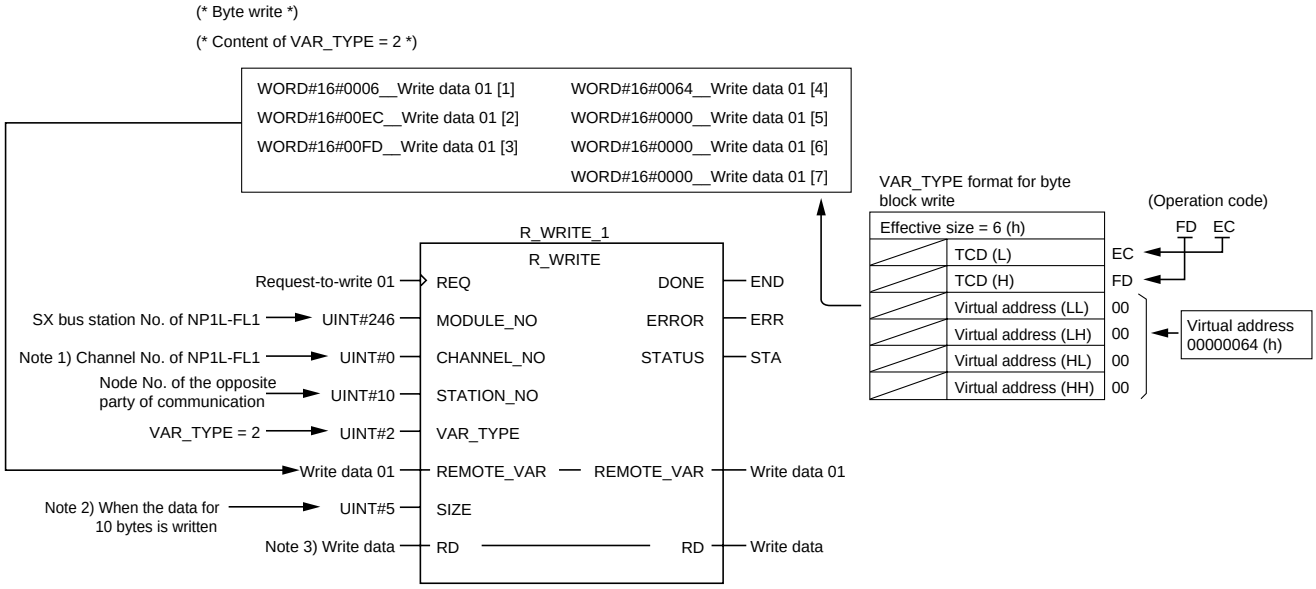
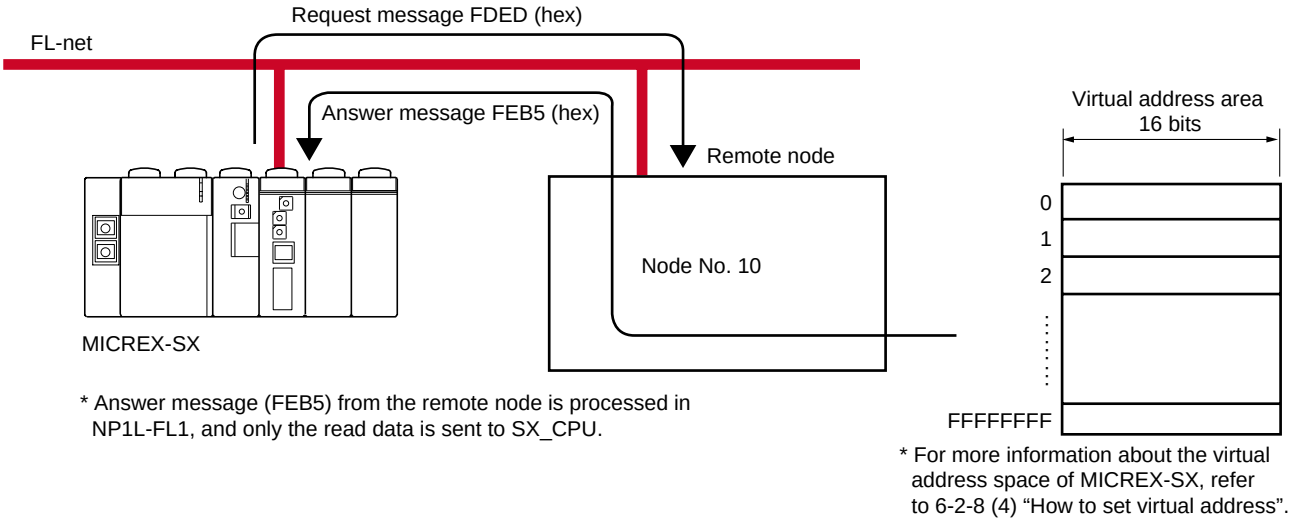


Figure 6-2 (18) Example of Byte Block Writing Program

Note: 1) Specify the channel No. of NP1L-FL1. Fixed to 0 (zero).
2) Because MICREX-SX CPU does not support byte data type, set so that the number of bytes of read data becomes an even number.
3) The data to be written is prepared here.

3) Word block read

This message function reads data by the word (in units of address, or 16 bits) from the virtual address area (32-bit address space) possessed by the remote node via the network. For the address map of virtual address space, refer to the specification for individual node. To request from SX_CPU, remote data read FB “R_READ” is used. (Variables setting is VAR_TYPE=2, and read request is FDED (hex).)



* Answer message (FEB5) from the remote node is processed in NP1L-FL1, and only the read data is sent to SX_CPU.

* For more information about the virtual address space of MICREX-SX, refer to 6-2-8 (4) “How to set virtual address”.

Figure 6-2 (19) Word Block Read

<Example of word block reading program>

This program reads the data for 10 words from the virtual addresses starting from “00000000” (h) of the CPU that is connected to the FL-net unit of node No. 10.

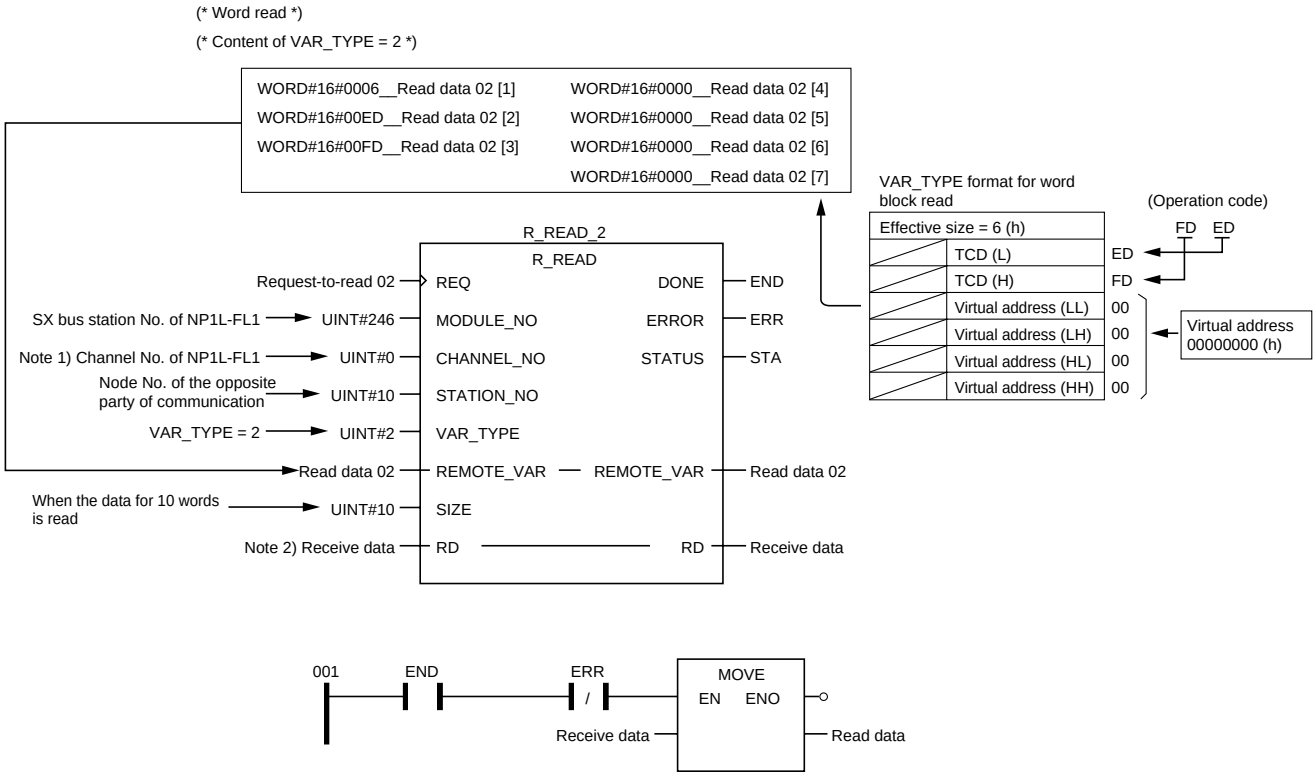


Figure 6-2 (20) Example of Word Block Reading Program

Note: 1) Specify the channel No. of NP1L-FL1. Fixed to 0 (zero).
2) Determine the size of receive data such that (the quantity (number of words) of read data) ≤ (the size of receive data).

4) Word block write

This message function writes data by the word (in units of address, or 16 bits) in the virtual address area (32-bit address space) possessed by the remote node via the network. For the address map of virtual address space, refer to the specification for individual node. To request from SX_CPU, remote data write FB “R_WRITE” is used. (Variables setting is VAR_TYPE=2, and write request code is FDEE (hex).)

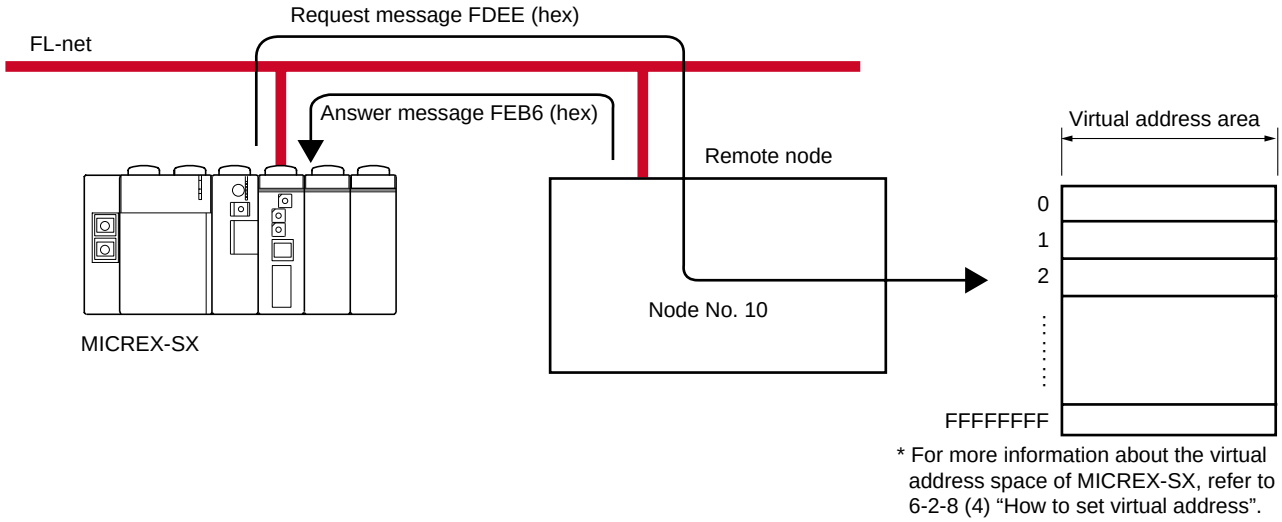


Figure 6-2 (21) Word Block Write

<Example of word block writing program>

This program writes the data for 5 words in the virtual addresses starting from “00000200” (h) of the CPU that is connected to the FL-net unit of node No. 10.

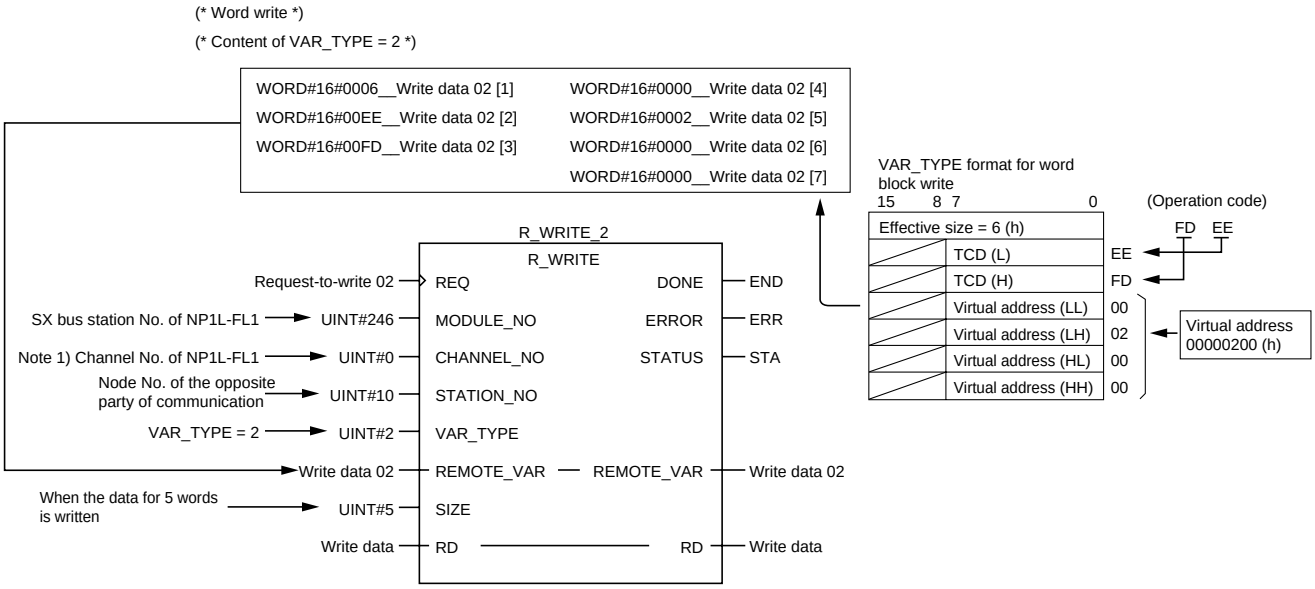
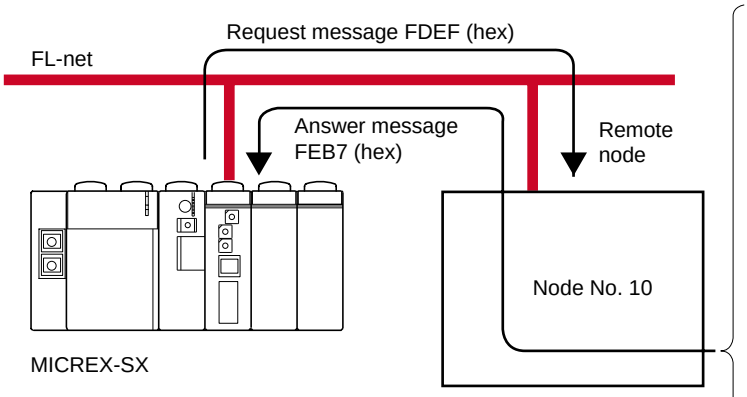


Figure 6-2 (22) Example of Word Block Writing Program

Note 1: Specify the channel No. of NP1L-FL1. Fixed to 0 (zero).

5) Network parameter read

This message function reads network parameter from the remote node via the network. To request from SX_CPU, remote data read FB "R_READ" is used. (Variables setting is VAR_TYPE=2, and read request code is FDEF (hex).)
The network parameter read function reads the following data.



0	Node name	
+4		
+5	Vendor name	
+9		
+10	Maker type	
+14		
+15	Top address of common memory area 1	
+16	Size of common memory area 1	
+17	Top address of common memory area 2	
+18	Size of common memory area 2	
+19	Unused	Token monitoring time-out time
+20	Unused	Minimum permissible frame interval
+21	Unused	Status of FA link
+22	Unused	Protocol version
+23	Status of upper layer	
+24	Refresh cycle time, allowable time (RCT setting value)	
+25	Refresh cycle time, measured value (current value)	
+26	Refresh cycle time, measured value (maximum value)	
+27	Refresh cycle time, measured value (minimum value)	

Figure 6-2 (23) Network Parameter Read

<Example of network parameter reading program>

This program reads network parameter from the FL-net unit of node No. 10.

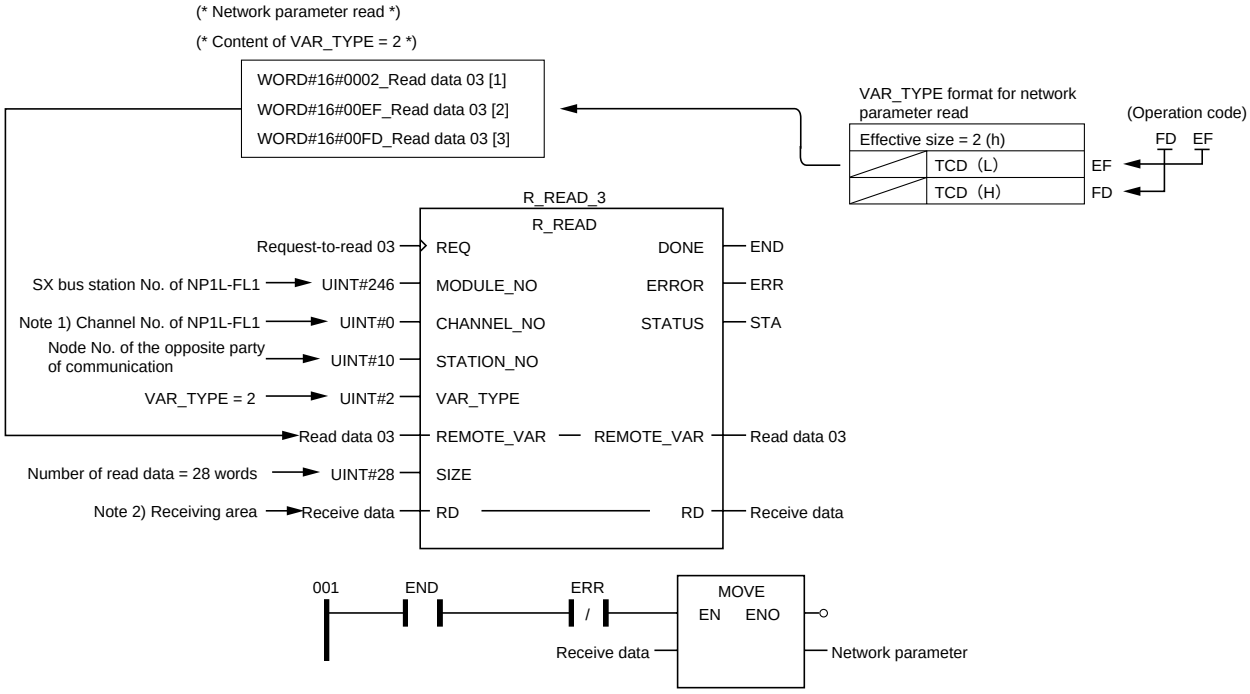


Figure 6-2 (24) Example of Network Parameter Reading Program

Note: 1) Specify the channel No. of NP1L-FL1. Fixed to 0 (zero).
2) Secure 28 words or greater receiving area because network parameter occupies 28 words.

6) Network parameter write

This function changes the network parameter data of the remote node via the network.
The following data can be changed:

- Node name
- Address and size of common memory

When the address and size of common memory are changed, the remote node will be disconnected from the network once and then connected again. When only node name is changed, the remote won't be disconnected from the network.
To request from SX_CPU, remote data write FB "R_WRITE" is used. (Variables setting is VAR_TYPE=2, and write request code is FDF0 (hex).)

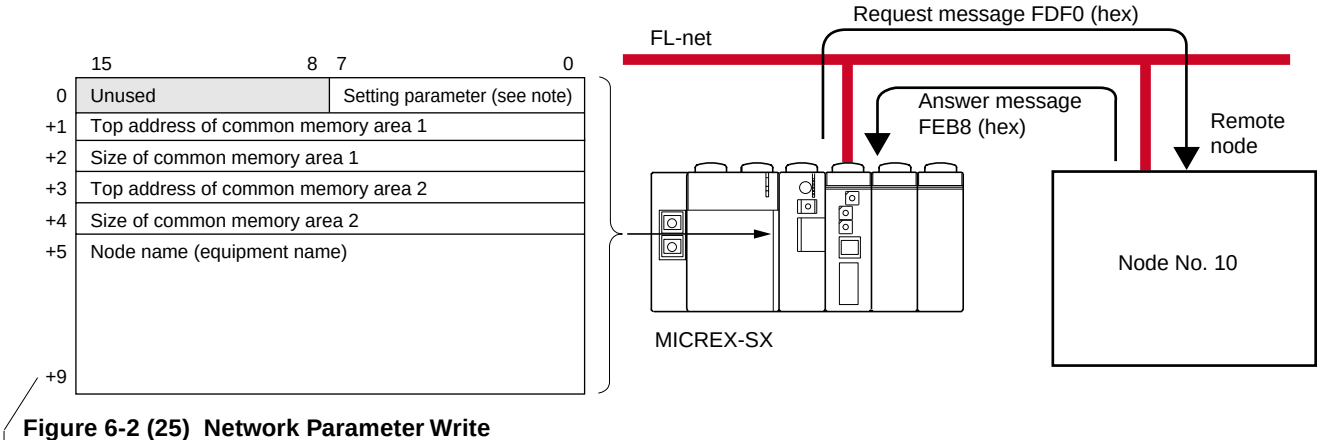


Figure 6-2 (25) Network Parameter Write

Note: About the setting parameters
Setting parameter 01 (h): Only the address and size of common memory are written.
Setting parameter 02 (h): Only node name is written.
Setting parameter 03 (h): The address and size of common memory as well as node name are written.

<Example of network parameter writing program>

This program writes the network parameter of the FL-net unit of node No. 10.

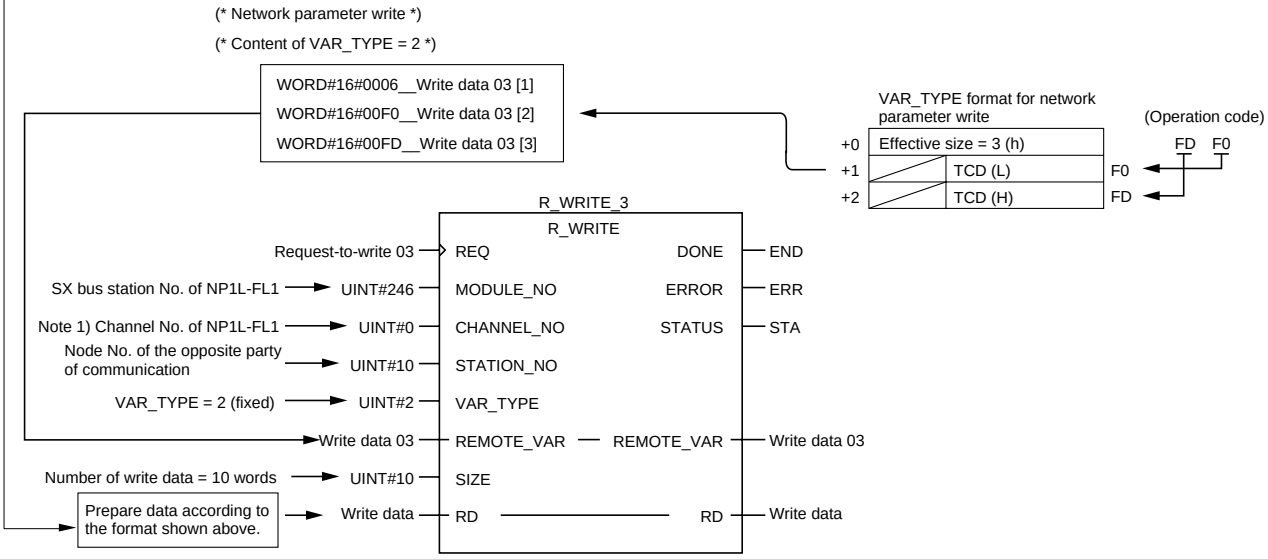


Figure 6-2 (26) Example of Network Parameter Writing Program

Note: 1) Specify the channel No. of NP1L-FL1. Fixed to 0 (zero).

7) Start/stop command

These commands start or stop the remote node via the network.
To request from SX_CPU, remote data write FB “R_WRITE” is used. (Variables setting is VAR_TYPE=2, and start/stop request code is: FDF1 (hex) for request to start; FDF2 (hex) for request to stop.)

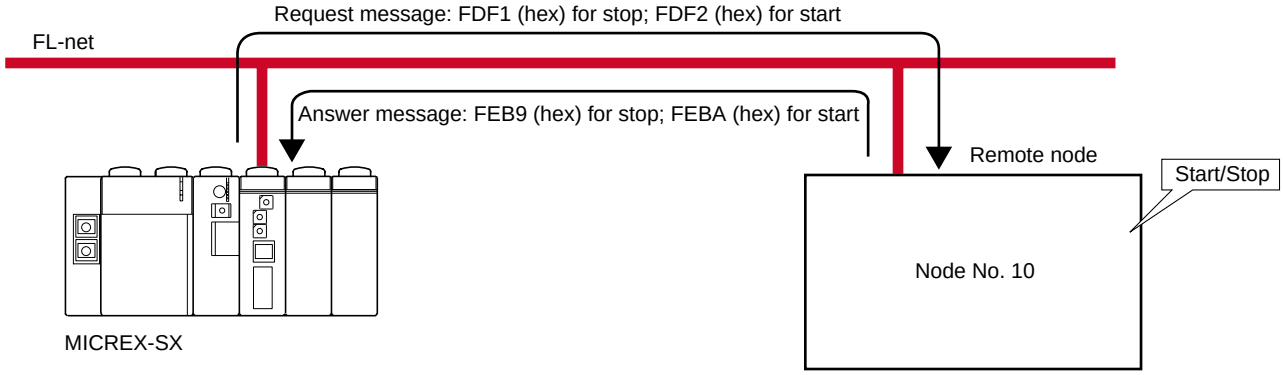


Figure 6-2 (27) Start/Stop

<Example of stop command program>

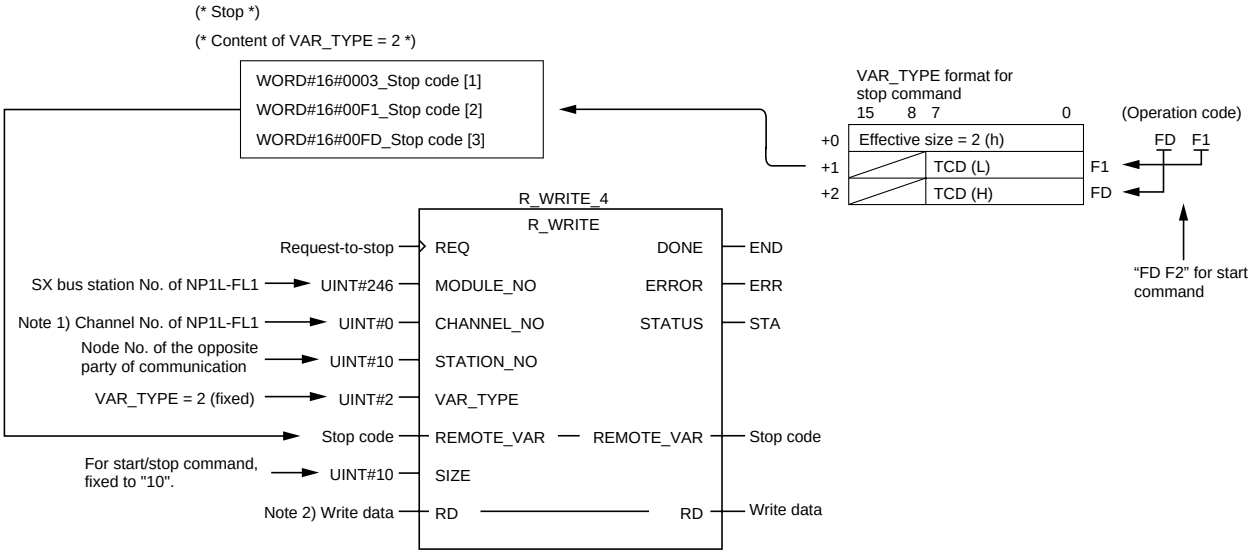


Figure 6-2 (28) Example of Stop Command Program

Note: 1) Specify the channel No. of NP1L-FL1. Fixed to 0 (zero).
2) Though there is no data to write, it is necessary to connect variables.

8) Profile read

This function reads system parameters (inherent data) from the remote node via the network. There are the following two system parameters:

- Common parameter (mandatory)
  NP1L-FL1 prepares only common parameter. For profile, refer to Appendix 8.
- Device inherent parameter (arbitrary)

To request from SX_CPU, remote data read FB “R_READ” is used. (Variables setting is VAR_TYPE=2, and read request code is: FDF3 (hex).)

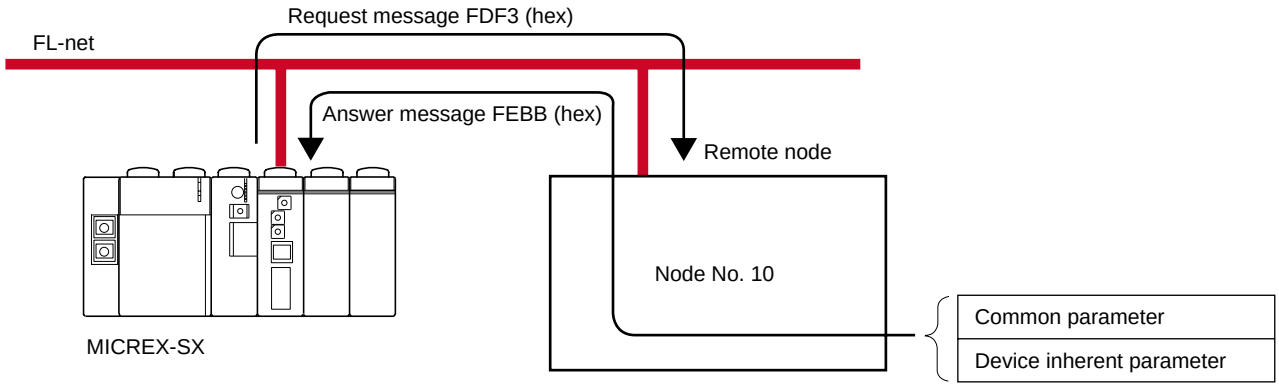


Figure 6-2 (29) Profile Read

<Example of profile reading program>

This program reads profile from the FL-net of node No. 10.

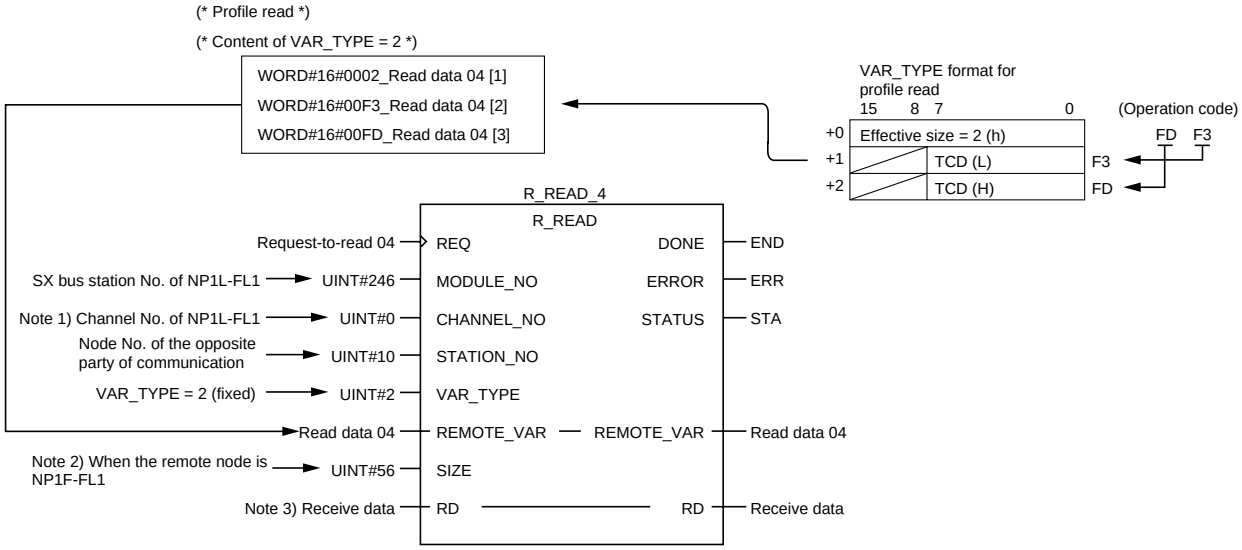


Figure 6-2 (30) Example of Profile Reading Program

Note: 1) Specify the channel No. of NP1L-FL1. Fixed to 0 (zero).
2) For the size (the number of words) of read data, refer to the profile specification of the remote node. For NP1L-FL1, the size of profile is 113 bytes. Therefore, the word size of read data is set to 57 (words).
3) Specify the size of receive data so that (Quantity of read data) ≤ (Size of receive data).

9) Communication log data read

This function reads log data from the remote node via the network.
To request from SX_CPU, remote data read FB “R_READ” is used. (Variables setting is VAR_TYPE=2, and read request code is FDF5 (hex).)

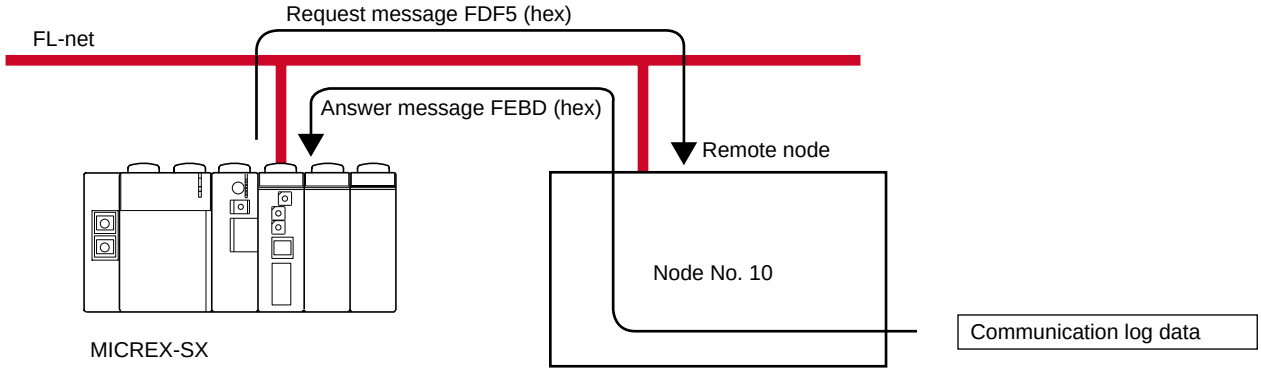


Figure 6-2 (31) Communication Log Data Read

<Example of communication log data reading program>

This program reads communication log data (512 bytes) from the FL-net unit of node No. 10.

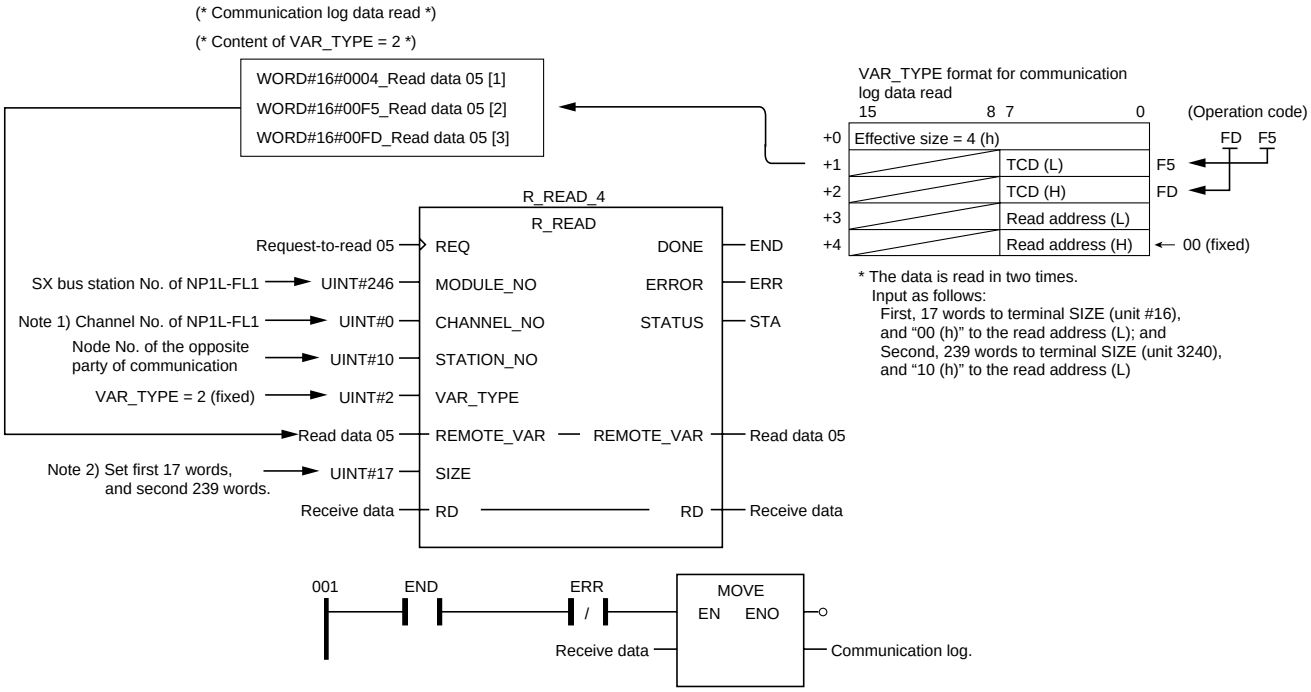


Figure 6-2 (32) Example of Communication Log Data Reading Program

Note: 1) Specify the channel No. of NP1L-FL1. Fixed to 0 (zero).
2) The size of communication log data is 512 bytes (fixed) for any node on FL-net. However, there are two item types: mandatory items and arbitrary items. For more information, refer to the specification of the corresponding node. For the communication log of NP1L-FL1, refer to the next page. The quantity of data that can be read out at a time is 239 words (480 bytes). Therefore, the log data needs to be read out in two times.

The answer data that NP1L-FL1 transmits to other nodes is as follows:

<Table 6-2 (6) Communication Log of NP1L-FL1>

+0, +1	Socket section total transmission count
+2, +3	Socket section total transmission error count
+4 ⋮	Unused
+12, +13	Total receive count
+14, +15	Total receive error count
+16 ⋮	Unused
+48, +49	Cyclic transmission error count
+50 ⋮	Unused
+72, +73	Message retransmission count
+74, +75	Message retransmission over count
+76 ⋮	Unused
+84, +85	Message transmission/receive error count
+86 ⋮	Unused
+96, +97	ACK error count
+98 ⋮	Unused
+120, +121	Token duplication recognition count
+122, +123	Token abolition count
+124, +125	Token re-issuance count
+126 ⋮	Unused
+134, +135	Token monitoring timeout count (arbitrary)
+136 ⋮	Unused
+146, +147	Frame waiting condition count
+148, +149	Participation count
+150, +151	Self disconnection count
+152, +153	Skip disconnection count
+154, +155	Other node disconnection recognition count
+156 ⋮ +255	Unused

10) Communication log data clear

This function clears the log data of the remote node via the network.
To request from SX_CPU, remote data read FB “R_READ” is used. (Variables setting is VAR_TYPE=2, and clear request code is FDF6 (hex).)

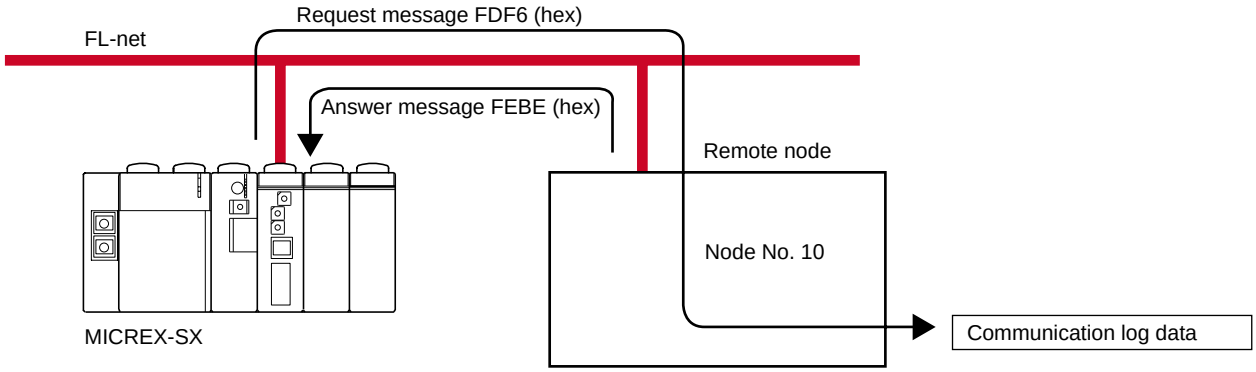


Figure 6-2 (33) Communication Log Data Clear

<Example of communication log data clearing program>

This program clears the communication log of the FL-net unit of node No. 10.

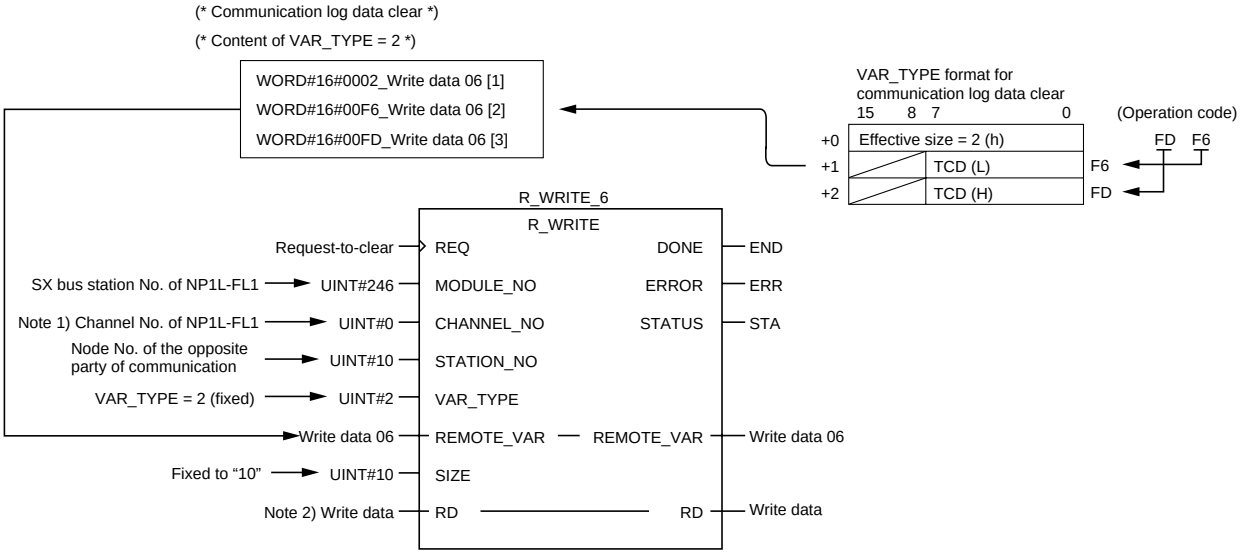


Figure 6-2 (34) Example of Communication Log Data Clearing Program

Note: 1) Specify the channel No. of NP1L-FL1. Fixed to 0 (zero).
2) Though there is no data to write, it is necessary to connect variables.

11) Message loop back

This function loops back received message. Message is automatically looped back in the FL-net module or unit.

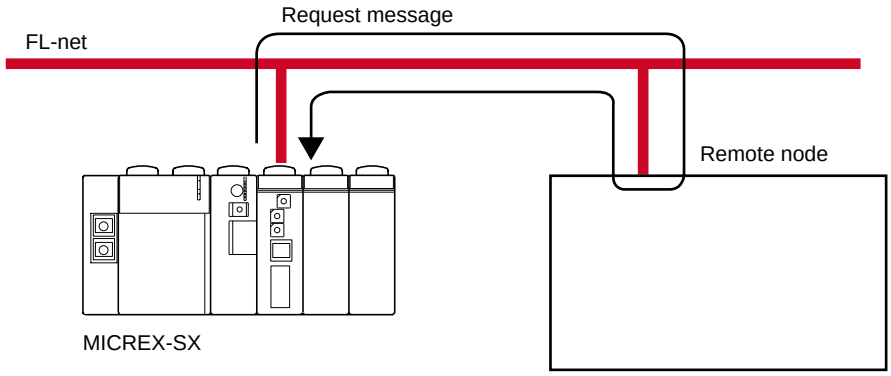


Figure 6-2 (35) Message Loop Back

<Example of message loop back program>

This program requests the FL-net unit of node No. 10 to loop back messages.

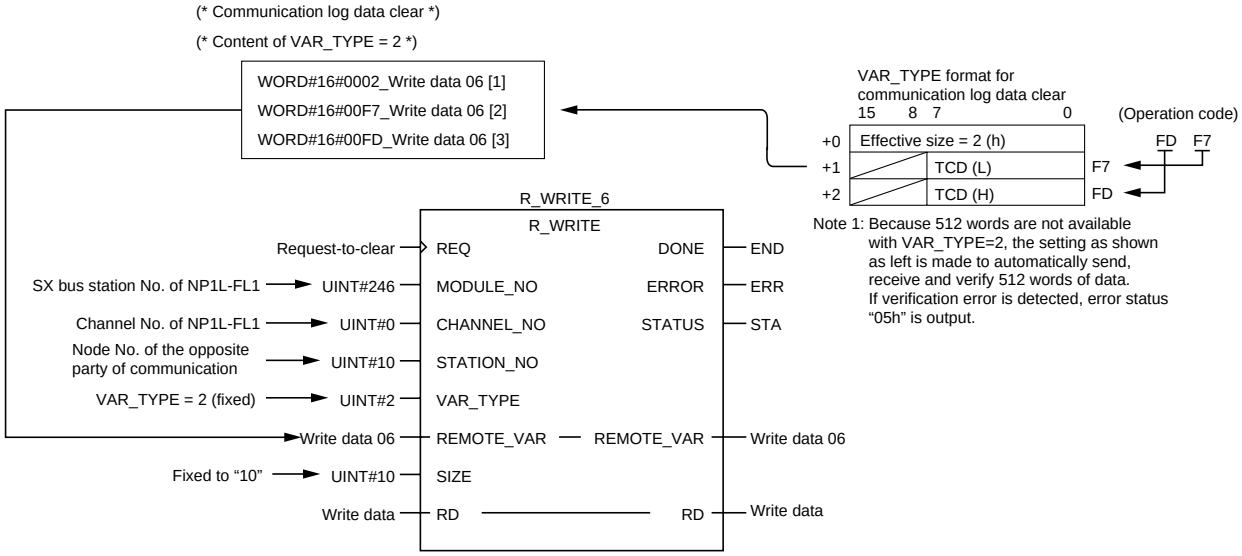


Figure 6-2 (36) Example of Message Loop Back Program

12) Transparent message transmission

When received a transparent message, FL-net module or unit notifies the upper layer of FL-net of the received message, and the upper layer notifies further the user interface level equipment of the message as it is. When notified of such message, the user interface level equipment needs to return the corresponding answer, using an appropriate application program. For this purpose, MICREX-SX uses M_SEND and M_RECEIVE function blocks.
Some equipments provide transparent message dedicated services.

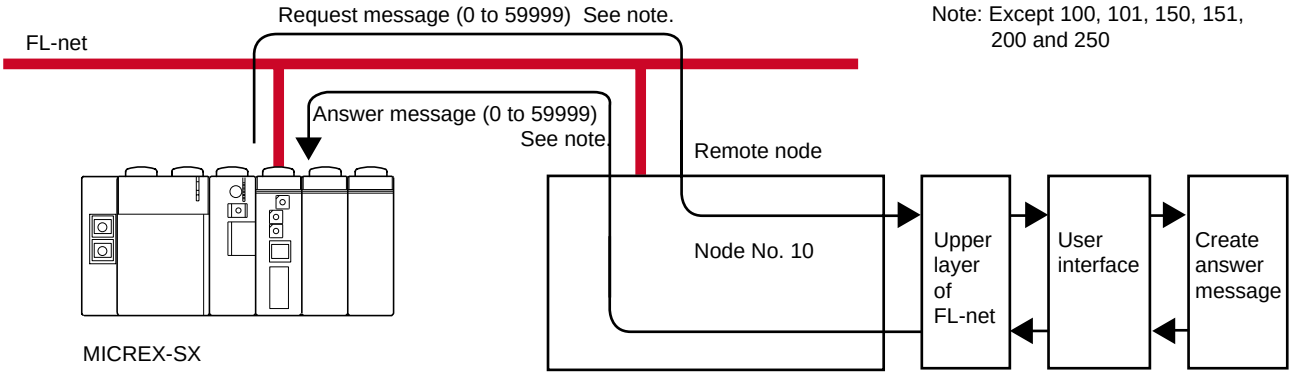


Figure 6-2 (37) Transparent Message Transmission

<Example of transparent message transmission program>

This program requests the FL-net unit of node No. 10 to loop back a message.

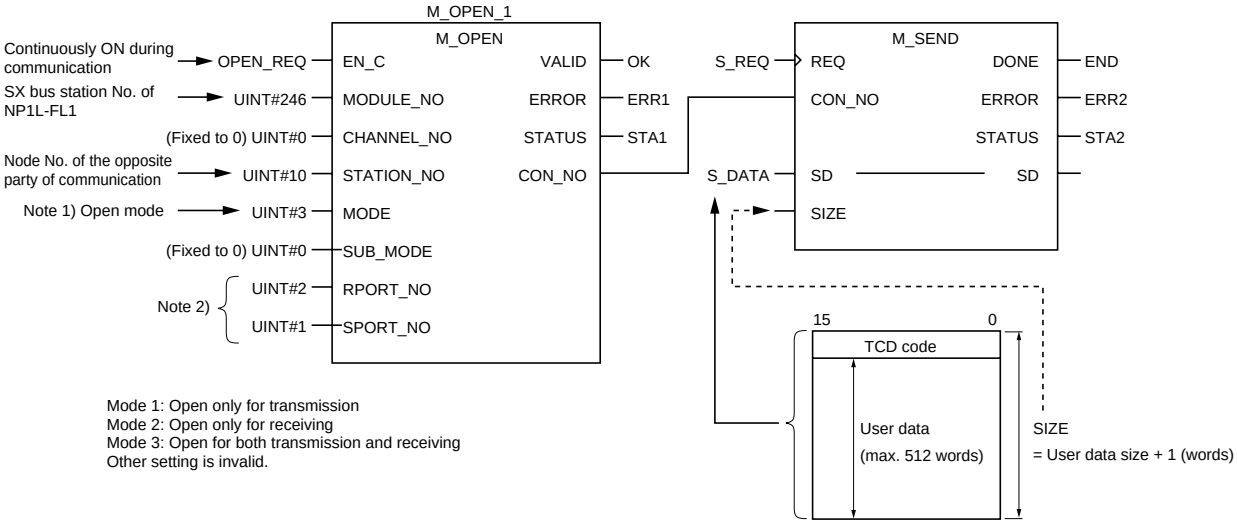


Figure 6-2 (38) Example of Transparent Message Transmission Program

Note: 1) In general, set to “3” (open for both transmission and receiving). Multiple open requests may not be issued to a same node (operation cannot be guaranteed). However, “1” (open only for transmission) and “2” (open only for receiving) can be set simultaneously to open the channel.
2) Port Nos. 1 to 127 can be set for SPORT_NO and RPORT_NO. Be careful not to doubly set a same port No. that is already used by other M_OPEN FB.

<Example of transparent message receiving program>

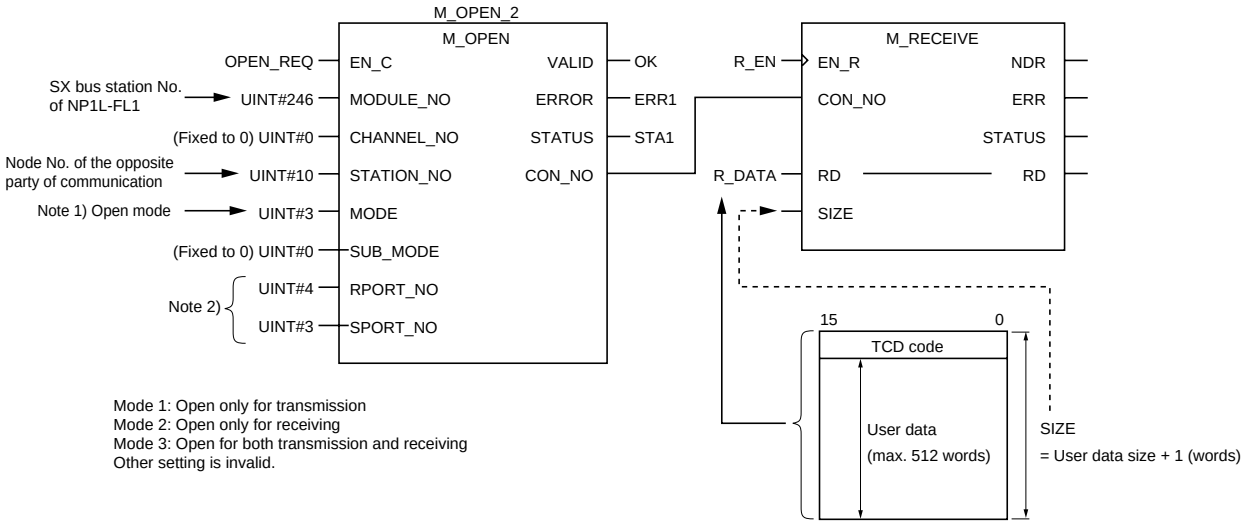


Figure 6-2 (39) Example of Transparent Message Receiving Program

Note: 1) In general, set to “3” (open for both transmission and receiving). Multiple open requests may not be issued to a same node (operation cannot be guaranteed). However, “1” (open only for transmission) and “2” (open only for receiving) can be set simultaneously to open the channel.

2) Port Nos. 1 to 127 can be set for SPORT_NO and RPORT_NO. Be careful not to doubly set a same port No. that is already used by other M_OPEN FB.

(4) Virtual address space

<Table 6-2 (7) Memory allocation to virtual address space>

Memory of MICREX-SX		Virtual address space
Input/output memory	I/Q	00□□□□□□h ~
Standard memory	M	02□□□□□□h ~
Retain memory	M	04□□□□□□h ~
System memory	M	08□□□□□□h ~

With the memory map (default, see note 1) for high-performance CPU module NP1PS-32, individual memories are accessed as shown in the figure below.

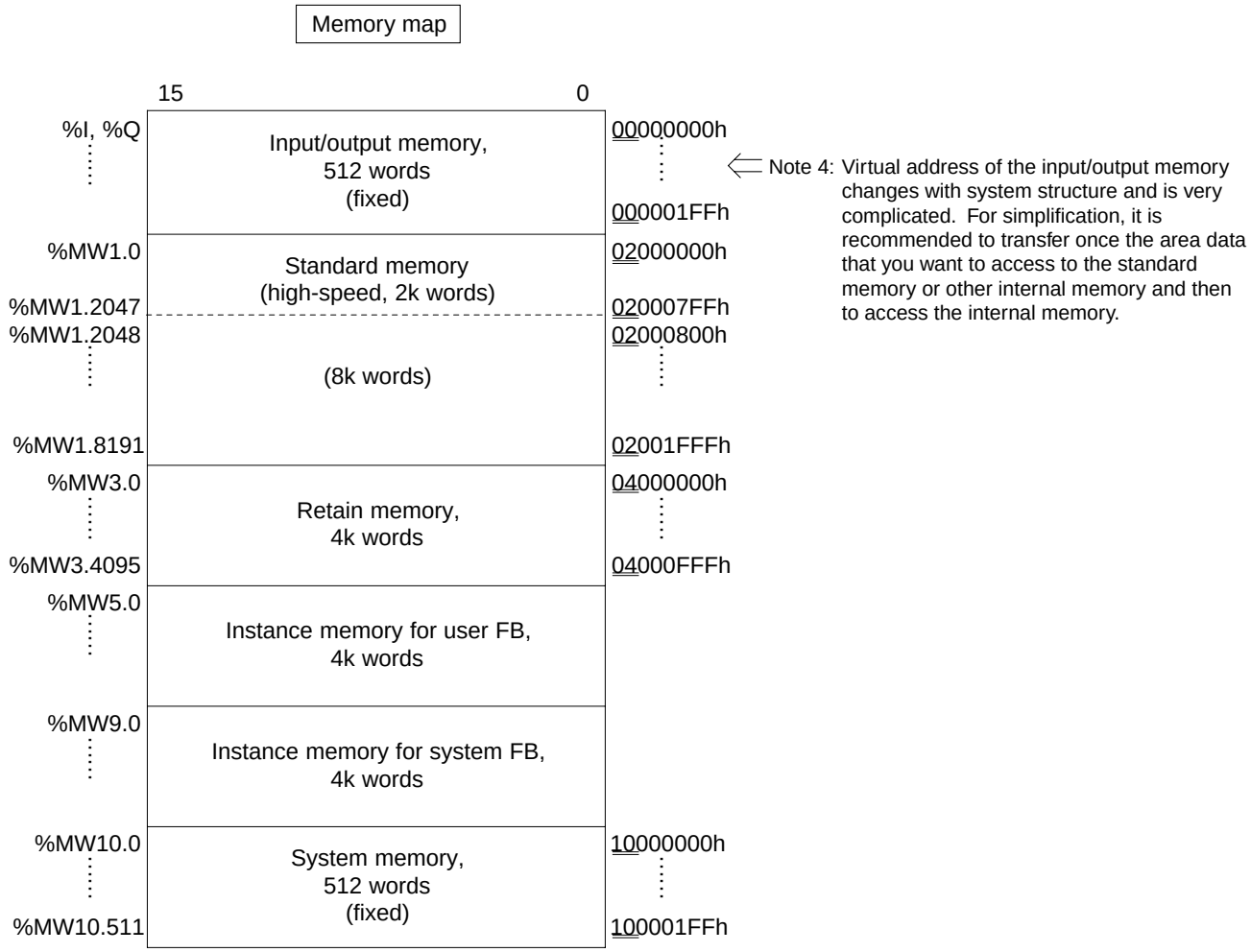


Figure 6-2 (40) Example of Virtual Address Space of NP1PS-32

Note: 1) Individual memory size can be changed by the setting from D300win loader.
2) Individual memory size changes with the CPU type you use. For more information, refer to the MICREX-SX Commands Volume of the User's Manual (FEH200).
3) Writing data in the system memory by mistake may result in malfunction or major failure to stop the system (operation of the system cannot be guaranteed).

(5) Message related FB error status list

<Table 6-2 (8) Message Related FB Error Status List>

Status code	Name	Description	Remedy	M_OPEN	M_SEND	M_RECIVE	M_READ	M_Write
164 (A4h)	Message transmission target setting error	No module exists at the specified SX station number.	Recheck the input terminal for setting the destination of transmission.	correct	correct	correct	correct	correct
165 (A5h)	Message receiving BUSY	The target of message transmission via SX bus is busy.	• Run the FB after waiting a while. • Reduce the message load.	correct	correct	correct	correct	correct
170 (AAh)	Message transmission BUSY	The resource in CPU module that transmits message is busy.	• Run the FB after waiting for a while. • Reduce the load of the local CPU module.	correct	correct	correct	correct	correct
197 (C5h)	Network transmission BUSY	The remote module of communication is busy.	• Start the FB after waiting for a while. • Reduce the load of the local CPU module.	–	correct	–	correct	correct
177 (B1h)	Parameter error	• Out-of-range value was input (M_OPEN). • SIZE is set to 0 (zero). • VAR_TYPE setting is wrong.		correct	correct	correct	correct	correct
193 (C1h)	Channel open error	• STATION_NO setting is wrong. • Communication mode is wrong. • CHANEL_NO. setting is wrong.		correct	–	–	–	–
195 (C3h)	Message transmission error	• Message cannot be transmitted. • No answer from the destination of transmission • STATION_NO setting is wrong. • Answer with error code was received. • The destination of transmission is not supported.		–	correct	–	correct	correct
199 (C7h)	Channel close	• The target of out-of-configuration communication is closed.		–	correct	correct	–	–
200 (C9h)	Port setting error	• SPORT_NO is not in the range from 1 to 127. • Already set in the resource. • The target of communication is not opened.		correct	correct	correct	–	–
201 (C9h)	Connection/client port number FULL	• Client port numbers are full. • 57 or more ports are opened in the resource. • Out-of-spec port is opened.		correct	–	–	correct	correct
206 (CEh)	Buffer over	• The number of transmission data exceeded 4096 bytes. • The receive data exceeded the size of storage variable. • The limit of communication module was exceeded when a value other than 0 was set for VAR_TYPE. • Error was detected at the destination of R_WRITE.		–	correct	correct	correct	correct
207 (CFh)	Connection No. error	• Unsupported connection No. is specified. • Already used connection No. is specified.		–	correct	correct	–	–
05 (05h)	Verification error	• Verification error was detected during message loop back.		–	–	–	–	correct
68 (44h)	Memory address setting error	• Out-of-range value was set for the address.		–	–	–	correct	correct
69 (45h)	Memory size over	• The number of address read/write words exceeded the effective range.		–	–	–	correct	correct

Link parameters for FL-net are set with D300win (V1.2.1.1 or newer version). The setting procedure is shown below:

6-3-1 Registration of system structure

<Setting procedure>

1) FP1L-FL1 is registered in the “System Definition” in the project tree.
Left-double-click the [System Definition] icon to bring up the system structure definition window.
In the initial condition, power module and CPU module are registered in [6-slots Base], as shown in the figure below.

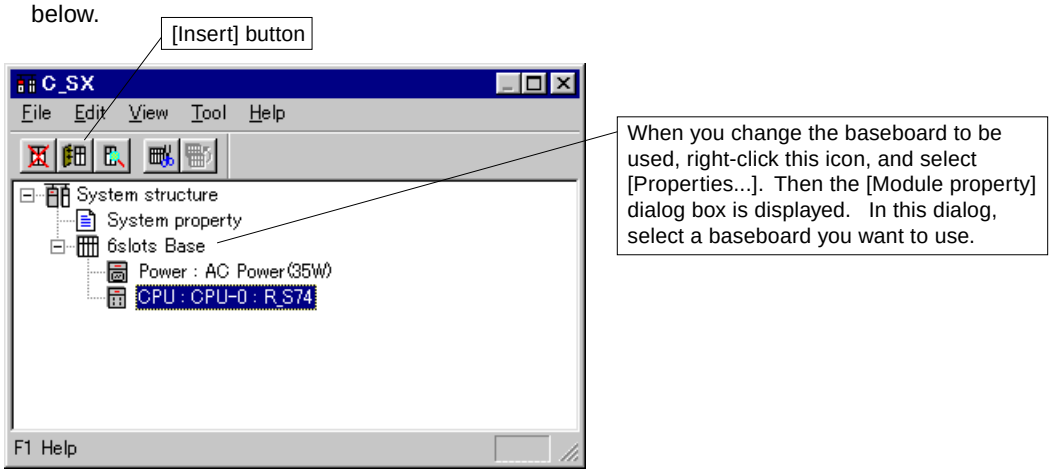


Figure 6-3 (1) System Structure Definition Initial Screen

2) Register FL-net module FP1L-FL1. With the cursor positioned on the CPU module, left-clicking the [Insert] button brings up the [Module insert] dialog box.

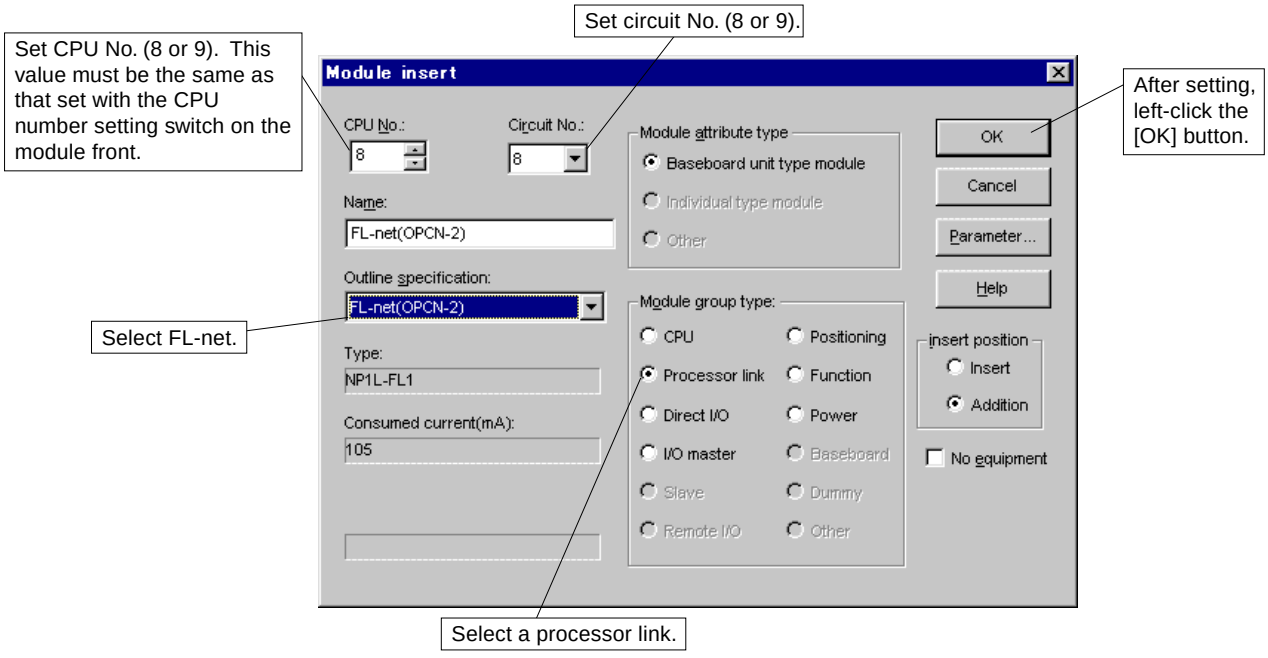


Figure 6-3 (2) [Module insert] Dialog Box

Note: 1) With FL-net, circuit No. determines a processor link channel in the configuration. Setting value is 8 or 9. When set to 8, processor link 0 is selected; processor link 1 when set to 9.
2) FL-net module is installed in a slot with processor bus connector on the baseboard.

3) FL-net module is registered, as shown below.

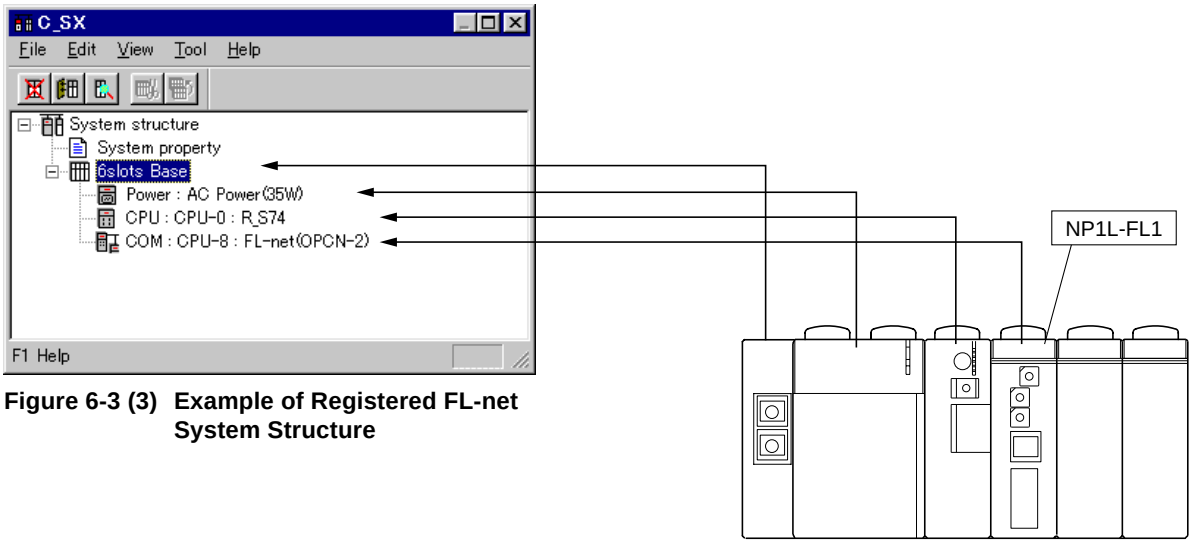


Figure 6-3 (3) Example of Registered FL-net System Structure

Figure 6-3 (4) Example of Actual structure of FL-net Module

6-3-2 Setting FL-net module parameters

<Setting procedure>

1) Select the icon for FL-net module to display the [FL-net (OPCN-2) parameter setting] dialog box.

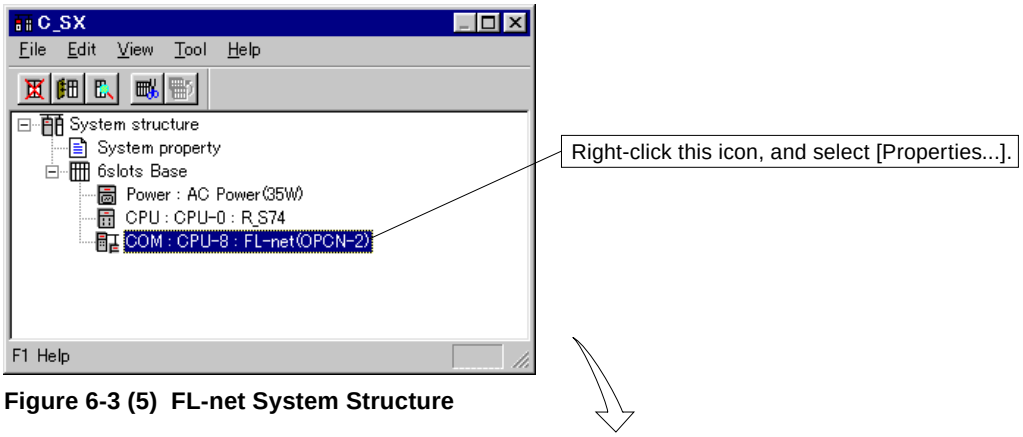


Figure 6-3 (5) FL-net System Structure

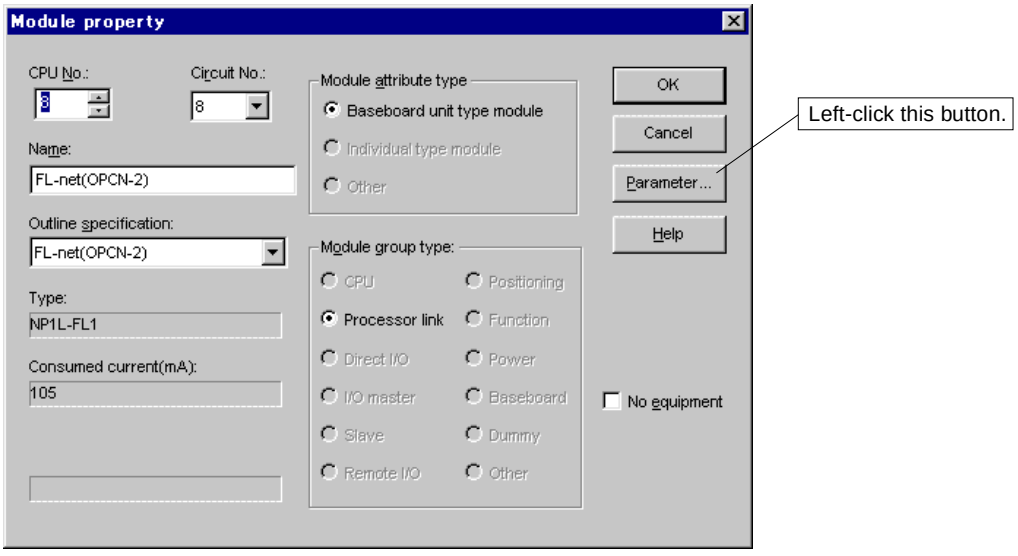


Figure 6-3 (6) [Module property] dialog box.

2) The [FL-net (OPCN-2) parameter setting] dialog box is displayed. Left-clicking a tab brings up the corresponding tab window. Set necessary items. After setting all necessary items, left-click the [OK] button.

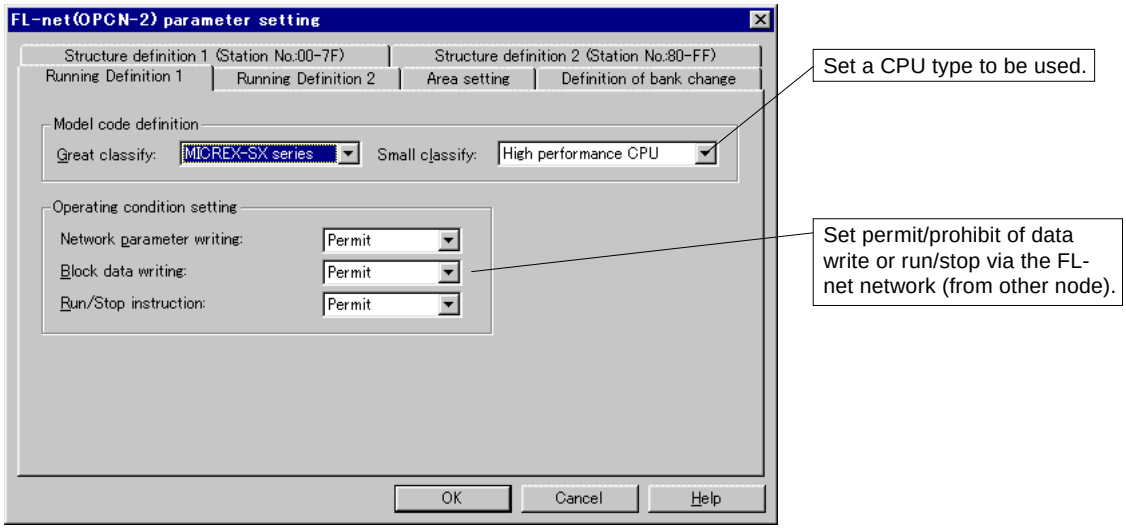


Figure 6-3 (7) [FL-net (OPCN-2) parameter setting] Dialog Box, [Running Definition 1] Tab Window

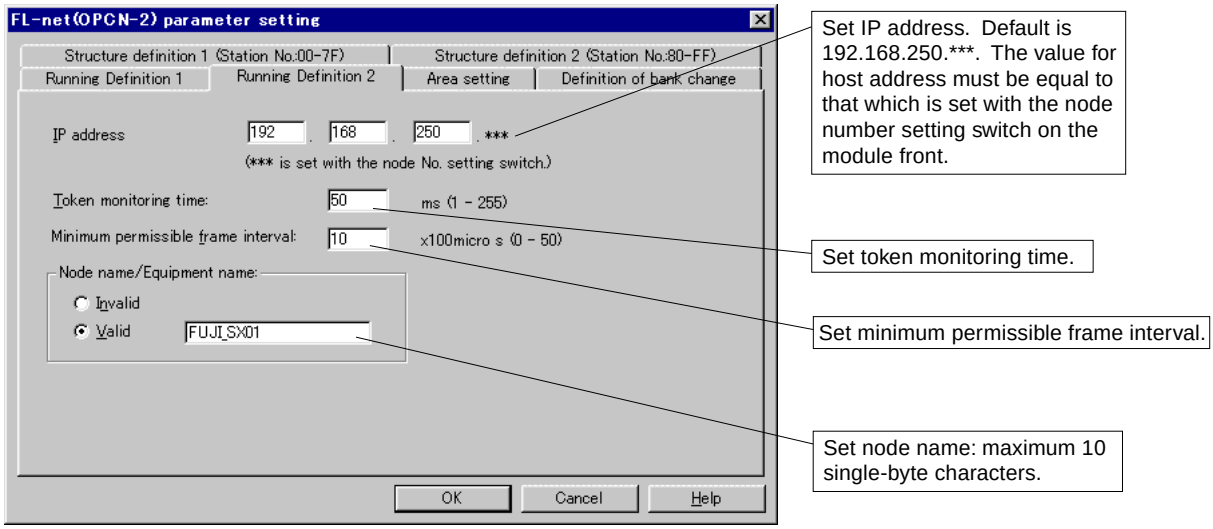


Figure 6-3 (8) [FL-net (OPCN-2) parameter setting] Dialog Box, [Running Definition 2] Tab Window

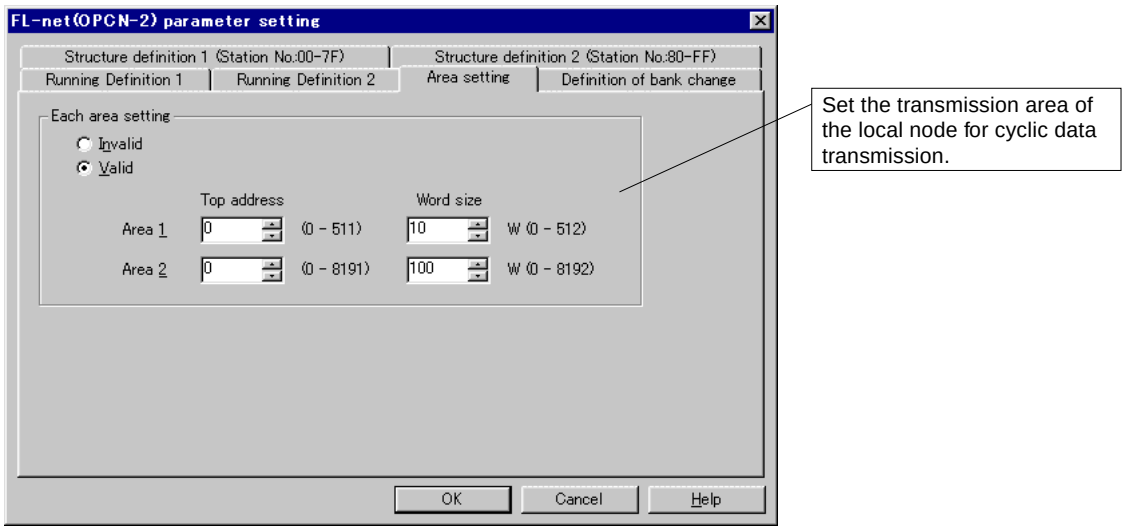


Figure 6-3 (9) [FL-net (OPCN-2) parameter setting] Dialog Box, [Area setting] Tab Window

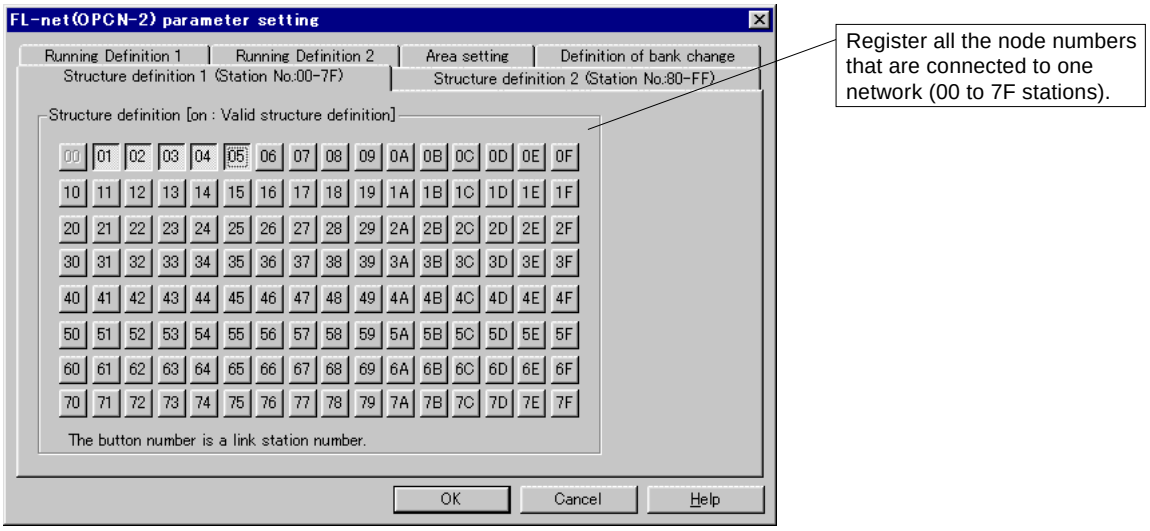


Figure 6-3 (10) [FL-net (OPCN-2) parameter setting] Dialog Box, [Structure definition 1] Tab Window

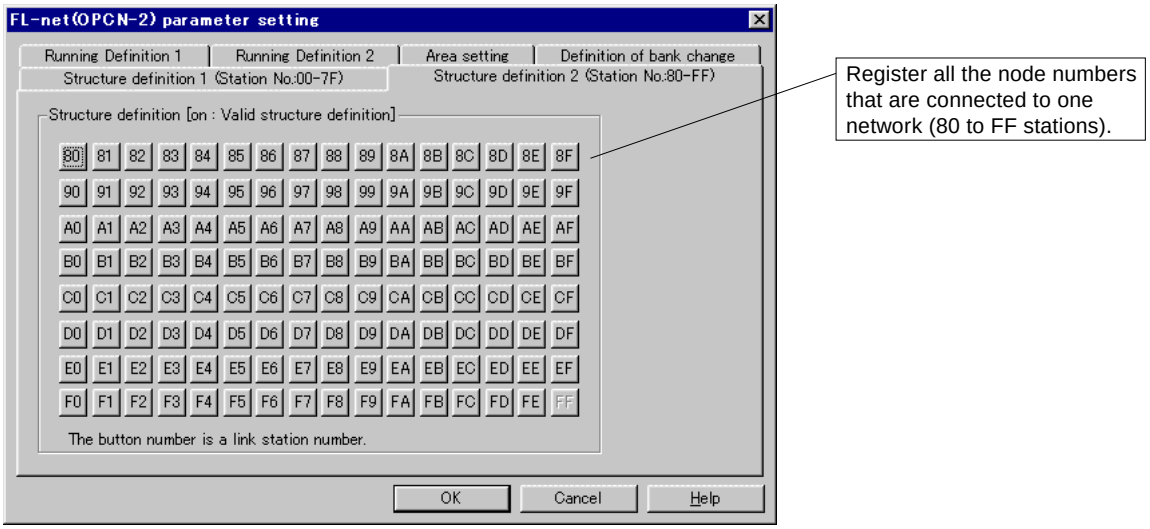


Figure 6-3 (11) [FL-net (OPCN-2) parameter setting] Dialog Box, [Structure definition 2] Tab Window

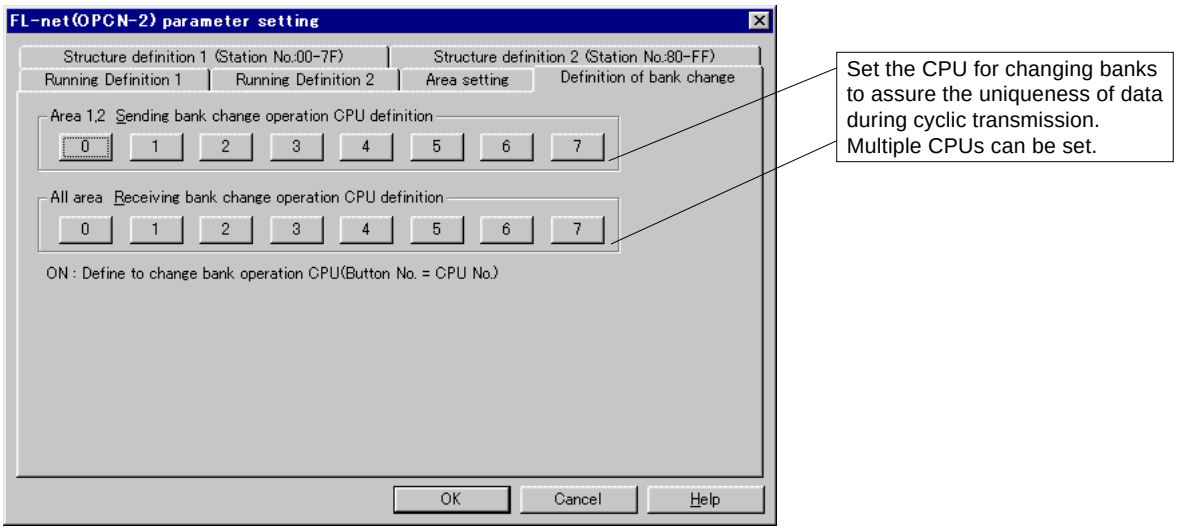


Figure 6-3 (12) [FL-net (OPCN-2) parameter setting] Dialog Box, [Definition of bank change] Tab Window

6-4-1 How to use the common memory

For cyclic transmission, the transmission area that is set from the [Area setting] tab window of the [FL-net (OPCN-2) parameter setting] dialog box becomes the area for writing data from SX_CPU; the transmission areas for other FL-net equipment become the areas for reading data from SX_CPU.

<Data flow>

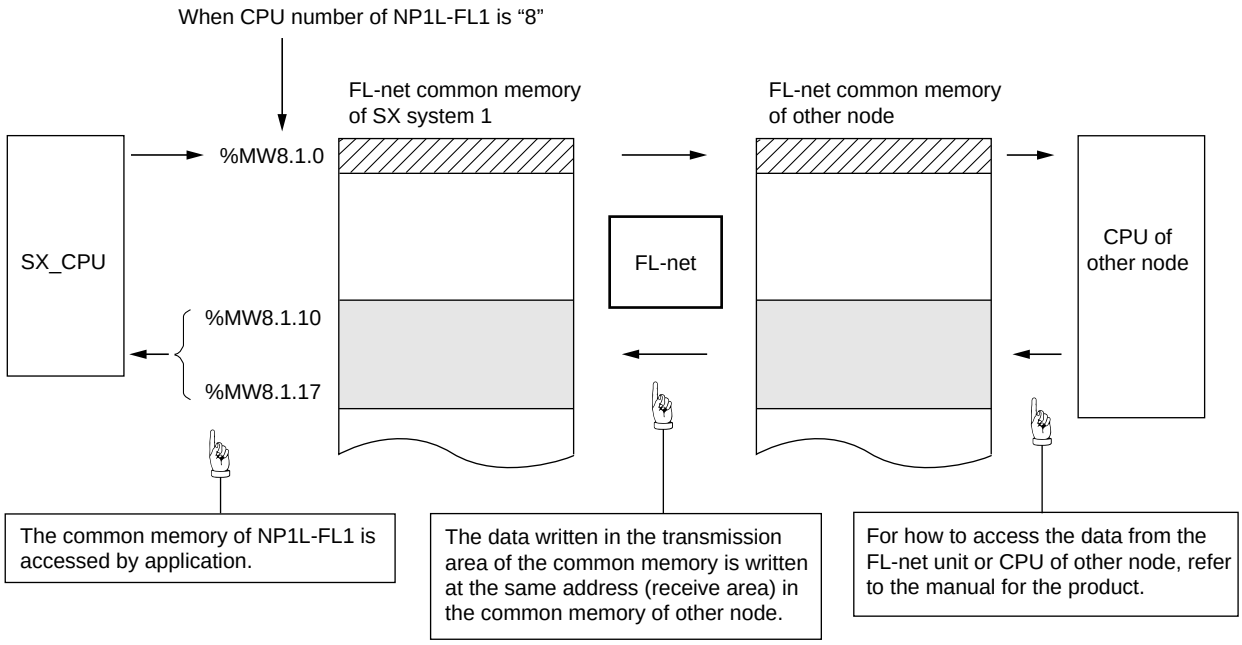


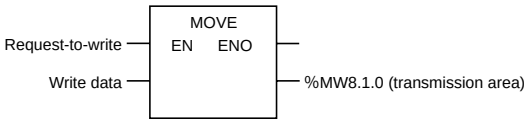
Figure 6-4 (1) Data Flow for Cyclic Transmission

(1) Sample program

The program for accessing the common memory can be created in the same manner as that for accessing the memory space in CPU. However, when it is necessary to assure the uniqueness of multiple-word data, BANK_CHG function block needs to be used. The uniqueness of one-word data is guaranteed.

<Example 1 of communication program, when banks are not changed>

Example of the program for writing one-word data in the transmission area of the local node (NP1L-FL1)



<Example 2 of communication program, when banks are changed>

Example of the program for reading data from the transmission area of the local node (NP1L-FL1) into the internal memory of the CPU

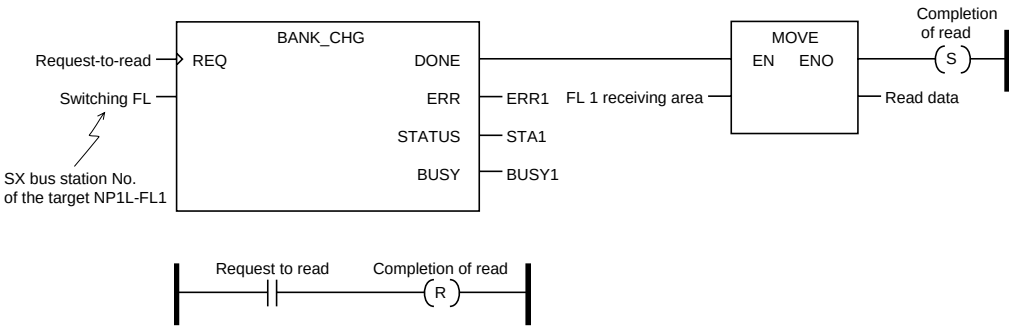


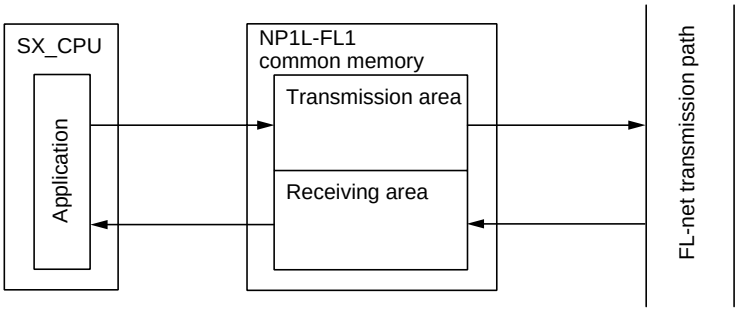
Figure 6-4 (2) Example of the Program for Reading Data via Processor Bus

(2) Operation for bank change

The FL-net module for MICREX-SX series has the memory for accessing the application in SX_CPU as well as the communication buffer for communicating data with FL-net, and changes banks when the local node retains a token to assure the uniqueness of the whole data in the transmission area.

1) Asynchronous mode

This mode allows FL-net and SX_CPU to simultaneously access one memory (common memory). However, because access from FL-net and access from SX_CPU are made asynchronously, the uniqueness of data cannot be guaranteed.

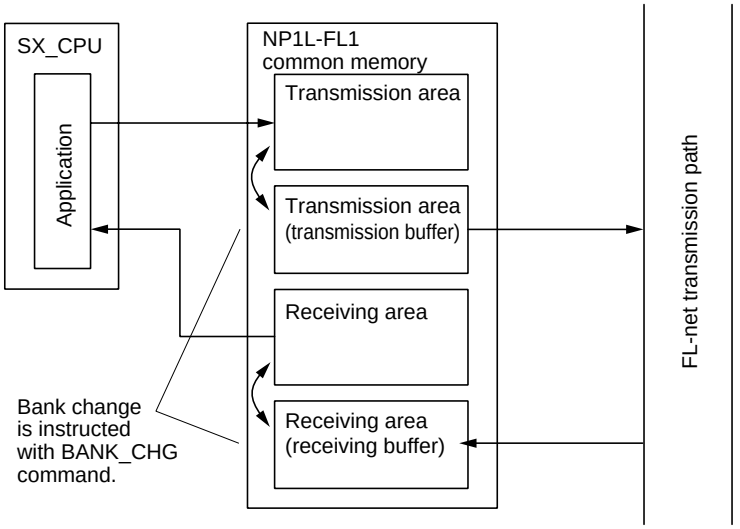


Note: Because one area is simultaneously accessed, the uniqueness of data cannot be guaranteed for the entire area. However, the uniqueness of data is guaranteed for one-word data.

Figure 6-4 (3) Asynchronous Mode

2) Bank Change mode

This mode has multiple transmission memory areas as well as multiple receiving memory areas, all of which are the same in size, and FL-net and SX_CPU access different areas. Because a same area is not simultaneously accessed, the uniqueness of data is guaranteed. Bank Change command (BANK_CHG FB) is sent from the application in SX_CPU. NP1L-FL1 does not change memory banks till it receives the next Bank Change command.



Note: The uniqueness of data is guaranteed in units of bank (for transmission area 1, transmission area 2, the entire receiving area).

Figure 6-4 (4) Bank Change Mode

Section 7 Troubleshooting

Page

Section 7 Troubleshooting

7-1 When the System Seems to Have Failed

When the system seems to have failed, check the following items.

<Table 7-1 (1) Check Items When the System Seems to Have Failed>

No.	Check item
1	Is NP1L-FL1 installed correctly?→ Does processor bus connector exist at the installation place?
2	Are the switches of NP1L-FL1 set correctly?
3	Is network IP address set correctly?
4	Is common memory area (transmission area of local node) set correctly? →Isn't the transmission area set doubly?
5	Check for loose connections of the module connectors.
6	Is the communication cable connected correctly?
7	Is terminating resistor connected to 10BASE5 cable?
8	Is 10BASE5 cable grounded?
9	Isn't cross cable used for 10BASE-T?
10	Is category 5 cable used for 10BASE-T?
11	Is power supplied to the hub and repeater of Ethernet?
12	Isn't token monitoring time too short?

(1) When communication is impossible

<Table 7-2 (1) Network Related Nonconformities and Remedies (When Communication Is Impossible)>

Location	Check item	Remedy
Power supply	Is the PWR LED lighting up on the power module?	Check connection of the power supply and the power cable as well as supply voltage.
	Is the lamp of AUI power unit lighting up?	
	Is the supply voltage from the AUI power unit at specified level (12 V DC)?	
	Is the power lamp lighting on the hub?	
	Is the AUI power cable connected to the equipment correctly?	
Connection of communication cable to transceiver	Isn't the transceiver mounted shakily?	Reinstall the transceiver according to Appendix 6.
	Isn't abnormality found with the transceiver installation condition checker?	Adjust till recognized as normal. If abnormality occurs continuously, install the transceiver at other place.
	Is the transceiver correctly insulated?	Re-execute the insulation work according to Appendix 6.
	Is the transceiver correctly mounted at the marked part on the communication cable?	Reinstall according to Appendix 6.
Connection between transceiver case and transceiver	Isn't the transceiver mounted shakily?	Reinstall according to Appendix 6, and retighten as needed.
	Is the transceiver locked correctly?	Lock correctly according to Appendix 6.
	Is the LED lighting normally on the transceiver?	Check connection of the power supply and the power cable as well as supply voltage.
Transceiver cable and connected equipment	Are TX (send) and RX (receive) LEDs lighting up normally on the FL-net module?	Check the content of error according to 7-4.
	Is the AUI/10BASE-T selector switch set correctly?	Set correctly so as to match the medium used.

(2) When communication becomes unstable

<Table 7-2 (2) Network Related Nonconformities and Remedies (When Communication Becomes Unstable)>

Location		Check item	Remedy
Transmission path		Is the external conductor of coaxial cable grounded at one point?	Ground correctly according to Appendix 6.
		Is the shielding wire of AUI cable treated correctly?	
	*	Does each station correctly answer to Ping command?	Check the power supply, wiring, etc. of the node that does not answer.
		Is the number of repeater stages equal to or smaller than 4?	
		Is individual segment within specified length?	
		Is terminating resistance connected at both ends of coaxial cable?	Re-execute according to Appendix 6.
		Is the number of connected nodes per segment equal to or smaller than specified value?	Adjust till recognized as normal. If abnormality occurs continuously, install the transceiver at other place.
		Is power supplied to the repeater?	Re-execute according to Appendix 6.
Setting items for participating nodes		Is network IP address set correctly?	Check the set IP address with the support tool (D300win for NP1L-FL1) or analyzer.
		Is node No. set correctly for each node?	Check the set node numbers with the support tool or visually.
		Are parameters correctly set for each node?	Check the parameters set for each node with the support tool.
		Is RX (receive) LED lighting continuously, or intermittently?	Check the communication cable or the AUI power unit.
		Is TX (send) LED lighting continuously, or intermittently?	Check the setting of equipment (node).
		Is the LNK (participation in FL-net) LED lighting?	Recheck the parameter setting on the node side.

* **PING (Packet Internet Groper)**
The command of TCP/IP that is used to know the condition of the remote node is referred to as “PING”.
PING uses ICMP (Internet Control Message Protocol) to send a request for echo to the remote node.
When received the request for echo, the remote node returns answer echo according to the protocol.
When the node that sent the request for echo receives the answer echo, the remote node is regarded as functioning normally.

7-3 Precautions for General Use of FL-net

For the standards that regulate the transmission path of FL-net, refer to the preceding paragraph or IEEE 802.3. In addition to these, there are the following limits or precautions that are peculiar to FL-net.

<Table 7-3 (1) List of Precautions for General Use of FL-net>

<table>
<tr><th></th><th>Description</th></tr>
<tr><td>1</td><td>Communication data of other Ethernet may not be sent on the communication cable of FL-net.</td></tr>
<tr><td>2</td><td>FL-net may not be connected to rooter.</td></tr>
<tr><td>3</td><td>There will be no effect even when switching hub is used for FL-net.</td></tr>
<tr><td>4</td><td>If infrared, radio or other medium is used, the real-time characteristic of communication may drop to a large extent.</td></tr>
<tr><td>5</td><td>When personal computer is used, depending on the capability of the personal computer or the OS or application that is used, the real-time characteristic of communication may drop to a large extent.</td></tr>
<tr><td>6</td><td>Be sure to use specified IP address.</td></tr>
<tr><td>7</td><td>Network address must be as specified (standard network address is 192.168.250.) In addition, there is a recommendation concerning the input range of node number (station number) in IP address.
Carefully set node numbers because the duplication of node number cannot be checked during initialization nor be recognized before error occurs after communication is started.
<table>
<tr><td>Network address</td><td>Node No.</td></tr>
<tr><td>192.168.250</td><td>1 to 249</td></tr>
</table>
</td></tr>
<tr><td>8</td><td>Surely connect the grounding cable. Be sure to use a sufficiently thick grounding cable.</td></tr>
<tr><td>9</td><td>Network cables must be sufficiently kept away from noise sources. Avoid laying them alongside power line, etc.</td></tr>
<tr><td>10</td><td>When cyclic data communication and message data communication are performed simultaneously, depending on the data volume, real-time characteristic may drop.</td></tr>
<tr><td>11</td><td>The area (common memory are) for cyclic data communication needs not be secured continuously.</td></tr>
<tr><td>12</td><td>When SQE switch is provided on the transceiver, set the switch correctly according to the instruction manual.</td></tr>
<tr><td>13</td><td>Depending on the processing capacity of a communicating node, fixed time communication property of the entire system may be influenced. All the nodes that are connected to the network communicate at the transmission rate that matches the capacity of the slowest node (minimum permissible frame interval). For this reason, connection or addition of one node may drop the real-time performance of the entire system to a large extent.</td></tr>
<tr><td>14</td><td>The header part for message communication is big endian; the data part, little endian. However, the system parameter that is the data part for profile read is big endian. (Big endian is the method to send MSB first.)</td></tr>
</table>

If an error occurred on the local module or a system on FL-net, NP1L-FL1 indicates the content of the occurred error by means of the LEDs provided on the module, and notifies the SX series CPU of it. (For the lighting conditions of the LEDs, refer to “3-6-2 Function of each part”.

7-4-1 Detail RAS data

The content of NP1L-FL1 related error can be read from D300win, as detail RAS data. The following RAS data can be read:

1) Module intensive status information
2) SX bus transmission information
3) FL-net running/structure/error flag
4) FL-net transmission information
5) Message error log
6) Onboard hard error factor
7) FL-net error information
8) Type information

Note: If CPU No. is wrong, if SX bus is broken, or if SX bus is not connected, detail RAS data cannot be read.

(1) Module intensive status information

Intensive status data of NP1L-FL1 is displayed in characters or hexadecimal code.

<Table 7-4 (1) Module Intensive Status List>

Status	Name	Code (hex)	Cause or description
Normal	Module valid running	0080	
Major fault	Fault input detection	0040	NP1L-FL1 hardware seems to have failed.
	WDT error	005F	
	CPU error	005E	
	ROM error	005D	
	RAM error	005C	
	Sub-processor error	005A	
	Processor bus error	0058	NP1L-FL1 hardware or baseboard hardware seems to have failed.
Light fault	External interface error	00DE	Error on FL-net (duplicated node number, etc.)
	Setting error	00D8	Switch or parameter setting error. For more information, refer to (7) “ FL-net error information” .

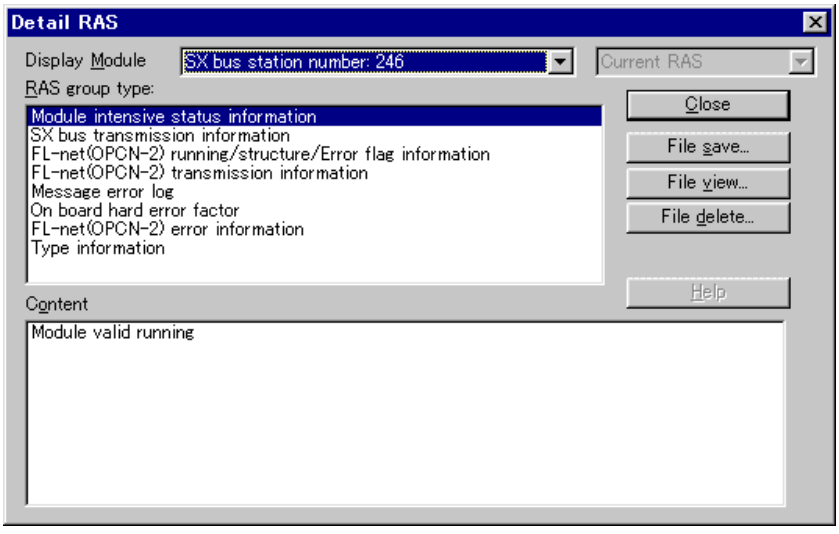


Figure 7-4 (1) Module Intensive Status Monitor Screen

(2) SX bus transmission information

SX bus transmission information includes the following:

<Table 7-4 (2) SX Bus Transmission Information List>

Name	Description
CRC error detected counter (Valid stamp)	Errors as shown at left may occur when there is an influence of noise on SX bus transmission path or if the SX bus is not properly laid. When any of these error counters is counting, it seems that the environment of the place where the SX system is installed is poor concerning noise, and some measures need to be taken.
Symbol error detected counter	
Frame length error detected counter	
Disconnection detected counter	
CRC error detected counter	
Frame error detected counter	
SD detected counter	
T.F1 END position error detected counter	
T.F2 END position error detected counter	
Buffer full 1 detected counter	
Buffer full 1 detected counter	
Buffer full 1 detected counter	

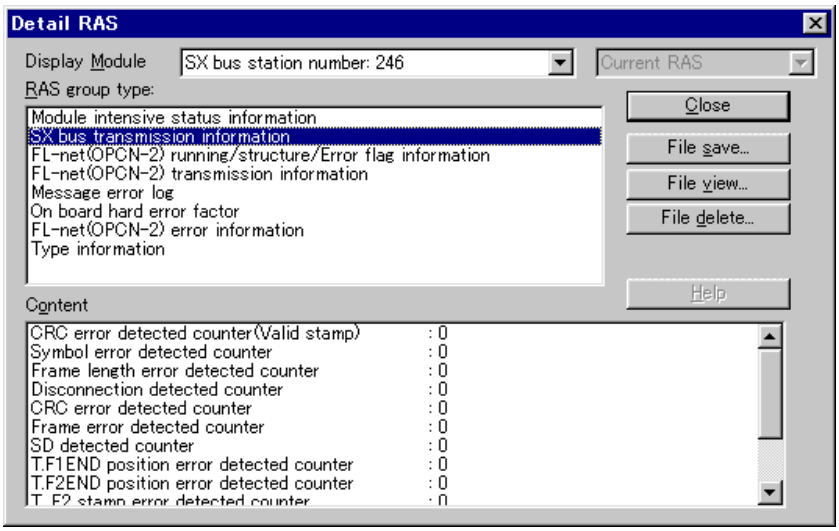


Figure 7-4 (2) SX Bus Transmission Information Monitor Screen

(3) FL-net participation (running) flag, structure flag, and error flag

These flags indicate the condition (participation, structure, or error) of a node that is connected to the FL-net. The ON condition of individual flag is as follows:

- Participation flag: The bit corresponding to the node that participates in the FL-net is turned ON.
- Structure flag: The bit corresponding to the node that participate in the FL-net and whose structure definition is registered is turned ON.
- Error flag:
  1) The bit corresponding to the node whose structure definition is registered is turned ON.
  2) The bit corresponding to the node whose structure definition is not registered but which participated once in the FL-net and then was disconnected is turned ON. However, when the node for which error flag turned ON participates again in the FL-net, the error flag turns off.

If even one of these error flags turns on, external interface error (light fault) occurs.

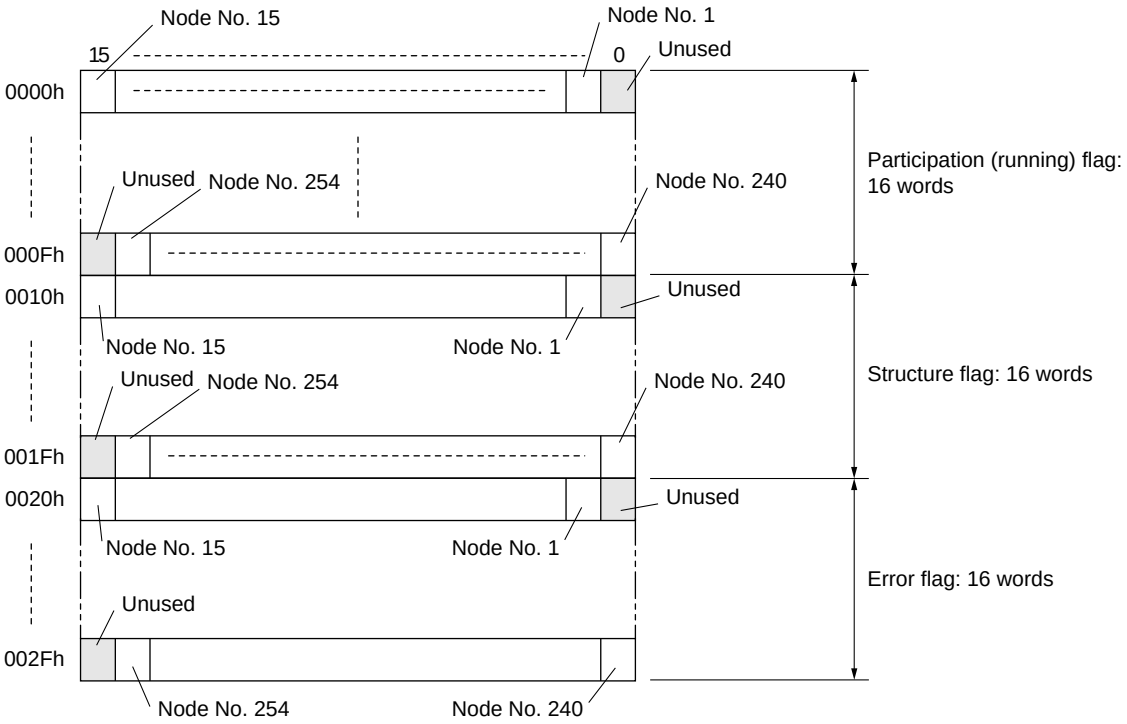


Figure 7-4 (3) FL-net Participation Flag, Structure Flag and Error Flag

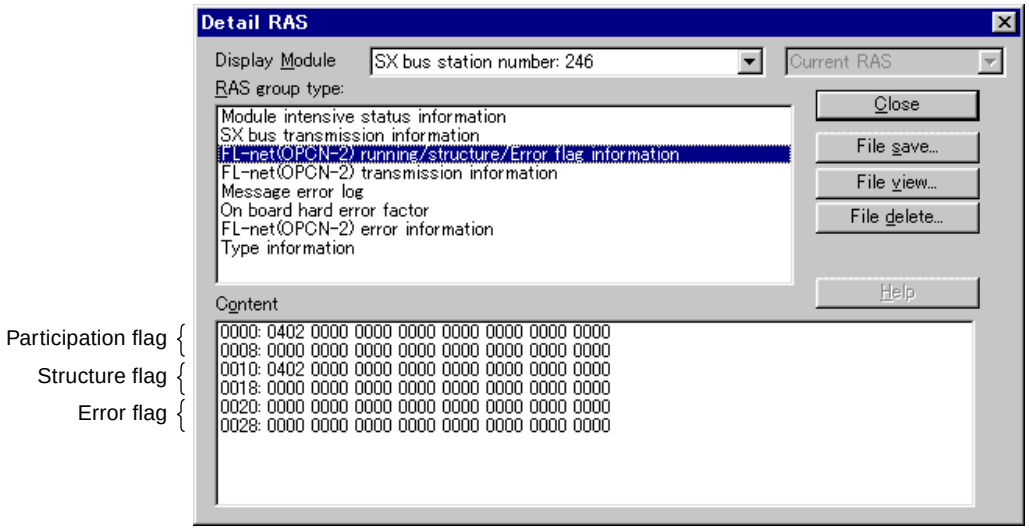


Figure 7-4 (4) FL-net Running/Structure/Error Flag Monitor Screen

(4) FL-net transmission information

This area is used to the interface with the FL-net protocol side.

+0000	Local node management table (26 words)
+001A	Network management table (6 words)
+0020	Participation nodes management table #C (1024 words)
+0420	Participation nodes management table #M (1792 words)
+0B20	Transmission count (2 words)
+0B22	Socket or lower level transmission error count (2 words)
	Unused (2 words)
+0B26	Receive count (2 words)
+0B28	Socket or lower level receive error count (2 words)
	Unused (2 words)
+0B2C	CYC error total count (2 words)
	Unused (8 words)
+0B36	Retransmission count (2 words)
+0B38	Retransmission over count (2 words)
	Unused (2 words)
+0B3C	Message receive error total count (2 words)
	Unused (4 words)
+0B42	ACK error count (2 words)
	Unused (8 words)
+0B4C	Multiple token recognition count (2 words)
+0B4E	Token disposal count (2 words)
+0B50	Token re-issuance count (2 words)
	Unused (2 words)
+0B54	Token monitoring timeout count (2 words)
	Unused (2 words)
+0B58	Frame waiting condition count (2 words)
+0B5A	Participation count (2 words)
+0B5C	Self disconnection count (2 words)
+0B5E	Skip disconnection count (2 words)
+0B60	Other node disconnection recognition count (2 words)

+0B62	Minimum number of participation nodes for midway participation (2 words)
+0B64	Local node token retain timeout count (1 word)
+0B65	Previous status (1 word)
+0B66	Previous event (1 word)
	Unused (1 words)
+0B68	Token circulation count for starting RCT measurement (2 words)
+0B6A	Minimum node token circulation counter (2 words)
	Unused (2 words)
+0B6E	For common memory setting check Receive count of token destined for the local node (2 words)
	Unused (2 words)
+0B72	Token continuous skip count (2 words)
	Unused (2 words)
+0B76	Status change/event (1 word)
+0B77	Token missing counter (256 words)
+0C77	Event counter (12 words)
	Unused (157 words)
+0D20	Local node' s area 1 check map (32 words)
+0D40	Local node' s area 2 check map (512 words)
+0F40	Other node' s area 1 check map (32 words)
+0F60	Other node' s area 2 check map (512 words)

Figure 7-4 (5) FL-net Transmission Information

(5) Message error log

Message communication error log is stored in ring file format (maximum 32 errors). One error occupies 2 words.

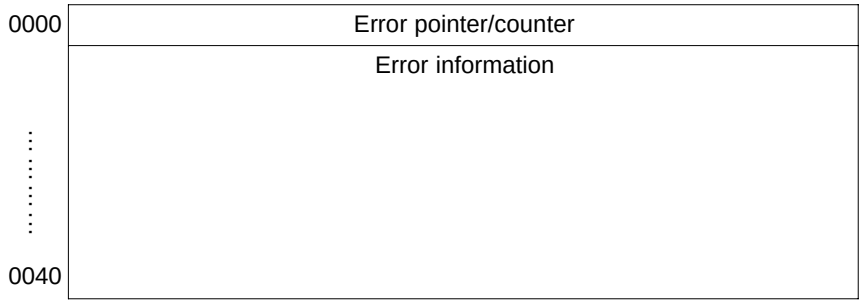


Figure 7-4 (6) Message Error Log

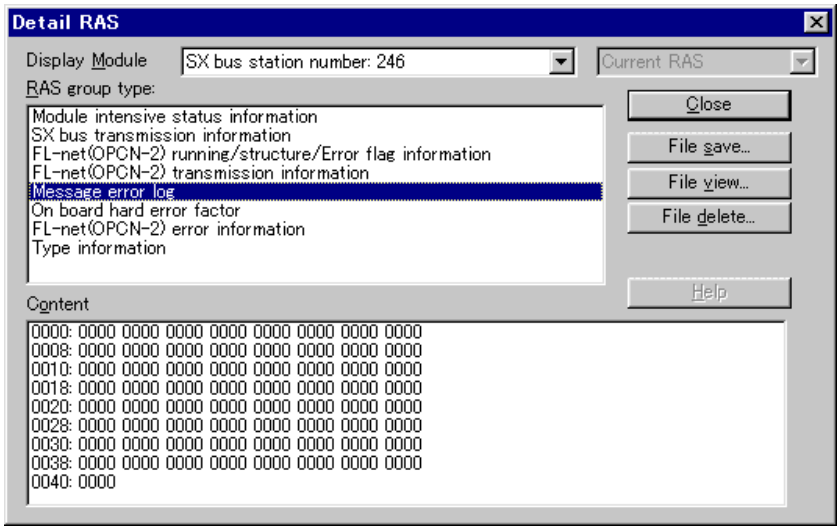


Figure 7-4 (7) Message Error Log Monitor Screen

· Error pointer/counter

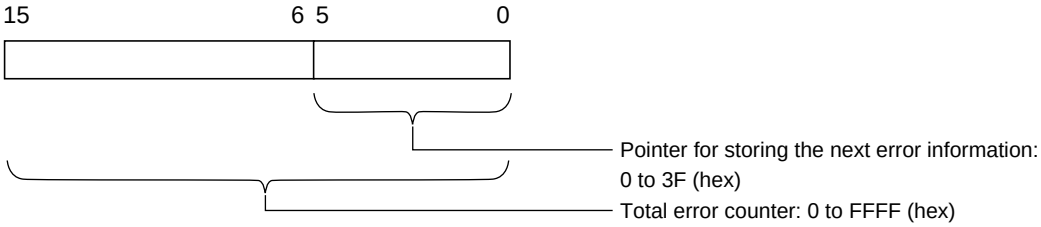


Figure 7-4 (8) Error Pointer/Counter

* The CPU number of FL-net module is entered in □. CPU number is set with the CPU No. setting switch provided on the module front.

· **Error information**

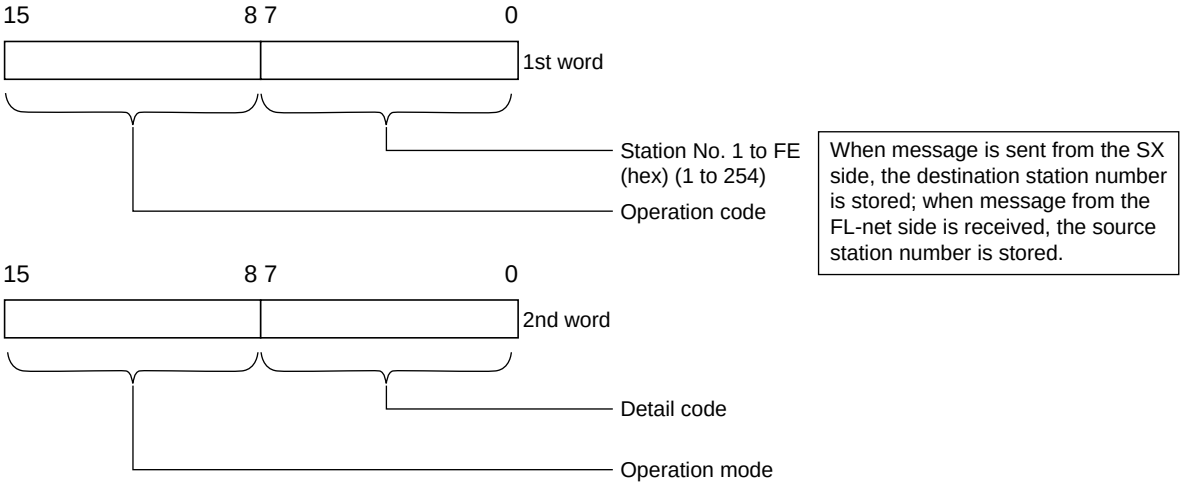


Figure 7-4 (9) Error Flag

<Table 7-4 (3) Operation Code>

Code (hex)	Description
00	Undefined command
01	Byte block data read
02	Byte block data write
03	Word block data read
04	Word block data write
05	Network parameter read
06	Network parameter write
07	Stop command
08	Run command
09	Profile read
0A	Log data read
0B	Log data clear
10	Standard transparent type
11	SX inherent transparent type (address read)
12	SX inherent transparent type (address write)
13	SX inherent transparent type (loader command)

<Table 7-4 (4) Operation Mode>

Code (hex)	Description
01	Message request from SX to FL-net
02	Answer message from SX to FL-net
03	Message request from FL-net to SX
04	Answer message from FL-net to SX

<Table 7-4 (5) Detail Code>

Code (hex)	Description
01	Remote station disconnected
02	Remote station data table empty
03	Remote station processing
04	Remote station response over
05	Undefined command
06	Read/write data size over
07	NACK received
08	“ Unsupported” received

Code (hex)	Description
09	Channel for M_SEND/M_RECEIVE not opened
12	Receiving side buffer full error
13	Receiving side queuing not started
14	Receiving side serial number error
15	Receiving side serial number version error
20	Sender side no ACK response
24	Sender side ACK check serial number error
25	Receiving side ACK check serial number version error
31	Protocol side receive queue access prohibited

(6) Onboard hard error factor

Detail causes of NP1L-FL1 hardware error are indicated.

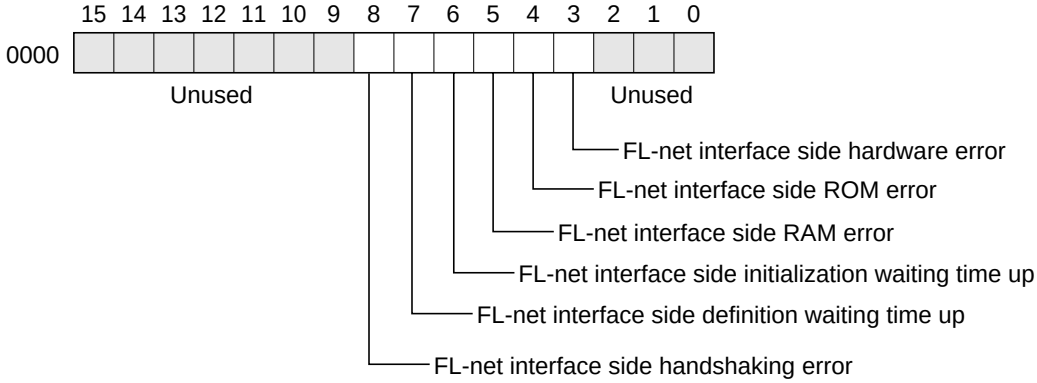


Figure 7-4 (10) Hardware Error Factor

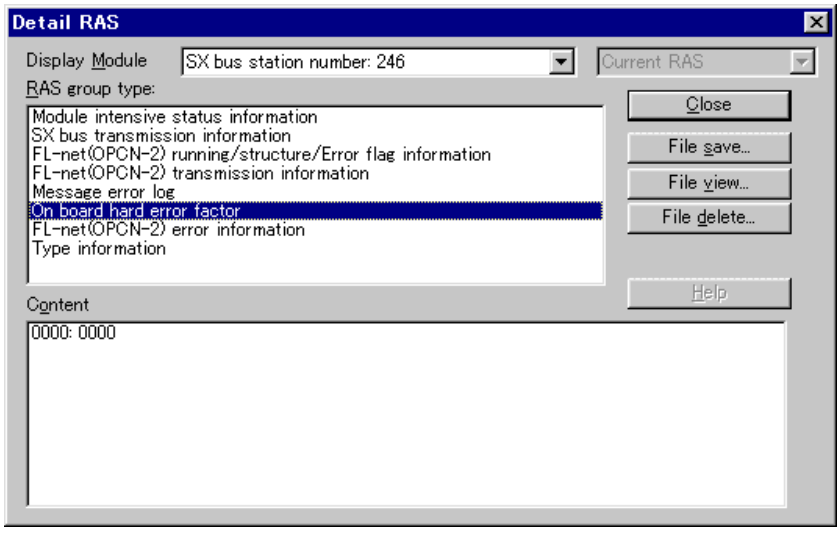


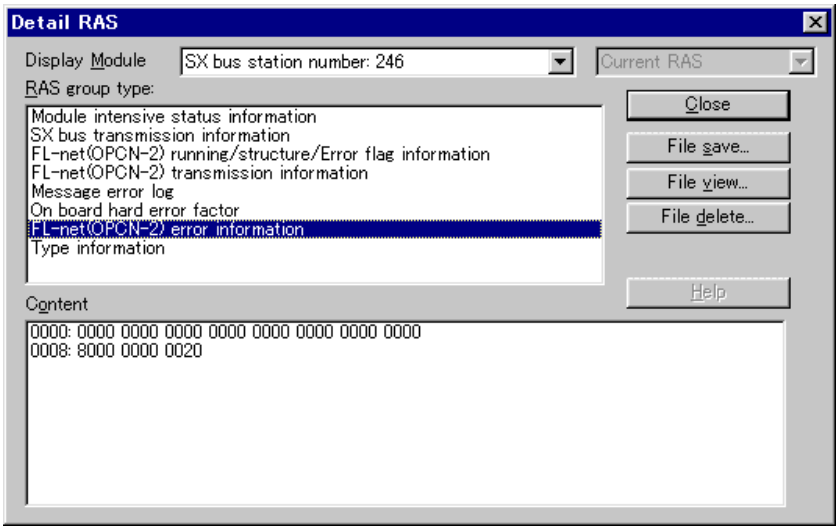
Figure 7-4 (11) Onboard Hard Error Factor Monitor Screen

(7) FL-net error information

+0000	Setting error information
+0001	Cyclic transmission error (bit 0 turned ON)
+0002	Cyclic transmission transfer error counter
+0003	Cyclic transmission transfer error total counter (low-order)
+0004	Cyclic transmission transfer error total counter (high-order)
+0005	Unused
+0006	Unused
+0007	Unused
+0008	Status of upper layer
+0009	Status of FL-net
+000A	Status of local node

← Transmission error factor

Figure 7-4 (12) FL-net Error Information



← +0001 to +0007 is unused.

Figure 7-4 (13) FL-net Error Information Monitor Screen

· Setting error detail information

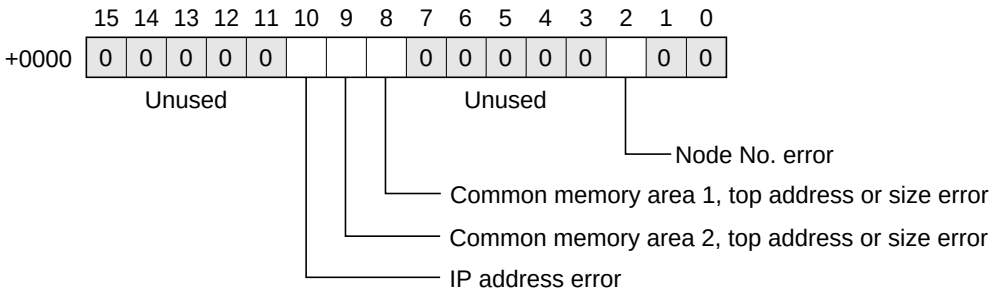


Figure 7-4 (14) Setting Error Detail Information

· Upper layer status detail information

The status of the upper layer of NP1L-FL1, namely the status of MICREX-SX system and that of CPU module (RUN/STOP), is indicated.

<Table 7-4 (6) Upper Layer Status Detail Information>

Display code for +0008	Status
0000	SX system is normal, and the CPU stops.
8000	SX system is normal, and the CPU is running.
4000	SX system is under major fault condition.
A000	SX system is under light fault condition, and the CPU is running.
2000	SX system is under light fault condition, and the CPU stops.

· FL-net status detail information

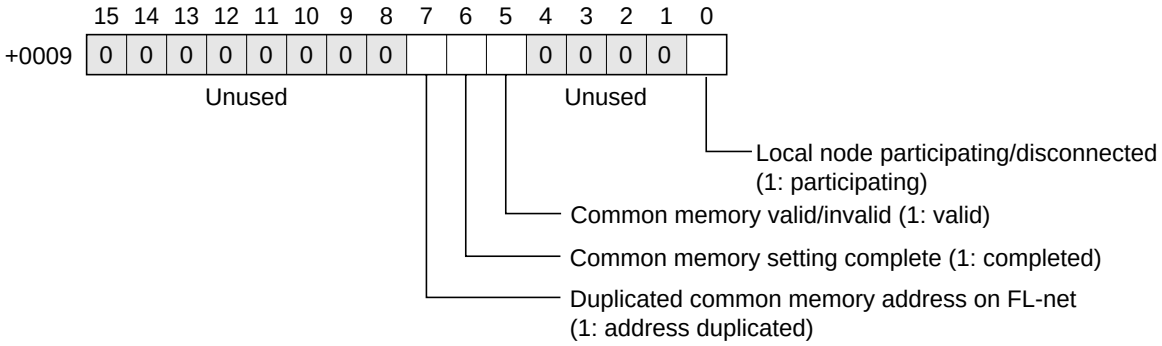


Figure 7-4 (15) FL-net Status Detail Information

· Local node status detail information

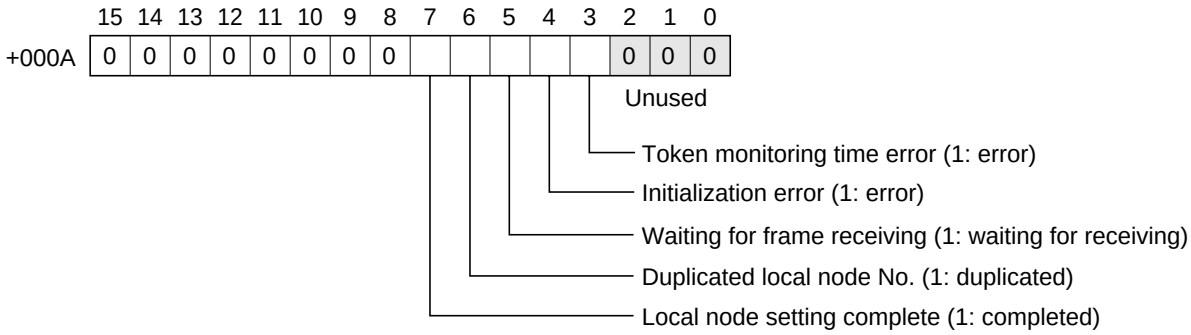


Figure 7-4 (16) Local Node Status Detail Information

(8) Type information

Module group type, representative type, type information, and software version No. are displayed.

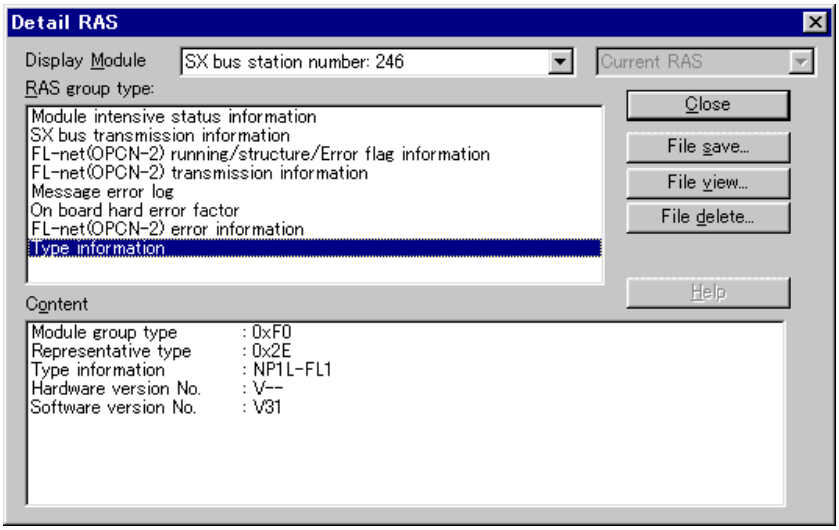


Figure 7-4 (17) Type Information Display Screen

Appendix 1 System Construction Guide

Page

Appendix 1 System Construction Guide
Appendix 1-1 Ethernet Overview

Ethernet is a LAN (Local Area Network) standard for communication among personal computers and printers. It regulates communication data format, cable and connectors. Ethernet standard is established by the IEEE Ethernet Working Group (IEEE 802.3). Till now, various standards such as 10BASE5, 10BASE2 and 10BASE-T have been established, and now new standards for 1000BASE-T and other advanced systems are under investigation. Figure App. 1-1 (1) shows the trend of standardization achieved by IEEE 802.3 working group.

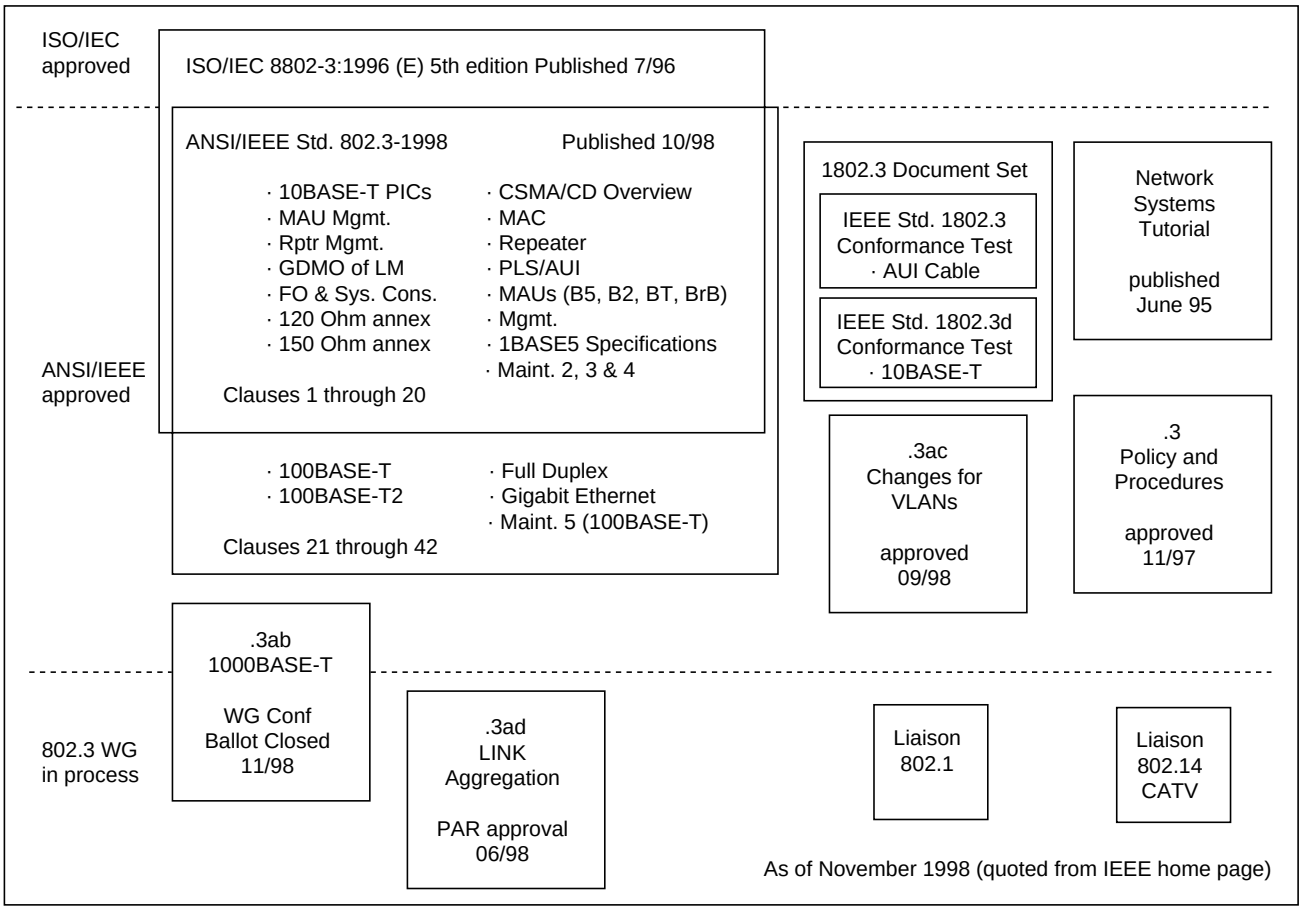


Figure App. 1-1 (1) Trend of Standardization by IEEE 802.3 Working Group

10BASE5 is the connecting method of Ethernet that uses approx. 10 mm thick coaxial cable (also called “thick cable” or “yellow cable”). “10” of 10BASE5 means that the transmission rate of Ethernet is 10 Mbps; “BASE”, that base band system is used for transmission; and “5”, that the transmission distance of trunk line is 500 m. To connect to a personal computer or other equipment, a transceiver is mounted on the coaxial cable, and transceiver cable (also called “AUI cable”) is used to connect between the transceiver and the personal computer, etc.
10BASE5 uses thick cable, which cannot easily be laid for networking, so that it is hardly used for office network. But due to the long transmission distance, it is often used for trunk network.
An example of 10BASE5 Ethernet system structure is shown below:

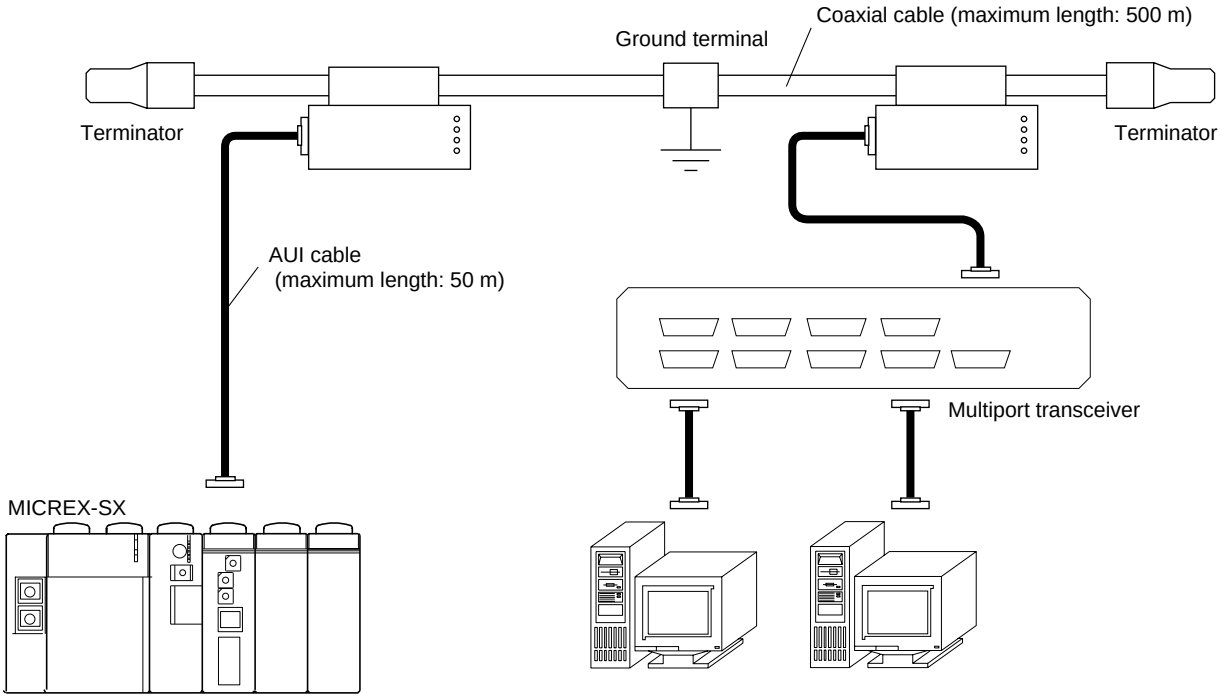


Figure App. 1-2 (1) Example of 10BASE5 Ethernet System Structure

* When multiport transceiver is used, the maximum total length of AUI cable between coaxial cable and terminal is 50 m.
* Cascade connection of multiport transceiver is up to 2 stages.

Appendix 1-3 Specification for 10BASE-T

10BASE-T is the connecting method of Ethernet that uses twisted pair cable. “10” of 10BASE-T means that the transmission rate of Ethernet is 10 Mbps; “BASE”, that base band system is used for transmission; and “-T”, that transmission medium is twisted pair cable. With 10BASE-T network, equipment such as personal computer must be connected in star shape using a hub. Equipments may not be connected directly. (1:1 direct connection is possible when the special cable called “cross cable” is used, which, however, is not general.) The maximum cable length between hub and individual equipment is 100 m.
10BASE-T cable is slender and can easily be laid, so that individual equipment can easily be connected to or disconnected from the network. Therefore, 10BASE-T is often used for office network.
An example of 10BASE-T Ethernet system structure is shown below:

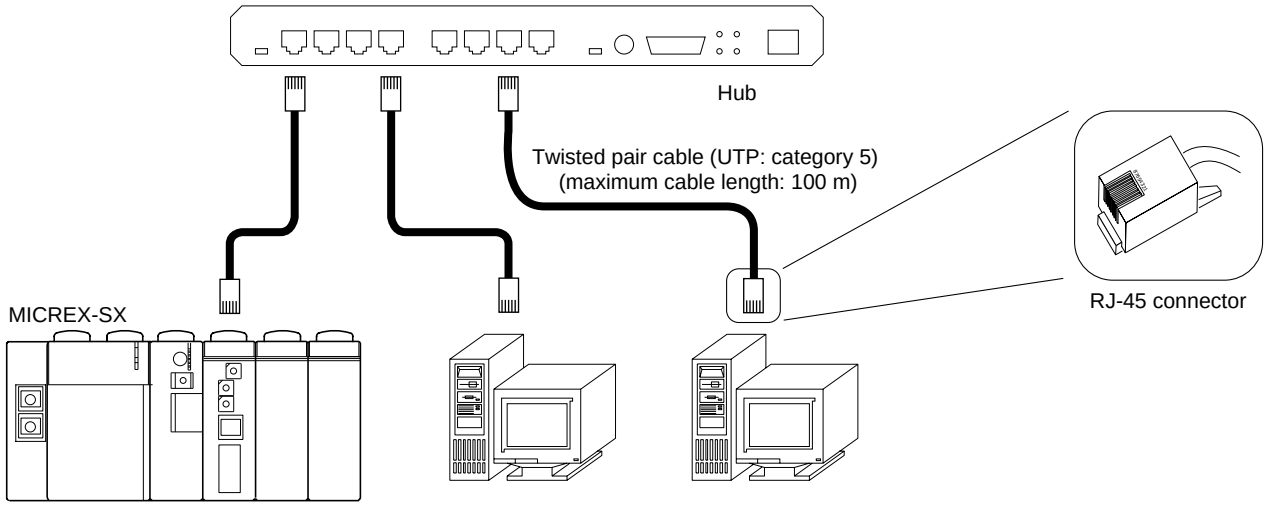


Figure App. 1-3 (1) Example of 10BASE-T Ethernet System Structure

(1) 10BASE2

10BASE2 is the connecting method of Ethernet that uses approx. 5 mm thick coaxial cable (also called “thin cable”). “10” of 10BASE5 means that the transmission rate of Ethernet is 10 Mbps; “BASE”, that base band system is used for transmission; and “2”, that the transmission distance of trunk line is 185 m (approximately 200m). To connect to a personal computer or other equipment, a T-shaped branch connector is mounted on the BNC connector of individual equipment, and coaxial cable is connected on both ends of the branch connectors.

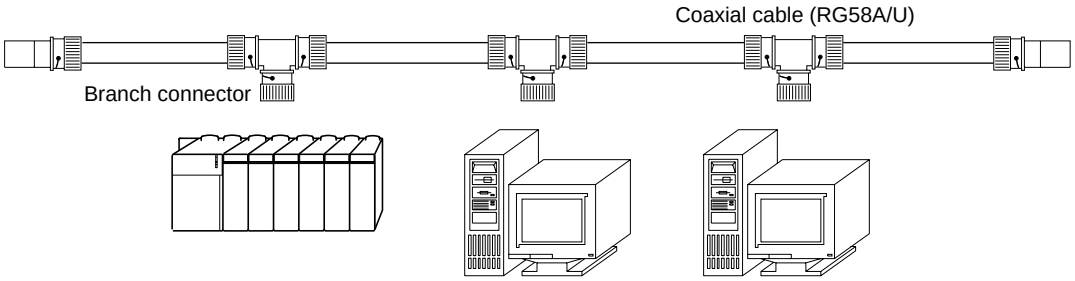


Figure App. 1-4 (1) Example of 10BASE2 Ethernet System Structure

(2) Optical Ethernet

Optical Ethernet uses optical fiber cable as transmission medium. It is used for 500 m or longer distance transmission or in the systems that require high immunity to noise. The optical Ethernet connecting method standardized by IEEE 802.3 include 10BASE-FP, 10BASE-FB, 10BASE-FL, 100BASE-FX, 1000BASE-LX and 1000BASE-SX.

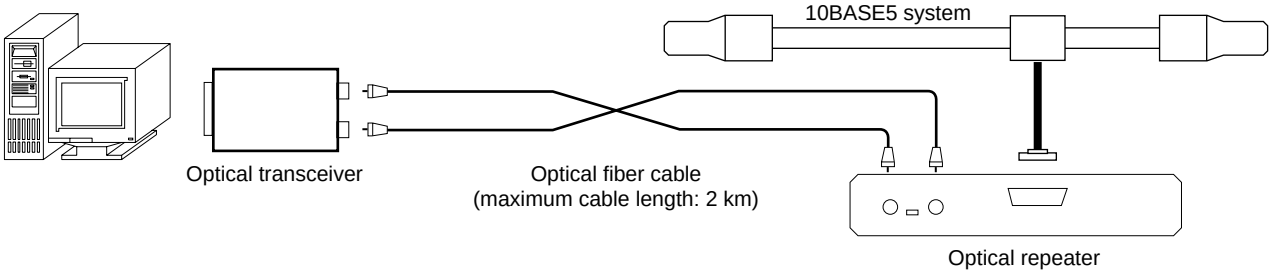


Figure App. 1-4 (2) Example of Optical Ethernet System Structure

(3) Radio Ethernet

Radio LAN uses radio wave or infrared rays as transmission media. It is used to connect a portable equipment to LAN, etc. Radio LAN is now being standardized by the IEEE Radio LAN Working Group (IEEE 802.11). Because radio LAN and Ethernet differ from each other in the protocol of MAC layer, a bridge is necessary to interconnect them.

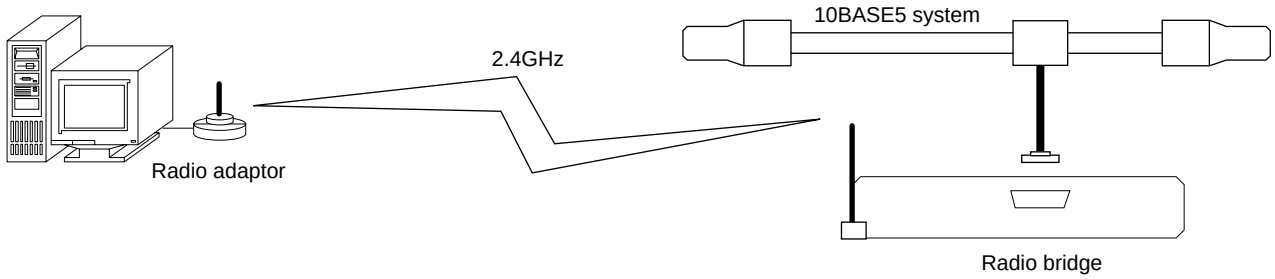


Figure App. 1-4 (3) Example of Radio Ethernet System Structure

Appendix 2 Example of System Structure Small-Scale Structure

Page

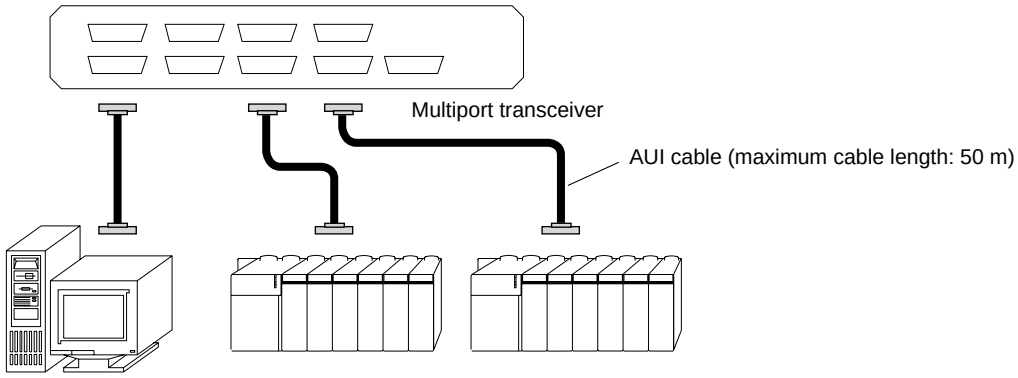
Appendix 2 Example of System Structure

Small-Scale Structure

Appendix 2-1 Small-Scale Structure

It is possible to construct a network system that consists of several units of equipment by using a single unit of multiport transceiver or hub.

<Structure using a multiport transceiver>



<Structure using a hub>

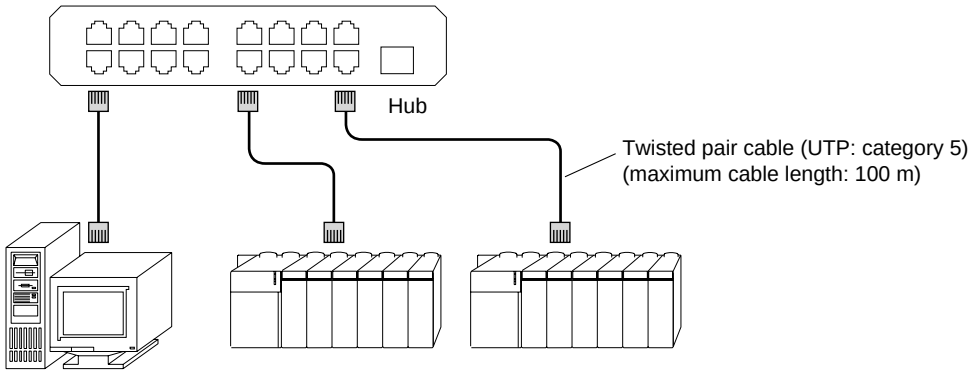


Figure App. 2-1 (1) Example of Small-Scale Structure

It is possible to construct a network system that consists of scores of equipment by connecting several units of multiport transceiver or hub to a single coaxial cable.

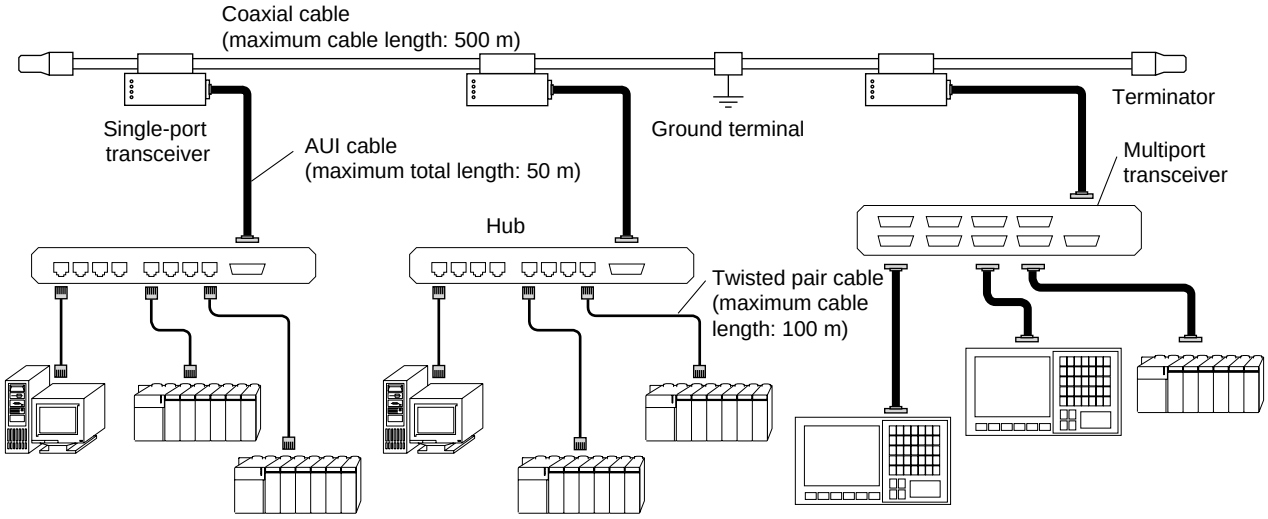


Figure App. 2-2 (1) Example of Basic Structure

* The total number of repeaters and hubs that can be installed between arbitrary terminals is a maximum 4 units.
* When multiport transceiver is used, the maximum total length of AUI cable between coaxial cable to terminal is 50 m.
* Cascade connection of multiport transceiver is up to 2 stages.

Appendix 2-3 Large-Scale Structure

It is possible to construct a network system that consists of hundreds of pieces of equipment by connecting multiple 10BASE5 network segments with repeaters.

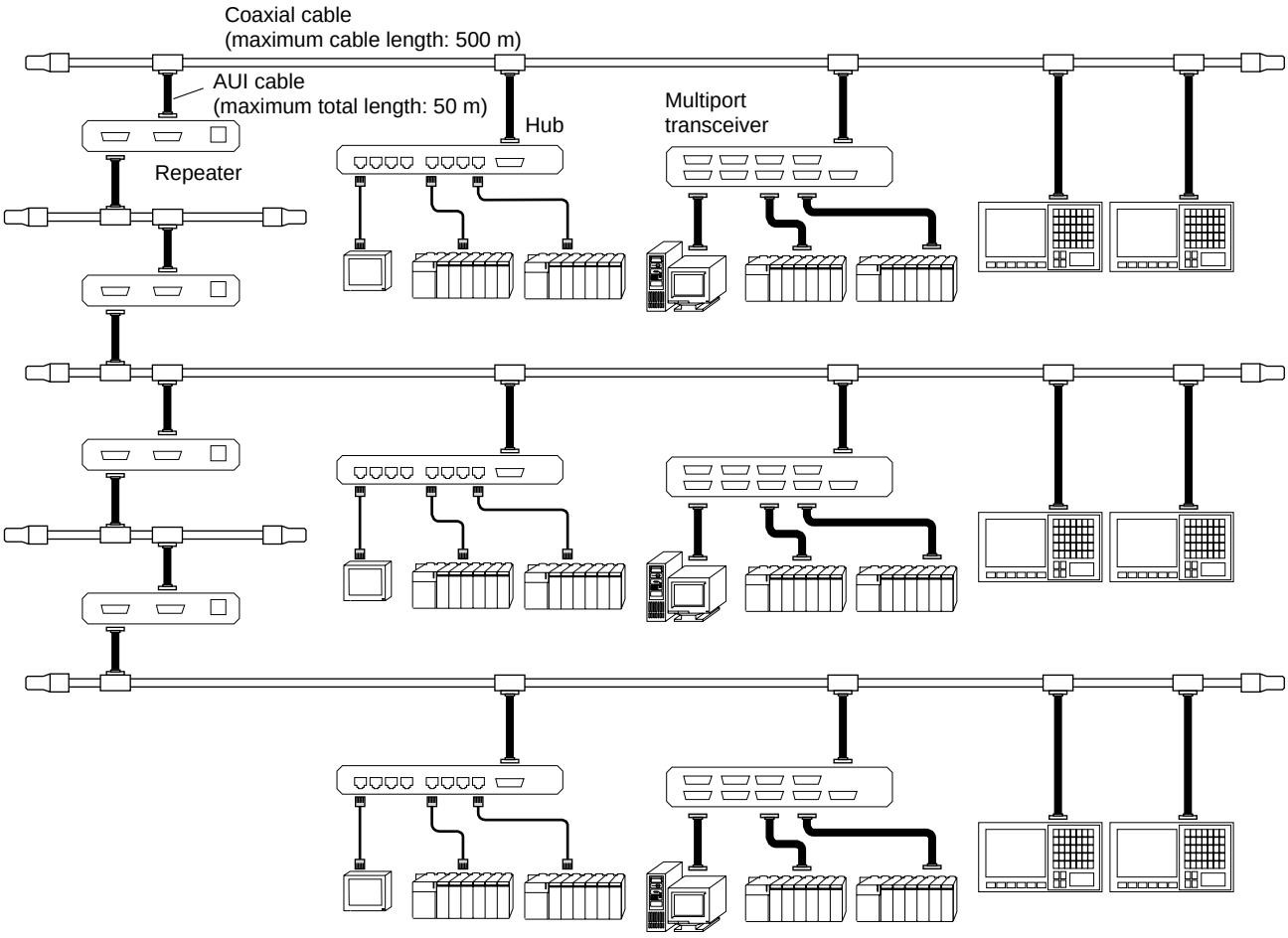


Figure App. 2-3 (1) Example of Large-Scale Structure

* The total number of repeaters and hubs that can be installed between arbitrary terminals is a maximum 4 units.
* When multiport transceiver is used, the maximum total length of AUI cable between coaxial cable to terminal is 50 m.
* Cascade connection of multiport transceiver is up to 2 stages.

Appendix 2-4 Long-Distance Distributed Structure

In a network system of large-scale structure, if the distance between network segments exceeds the limit on transmission distance for 10BASE5 (500 m), it is possible to construct a network system the distance between repeaters of which is 2 km, by using optical repeaters to connect between network segments.

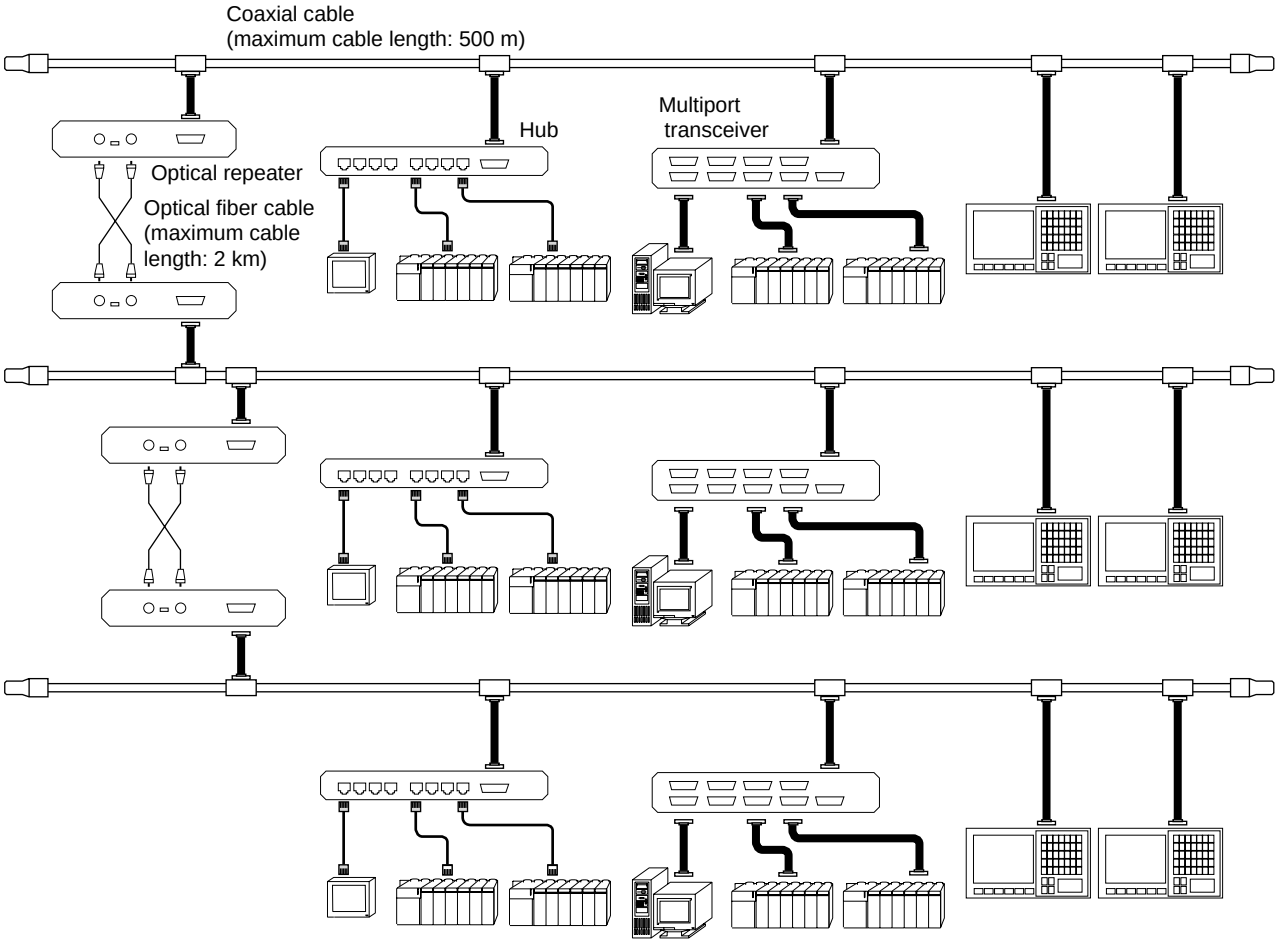


Figure App. 2-4 (1) Example of Long-Distance Distributed Structure

* The total number of repeaters and hubs that can be installed between arbitrary two terminals is maximum 4 units.
* When multiport transceiver is used, the maximum total length of AUI cable between coaxial cable to terminal is 50 m.
* Cascade connection of multiport transceiver is up to 2 stages.

Appendix 2-5 Locally Intensive Structure

When scores of equipment are gathered locally, it is possible to construct a network system using stackable hub.

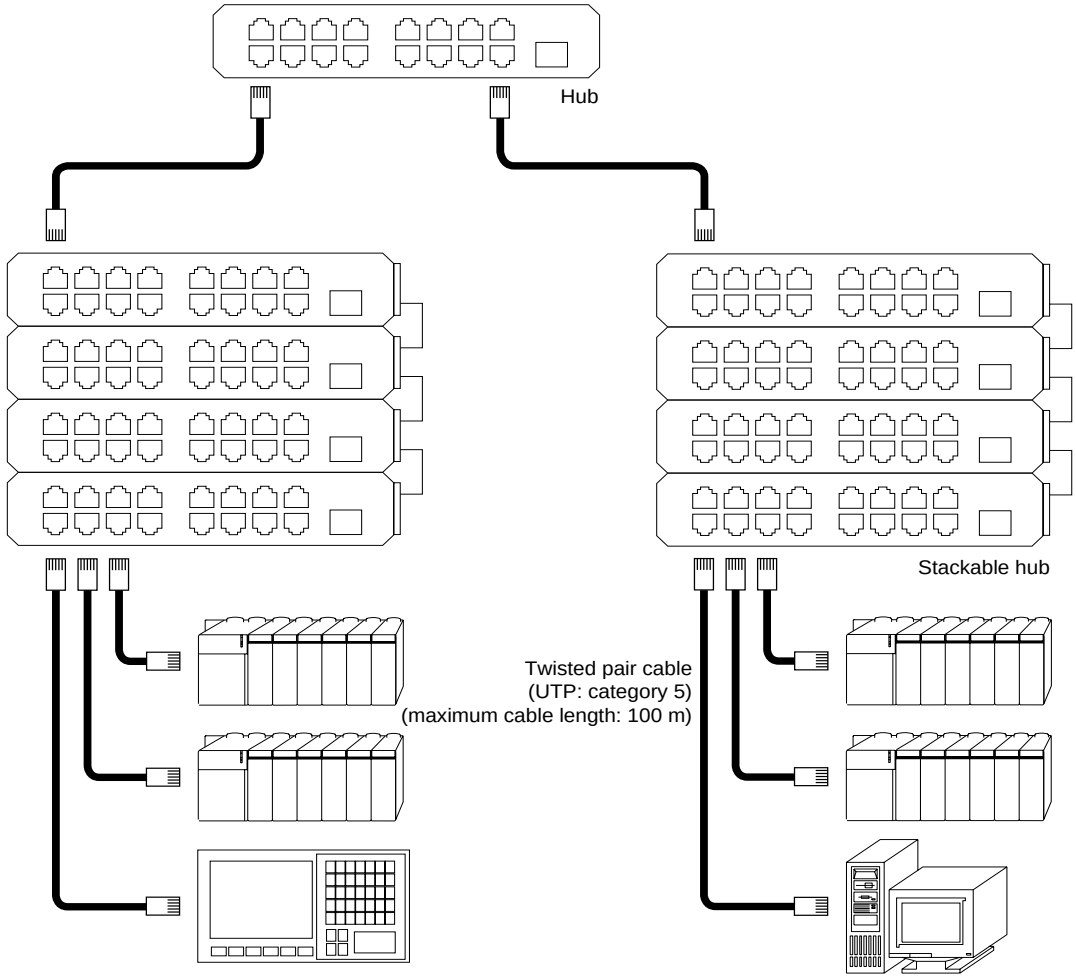


Figure App. 2-5 (1) Example of Locally Intensive Structure

Appendix 2-6 Locally Long-Distance Distributed Structure

In a network system of basic structure, when specific controller is installed at a long-distance place, or when a high-voltage power supply or other noise source exists near the network, it is possible to construct a network that can perform long-distance transmission as well as has high immunity to noise, by splitting the network into two segments and connecting them by optical repeater.

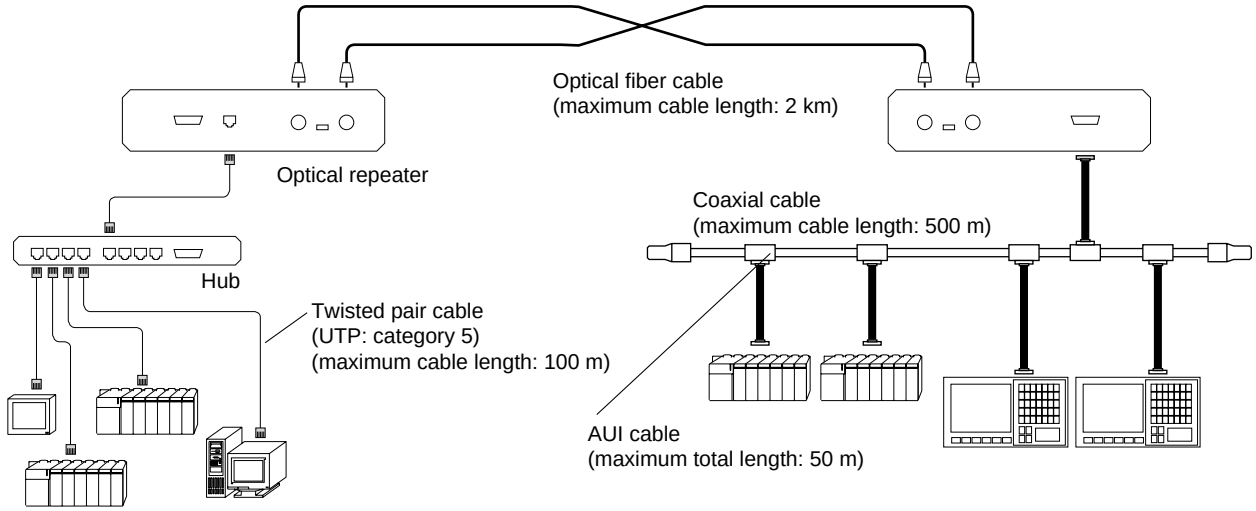


Figure App. 2-6 (1) Example of Locally Long-Distance Distributed Structure

Appendix 2-7 Concept of FL-net System

The purpose of FL-net is to provide real-time communication among controllers of production system, such as programmable controller, robot controller, and computerized numerical control device.
FL-net constructs a system in which token is passed by means of broadcasting that is based on EDP/IP protocol for Ethernet in order to realize cyclic communication and message communication.

Appendix 2-8 Difference between Universal Ethernet and FL-net

FL-net is a network dedicated to FA, so that it cannot use all universal Ethernet equipments. Some of them cannot be used with FL-net from the viewpoint of noise immunity or environmental resistance.
Because FL-net is required the response performance as real-time communication for control use, it can connect only the controllers and other control equipment that are adapted to FL-net.
Because of the cyclic communication system that uses the broadcasting function of UDP/IP communication based on 10BASE5 or 10BASE-T, there are the following limits on the present protocol:

- Currently adapted equipment is only 10Mbps Ethernet LAN.
- FL-net cannot be connected to other universal Ethernet.
- TCP/IP communication function is not supported.
- There will be no effect even when switching hub is used.
- Rooter, etc. cannot be used.

Appendix 3 Definition of Network System

Page

Appendix 3 Definition of Network System

Appendix 3-1 Communication Protocol Related Standards

Communication protocol is the rules that are applied when a certain system communicates information with other system via communication line or the like. The communication protocol that FL-net uses is based on the following standards:

<Table App. 3-1 (1) Communication Protocol for FL-net>

Communication protocol for FL-net	Applicable specification
FL-net	FA link protocol specification (issued from the FA Control Network Subcommittee of the MSTC Open FA Network Promotion Council)
UDP	RFC768
UP, ICMP, etc.	RFC791, 792, 919, 922, 950
ARP, etc.	RFC826, 894
Ethernet	IEEE 802.3

Appendix 3-2 Hierarchical Structure of Communication Protocol

Communication protocol is modeled using a hierarchical structure, and communication related operations are grouped into several levels for expression or standardization. FL-net consists of the following 6 protocol layers, as shown below:

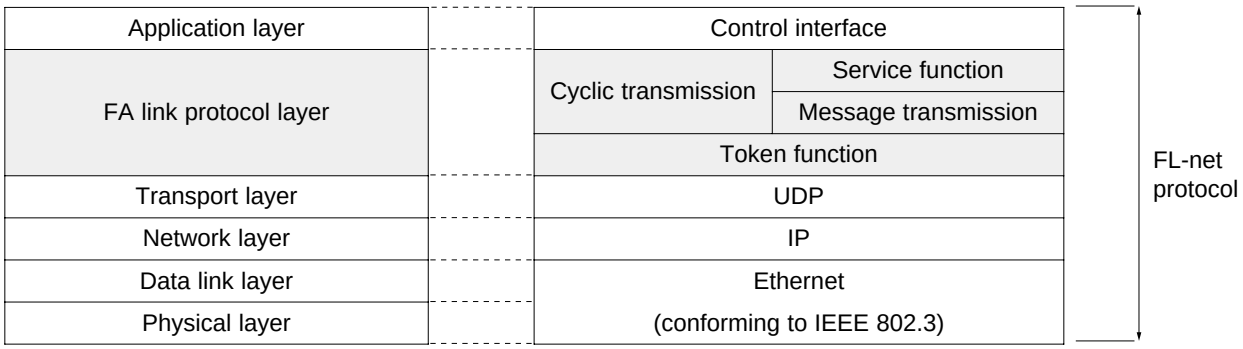


Figure App. 3-2 (1) Location of FA Link Protocol

For the transmission rate of 10 Mbps, the physical layer of Ethernet prepares the following 5 types of transmission methods: 10BASE5, 10BASE2, 10BASE-T, 10BASE-F and 10BROAD36. In addition to these, there is 100 Mbps Ethernet. Of these, FL-net uses 10BASE5 (commendable), 10BASE2 and 10BASE-T.
MICREX-SX can use 10BASE5 and 10BASE-T.

Appendix 3-4 IP Address of FL-net

To distinguish specified communication equipment from many other communication equipments that are connected via Ethernet, address called “IP address” (or INET address) is used. Therefore, you must set a peculiar IP address for individual communication equipment that is connected to the Ethernet.
IP address consists of the part that expresses the network address at which the subject communication device is connected and the part that expresses the address of the host for the communication equipment. According to the size of network, IP address is classified into 3 categories: Class A, Class B and Class C. (There are also Classes D and E, but these are for special purposes.)

<Table App. 3-4 (1) Classification of IP Address>

	Value of top 1 octet	Network address part	Host address part
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

* Shading means the part that corresponds to the respective address.

For the communication equipments that are connected to a same network, the network address part of IP address has the same value, and only the host address part has a peculiar value that is not duplicated.
Default IP address for FL-net is 192.168.250N (N: node address No. 1 to 254).
It is recommended to use Class C IP address and that the low-order host address be coincided with the node number of FL-net protocol.

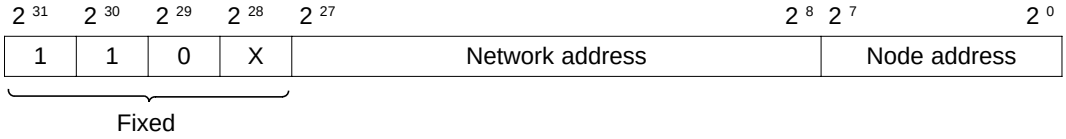


Figure App. 3-4 (1) IP Address of FL-net

Appendix 3-5 FL-net Sub-network Mask

FL-net sub-network mask is fixed to 255.255.255.0. The user of FL-net needs not set this sub-network mask.
This value is the same as those of the original network address part and host address part for Class C.

Appendix 3-6 TCP-IP and UDP/IP Communication Protocols

TCP, UDP and IP are main protocols that are used for Ethernet.
IP is located in the network layer of communication protocol to control the flow of communication data.
TCP and UDP are located in the transport layer and use IP as network layer, but they differ from each other in the content of service.
TCP provides reliable services that make upper layers unconscious of elimination of data. On the other hand, UDP transfers the data block (data diagram) it received from IP to upper layer as it is, so that it cannot be guaranteed whether or not the data surely reached the destination. The confirmation of data receiving, retransfer and other operations are entrusted to upper layers. Though UDP is inferior in reliability to TCP, it can provide communication service with small overhead.
FL-net uses UDP. This is because the exquisite procedure for data confirmation and retransfer of TCP is too redundant for FL-net. This procedure is omitted, and instead the management of transmission right by means of token, the division and synthesis of frames, and other operations are performed in the upper FL-net protocol layer to realize high-speed data exchange.

Appendix 3-7 FL-net Port Numbers

Because FL-net provides services from the FL-net protocol layer that is located above transport layer in the hierarchy, the following port numbers are predetermined. However, the user of FL-net needs not set these port numbers by parameters.

<Table App. 3-7 (1) FL-net Port Numbers>

Name	Port No.
Port No. for cyclic transmission	55000 (fixed)
Port No. for message transmission	55001 (fixed)
Port No. for participation request frame	55002 (fixed)
Port No. for sending	55003 (fixed)

(1) Overview of FL-net data format

The data that is communicated via FL-net is encapsulated in individual layer of the communication protocol, in the following manner:

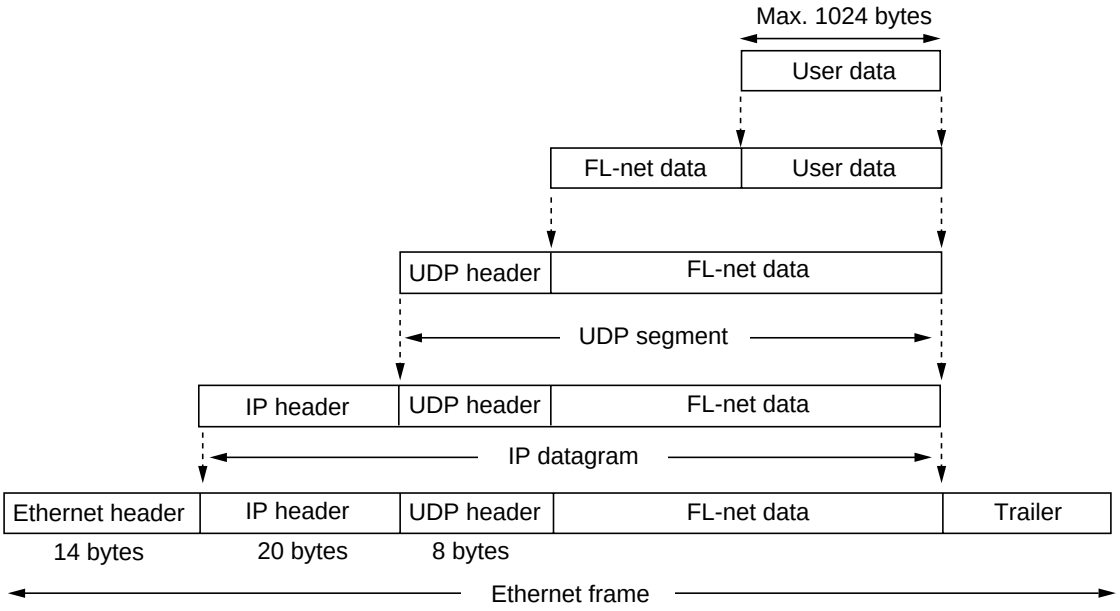


Figure App. 3-8 (1) Outline of FL-net Data Format

The following figure shows the FL-net data (for 1 frame) that can be observed on the communication line. In this example, 128 bytes of cyclic data are transferred.

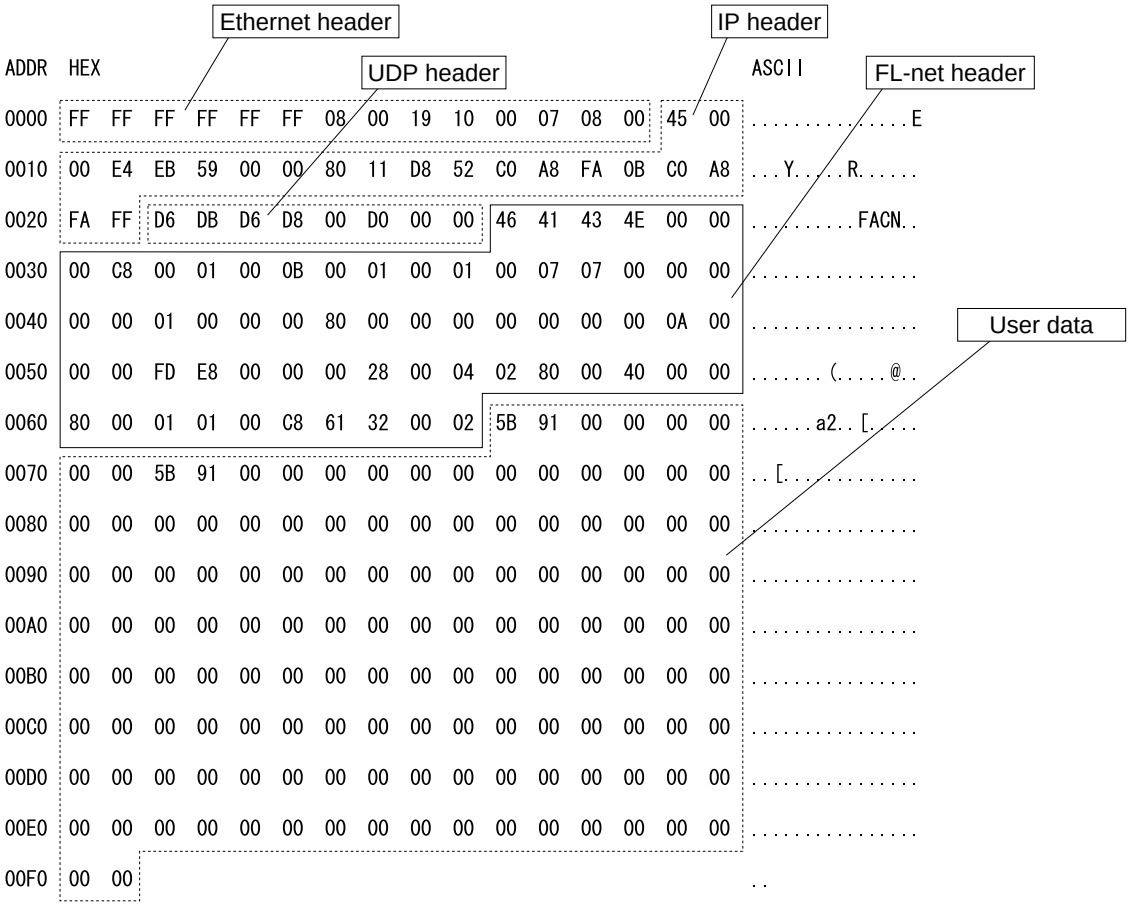


Figure App. 3-8 (2) Example of FL-net Data (for 1 Frame)

(2) Format of FL-net header
FL-net header has the size of 64 to 96 bytes.

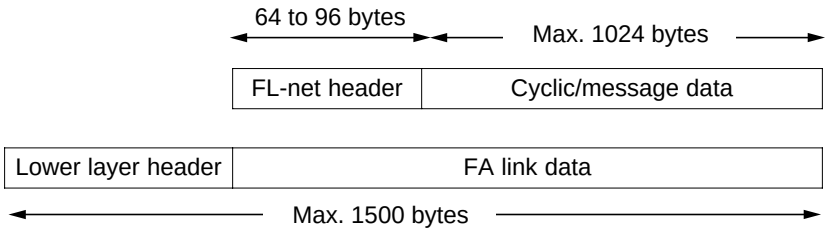


Figure 3-8 (3) FL-net Header

Appendix 3-9 Transaction Codes for FL-net

The following message transmission services are available with FL-net:

<Table App. 3-9 (1) Message Transmission Service>

Type of message	
Byte block read	
Byte block write	
Word block read	
Word block write	
Network parameter read	
Network parameter write	
Run command	
Stop command	
Profile read	
Communication log read	
Communication log clear	
Message loop back	
Transparent message	
Reserved for SX	Address read
	Address write
	Loader command

Individual message includes a transaction code (operation code) for request or answer in the header, according to which message frames are distinguished.

<Table App. 3-9 (2) Transaction Code List>

Type of message		Operation code	
		Request	Answer
Byte block read		65003 (FDEB)	65203 (FEB3)
Byte block write		65004 (FDEC)	65204 (FEB4)
Word block read		65005 (FDED)	65205 (FEB5)
Word block write		65006 (FDEE)	65206 (FEB6)
Network parameter read		65007 (FDEF)	65207 (FEB7)
Network parameter write		65008 (FDF0)	65208 (FEB8)
Stop		65009 (FDF1)	65209 (FEB9)
Run		65010 (FDF2)	65210 (FEBA)
Profile read		65011 (FDF3)	65211 (FEBB)
Communication log read		65013 (FDF5)	65213 (FEBD)
Communication log clear		65014 (FDF6)	65214 (FEBE)
Message loop back		65015 (FDF7)	65215 (FEBF)
Transparent message		10000 to 59999 (2710 to EA5F)	
Reserved for SX	Address read	100 (64)	150 (96)
	Address write	101 (65)	151 (97)
	Loader command	200 (C8)	250 (FA)

Note: ( ) the character is hexadecimal number.

Appendix 4 Network Management by FL-net

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Appendix 4 Network Management by FL-net

Appendix 4-1 Token Management by FL-net

(1) Token

A node can send data basically when it retains a token.
When a node retains no token, it can send only two types of data: token re-issuance request frame in case token monitoring time is up, and participation request frame in case the node does not yet participate in the network.

1) FL-net circulates one token through nodes.
2) Individual node has the right to send data onto the network after it received the token till it passes the token to the next node.
3) Token circulates through all the nodes that participate in the FL-net.
4) Token can accompany cyclic data when it is sent.
5) It is possible to circulate only token without any data attached to it.
6) Token is monitored by a timer and if no token flows in the network for a given time, token is automatically reissued.
7) There is the function to unify the token into one when more than one token exist on the network.

(2) Flow of token

1) Basically only one token exists on a network. If more than one token exist on a network, the nodes will give priority to the token with smallest destination number, and other tokens will be discarded.
2) The frame that has a token (token frame) contains token destination node number and token source node number.
3) Individual node can be a token retain node only when its node number coincides with the destination node number of the token contained in the received token frame.
4) In what order to rotate the token is determined according to node numbers.
   Individual node rotates the token in the ascending order of the node numbers that are registered in the participation node management table. A node of the greatest node number passes the token to a node of the smallest node number.

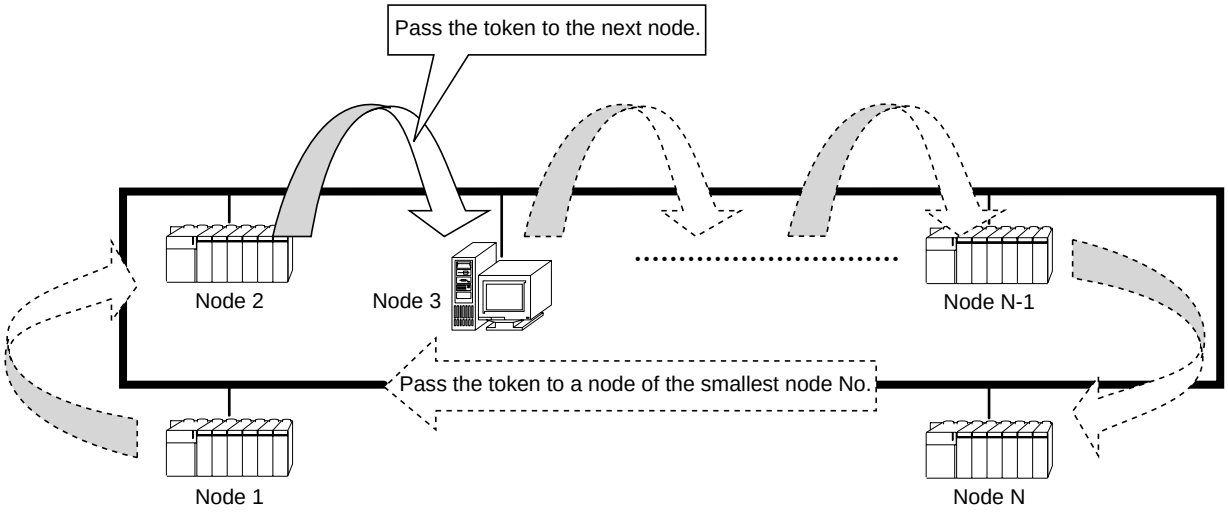
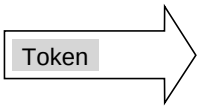
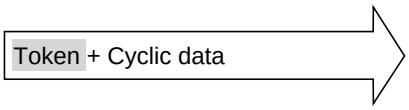
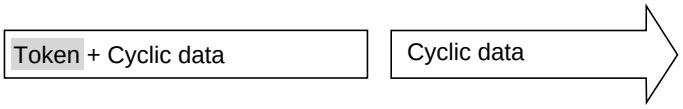
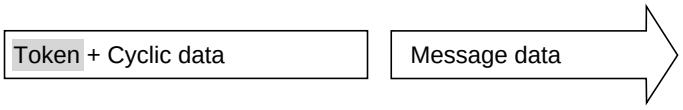
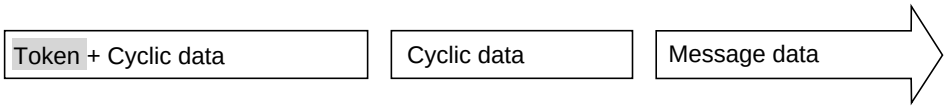


Figure App. 4-1 (1) Token Flow

(3) Token and data
There are the following 6 data patterns for sending the token.

<Table 4-1 (1) Token and Data>

No.	Item	Description
1	When no data is accompanied	Only token is sent.
		
2	When only cyclic data is sent	Token is added to the cyclic data to be sent.
		
3	When only cyclic data is sent, but divided into frame	Only the cyclic data is sent, with token attached to the last frame.
		
4	When only message data is sent	Token is sent after the message data is sent.
		
5	When cyclic data and message data are sent	After the message data is sent, the cyclic data is added a token and sent.
		
6	When cyclic data and message data are sent, but the cyclic data divided into frames	After the message data is sent, the cyclic data is sent with a token attached to the last frame.
		

(4) Frame interval (minimum permissible frame interval)
The time after the local node received a token from other node till it sends a frame is referred to as “frame distance”. And the minimum time that you must wait till individual frame snds a frame is referred to as “minimum permissible frame interval”. With FL-net, this minimum permissible frame distance is common throughout the network.
The maximum value of the minimum permissible frame intervals that are set for individual nodes participating in the network is recalculated and updated each time a node participates in or is disconnected from the network.

Appendix 4-2 Participation in/Disconnection from FL-net

(1) Participation in FL-net

At start-up, individual node monitors the line for the period of participation token detection time. When no token is received in this period, it is judged as the network being started, and the node newly participates in the network. When a token is received, it is judged as being in the condition of midway participation, and the node participates in the network in the middle.

1) New participation

When no token is received in the period of participation token detection time, the node prepares for sending trigger and sends trigger signal in (the remainder of node number divided by 8) × 4 ms. If trigger is received before it is sent, no trigger is sent. For the period of participation request frame receive waiting time (1200 ms) after receiving trigger, the system waits till all nodes send a participation request frame while checking for duplicated node number or address or updating the participation node management table. When participation request frame send waiting time (node No. × 4 ms) is elapsed after trigger has been received, participation request frame is sent. Here, if a node recognizes duplicated address in the participation request frame sent from other node, it sets the top address and size of common memory of both area 1 and area 2 to 0 (zero) and does not sent cyclic data. The node that recognized duplicated address sets address duplication flag and resets common memory data valid notification flag. When participation request frame receive waiting time is elapsed, a node of the smallest node number first sends a token according to the participation node management table. The node that recognized duplicated node number does not communicate data at all.

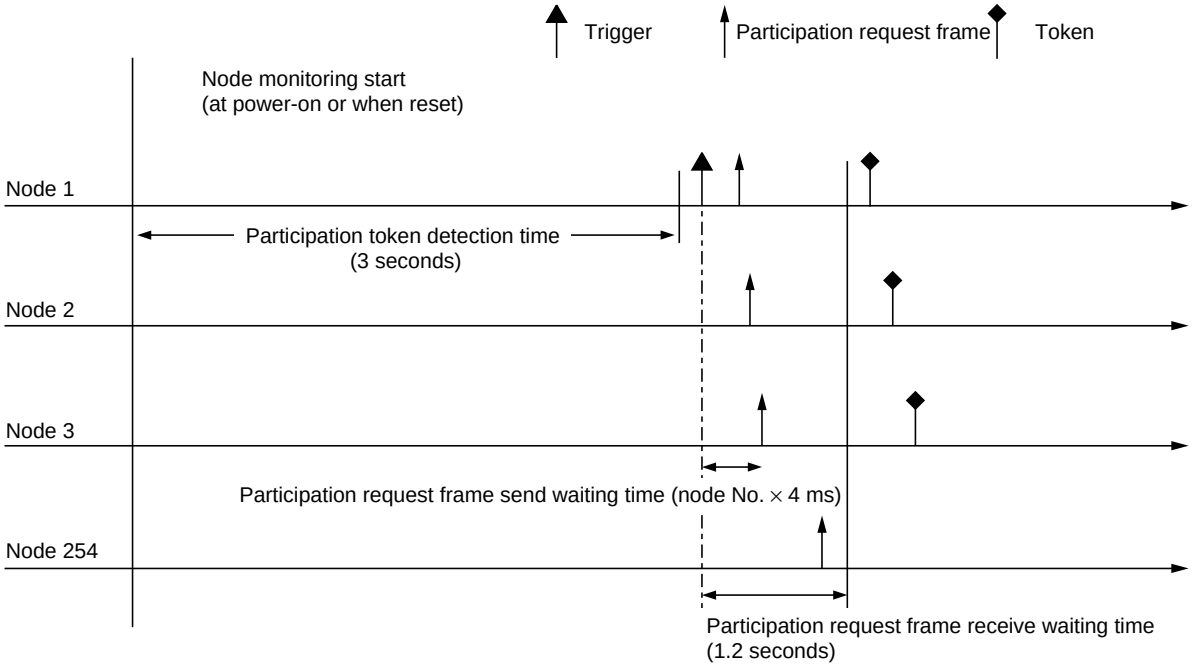


Figure App. 4-2 (1) Time Chart 1 for Start-up

2) Midway participation

When a node receives a token in the period of participation token detection time, it is recognized as the link being already established. And the node waits for participation request frame being sent till the token circulates the network 3 rounds. The node checks the frame, which is received in the meanwhile, for duplicated node number or address, and updates the participation node management table. If a duplicated address is detected, the node sets the top address and size of common memory of both area 1 and area 2 to 0 (zero) and resets common memory data valid notification flag. When there is no node number error, the node sends a participation request frame after participation request frame send waiting time is elapsed. Participation request frame is sent, whether the token is retained or not. The node that recognized a duplicated node number does not send any participation request frame nor participate in the network.

(Remarks)
Participation token detection time: The time for checking whether or not the network is active
Circulation rounds: The reference for circulation rounds is the point of time when the token destined for the smallest node number is received.
Participation request frame send waiting time: Participation request frame is sent after the time of local node number x 4 ms is elapsed so that it does not overlap on other node that newly participates in the network.

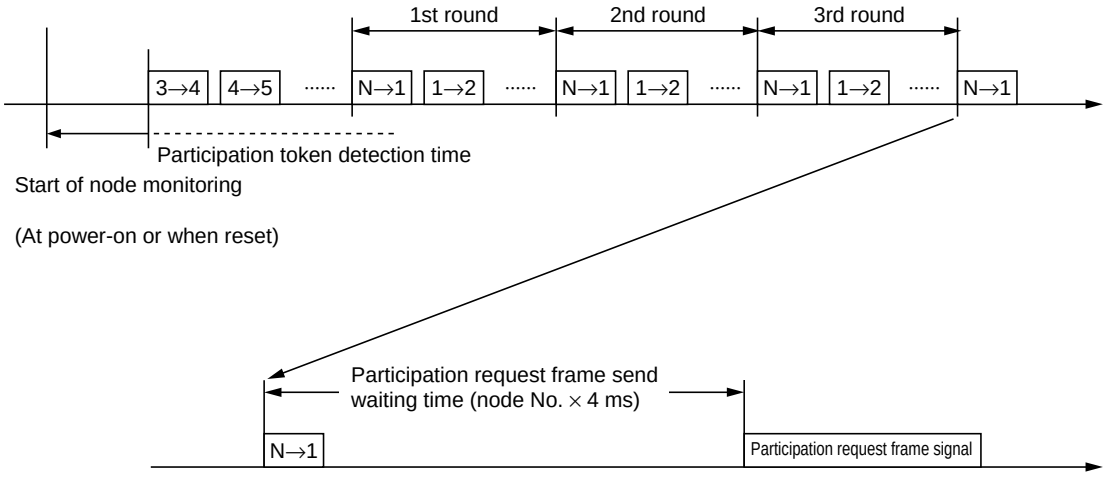


Figure 4-2 (2) Time Chart 2 for Start-up

(2) Disconnection from FL-net

Individual node checks node number each time it receives a token or a frame. And if no token frame is received from a certain node consecutively for 3 rounds, the node is regarded as disconnected (including the case where a token retain node does not sent the token even after token monitoring time is elapsed.).
As explained above, if a node is judged as disconnected from the network, the node data is deleted from the management table.

Appendix 4-3 Node Status Management

The status of node is managed with “Local Node Management Table”, “Participation Node Management Table” and “Network Management Table”.

<Table App. 4-3 (1) Outline of Node Status Management Table>

Name	Description
Local node management table	Manages the setting of the local node.
Participation node management table	Manages the data of the nodes that participate in the network.
Network management table	Manages the common data of the network.

Appendix 4-4 FL-net Local Node Management Table

(1) Basic function

This table manages the setting data of the local node.

1) Used to read participation request frame or network parameter.
2) Management data is set from upper layer of FL-net when the node is started up.
3) Node name as well as the top address and size of the transmission area of common memory can be set via the network.

(2) Management data

<Table App. 4-4 (1) Local Node Management Table>

Item	Length in bytes	Description
Node number	1 byte	1 to 254
Top address of the data in common memory area 1	2 bytes	Word address 0 to 1FF (hex)
Data size of common memory area 1	2 bytes	Size 0 to 200 (hex)
Top address of the data in common memory area 2	2 bytes	Word address 0 to 1FFF (hex)
Data size of common memory area 2	2 bytes	Size 0 to 2000 (hex)
Status of upper layer	2 bytes	RUN/STOP/ALARM/WARNING/NORMAL
Token monitoring time	1 byte	In units of 1 ms
Minimum permissible frame interval	1 byte	In units of 100 μs
Vendor name	10 bytes	Vendor name: “ FIJI ELEC”
Maker type	10 bytes	Maker type, name of device or module: “ NP1L-FL1”
Node name (equipment name)	10 bytes	Node name set by user
Protocol version	1 byte	80 (hex) fixed
Status of FA link	1 byte	Participating, disconnected, etc.
Status of local node	1 byte	Detection of duplicated node No., etc.

Appendix 4-5 FL-net Participation Node Management Table

(1) Basic function
Status of the nodes that participate in the network is managed by the participation management table that individual node retains.

1) When token frame is received at start-up, the participation node management table and the network management table are updated.
2) When a node receives a token frame, it updates the participation node management table.
3) When a node receives a participation request frame for new participation, it updates the participation node management table.
4) When “no token frame receive” or timeout is detected consecutive 3 times at a node, the node is deleted from the table.

(2) Management data
Participation node management table is created and managed by continuously monitoring the token retaining condition of individual node.

<Table App. 4-5 (1) Participation Node Management Table>

Item	Length in bytes	Description
Node number	1 byte	1 to 254
Top address of the data in common memory area 1	2 bytes	Word address 0 to 1FF (hex)
Data size of common memory area 1	2 bytes	Size 0 to 200 (hex)
Top address of the data in common memory area 2	2 bytes	Word address 0 to 1FFF (hex)
Data size of common memory area 2	2 bytes	Size 0 to 2000 (hex)
Refresh cycle time	2 bytes	In units of 1 ms
Token monitoring time	1 byte	In units of 1 ms
Minimum permissible frame interval	1 byte	In units of 100 μs
Status of link	1 byte	Participation, disconnection, etc.

Appendix 4-6 FL-net Status Management

(1) Basic function
Manages parameters that are related to the status of the network.

(2) Management data for sending

<Table 4-6 (1) Network Management Table>

Item	Length in bytes	Description
Token retain node No.	1 byte	
Minimum permissible frame interval	1 byte	In units of 100 μs
Allowable refresh cycle time	2 bytes	In units of 1 ms
Measured refresh cycle time (current value)	2 bytes	In units of 1 ms
Measured refresh cycle time (maximum value)	2 bytes	In units of 1 ms
Measured refresh cycle time (minimum value)	2 bytes	In units of 1 ms

Appendix 4-7 FL-net Message Serial Number Management

(1) Basic function
Manages the serial number for transmission and the version of the serial number.

(2) Management data for sending

<Table App. 4-7 (1) Message Serial Number Management Data for Sending>

Item	Length in bytes	Description
Version of serial number	4 bytes	Version of the serial number for message transmission
Serial number (1:N transmission)	4 bytes	1 to FFFFFFFF (hex)
Serial number (1:1 transmission)	4 bytes*256	1 to FFFFFFFF (hex)

(3) Management data for receiving

<Table 4-7 (2) Message Serial Number Management Data for Receiving>

Item	Length in bytes	Description
Version of serial number	4 bytes	1 to FFFFFFFF (hex)
Serial number (1:1 transmission)	4 bytes	1 to FFFFFFFF (hex)
Serial number (1:N transmission)	4 bytes	1 to FFFFFFFF (hex)

Appendix 5 Network Component Parts

Page

Appendix 5 Network Component Parts

Appendix 5-1 Ethernet Component Parts List

Ethernet component parts are as follows. For more information of individual component part, refer to Appendices 5-2 and 5-3. Be sure to use network equipment that conforms to IEEE 802.3.

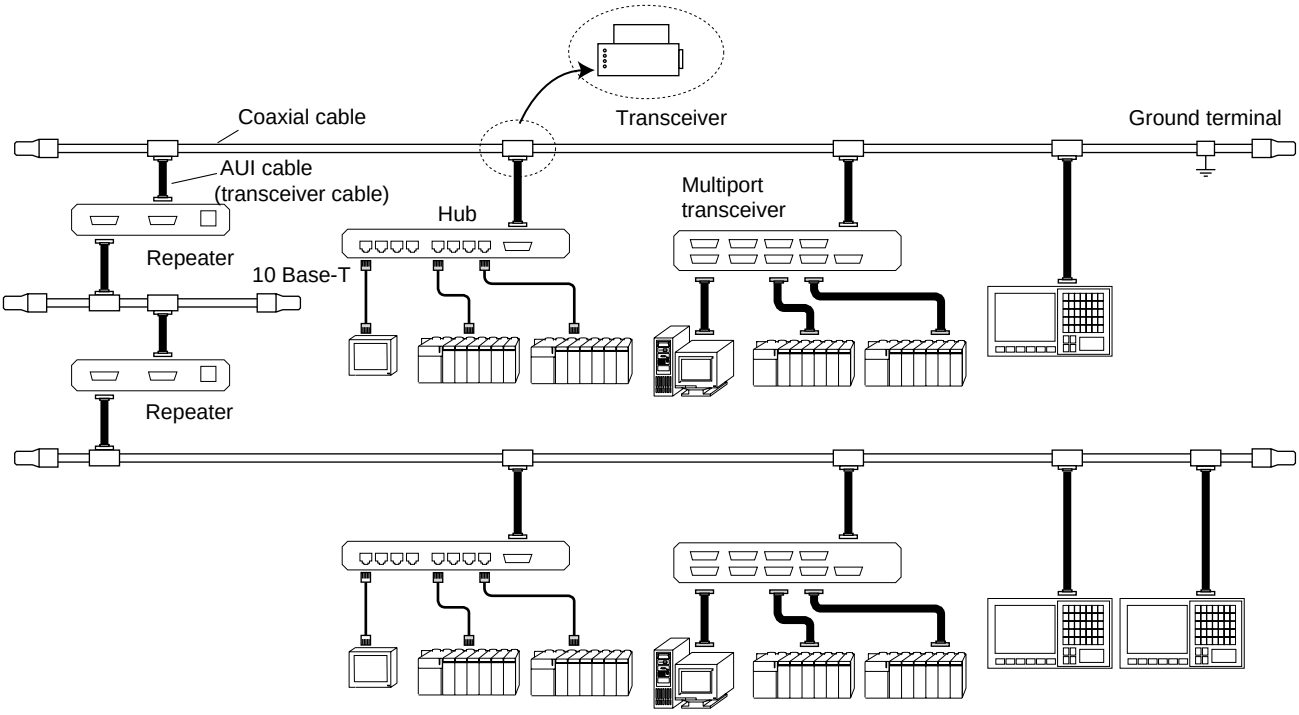


Figure App. 5-1 (1) Ethernet Component Parts

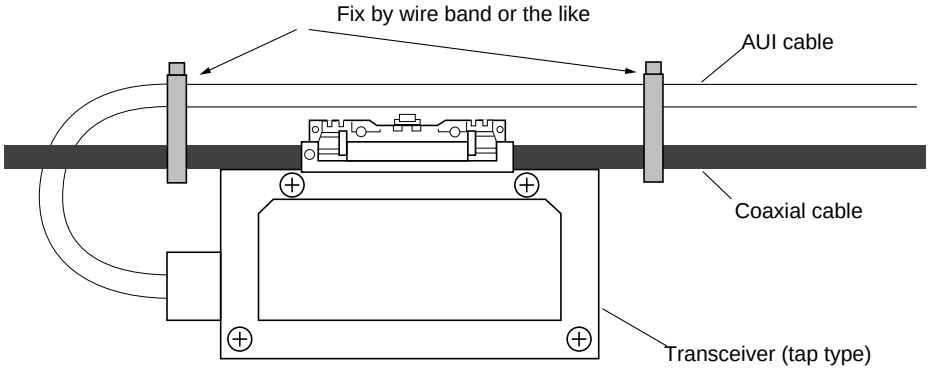
* For more information about the component parts, refer to the following pages.

(1) Transceiver

The transceiver converts the signal that flows through the coaxial cable (yellow cable) into the signal that is required by nodes, or vice versa.

When transceivers are mounted on the coaxial cable, they must be distant from each other by a multiple of 2.5 m. Connect them at the points that are marked on the coaxial cable.

Before connecting a transceiver to the coaxial cable, be sure to turn off the power supplies for the node and the transceiver. Otherwise, short-circuit may occur.



Provide a sufficient margin, taking the bending radius of AUI cable (minimum bending radius: 80 mm) into consideration.

Figure App. 5-2 (1) Sketch Drawing of Transceiver

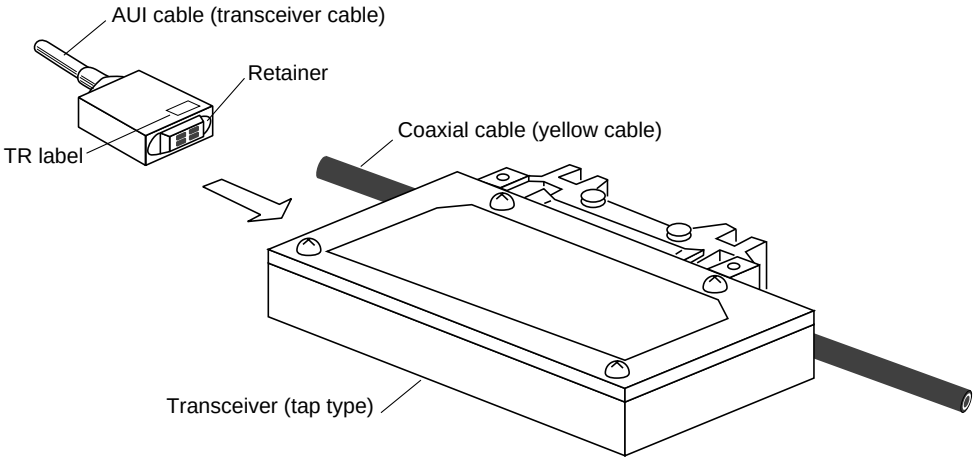


Figure App. 5-2 (2) Transceiver and AUI Cable

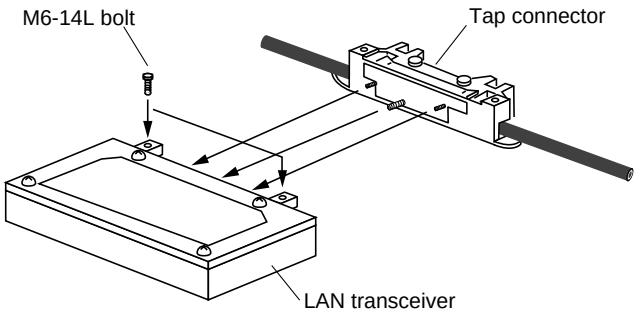


Figure 5-2 (3) Mounting Tap onto Transceiver Main Unit

1) Transceiver (tap type)

For connecting the tap type transceiver, make a hole on the coaxial cable and insert a needle till it come in contact with the center conductor, and mount an alligator clip such that the toothed clip breaks through the insulating jacket to come in contact with the shielding conductor. This operation requires a special tool.

Some types of AUI cable require 12 V DC power supply. For more information, refer to the hardware manual for the node.

The “SQE” switch of the transceiver is set as follows:

• When connecting to a node: ON

• When connecting to a repeater: OFF

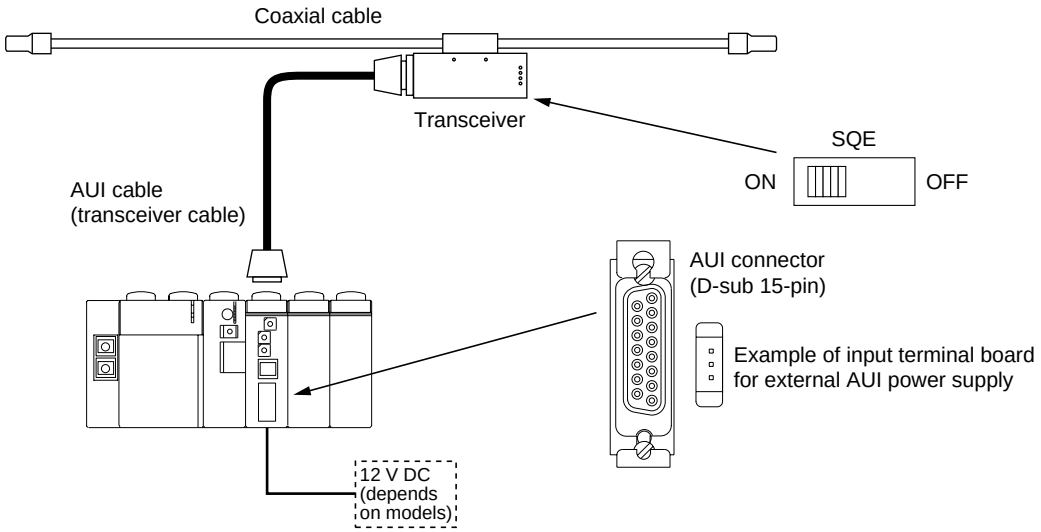


Figure App. 5-2 (4) Transceiver for Ethernet (Tap Type)

2) Transceiver (connector type)

For connecting the connector type transceiver, mount the connector on the coaxial cable, and then connect the transceiver to the connector. No special tool is necessary for connection, and the transceiver can easily be connected or disconnected.

Power is supplied to the transceiver from a node via the AUI cable.

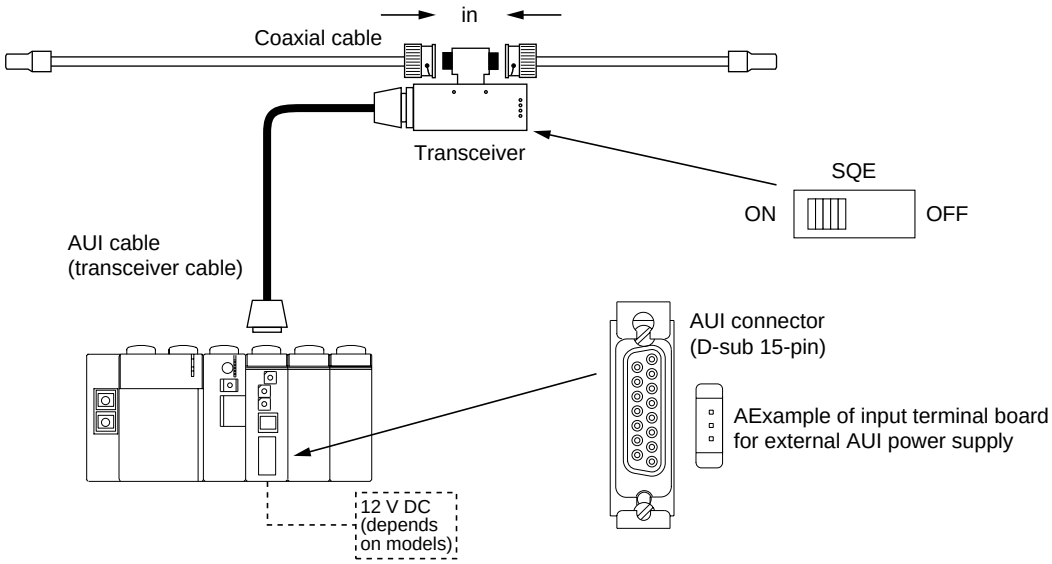


Figure App. 5-2 (5) Transceiver for Ethernet (Connector Type)

3) Multiport transceiver

One unit of tap type or connector type transceiver can connect only one terminal. On the other hand, one unit of multiport transceiver can connect multiple terminals. In general, 4-port and 8-port transceivers are used.

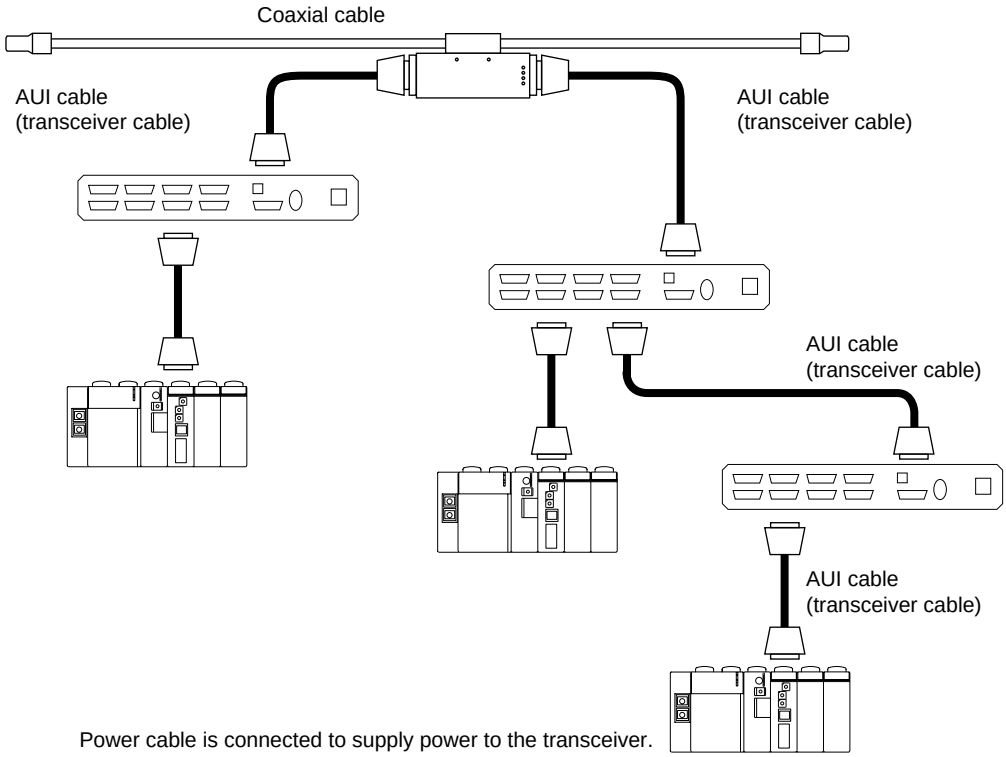


Figure App. 5-2 (6) Multiport Transceiver for Ethernet

4) Repeater

Repeater is the equipment that relays transmission signal. It is used to interconnect different types of media segments, to extend the transmission distance of media segment, to increase the number of connected terminals, or to convert signal between cable media. Repeater shapes the waveform of the signal received from one of interconnected segments, amplifies the signal to predetermined level, and sends (repeats) the signal to all the segments that are connected to it. The maximum length of AUI cable that can be connected to a repeater is 50 m. But, from the viewpoint of noise immunity, it is recommended to limit the cable length within 2 m. Be also careful of SQE switch setting.

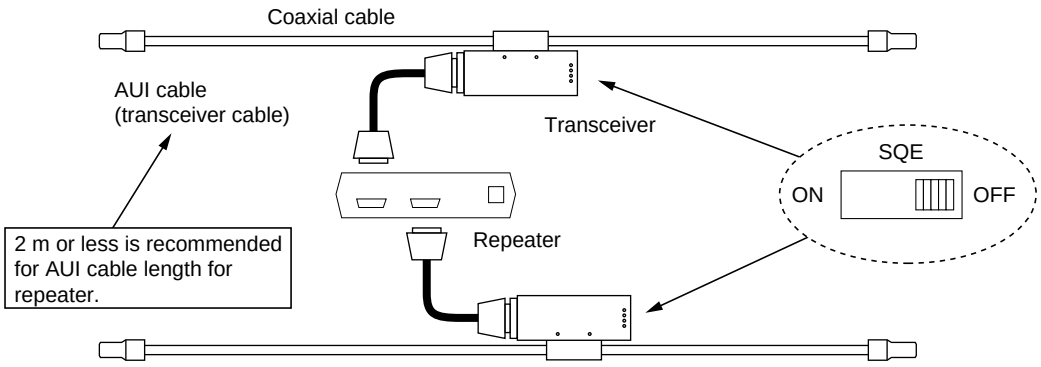


Figure App. 5-2 (7) Repeater for Ethernet

(2) Coaxial cable

Coaxial cable consists of center conductor and the external conductor that functions as shielding. The coaxial cable for Ethernet connection has the impedance of 50 ohm, and RG58A/U for 10BASE2 and the coaxial cable for 10BASE5 (generally called “yellow cable”) are prepared.
The maximum length of 10BASE2 cable is 185 m; that of 10BASE5 cable is 500 m.
When using the coaxial cable, be sure to ground it to prevent noise (one-point grounding or type D grounding).

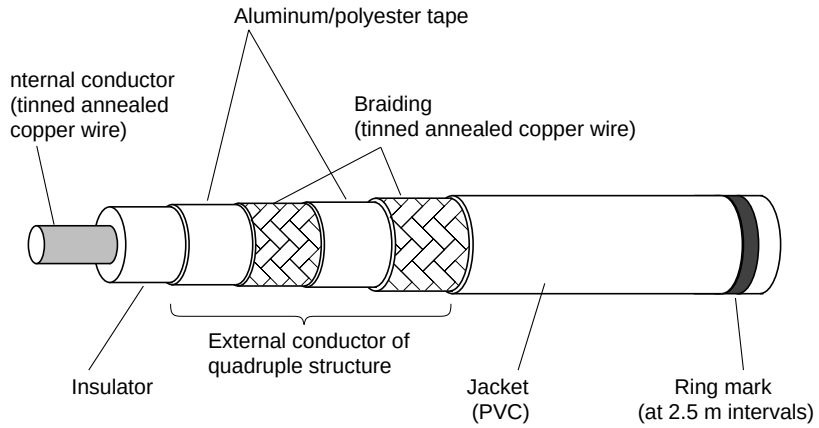


Figure App. 5-2 (8) Coaxial Cable for Ethernet

(3) Coaxial cable connector

Coaxial cable connector is generally called “type N connector”. It is used to connect between coaxial cable and terminal equipment or between coaxial cable and connector type transceiver.

Figure App. 5-2 (9) Coaxial Cable Connector for Ethernet

(4) Repeating connector
This type of connector is used to extend the coaxial cable length. While repeater is used to extend the segment, repeating connector is used to extend the cable on a same segment.
Be careful that if multiple repeating connectors are used, the resistance of the coaxial cable may change. (It is recommended not to use multiple repeating connectors.)

Figure App. 5-2 (10) Repeating Connector for Ethernet

(5) Terminator (terminating resistance)
For bus type wiring, in order to prevent the reflection of signal, terminator is mounted on both ends of the cable. If no terminator is mounted, signal is reflected (collides) to cause the network to be down. There are two types of terminator: “type J” that is used for tap type transceiver and “type P” that is used for connector type transceiver. Terminator shall be connected at the point marked (jacket mark) on the coaxial cable.

Figure App. 5-2 (11) Terminator for Ethernet

(6) Coaxial cable ground terminal
This device is used to prevent the occurrence of communication data error due to noise that rides on the coaxial cable. Be sure to mount one ground terminal on each coaxial cable. Grounding shall be type D.

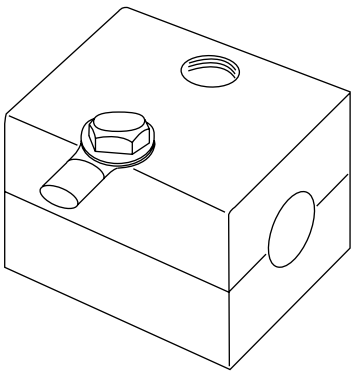


Figure App. 5-2 (12) Coaxial Cable Ground Terminal for Ethernet

Appendix 5-2 10BASE5 Related Parts

(7) AUI cable

This cable is used to connect between transceiver and node. AUI cable is mounted D-sub 15-pin AUI connector on both ends. The maximum available length of AUI cable is 50 m, but in the field of FA, it is recommended to use 15 m or shorter cable from the viewpoint of noise. When you use the AUI cable that is equipped with a ground terminal, be sure to connect the ground terminal to an authorized grounding line.

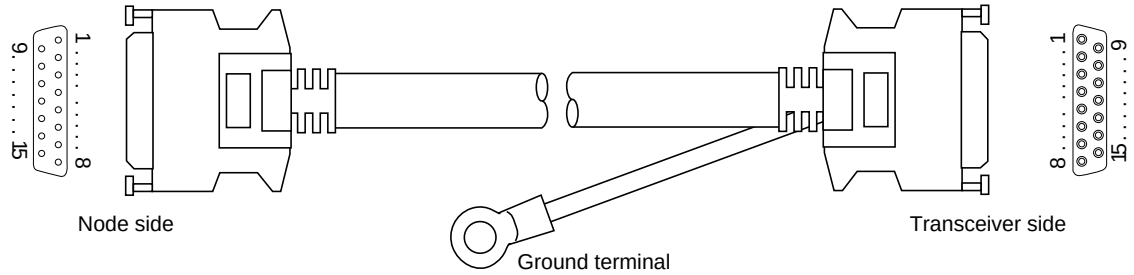


Figure App. 5-2 (13) AUI Cable for Ethernet

(8) 10BASE5-10BASE-T converter

This converter is used to connect the cable equipped with 10BASE5 interface to 10BASE-T.
NP1L-FL1 has both 10BASE5 connector and 10BASE-T connector and therefore does not require this converter.

(9) Coaxial-optical media converter/repeater

Coaxial-optical media converter/repeater converts electric signal of coaxial cable (10BASE5, 10BASE2) into optical signal. FOIRL (Fiber Optic Inter Repeater Link) for connecting between repeaters, 10BASE-FL for connecting terminals, and other models are available. Coaxial-optical media converter/repeater is used to prevent noise or to extend the cable length.

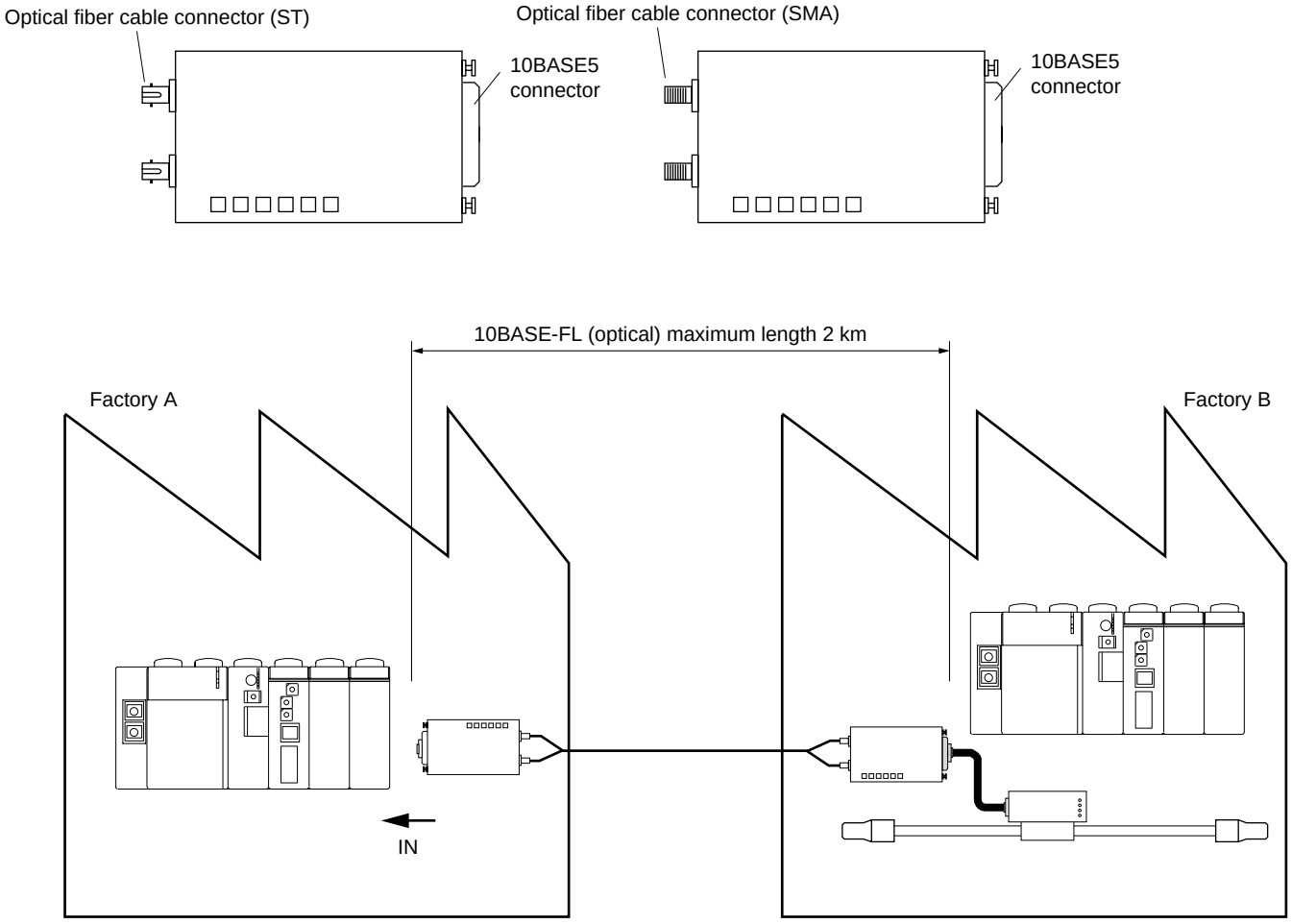


Figure App. 5-2 (14) Coaxial-Optical Media Converter/Repeater for Ethernet

Appendix 5-3 10BASE-T Related Parts

(1) Hub

Hub is the line concentrator having the repeater function and is used to accommodate twisted pair cables that are used for 10BASE-T. Several types of hub are available: the one with 10BASE2 interface, the one with the interface for cascading (multi-stage connection), etc. Maximum 4 hubs can be cascaded. Stackable hub is also available, with which several hubs can be made into a single hub.

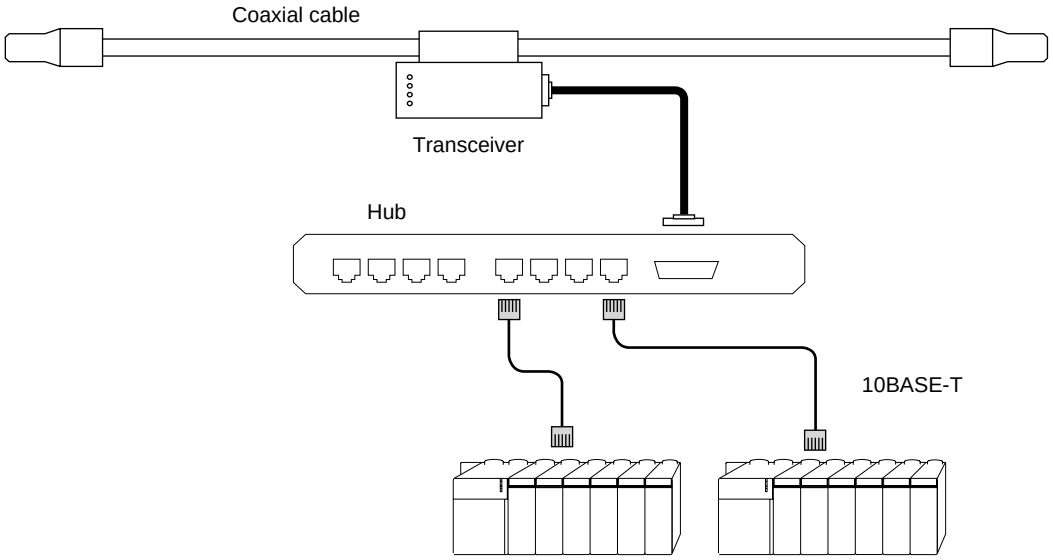


Figure App. 5-3 (1) Hub for Ethernet

(2) 10BASE-T cable

This cable is called “twisted pair cable”, in which a pair of copper wires are made into a stranded wire and multiple stranded wires are gathered and covered with external protector. There are the following types of 10BASE-T cable:

• Unshielded STP cable and shielded UTP cable

• “Cross cable” that can directly connect between nodes and “straight cable” that connects via a hub.

The maximum transmission distance and maximum length of 10BASE-T cable are 10 Mbps and 100 m, respectively. For the cable end connectors, 8-pole modular connector per ISO 8877 is used.

For FL-net, be sure to use the 10BASE-T cable of category 5 or equivalent.

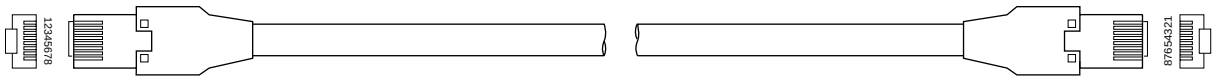


Figure App. 5-3 (2) 10BASE-T Cable for Ethernet

(3) 10BASE-T-optical media converter/repeater

10BASE-T-optical media converter/repeater converts electrical signal of 10BASE-T cable into optical signal. FOIRL (Fiber Optic Inter Repeater Link) for connecting between repeaters, 10BASE-FL for connecting terminals, and other models are available. 10BASE-T-optical media converter/repeater is used to prevent noise or to extend the cable length.

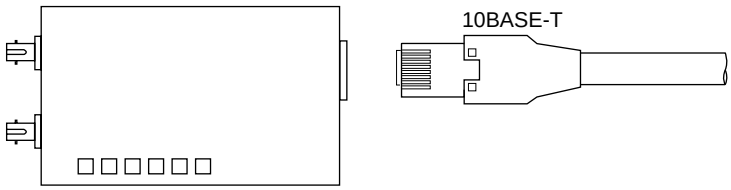


Figure App. 5-3 (3) 10BASE-T-Optical Media Converter/Repeater

Appendix 6 How to Construct an FL-net

Page

Appendix 6 How to Construct an FL-net Network

Appendix 6-1 10BASE5 Coaxial Cable Laying

(1) Cabling

You can select various methods for cabling according to the condition of installation place. General methods are as follows:

- Exposed wiring on wall surface
- Wiring in free access or floor pit
- Wiring in cable rack
- Wiring in the ceiling

(2) Precautions for cabling

- Coaxial cable shall be wired or laid basically indoors.
- When wiring on wall surface, because stress acts on the cable due to its dead weight, the cable shall be fixed at approximately 1 m intervals, except in special cases. In doing so, be careful not to deform the cable.
- When cable is fixed in a cable rack or the ceiling, the fixing interval shall be such that the cable is not deformed.
- When cable is laid under the floor or along floor corners, be sure to protect the cable so that it is not deformed or damaged by people's riding on it or heavy thing's being put on it.
- For safety, ground the external conductor of cable.
  Grounding shall be type D or higher grade and be made at one point of a segment.
- To prevent exposed metal part other than grounding point of cable from coming in contact with earth or other metal part, be sure to insulate such part by covering type N connector, type L connector, straight sleeve, and terminators with the attached boots, or winding insulating tape around them.
- Coaxial cables shall be kept 60 cm or more away from power cables (100 V AC or high). And avoid laying them in parallel.

(3) Precautions for laying coaxial cable

<Table App. 6-1 (1) Precautions for Laying Coaxial Cable>

Item	Specification
Bending radius for laying or fixing	Min. 100 mm
Tension	Max. 245 N
Cable mass	188 kg/km

(4) Coaxial cable mounting

<Operating procedure>

1) Remove the coating of coaxial cable by 10 to 11 mm from the end.

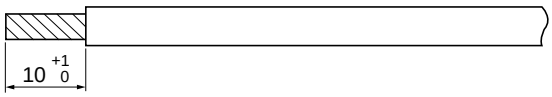


Figure App. 6-1 (1) Removal of Coaxial Cable Coating

2) Remove the aluminum tape that is wound in two layers in the coaxial cable.

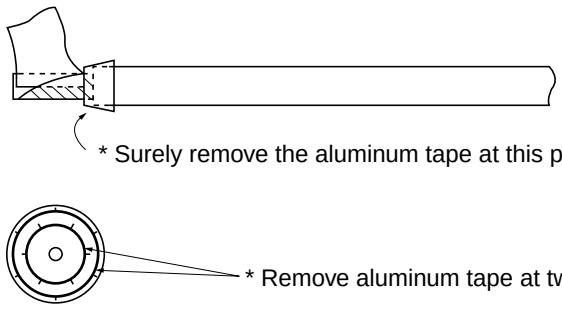


Figure App. 6-1 (2) Removal of Aluminum Tape

3) Remove the insulator of the coaxial cable by 6.5 to 7.0 mm from the end.

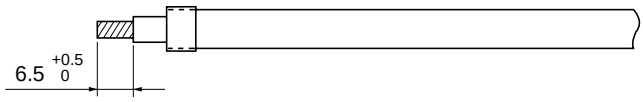


Figure App. 6-1 (3) Removal of Insulator from Coaxial Cable

4) Mount the coaxial cable connector, and treat the braided shielding wire according to the figure below.

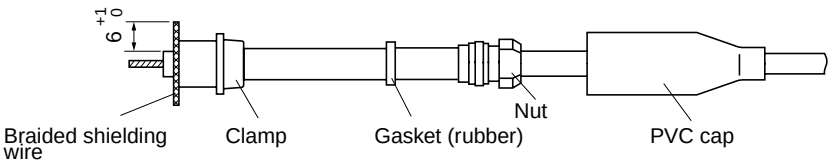


Figure App. 6-1 (4) Mounting of Coaxial Cable Connector and Treatment of Shielding

5) Solder the pin contact.

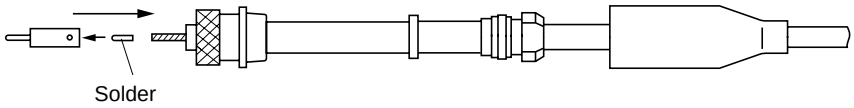


Figure App. 6-1 (5) Soldering Pin Contact on Coaxial Cable

6) Assemble the coaxial cable connector.

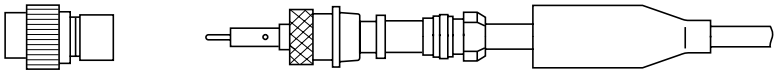


Figure App. 6-1 (6) Assembly of Coaxial Cable Connector

(5) Installation of transceiver (tap type)

- Mounting on wall surface
- Mounting under the floor (in free access or pit)
- Mounting in the ceiling or cable rack
- Mounting beside a station

When installing the transceiver, be careful of the following matters:

- Transceiver can be installed with legs as stationary type or fixed with wood screws or the like.
- When transceiver is installed in the ceiling or under the floor, select a proper place where maintenance and inspection are easy.
- Transceivers shall be mounted at 2.5 m intervals. (Mount them at marker points that are indicated at 2.5 m intervals on the cable.)

Appendix 6-1 10BASE5 Coaxial Cable Laying

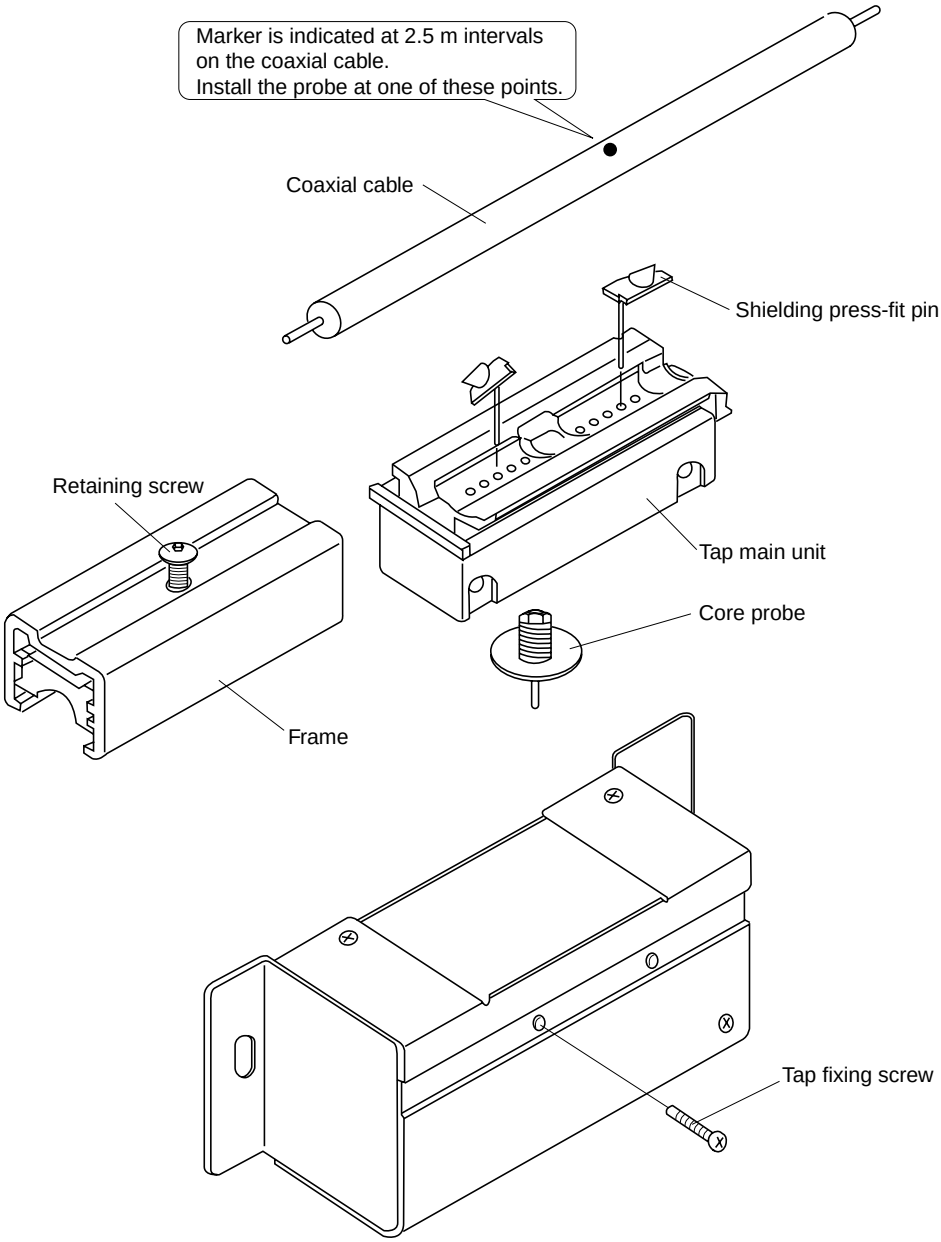


Figure App. 6-1 (7) Name of Each Part of the Transceiver

<Operating procedure>

1) Insert shielding press-fit pin in tap main unit.

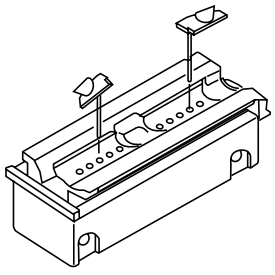


Figure App. 6-1 (8) Insertion of Transceiver Shielding Press-fit Pin in Tap Main Unit

2) Loosen retainer screw to the extent it does not come out.

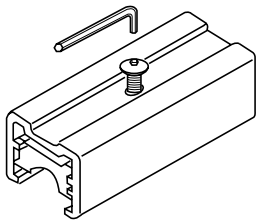


Figure App. 6-1 (9) Loosening Tap Frame Screw

3) Align tap main unit with the 2.5 m marker on the cable. Then slide the frame to engage it with the mating part, and tighten the retainer screw to fix it. (Tighten the screw such that the gap between the top of tap main unit and the retainer becomes approximately 1 mm.)

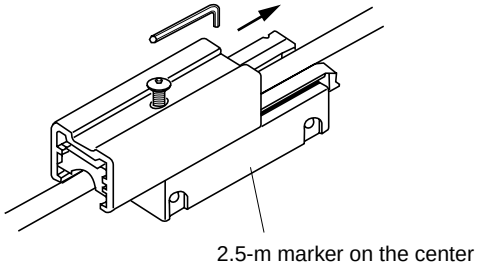
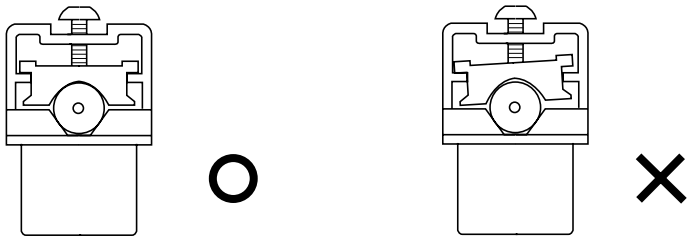


Figure App. 6-1 (10) Mounting Transceiver Tap Frame on Tap Main Unit



Note: Carefully mount the frame so that the cable comes at the center of the shielding press-fit pin. If the retainer tilts when it is moderately tightened, loosen the screw and set again so that the screw comes on the center of the retainer before fully tightening.

Figure App. 6-1 (11) Transceiver Tap Frame and Insertion of Coaxial Cable

4) With a drill, make a hole for core probe till white insulator comes out. (Be careful that aluminum tape may remain if the retaining screw is too loose. Completely remove shield chips out of the hole.)

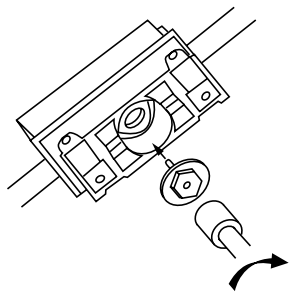


Figure App. 6-1 (12) Drilling a Hole for Core Probe on the Coaxial Cable

5) With the dedicated spanner, tighten the core probe.

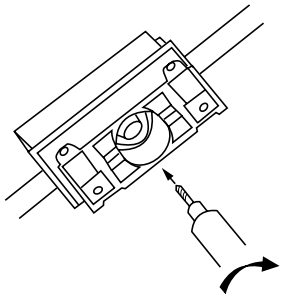


Figure App. 6-1 (13) Mounting the Core Probe for Coaxial Cable

Note: This completes the mounting operation of tap connector. Whether the connector is connected properly is tested as follows:
- Shielding press-fit pins are short-circuited.
- When terminator is mounted at both ends of the coaxial cable, the resistance between core probe and shielding press-fit pin is 25 Ω.
  Do not perform these tests when the system is running as doing so may cause malfunction.

6) Mount transceiver main unit on the tap connector. For this, shielding press-fit pin and core probe must be aligned such that they are at right angle to each other.

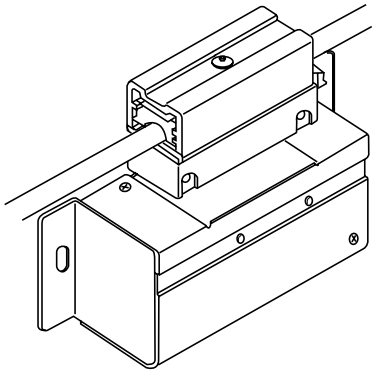


Figure App. 6-1 (14) Mounting Transceiver Main Unit on Tap Main Unit.

7) If shielding press-fit pin and core probe seem to be aslant, pull them out after mounting. If they are mounted improperly, they become aslant to such extent that you can recognize by naked eyes. Re-align them. Insert tap fixing screw in the hole provided on the casing top and tighten it.

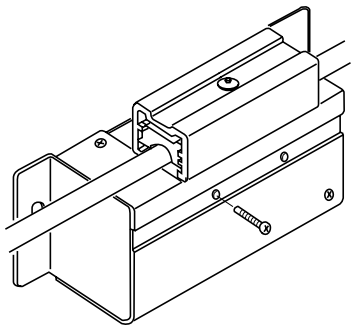


Figure App. 6-1 (15) SQE Switch Setting

In general, the SQE switch is set as follows:

<Table App. 6-1 (2) SQE Switch Setting>

Item	Setting
When connecting to a node	ON
When connecting to a repeater	OFF

(6) Insulation of connector and repeater

Repeating connector and type L connector are insulated as shown in the figure below.

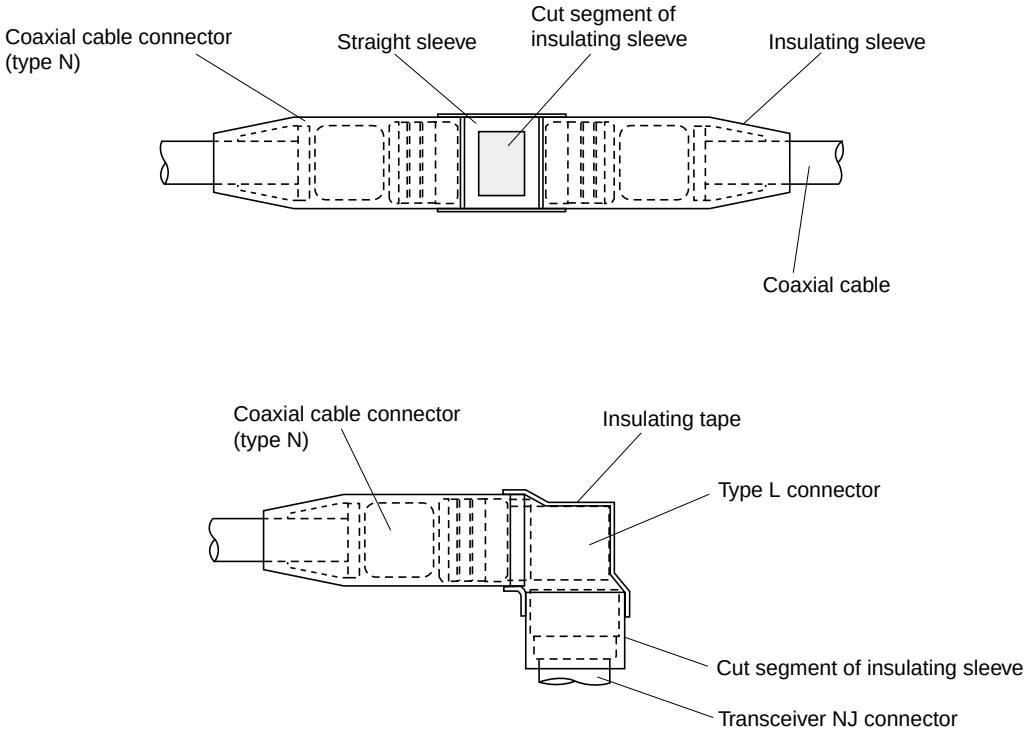


Figure App. 6-1 (16) Insulation of Repeating Connector and Type L Connector

Terminators T-NP (male) and T-NJ (female) are insulated in the following manner:

- T-NP (male) is covered by insulating sleeve I-NPC (black).
- T-NJ (female) is covered by insulating sleeve I-NJP (black) and fixed by taping.

(7) Mounting the AUI cable

Examples of transceiver and AUI cable installation are shown below:

- Example of mounting on wall surface
- Example of mounting in the ceiling
- Example of mounting under the floor

Appendix 6-1 10BASE5 Coaxial Cable Laying

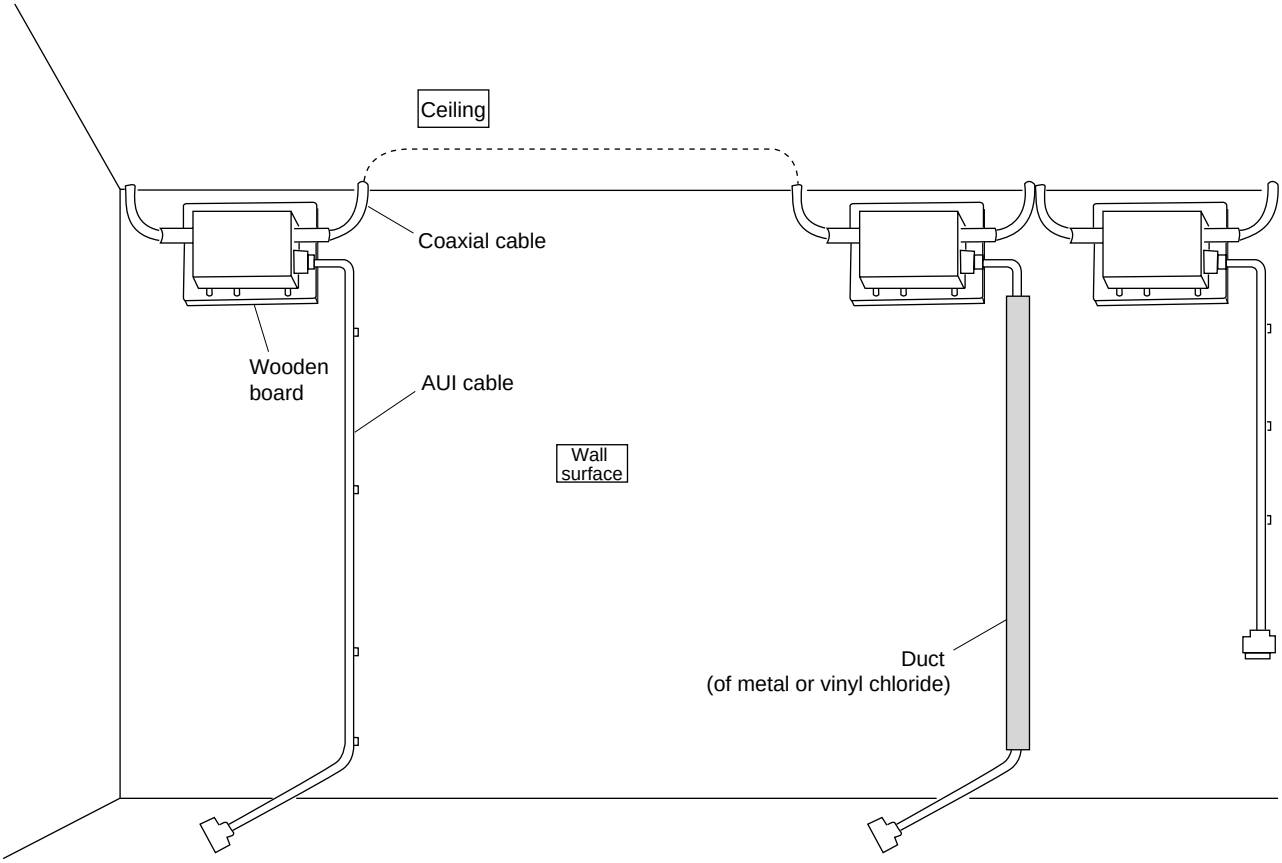


Figure App. 6-1 (17) Example of Mounting Transceiver and AUI Cable on Wall Surface (1)

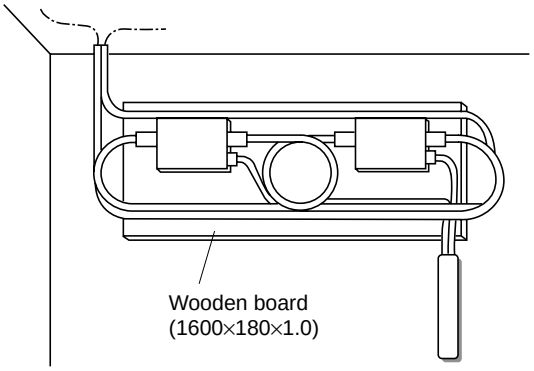


Figure App. 6-1 (18) Example of Mounting Transceiver and AUI Cable on Wall Surface (2)

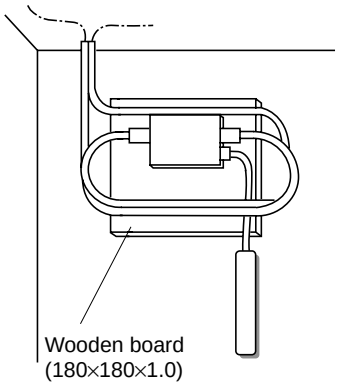


Figure App. 6-1 (19) Example of Mounting Transceiver and AUI Cable on Wall Surface (3)

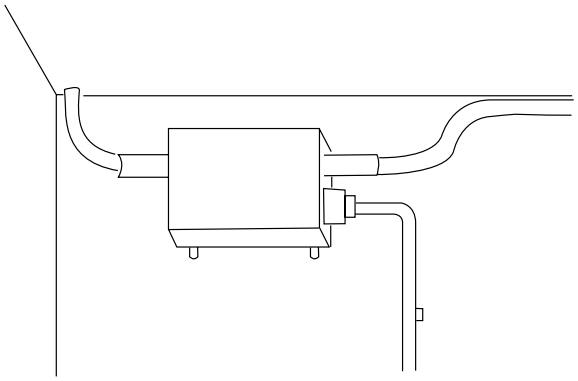


Figure App. 6-1 (20) Example of Mounting Transceiver and AUI Cable on Wall Surface (4)

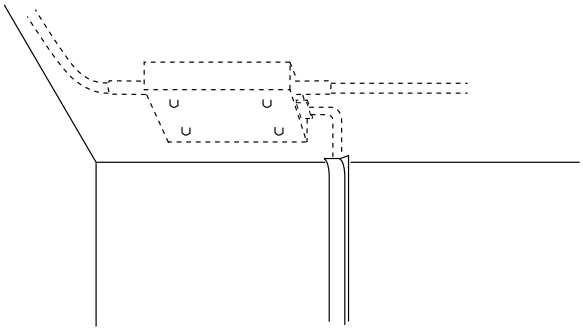


Figure App. 6-1 (21) Example of MOunting Transceiver and AUI Cable in the Ceiling

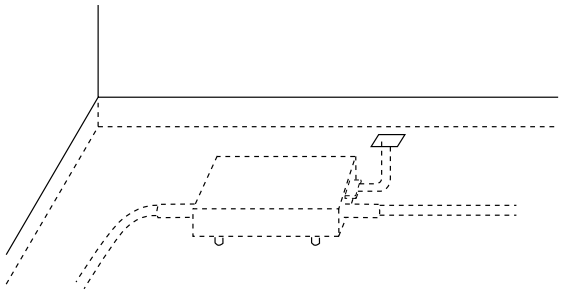


Figure App. 6-1 (22) Example of Mounting Transceiver and AUI Cable Under the Floor

(8) Mounting ground terminal on coaxial cable

The coaxial cable needs to be grounded at one point (type D or higher grounding) using the ground terminal (G-TM). The ground terminal can be mounted at arbitrary point. There is no specification about the mounting point.

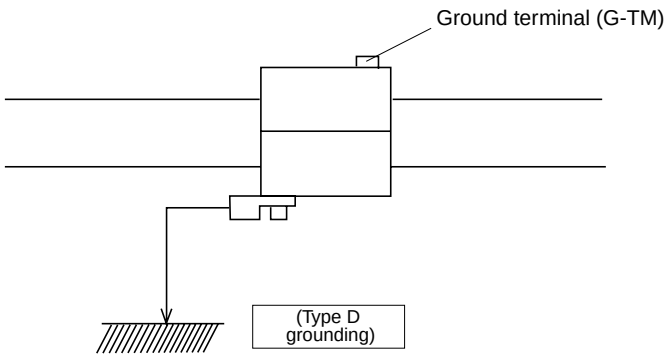


Figure App. 6-1 (23) Mounting Ground Terminal on Coaxial Cable

Appendix 6-2 10BASE-T (UTP)

(1) How to make up 10BASE-T (UTP) cable
<Operating procedure>

1) Removing the coating of UTP cable
With the coating removed by about 10 mm, correct the twisted internal conductors and put them in order. In general, normal (straight) type is used.

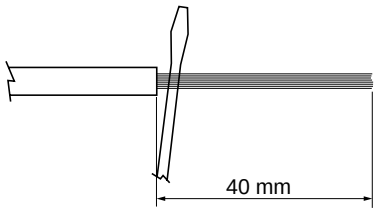


Figure App. 6-2 (1) Removal of UTP Cable Coating

<Table 6-2 (1) Conductor Arrangement>

	T568B	T568A
	Normal	Cross
8	Brown	Brown
7	White/brown	White/brown
6	Orange	Orange
5	White/blue	White/blue
4	Blue	Blue
3	White/orange	White/orange
2	Green	Green
1	White/green	White/green

2) Cutting 10BASE-T (UTP) cable
With a nipper or the like, cut the conductor at approx. 14 mm from the cover.

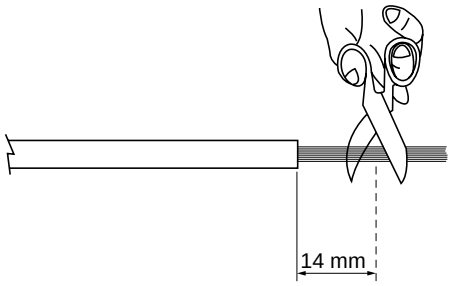


Figure App. 6-2 (2) Cutting UTP Cable Conductor

3) Inserting UTP cable in the connector
With the conductors kept in order, insert the cable in the connector. Check visually from front, above and down to see that the cable is surely inserted to the end.

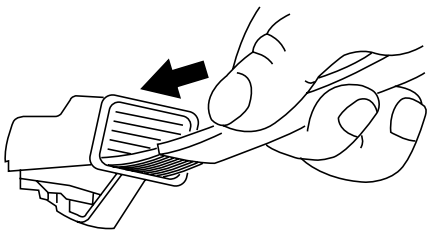


Figure App. 6-2 (3) Insertion of UTP Cable in Connector

4) Assembly

After checking the inserted condition, press fit the cable with the dedicated tool. After the end of press fit, be sure to check connection by a tester.

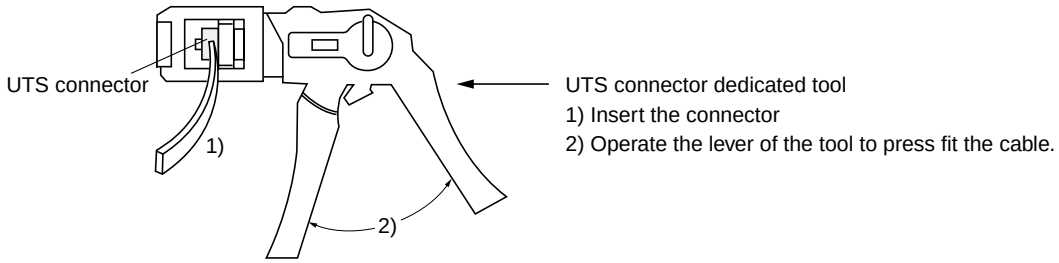


Figure App. 6-2 (4) Assembly of UTP Cable

Appendix 7 FL-net Construction Work Check Sheet

Appendix 7 FL-net Construction Work Check Sheet

Appendix 7-1 FL-net Construction Work Check Sheet

<Table App. 7-1 (1) FL-net Construction Work Check Sheet>

FL-net Construction Work Check Sheet

Communication line name　　Station No.

	Check item	Inspected on / Inspected by (Company / Inspector)
Cable	Are all connectors locked surely?	
	Isn't cable bending radius smaller than specified value?	
	Are connectors protected by jacket, etc.?	
	Is line ID No. (line No.) tab mounted on the cable? Is line No. correct?	
	Isn't communication cable put under heavy thing?	
	Isn't communication cable bundled with power cable, etc.?	
	Is the length of AUI cable for repeater within 2 m? Is that for transceiver within 50 m?	
	Is the length of coaxial cable (10BASE5) within 500 m?	
	Is coaxial cable properly grounded with ground terminal?	
	Is the shielding of coaxial cable isolated from transceiver?	
	Is terminating resistance correctly mounted on coaxial cable?	
	Is the number of stages of hub or repeater within specified value?	
	Is straight type twisted pair cable used?	
	Is the twisted pair cable of category 5, and the length within 100 m?	
Unit	Is the GND terminal of equipment properly grounded?	
	Is individual module surely mounted on the base?	
	Is the baseboard surely fixed in the control panel?	
	Is AUI cable surely locked?	
	Isn't excess force acting on the mounting part of AUI cable due to door, etc.?	
Hub, etc.	Is RH45 connector properly mounted?	
	Is AUI cable connector locked?	
	Is line No. tab mounted on the cable?	
	Are transceivers installed correctly at points of the markers indicated on the cable?	
	Is transceiver SQE switch correctly set per equipment specification?	
	Is hub fixed surely?	
	Is the HUB/MAU changeover switch on the hub correctly set?	
	Is supply voltage to the hub at specified level?	

- When modified, changed, or inspected, be sure to check and fill the result in this table.
- In the result column, fill in ○ when acceptable; X when unacceptable. In the parentheses in the setting switch column, fill in the setting value of the rotary switch number and ON/OFF of the DIP switch.

Appendix 8 Profile of FL-net

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Appendix 8 Profile of FL-net

Appendix 8-1 Classification of Equipment Communication Information

In this manual, the information that is communicated among the equipments connected to the network is classified into 3 categories as shown in the figure below.

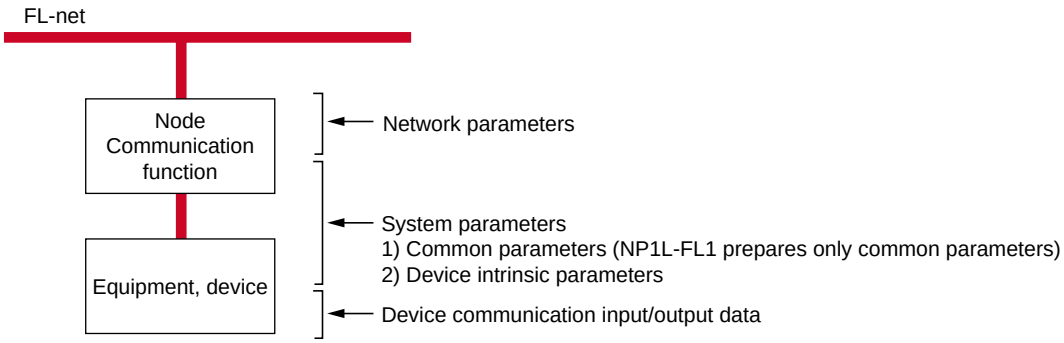

Figure 8-1 (1) Classification of Equipment Communication Information

1) Network parameters are the setting data necessary for transmission.
2) System parameters are static parameters related to the management data that is used to distinguish what equipment (device) is connected to the network. System parameters are divided into two groups: common parameters and device intrinsic parameters.
   NP1L-FL1 prepares only common parameters.
3) Device intrinsic communication I/O data can be accessed from other device on the network when application requires. This data includes dynamic information the content of which changes with the operation of application or the status of equipment.
4) Data types available for system parameters
   Of the UNIVERSAL TAG, the following data types can be used for system parameters:

<Table App. 8-1 (1) Available Data Types for System Parameters>

○: Usable X: Unusable

Tag No. (hex)	Type	Usability	Remarks
00	(Reserved)	X	
01	BOOLEAN	○	
02	INTEGER	○	
03	BIT STRING	○	
04	OCTET STRING	○	
05	NULL	○	
06	OBJECT IDENTIFIER	X	
07	ObjectDescriptor	X	
08	EXTERNAL	X	
09	REAL	X	
0A	ENUMERATED	X	
0B to 0F	(Reserved)	X	
10	SEQUENCE and SEQUENCE OF	○	See note.
11	SET and SET OF	X	
12	NumericString	X	
13	PritableString	○	
14	TeletexString	X	
15	VideotexString	X	
16	IA5String	X	

Appendix 8-1 Classification of Equipment Communication Information

○: Usable X: Unusable

Tag No. (hex)	Type	Usability	Remarks
17	UTC Time	X	
18	GeneralizedTime	X	
19	GraphicString	X	
1A	VisibleString	X	
1B	GeneralString	X	
1C	CharacterString	X	
1D to 1E	(Reserved)	X	

Note: For structure type, only SEQUENCE and SEQUENCE OF can be used.

5) Device communication I/O data
The vendors that install FL-net protocol in their equipment must make public the part peculiar to individual vendor in a document of common format, for the convenience of users.
The object is the following information:
a) Information of the access to data other than system parameters
This includes the information related to word/byte block read/write services for message transmission.
b) Status/mode related information
What statuses exist? How do they look? Are they controllable? Including the information related to stop/run command services for message transmission.
c) Download/upload related information
Does the object program or data of upload or download exist? When exists, the procedure
d) Message service
Supported message services shall be described.
e) Information related to transparent services of FA link protocol
When transparent services are implemented, their format, meaning, using method, etc.
f) Security related function
When security function for individual resource is provided, their procedure (security setting and cancellation, etc.)
6) Others
For individual selective item that is read by the log data read service, “implemented” or “not implemented” must be declared.

Appendix 8-2 System Parameters

Appendix 8-2-1 General Types of System Parameter

(1) Message transmission service
To read system parameters, the following message service is used.

<Table 8-2 (1) Message Service for Accessing System Parameters>

TCD	Service name	Function
65011 (FDF3)	Profile read (request)	Request to read system parameters as a batch
65211 (FEBB)	Profile read (answer)	Answer for batch read of system parameters The size of answer data part is maximum 1024 bytes.

(2) Parameter structure
System parameter is structured as follows:

<Table App. 8-2 (2) Structure of System Parameter>

Parameter name	Remarks
Common parameter	Parameters that are set commonly for all devices.
Device intrinsic parameter	Parameters that vendor can freely set for their device (option)

Note: System parameters prepared for NP1L-FL1 are all “common parameter”.

(3) Common parameter detail information
The following items are mandatory.

<Table App. 8-2 (3) Common Parameter Detail Information>

Parameter name	Name code [Printable String type] (Length) (Code)	Data type [Type]	Content of parameter (Length) (Content)
Device profile Common specification version	6, “ COMVER”	INTEGER	Example: 1, 1
System parameter ID code	2, “ ID”	PrintableString	7, ” SYSPARA”
System parameter Revision No.	3, “ REV”	INTEGER	Example: 1, 0
System parameter Data of revision	7 “ REVDATE”	[INTEGER], 2, (0001-9999), [INTEGER], 1, (01-12), [INTEGER], 1, (01-31)	Example: 2, 1998 1, 9 1, 30
Device type	10 “ DVCATEGORY”	PrintableString	Example: 3, “ PLC” See note.
Vendor name	6 “ VENDOR”	PrintableString	Example: 10, “ FUJI ELEC.”
Product type	7 “ DVMODEL”	PrintableString	Example: 8, “ NP1L-FL1”

Note: The content of the parameter for device type is as follows:
“PC” or “PLC”: Programmable controller
“NC” or “CNC”: Computerized numerical control device
“RC” or “ROBOT”: Robot controller
“COMPUTER”: Personal computer, panel controller, workstation, display, and other computers.
“SP-*...*”: Vendor specific data that is set by vendor (*...* are single-byte alphanumeric characters.)
“OTHER”: Others

Appendix 8-3 Example of System Parameters

Appendix 8-3-1 Tabular Expression of System Parameters

As follows for NP1L-FL1

<Table App. 8-3 (1) System Parameters for NP1L-FL1>

Parameter name	Name code [Printable String type] (Length) (Code)	Data type [Type]	Content of parameter (Length) (Content)
SysPara			
Device profile Common specification version	6, “ COMVER”	INTEGER	1, 1
System parameter ID code	2, “ ID”	PrintableString	7, “ SYSPARA”
System parameter Revision No.	3, “ REV”	INTEGER	1, 0
System parameter Data of revision	7 “ REVDATE”	[INTEGER], 2, (0001-9999), [INTEGER], 1, (01-12), [INTEGER], 1, (01-31)	2, 1999 1, 9 1, 30
Device type	10 “ DVCATEGORY”	PrintableString	3, “ PLC”
Vendor name	6 “ VENDOR”	PrintableString	10, “ FUJI ELEC.”
Product type	7 “ DVMODEL”	PrintableString	8, “ NP1L-FL1”

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