HITACHI

S10mini

S10mini
HARDWARE MANUAL

OPTION

IR.LINK

SME-1-117 (B)

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HARDWARE MANUAL

OPTION
IR.LINK

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Printed in Japan.

BI-NR-HS<IC-NS> (FL-MW20, AI8.0)

SAFETY PRECAUTIONS

Be sure to read this manual and all other attached documents carefully before installing, operating inspecting or conducting maintenance on this unit. Always use this unit properly. Be sure to carefully read the information about the device, the safety information and precautions before using this unit. Be sure that the person(s) responsible for maintenance receives and understands this manual completely.

This manual divides the safety precautions into DANGERs and CAUTIONs.

DANGER : Failure to observe these warnings may result in death or serious injury.

CAUTION : Failure to observe these cautions may result in injury or property damage.

Failure to observe any **CAUTION** may lead to serious consequences.

All of these DANGERs and CAUTIONs provide very important precautions and should always be observed.
Additional safety symbols representing a prohibition or a requirement are as follows:

: Prohibition. For example, “Do not disassemble” is represented by:

: Requirement. For example, if a ground is required, the following will be shown:

1. Installation

CAUTION

- Use this product under the environmental conditions specified in the catalogs and manual.
  Utilizing this product in a hot, damp, or dusty atmosphere or in an atmosphere of corrosive gas, vibration or impact may lead to a malfunction, shock hazard or fire.
- Install this product according to the procedure outline in the manual.
  Imperfect installation may lead to a part drop, failure or malfunction.
- Do not put any wire chip or other foreign matter into this product.
  This may cause a malfunction, failure or fire.

2. Wiring

REQUIREMENT

Be sure to ground this product with FG.
Failure to ground this product may lead to a malfunction or shock hazard.

CAUTION

- Connect this product to a power supply with the same ratings.
  Connecting this product to a power supply exceeding its voltage rating may lead to a fire.
- Wiring must be conducted by a qualified technician.
  Miswiring may lead to failure, shock hazard or fire.
- Wiring by transceiver cables and coaxial cables must be separated from wiring from high-voltage equipment. Combining these two systems of wires in one place may lead to a malfunction.

3. Handling precautions

DANGER

- Do not touch any terminal while this product is live, as this may lead to a shock hazard.
- Configure an emergency stop circuit, interlocking circuit and related circuitry outside the programmable controller.
  A programmable controller failure may lead to a general breakdown or an accident.

CAUTION

- Make sure that everything is safe before changing programs, running or stopping this product while on the fly or producing forced output.
  Mishandling may lead to product breakdown or an accident.
- Turn on the product according to the correct power - on procedure.
  Mishandling may lead to product breakdown or an accident.

4. Maintenance

PROHIBITION

Do not disassemble or remodel this product, as this may lead to a malfunction, failure or fire.

CAUTION

Power off this product before attaching or detaching any module or unit as this may lead to a malfunction, failure or shock hazard.

WARRANTY AND SERVICING

Unless a special warranty contract has been arranged, the following warranty is applicable to this product.

1. Warranty period and scope
   Warranty period
   The warranty period for this product is for one year after the product has been delivered to the specified delivery site.

   Scope
   If a malfunction should occur during the above warranty period while using this product under normal product specification conditions as described in this manual, please deliver the malfunctioning part of the product to the dealer or Hitachi Engineering & Services Co., Ltd. The malfunctioning part will be replaced or repaired free of charge. If the malfunctioning is shipped, however, the shipment charge and packaging expenses must be paid for by the customer.

   This warranty is not applicable if any of the following are true.

   - The malfunction was caused by handling or use of the product in a manner not specified in the product specifications.
   - The malfunction was caused by a unit other than that which was delivered.
   - The malfunction was caused by modifications or repairs made by a vendor other than the vendor that delivered the unit.
   - The malfunction was caused by a relay or other consumable which has passed the end of its service life.
   - The malfunction was caused by a disaster, natural or otherwise, for which the vendor is not responsible.

   The warranty mentioned here means the warranty for the individual product that is delivered. Therefore, we cannot be held responsible for any losses or lost profits that result from the operation of this product or from malfunctions of this product. This warranty is valid only in Japan and is not transferable.

2. Range of services
   The price of the delivered product does not include on-site servicing fees by engineers. Extra fees will be charged for the following:

   - Instruction for installation and adjustments, and witnessing trial operations.
   - Inspections, maintenance and adjustments.
   - Technical instruction, technical training and training schools.
   - Examinations and repairs after the warranty period is concluded.
   - Even if the warranty is valid, examination of malfunctions that are caused by reasons outside the above warranty scope.

This manual provides information for the following hardware product:

<Hardware product>
IR.LINK (LQE541)

<Changes added to this manual>

Description of added changes	Page
Subsection 6.1.4, “Replacing or adding on the module” is newly added.	6-5

In addition to the above changes, all the unclear descriptions and typographical errors found are also corrected without prior notice.

Revision record

Revision No.	Revision Record (revision details and reason for revision)	Month, Year	Remarks
A	First Edition	October 2001	
B	Subsection 6.1.4, “Replacing or adding on the module” is newly added.	October 2008	

PREFACE

We greatly appreciate your making use of the CPU option IR.LINK module. This hardware manual on the option IR.LINK describes how to handle the IR.LINK module. Read this hardware manual carefully to use the module properly.

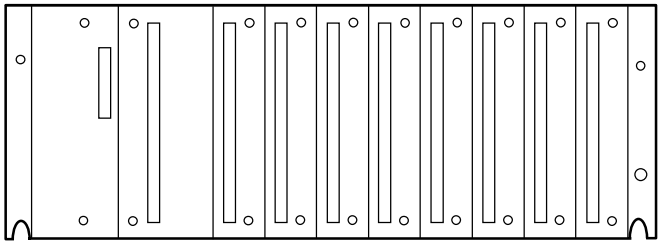
<Note for storage capacity calculations>

- Memory capacities and requirements, file sizes and storage requirements, etc. must be calculated according to the formula 2^n. The following examples show the results of such calculations by 2^n (to the right of the equals signs).
  1 KB (kilobyte) = 1,024 bytes
  1 MB (megabyte) = 1,048,576 bytes
  1 GB (gigabyte) = 1,073,741,824 bytes
- As for disk capacities, they must be calculated using the formula 10^n. Listed below are the results of calculating the above example capacities using 10^n in place of 2^n.
  1 KB (kilobyte) = 1,000 bytes
  1 MB (megabyte) = $1{,}000^2$ bytes
  1 GB (gigabyte) = $1{,}000^3$ bytes

CONTENTS

1 BEFORE USE

1.1 CPU Mount Base



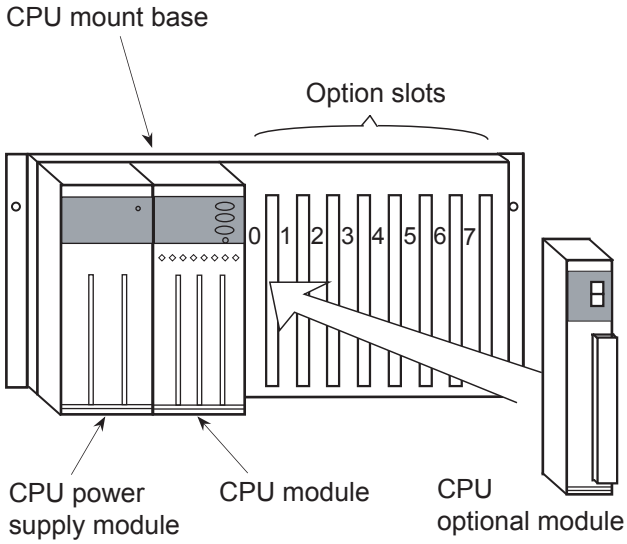
8-slot mount base

There are three types of CPU mount bases:

- 2-slot mount base (model: HSC-1020)
- 4-slot mount base (model: HSC-1040)
- 8-slot mount base (model: HSC-1080)

On the 8-slot mount base, for example, up to eight modules, except the power supply module and CPU module, can be mounted.

1.2 Mounting Optional Modules



CPU mount base: HSC-1080

PS slot: A slot into which the CPU power supply (LQV000, LQV020 or LQV100) module is inserted.

CPU slot: A slot into which the CPU module (LQP000, LQP010, LQP011 or LQP120) is inserted.

Slots 0 to 7: Slots into which optional modules or I/O modules.

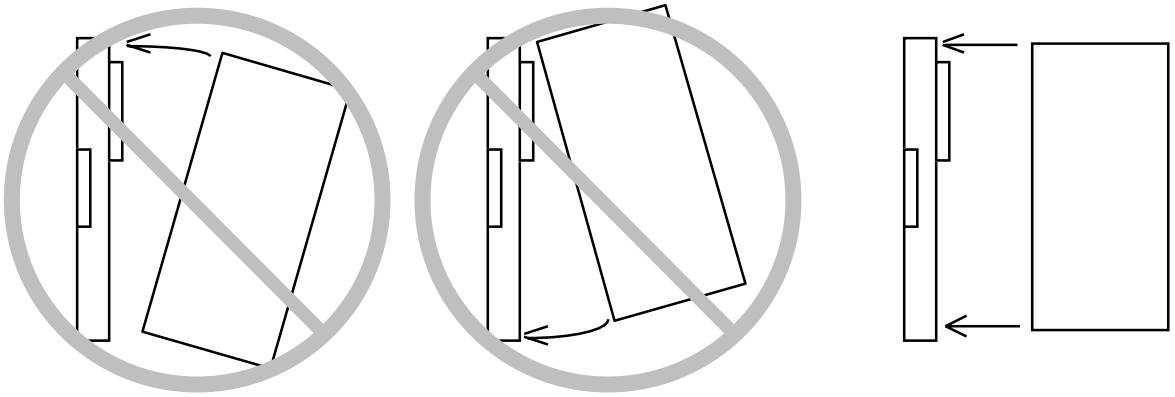
CAUTION

- Insert IR.LINK modules sequentially into the slots, starting from the leftmost slot, without creating any empty slots in between.
- Only one IR.LINK module can be installed on the CPU mount base. It must be configured as a main module.
- When a J.NET (LQE040) or a J.NET-INT module (LQE045) and the IR.LINK module are installed on the same CPU mount base, set the J.NET or J.NET-INT as the main module and IR.LINK as a sub-module.

When mounting an optional module, observe following rules.

- Mount the module straight to the front of the CPU mount base. If it is mounted at a slant as shown in the bad examples, the connectors may be damaged and the option module may malfunction.

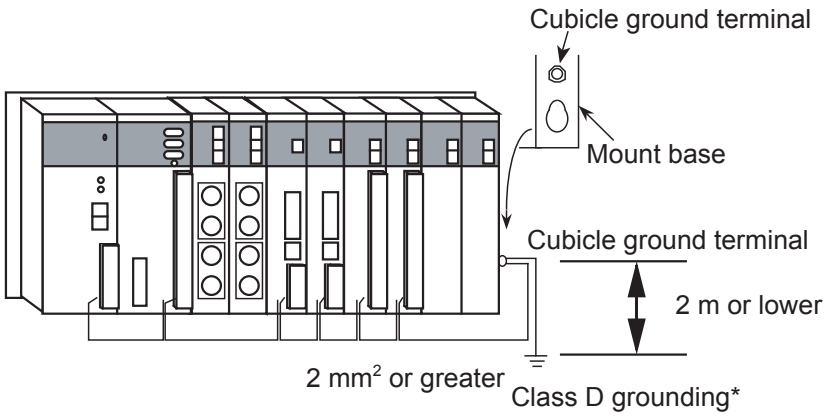
[Bad examples] [Good example]



CAUTION

When the CPU mount base is located over the head because of the cabinet structure used, take care not to mount the optional modules aslant by using a stepladder or the like.

1.3 Grounding



REQUIREMENT

- In frame ground (FG) cabling, connect the FG terminal of each module with external terminals to the cubicle ground terminal of the mount base. Apply Class D grounding from the cubicle ground terminal of the mount base.
- Use a ground wire whose cross-sectional area is 2 mm^2 or greater.

* Class D grounding is defined in the Technical Standard for Electrical Facilities of Japan. This standard states that the grounding resistance must be 100 ohms or less for equipment operating on 300 VAC or less, and 500 ohms or less for devices that shut down automatically within 0.5 seconds when shorting occurs in low tension lines.

2 SPECIFICATIONS

2.1 Use

Before using the IR.LINK module (type: LQE046), make sure that the IR.Station module (LQS021) is connected. It communicates digital or analog data with the IR.Station. It also supports a function that starts up a task upon the detection of a change in digital input.

2.2 Specifications

2.2.1 System specifications

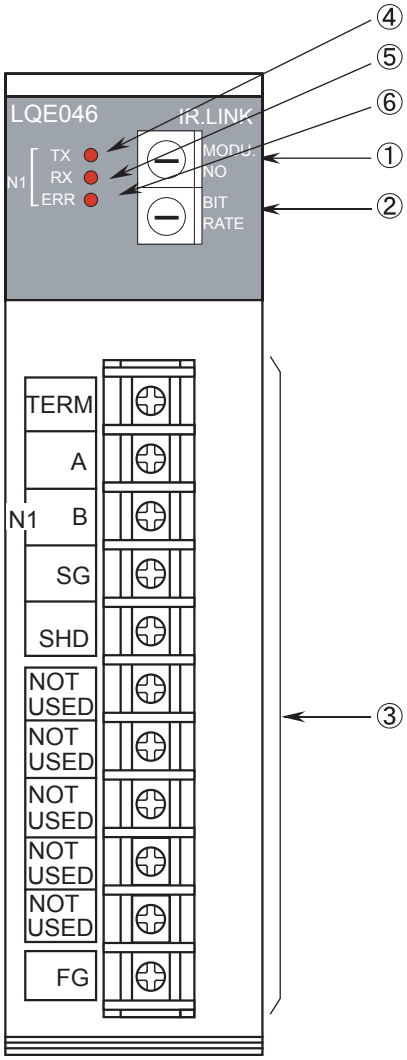
Item	Specifications
Type	LQE046
Number of networks	1 network/module
Maximum number of IR.LINK module that can be mounted in the CPU	1 (install from the leftmost slot)
Mass	260 kg

2.2.2 Line specifications

Item		Specifications
Transmission method		Serial transmission (bit serial transmission)
Electrical interface		RS-485
Number of stations		Up to 31 stations
Connection cable	Line type	Two pairs of shielded twisted-pair cables Recommended cable: KPEV_SB 2P 0.5 mm^2 (Hitachi Cable, Ltd.)
	Distance	The distance depends on the transmission rate as follows: Transmission rate ≤ 1.0 Mbps: Up to 240 m Transmission rate ≤ 0.5 Mbps: Up to 480 m Transmission rate ≤ 0.25 Mbps: Up to 800 m Transmission rate ≤ 0.125 Mbps: Up to 1000 m
	Terminal block	6-point terminal block (M3 × 6)

3 NAMES AND FUNCTIONS OF EACH PART AND CABLING

3.1 Names and Functions of Each Part



① Module No. setting switch
Use this switch to set up the main module and sub-module. (For details on T/M, see Subsection 6.1.2.)
Set IR.LINK as a sub-module when you install J.NET (LQE040) or a J.NET-INT module (LQE045) on the same CPU mount base.
Set up the main module and sub-module according to the table shown below.

Setting No.	Main module/sub-module
0	Main module
1	Sub-module
8, 9	Use of T/M

② Bit rate setting switch
The bit rate setting switch is used to set a transmission rate. The table below shows the relationship between setting Nos. and transmission rates.

Setting No.	Transmission rate
0	1.0 Mbps
1	0.5 Mbps
2	0.25 Mbps
3	0.125 Mbps
8 to F	Use of T/M

③ Terminal blocks for interface
TERM: Terminals for a terminating resistor. Short these terminals with a jumper when the IR.LINK module is used at an end of the network.
A, B: Used to connect a transmission/reception data line.
SG: Used for signal ground terminal.
SHD: Used for shield ground terminal.
FG: Used for frame ground terminal.

④ LED for transmission
Comes on when the IR.LINK module starts transmitting data.

⑤ LED for reception
Comes on when the IR.LINK module starts receiving data.

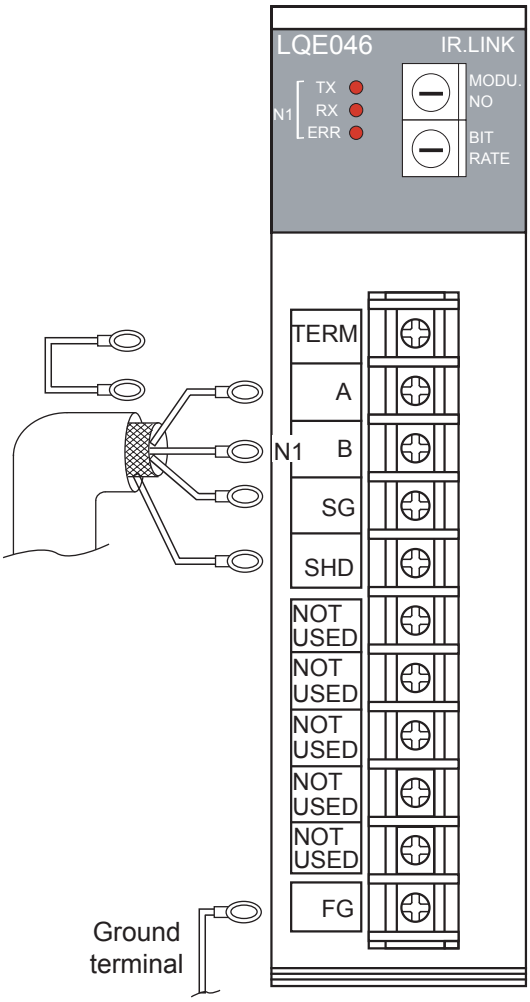
⑥ LED for errors
Comes on when a hardware error is detected in the IR.LINK module (see Subsection 6.3.2).

⚠ CAUTION

Do not operate the module No. switch and bit rate switch when the IR.LINK module is in operation. Failure to observe this rule may lead to a module malfunction.

3.2 Cabling

3.2.1 Interface signals and cabling method



Network 1 (N1)

Signal name	
Abbreviation	Name
A	(Linkage data)
B	Send/receive data
SG	(Signal Ground) Grounding for signal
SHD	(SHielD ground) Grounding for shield
TERM	(TERMinal registor) Terminating resistor for transmission/reception

Others

Signal name	
Abbreviation	Name
FG	(Frame Ground) Grounding for frame

Interface signal voltage levels

Designation	Mark	Space
Interpretation	1/OFF	0/ON
Output condition	-6 to -1.5 V	1.5 to 6 V
Input condition	-0.2 V or lower	0.2 V or higher

The input condition represents the electric potential of A viewed from B.
Short TERM and A terminal if the network of this module is the trailing end. The terminating resistor (120 ohms) is internally connected.

CAUTION

Shield terminal (SHD) and one frame ground (FG) terminal are internally connected. Be sure to ground the FG terminal.

3.2.2 Cable specifications

The IR.LINK module requires two pairs of shielded twisted-pair cables.
A polyethylene-insulated vinyl sheath cable for instrumentation should be used as the cable for IR.LINK and IR.Station.

Interface Cable Specifications for KPEV-SB 2P 0.5 mm^2 of Hitachi Cable, Ltd.
(Recommended Cable Type)

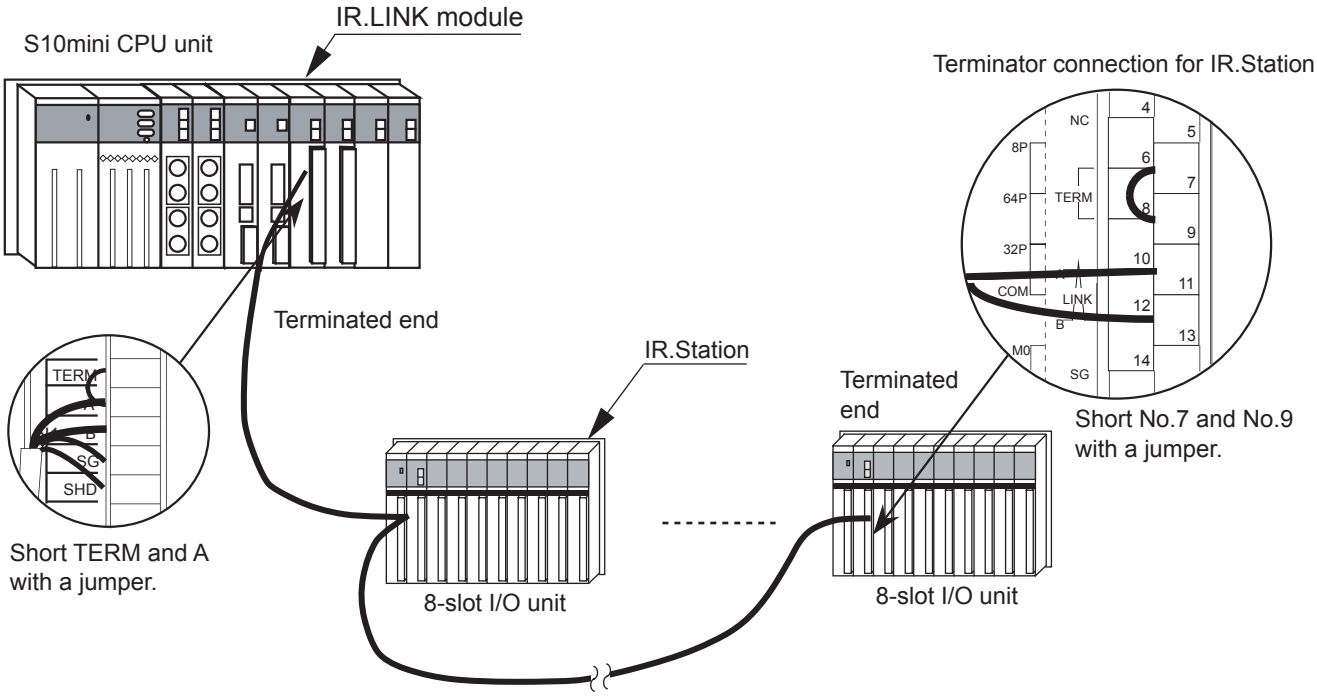
Item	Specifications
Maximum conductor resistance (20°C)	34.0 Ω/km
Withstand voltage	1000 VAC/minute
Minimum insulation resistance (20°C)	2500 MΩ･km
Electrostatic capacity (1 kHz)	60 pF/m
Characteristics impedance (1 MHz)	110 Ω

Note: The 1-MHz characteristics impedance of the above cable is 110 ohms but IR.LINK and IR.Station have 120-ohm internal terminating resistors in consideration of other transmission rates.
Short TERM terminals with a jumper when the IR.LINK module is used at an end of the network.
120-ohm terminating resistors are connected in IR.LINK and IR.Station.

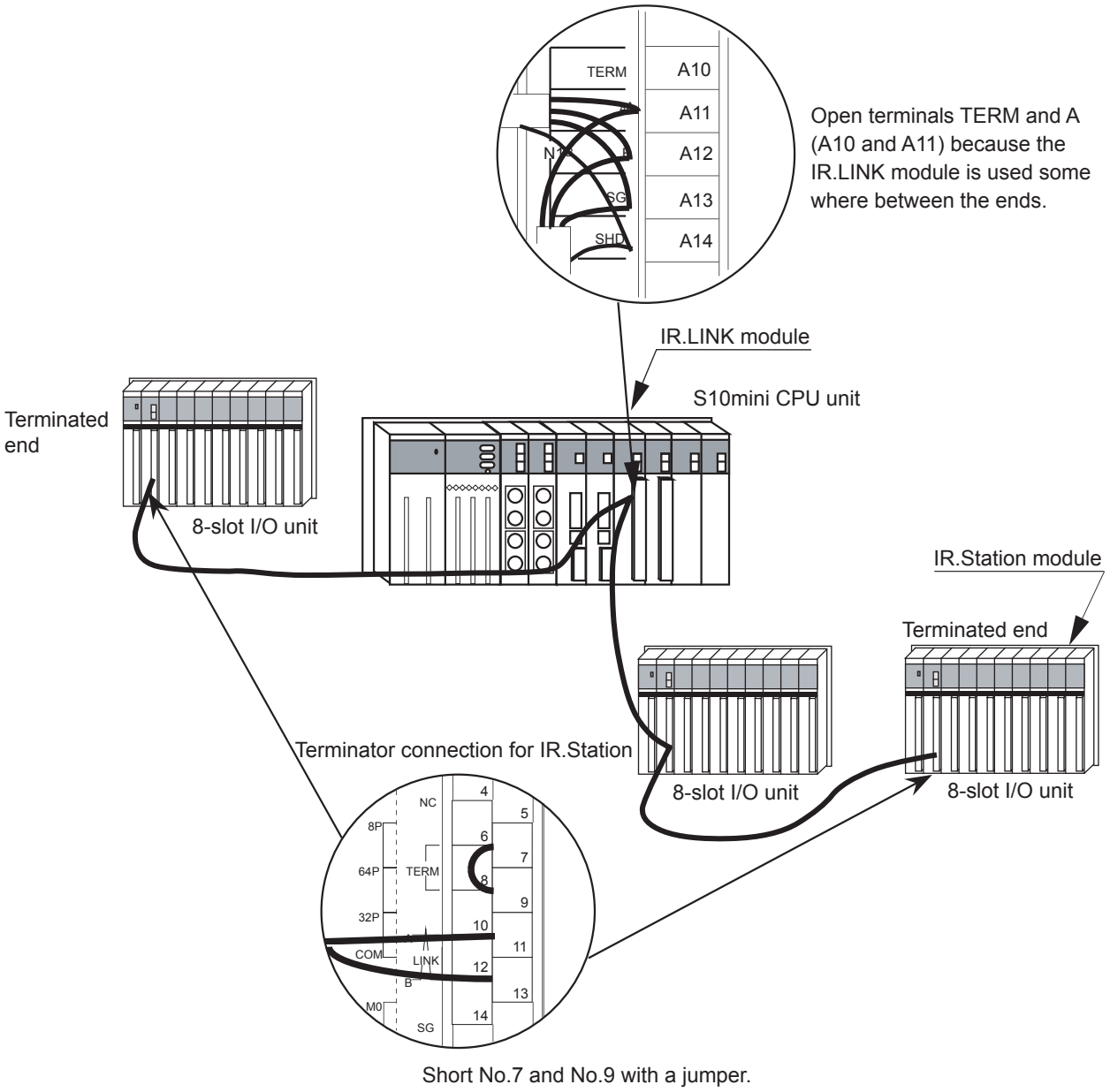
3.2.3 Examples of cabling

Connect terminating resistors to the devices connected to both ends of the cable.
Examples of cabling are given below.

- Connection when the IR.LINK module is used at an end.



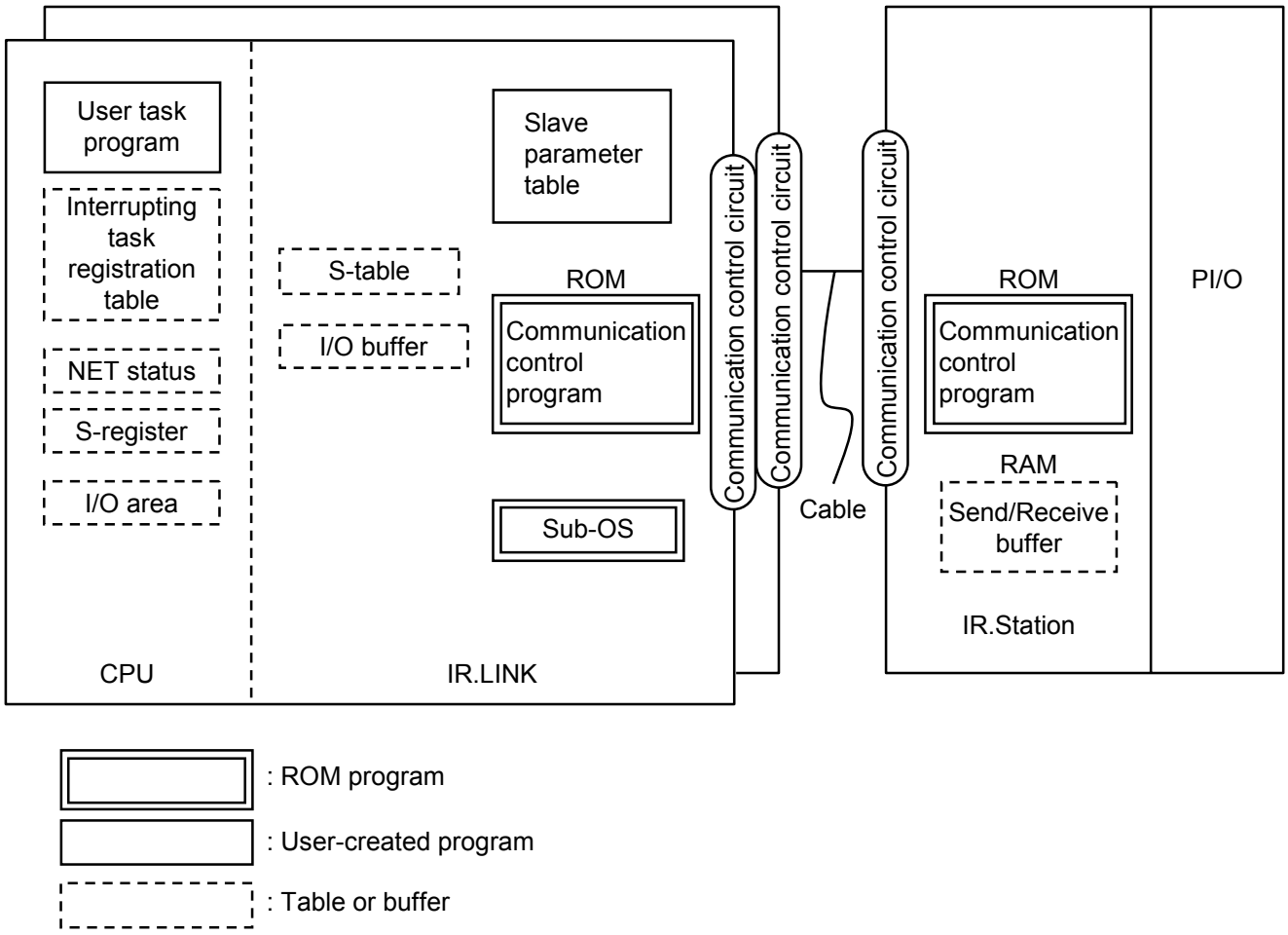
- Connection when the IR.LINK module is used somewhere between the ends.



4 USER GUIDE

4.1 Software Configuration of IR.LINK System

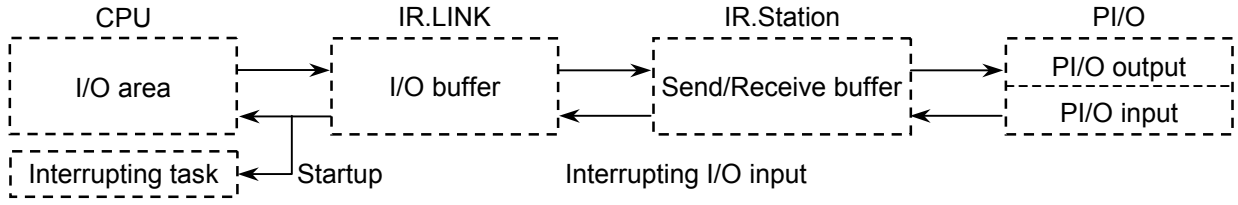
The software configuration of the IR.LINK system is shown in the figure below. The communication control programs and sub-OS in the figure need not be loaded into memory by the user because they are ROM programs.



- Communication control program

  The main functions of the communication control program are as follows:

  • The communication control program communicates data with the IR.Station and boots up the sub-OS by interrupting the CPU when a specific DI input turns from OFF to ON.



- Sub-OS

  When interruption from the communication control program is detected, the sub-OS starts up a task that corresponds to a specific DI with status change (OFF to ON).

- NET status table, S-register, and S-table

  The communication control program sets data transmission/reception information and error information in the NET status table, S-register, and S-table.

- I/O area

  The table below shows the I/O areas that can be used for I/O communication.

Name	Symbol range	Number of points
External input	XW000 (X000) to XWFF0 (XFFF)	256 words (4,096 points)
External output	YW000 (Y000) to YWFF0 (YFFF)	256 words (4,096 points)
Internal register	RW000 (R000) to RWFF0 (RFFF)	256 words (4,096 points)
Global link register	GW000 (G000) to GWFF0 (GFFF)	256 words (4,096 points)
Transfer register	JW000 (J000) to JWFF0 (JFFF)	256 words (4,096 points)
Receive register	QW000 (Q000) to QWFF0 (QFFF)	256 words (4,096 points)
Event register	EW400 (E400) to EWFF0 (EFFF)	192 words (3,072 points)
Extended internal register	MW000 (M000) to MWFF0 (MFFF)	256 words (4,096 points)
Function work register	FW000 to FWBFF	3,072 words
Extended memory	/100000 to /4FFFFF	2 M words

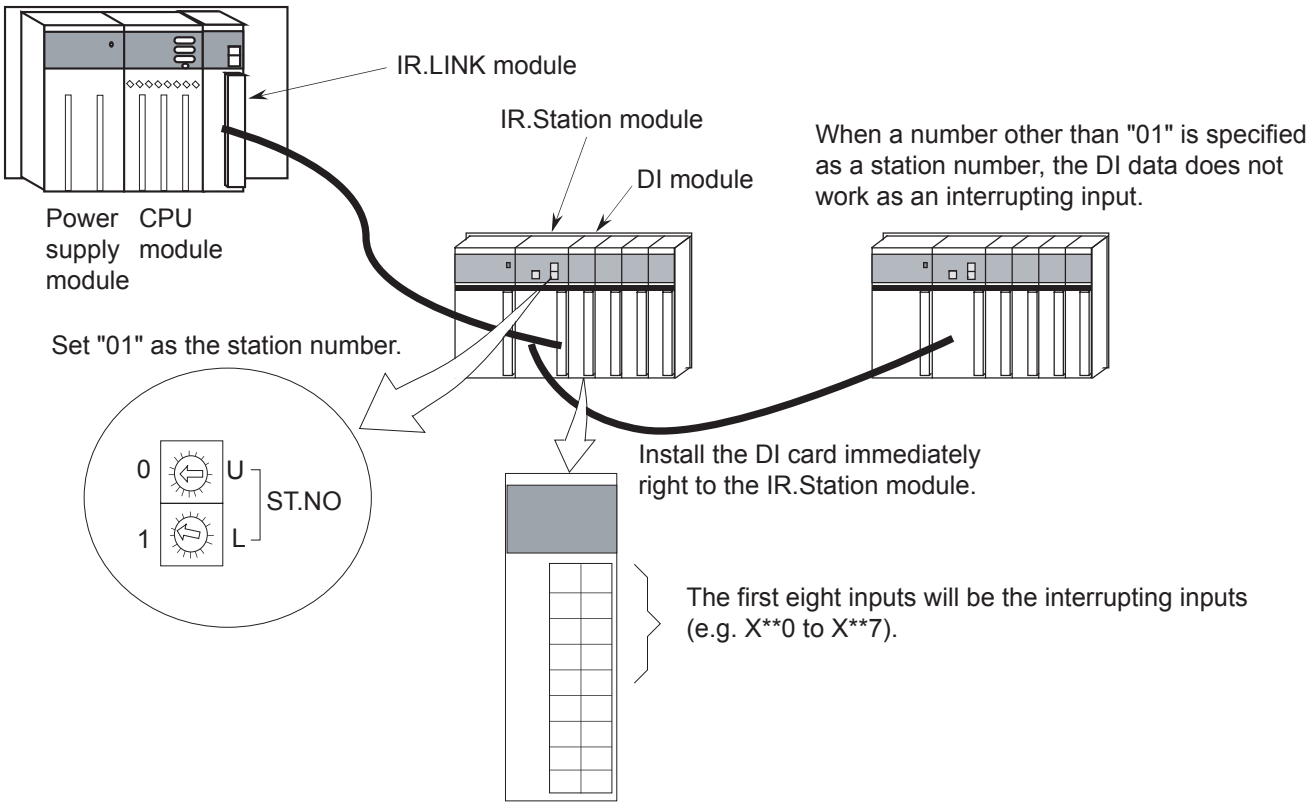
4.2 Startup of Tasks Activated by Interrupting I/O Input

4.2.1 Outline

The IR.LINK module generates an interruption by DI signal and activates a pre-registered interrupting task. The IR.LINK module can generate eight interrupting inputs. To startup interrupting tasks, configure the setting of the IR.Station and register tasks.

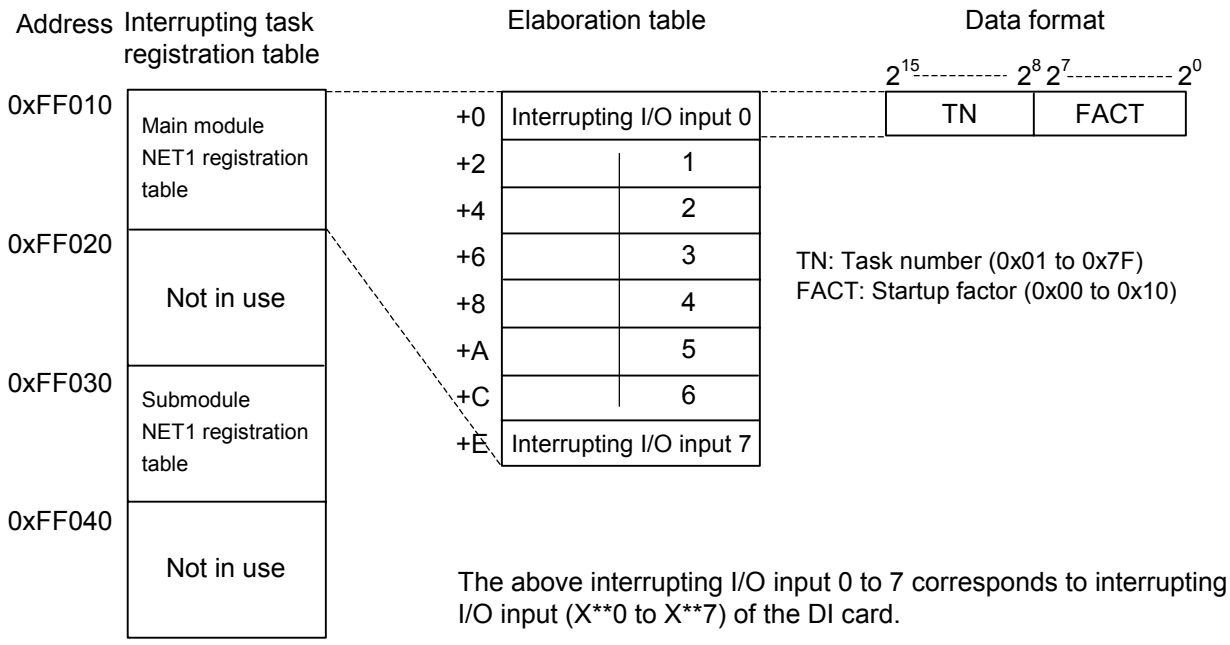
4.2.2 The Configuration and Installation of the IR.Station module

- Setting of the station numbers
  Set “01” as the station number of the IR.Station module. If a number other than “01” is entered, the task will be stored as mere data and will not activate any task.
- Installation of the IR.Station module
  Install the DI card of an interrupting I/O input immediately right side of the IR.Station module. When the DI card is installed in other slot, the task will be stored as a mere data and will not activate the task. A task is executed only when the status of an input signal changes from OFF (Low level) to ON (High level).



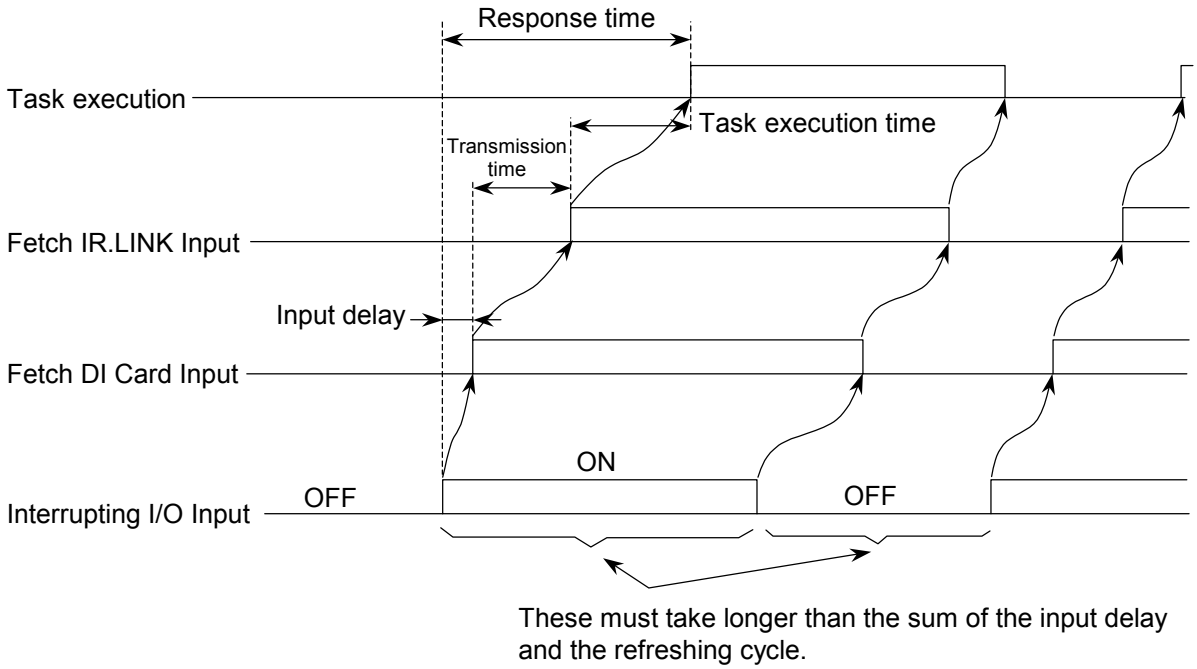
4.2.3 Registration of interrupting tasks

To register the interrupting task that is activated by interrupting I/O inputs, specify the task numbers and the startup factors in the interrupting task registration table by using a tool. (See "5.4 Registration of Interrupting Tasks.")



4.2.4 Startup Timing

- Startup timing of the interrupting task
  The figure below shows the timing of the interrupting I/O input and activation.



Input delay may occur in the interrupting I/O input signals, due to filtering of the DI card and so on (For the delay time caused by filtering, see the configuration of each DI card).
The input signal is cyclically communicated to the IR.LINK after DI card fetches it as an input. The transmission time takes as long as what IR.LINK refresh cycle takes at maximum.
Therefore, keep the interrupting I/O input ON for longer time than the sum of input delay and refresh cycle (1.5 times). If ON time period is shorter than the sum, the interrupting I/O input will not be recognized and thus the task may not be activated. Similarly, if the OFF time period is shorter than the sum, interrupting I/O input will be recognized as kept ON and the task may not be started as a result.
Although a task is started immediately after the interrupting I/O input is recognized, the delay may still occur depending on the priority level of the task and the program processing status of the CPU.

- Releasing interrupting tasks
  At the time of task execution after the recognition of interrupting I/O input, the task release is not done. Therefore, it must be released using the user program. If the interrupting task is not released, the task will not be executed.

4.3 NET Status

The NET status table stores communication information (binary) for each station. The user must register the starting address of the NET status table in any of the following eight areas.

X000 to XFFF
Y000 to YFFF
J000 to JFFF
Q000 to QFFF
G000 to GFFF
R000 to RFFF
E400 to EFFF
M000 to MFFF

The NET status table is configured as shown in the table below and requires a capacity of successive 128 points. (For example, when X500 is specified, table elements X500 to X57F are occupied. In the table below, the portion "X5" of each element number replaces △△.)

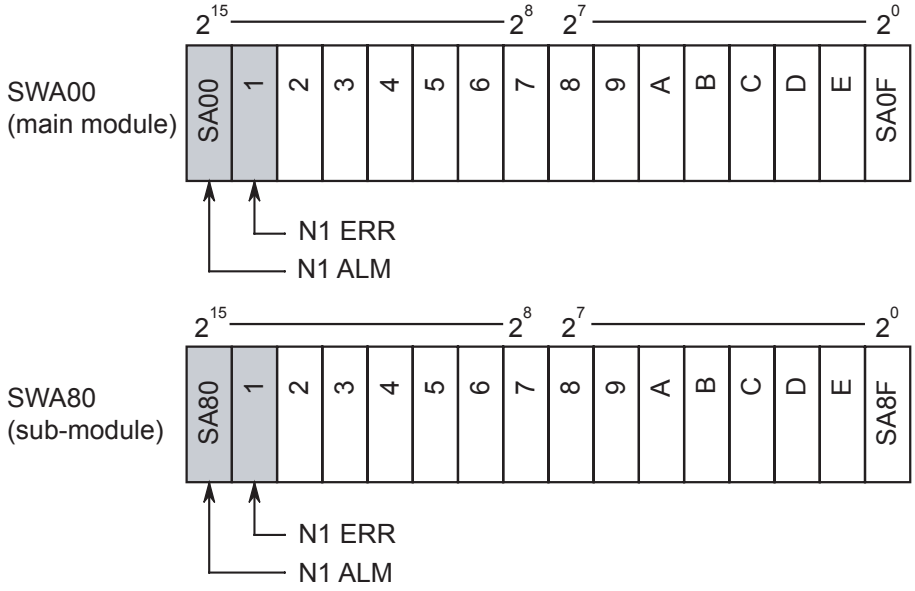
Station ID	Transmission enable flag	Data reception flag	Response reception flag	Error flag
Unoccupied	–	–	–	–
1	△△01	△△21	△△41	△△61
2	△△02	△△22	△△42	△△62
⋮	⋮	⋮	⋮	⋮
30	△△1E	△△3E	△△5E	△△7E
31	△△1F	△△3F	△△5F	△△7F

Contents of bits					
	0	Being transmitted	Data not received	Response not received	No errors detected
	1	Transmission enable	Data received	Response received	Error detected

△△ indicates registered symbols

4.4 S-register

The S-register stores error information. This register is set if an error is detected even in one of the stations (sub-stations).



Note: ALM: communication error ERR: hardware error.

Symbol	Bit	Description
SA00	0	N1 of the main module is providing data communications service normally.
	1	A communication error was detected in N1 of the main module.
SA01	0	N1 of the main module is in normal operation.
	1	A hardware error was detected in N1 of the main module.
SA80	0	N1 of the sub-module is providing data communications service normally.
	1	A communication error was detected in N1 of the sub-module.
SA81	0	N1 of the sub-module is in normal operation.
	1	A hardware error was detected in N1 of the sub-module.

Any other bits not listed above are unused.

4.5 S-table

The S-table is an address table that stores communication error codes. (For details on communication error codes, see Subsections 6.3.3 and 6.3.2.)

Table 4-1 S-table Assignment

Net No.	Station ID	Main module error code	Sub-module error code
N1	Unoccupied	/A40080	/AC0080
	1	82	82
	2	84	84
	⋮	⋮	⋮
	30	/A400BC	/AC00BC
	31	BE	BE

4.6 Communication Time

The time required by IR.LINK module and IR.Station for communication depends on the number of installed slots and I/O sizes. Calculation method to derive the time elapsed for the communication is shown below as a rule of thumb.

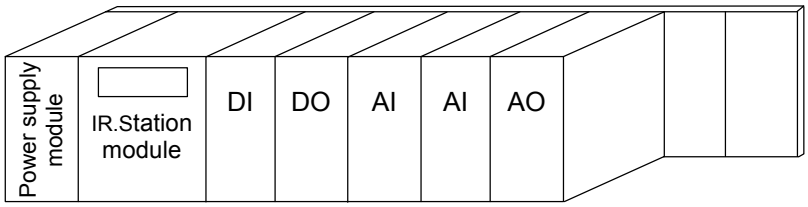
- Communication when the analog I/O is set to the asynchronous mode
  The communication time per station is approximately expressed by the following:

  - At a rate of 1 Mbps: 1.4+(DS×0.06)+(DN×0.070)+(AS×0.015)+(AN×0.013) [ms]
  - At a rate of 0.5 Mbps: 1.7+(DS×0.06)+(DN×0.077)+(AS×0.015)+(AN×0.024) [ms]

  DS: Number of slots with DI/DO module installed
  DN: Total I/O size (in bytes) of DI/DO modules
  AS: Number of slots with AI/AO module installed
  AN: Total I/O size (in bytes) of AI/AO modules

For example, for a communication at a rate of 1 Mbps in a system containing one 16-point DI model (2 bytes), one 16-point DO model (2 bytes), two 4 channel AI modules (8bytes) and two 4-channel AO modules (8 bytes), the time taken can be calculated as follows:
Communication time (in analog asynchronous mode) =

1.4+(2×0.06)+(4×0.070)+(3×0.015)+(24×0.013) = 2.157 [ms]



The refresh cycle value must be greater than the total communication time of the IR.Station module.

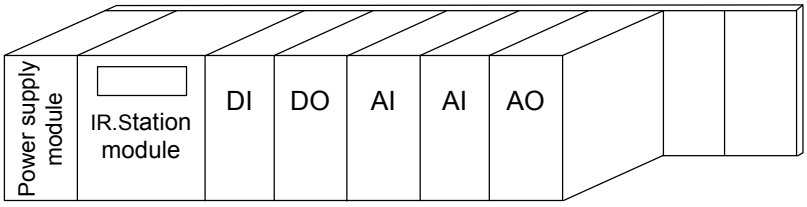
- Communication when the analog I/O is set to the synchronous mode
  The communication time per station is approximately expressed by the following:

  - At a rate of 1 Mbps: 1.4+(DS×0.06)+(DN×0.070)+(AS×0.23)+(AN×0.013) [ms]
  - At a rate of 0.5 Mbps: 1.7+(DS×0.06)+(DN×0.077)+(AS×0.23) +(AN×0.024) [ms]

  DS: Number of slots having DI/DO modules
  DN: Total I/O size (in bytes) of DI/DO modules
  AS: Number of slots having AI/AO modules
  AN: Total I/O size (in bytes) of AI/AO modules

For example, for a communication at a rate of 1 Mbps in a system containing one 16-point DI module (2 bytes), one 16-point DO module (2 bytes), two 4-channel AI modules (8 bytes), and one 4-channel AO modules (8 bytes), the time taken can be calculated as follows:
Communication time (in analog asynchronous mode) =

1.4+(2×0.06)+(4×0.070)+(3×0.23)+(24×0.013) = 2.802 [ms]



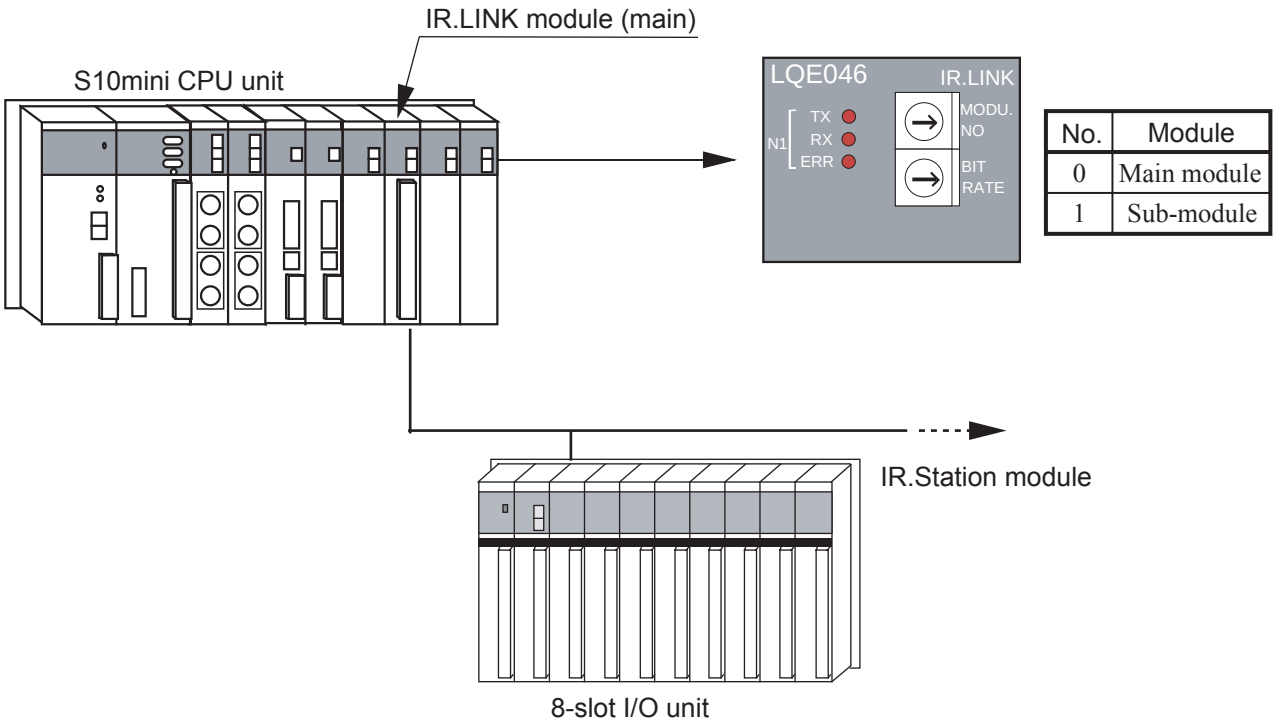
The refresh cycle value must be greater than the total communication time of the IR.Station modules.

5 OPERATION

5.1 About IR.LINK SUPPORT System

Use the IR.LINK system as a tool for starting and setting the IR.LINK module.
The IR.LINK SUPPORT system is a man-machine tool that sets communication information for IR.LINK modules and stations.

5.1.1 System configuration



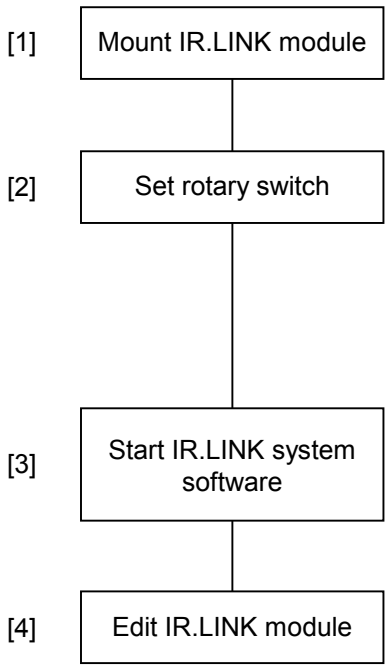
No.	Module
0	Main module
1	Sub-module

CAUTION

- Only one IR.LINK module can be installed. Set IR.LINK module as the main module if installed.
- When installing a J.NET (LQE040) or a J.NET-INT module (LQE045) and the IR.LINK module on the same CPU mount base, set the J.NET or J.NET-INT module as the main module and the IR.LINK module as a sub-module.

5.2 System Startup

5.2.1 IR.LINK SUPPORT system startup procedure



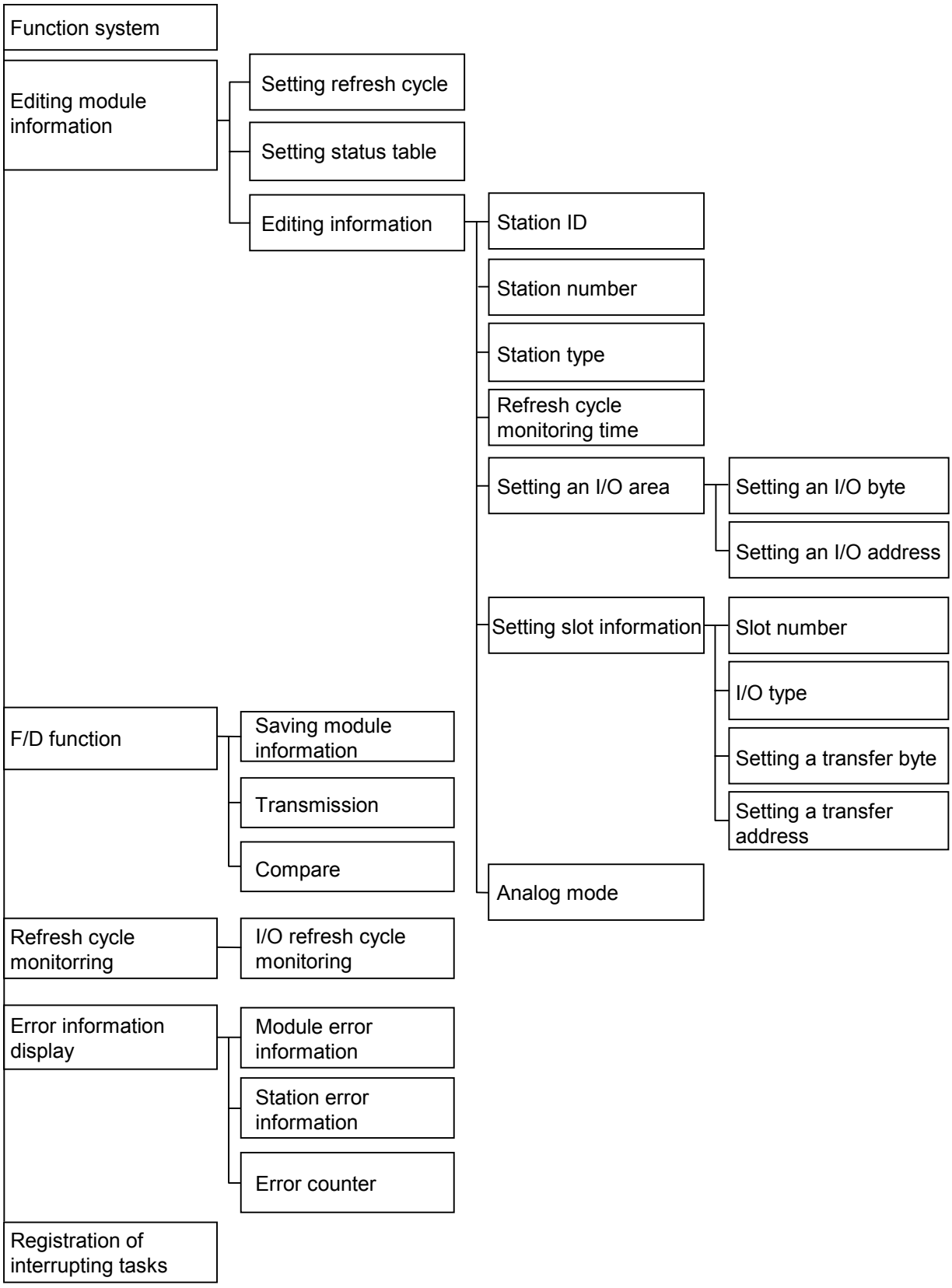
[1] Power down the CPU and then mount the IR.LINK module.

[2] (a) Set the MODU No. switch of the IR.LINK module to 0 (main module) or 1 (sub-module).
(b) Use the BIT RATE switch of the IR.LINK module to set the bit rate to 0 (1 Mbps), 1 (0.5 Mbps), 2 (0.25 Mbps), or 3 (0.125 Mbps).

[3] Connect the CPU-Windows personal computer and then start the IR.LINK system software system.

[4] Edit the IR.LINK module refer to the SOFTWARE MANUAL OPTION IR.LINK For Windows (manual number SAE-3-155).

5.2.2 Function system



5.3 Editing Module Information

5.3.1 Setting refresh cycle

Set an I/O service refresh cycle.

Setting range	1.5, 2, 2.5, 3 to 3000	Unit: ms

5.3.2 Setting status table

Set a status table. (Leave this section unused when you do not need it.)

Setting range	X000 to XFFF Y000 to YFFF J000 to JFFF Q000 to QFFF G000 to GFFF R000 to RFFF E400 to EFFF M000 to MFFF

5.3.3 Station ID

Select a station ID (serial sub-station (IR.Station) information No.).

Setting range	/01 to /1F

- Station number
  Set the station number to be assigned to the sub-station.

Setting range	/01 to /7F

- Station type
  Set the station type of the sub-station. (Select one of the station types listed in the table below according to the sub-station specifications.)

Station type	Specifications	I/O area	Slot information
AUTO	Set I/O area for one IR.Station collectively. Although it is not necessary to set slot information individually, specific setup is not available.	√	nd
MANUAL	As setting slot information (the difference between analog and digital or address and size of I/O area) of IR.Station individually, the user can set slot information specifically.	nd	√

√: Need be set, nd: Need not be set

- Refresh cycle monitoring time
  Set the refresh cycle monitoring time of the sub-station. The refresh cycle monitoring time must be five times refresh cycle time or longer.

Setting range	0 to 65535	Unit: 10 ms

5.3.4 Setting an I/O area

- Setting the number of input and output bytes

Setting range	/00 to /100

- Setting input and output addresses

Setting range	FW000 to FWBFF XW000 to XWFF0 YW000 to YWFF0 JW000 to JWFF0 QW000 to QWFF0 GW000 to GWFF0 RW000 to RWFF0 EW400 to EWFF0 MW000 to MWFF0 /100000 to /4FFFFE (extended memory)

5.3.5 Setting slot information

- Slot number
  Select the number of the slot into which the set module is to be inserted.

Setting range	/0 to /7

- I/O type
  Set the I/O module to be inserted into each slot.

Setting value
Deletion
DI
DO
AI
AO
S10 AI (4 ch)
S10 AO (4 ch)
S10 PCT (Pulse counter)

CAUTION

Pay attention to the contents below and set I/O type when using AI/AO modules.

MODE switch setting	Set value
MODE switch = “1”	AI or AO
MODE switch = “2”	S10 AI (4 channels) or S10 AO (4 channels)

• Setting the number of transfer bytes

Setting range	/01 to /10

• Setting transfer addresses

Setting range	FW000 to FWBFF XW000 to XWFF0 YW000 to YWFF0 JW000 to JWFF0 QW000 to QWFF0 GW000 to GWFF0 RW000 to RWFF0 EW400 to EWFF0 MW000 to MWFF0 /100000 to /4FFFFE (extended memory)

5.3.6 Analog mode

Select whether to obtain analog value of the IR.Station side when I/O data is requested (synchronous) or not (asynchronous).
If AI/AO synchronous is selected, time delay is less in comparison to AI/AO asynchronous. However, the time takes to refresh I/O data will be longer.
If AI/AO asynchronous is selected, the time takes to refresh I/O data is less in comparison to AI/AO asynchronous. However, time delay will be longer.

5.4 Registration of Interrupting Tasks

The IR.LINK module generates an interruption by DI signal and allows a pre-registered task to startup. The module can generate eight interrupting inputs. To startup interrupting tasks, select the “Enter interrupt task” button from the main screen of the IR.LINK system and register task numbers and the starting factor. A tool automatically distinguishes the address of the interrupting task registration table depending on the module type (main or sub-module) of the IR.LINK (See “4.2 Startup of Tasks Activated by Interrupting I/O Input ”).

- Task number

Setting range	1 to 127

- Starting factor

Setting range	0 to 16

6 MAINTENANCE

6.1 Maintenance and Check

6.1.1 Periodic check

Item	Description	Frequency
Unit cleaning	Turn off all the power supplies and then vacuum the interior of the IR.LINK module through the slits in its casing. Do not raise dust during cleaning.	Once/year
Mechanical check	Check IR.LINK module mounting screws, TB mounting screws, and communication cable mounting screws for looseness and damage. If a mounting screw is loose, tighten it. Replace damaged parts.	Once/year
Operation check	Check IR.LINK module operation with a test/maintenance program (T/M). (T/M is started automatically due to any power failure and recovery after the Module No. and BIT RATE switches have been set.)	Once/year

CAUTION

Be sure to use T/M offline. Failure to observe this rule may lead to a program malfunction.

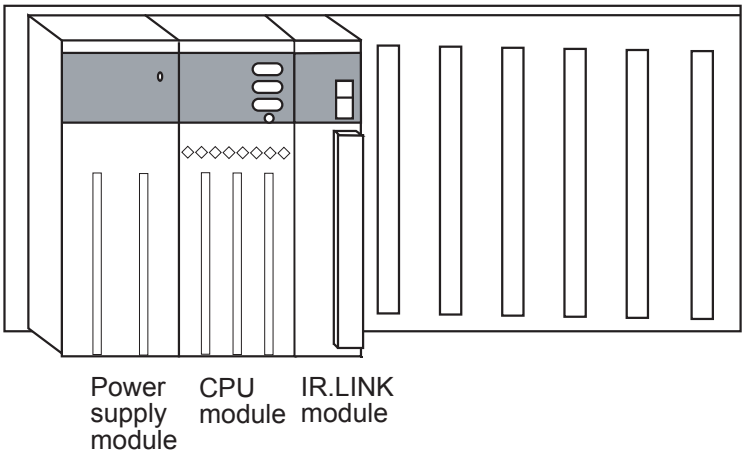
6.1.2 Test/maintenance program (T/M)

T/M is a program for IR.LINK module maintenance check and can be started automatically due to any power failure and recovery after the MODU No. and BIT RATE switches have been set.

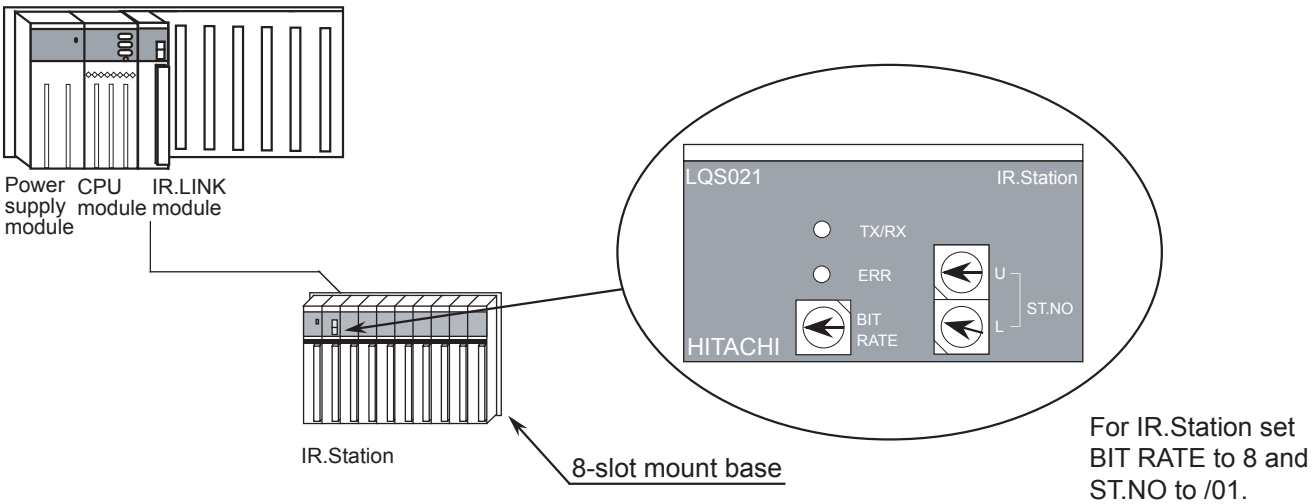
No.	MODU No.	BIT RATE	Description	Cabling
1	8	8	Internal loopback communication (main module)	Unnecessary
	9		Internal loopback communication (sub-module)	Unnecessary
2	8	9	Internal memory write/read/compare in IR.LINK module (main module)	Unnecessary
	9		Internal memory write/read/compare in IR.LINK module (sub-module)	Unnecessary
3	8	A	CPU memory function check (main module)	Unnecessary
	9		CPU memory function check (sub-module)	Unnecessary
4	8	B	Unused	–
	9		Unused	–
5	8	C	Unused	–
	9		Unused	–
6	8	D	Unused	–
	9		Unused	–
7	8	E	External loopback communication (main module)	Necessary
	9		External loopback communication (sub-module)	Necessary
8	8	F	Unused	–
	9		Unused	–

6.1.3 Hardware configuration for T/M operation

- T/M No.1 to T/M No. 3 (cabling unnecessary)



- T/M No.7 (cabling is performed as shown in the figure below)



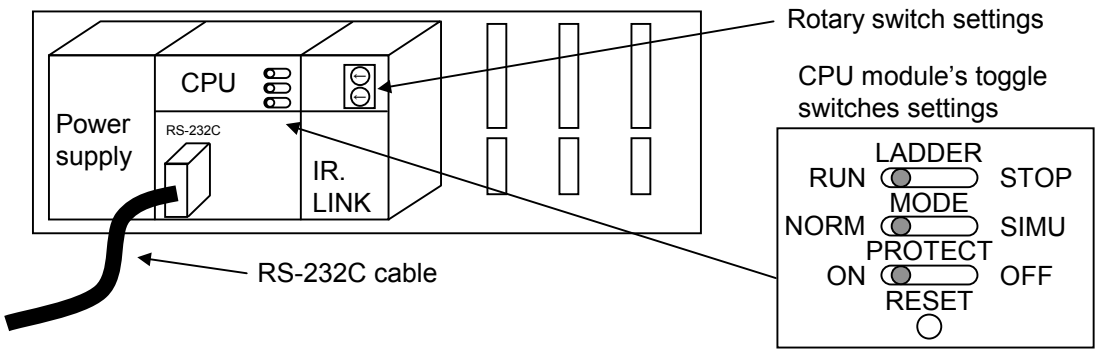
For IR.Station set BIT RATE to 8 and ST.NO to /01.

6.1.4 Replacing or adding on the module

- What you should get in preparation
  ① Personal computer (with Hitachi's S10 IR.LINK System installed in it)
  ② RS-232C cable (or 10BASE-T cable if the communication module used is an ET.NET module)
  ③ New or add-on IR.LINK module (LQE046)
  ④ Copies of the parameter values for the module to be replaced. (These copies are prepared for use in cases where the parameters are not accessible for some reason.)
  ⑤ The above-mentioned ET.NET module is an optional module and, if it is mounted in place, may be selected as the type of communication module to be used.

  For more information, refer to Section 2.1, "Names and Functions of Each Part," and Section 3.2, "Mounting the Module," in the USER'S MANUAL OPTION ET.NET (LQE520) (manual number SVE-1-103).

- Replacement procedure
  ① Write down, on a piece of paper, the current settings of the rotary switches that are, as shown below, accessible at the front side of the IR.LINK module to be replaced.
  ② Write down also the current settings of three switches, labeled LADDER (toggle switch), MODE (toggle switch), and PROTECT (toggle switch), respectively, that are, as shown below, accessible at the front side of the CPU module.



  ③ Connect the personal computer and the CPU module together with the RS-232C cable.
  ④ Start Hitachi's S10 IR.LINK System and save the set values of all the existing parameters by using its F/D function. (If the existing parameters are not accessible for some reason, use the copies of their set values [item ④] that were obtained in preparation.)

⑤ Set the CPU module's LADDER switch in STOP position and turn off the power supply of the controller unit.
⑥ Remove the connecting cables from the IR.LINK module to be replaced.
⑦ Replace the existing IR.LINK module with the new one and set the new IR.LINK module's rotary switches in the same way as you wrote down in Step ①.
⑧ Turn on the power supply of the controller unit and send to the new IR.LINK module the set parameter values that you saved in Step ④ using the F/D function.
⑨ By using the F/D function, compare the set parameter values before and after you sent. This comparison may reveal a discrepancy for the following memory areas:
/A3BFFE for the main IR.LINK module mounted
/ABBFFE for the IR.LINK sub-module mounted
However, if no discrepancies are found for any other area, the set parameter values (system information) for the new IR.LINK module may be considered as being identical between the saved file and memory.
⑩ Reset the CPU module by pressing the RESET switch at its front.
⑪ Turn off the power supply of the controller unit.
⑫ Remove the RS-232C cable from both the personal computer and CPU module, which were connected together in Step ③.
⑬ Connect to the new IR.LINK module the connecting cables that you removed in Step ⑥.
⑭ Set the CPU module's LADDER, MODE, and PROTECT switches in the same way as you wrote down in Step ②.
⑮ Turn on the power supply of the controller unit and check that the new IR.LINK module is running normally.

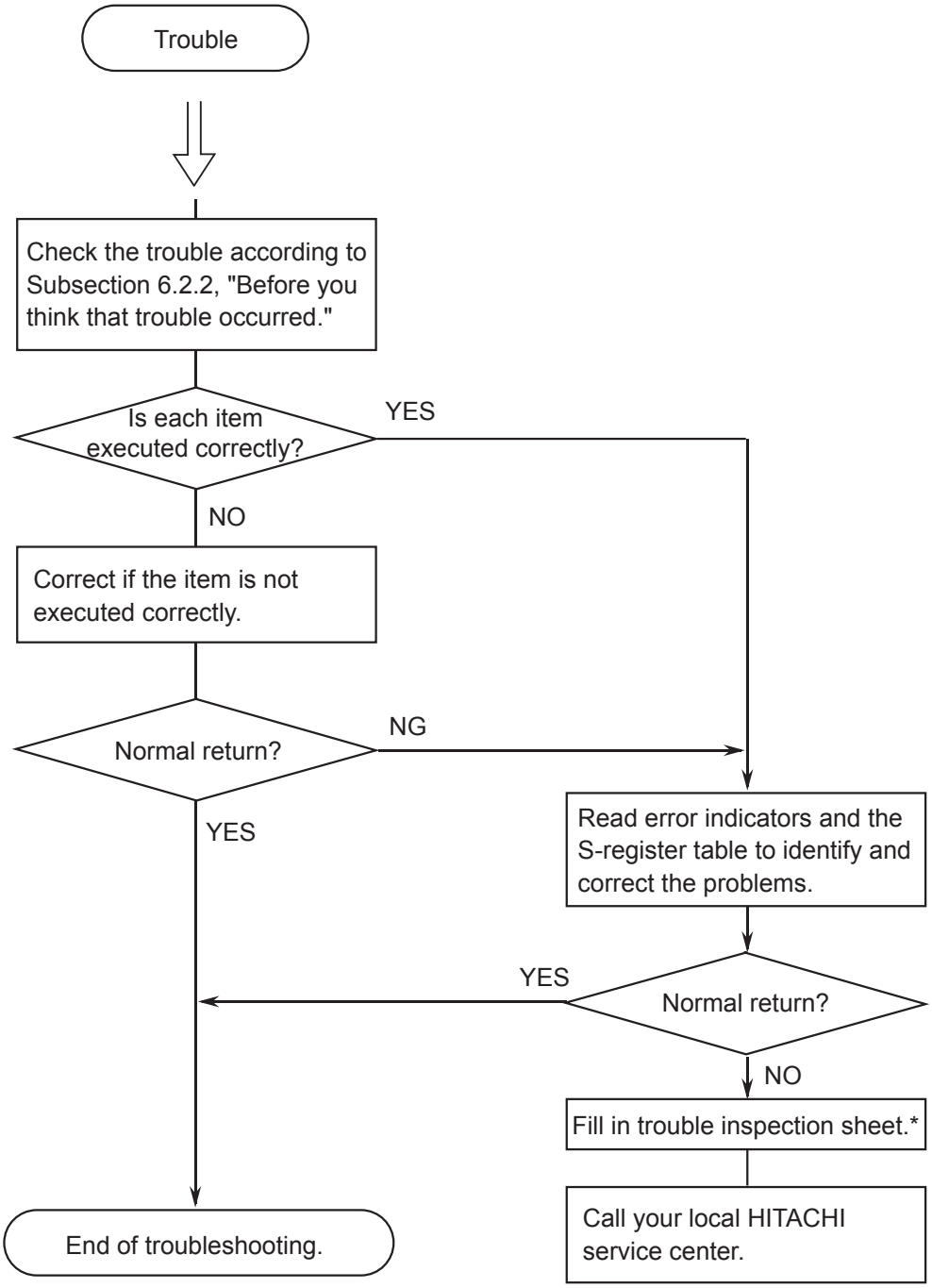
- Add-on procedure

① Write down, on a piece of paper, the current settings of three switches, labeled LADDER (toggle switch), MODE (toggle switch), and PROTECT (toggle switch), respectively, that are accessible at the front side of the CPU module, the one that is installed in the controller unit in which you are adding on a IR.LINK module.
② Ensure that your application system has been shut down. Then, set the CPU module's LADDER switch in STOP position and turn off the power supply of the controller unit.
③ Mount the add-on IR.LINK module in place according to the instructions given under "1.2 Mounting Optional Modules."
④ Set the add-on IR.LINK module's rotary switches in such a way that a new module No. setting, which must be a sub-module No. setting, will not duplicate with the current rotary switch settings of the existing main IR.LINK module.

⑤ Connect the personal computer and the CPU module together with the RS-232C cable. Then, turn on the power supply of the controller unit and set parameters for the add-on IR.LINK module by using the S10 IR.LINK System.
⑥ Reset the CPU module by pressing the RESET switch at its front.
⑦ Turn off the power supply of the controller unit and connect the connecting cables to the add-on IR.LINK module.
⑧ Set the CPU module's LADDER, MODE, and PROTECT switches in the same way as you wrote down in Step ①.
⑨ Remove the RS-232C cable from both the personal computer and CPU module, which were connected together in Step ⑤.
⑩ Turn on the power supply of the controller unit and check that the add-on IR.LINK module is running normally.

6.2 Troubleshooting

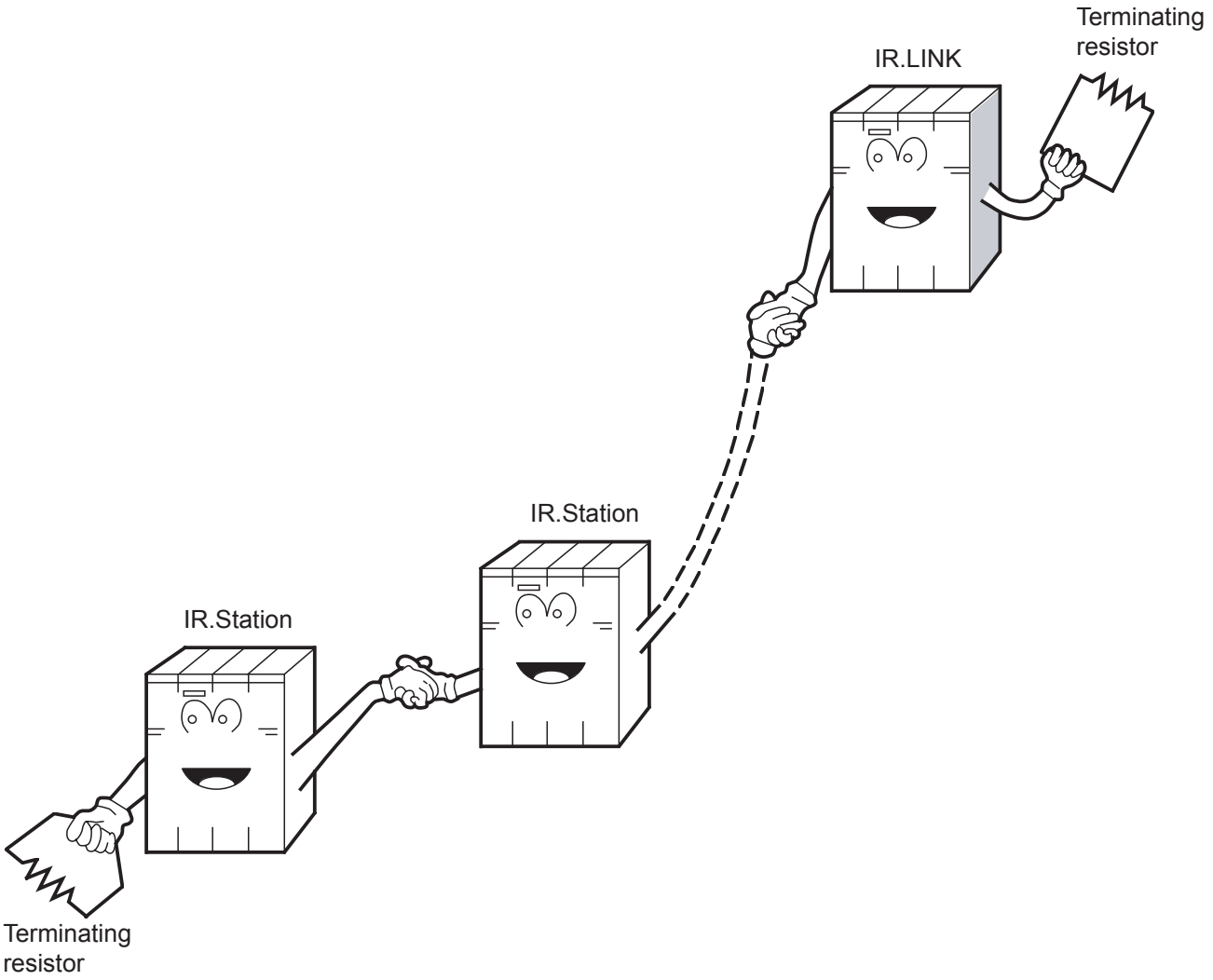
6.2.1 Procedure



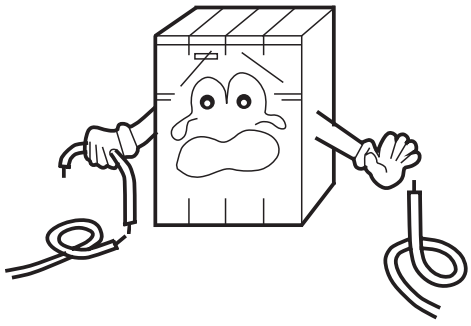
* See A.9, “Trouble Inspection Sheet.”

6.2.2 Before you think that trouble occurred

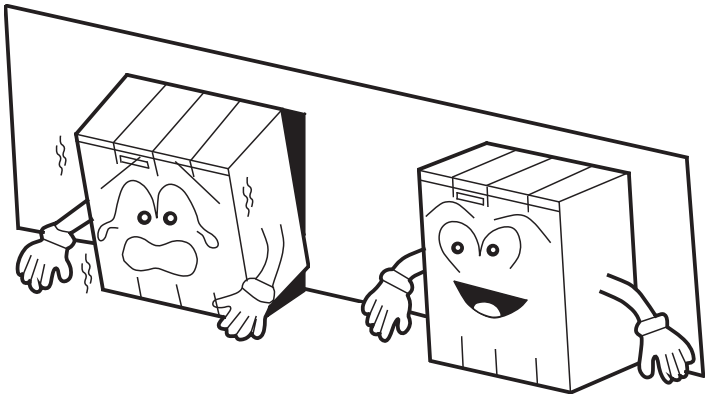
- Are the terminating resistors of the communication cable connected?
  - Terminating resistors (120 ohms) must always be connected to both ends of the communication cable line. (In IR.LINK and IR.Station, short the TERM terminals with a jumper and thereby connect to the 120-ohm internal resistor.)



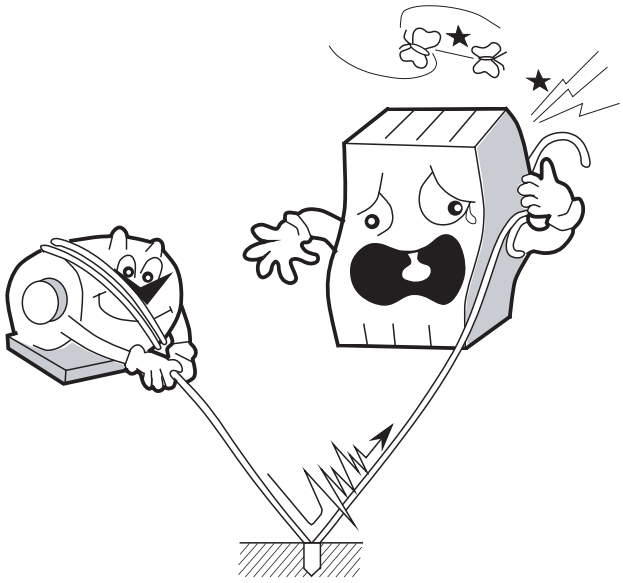
- Is the cabling correct?
  - Check cables for disconnection or incorrect connection.



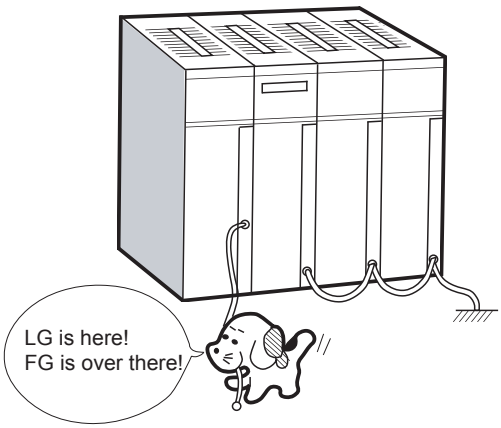
- Is the IR.LINK module mounted correctly?
  - Check whether the IR.LINK module is left-justified with no idle slot between the modules.
  - Check whether all mounting screws are tightly fastened.



- Is grounding correct?
  - Do not ground the IR.LINK module in the same place where high-voltage equipment is grounded. They must be grounded in separate places.
  - Apply Class D grounding* or higher.



- Are LG and FG separate?
  - Be sure to separate the LG from the FG or vice versa because power noise enters the FG via the LG. Failure to observe this rule may result in an equipment malfunction.
  - Ground the LG to the power supply side.



6.3 Errors and Countermeasures

6.3.1 CPU LED display messages

As shown in the table below, CPU LED display messages depend on the main module and sub-module.

MDL	Message	Description	Countermeasure
Main module	IRLM @. @	The IR.LINK module (main module) was started normally.	This is not an error.
	EX92 PTY	A parity error was detected when the CPU read data from memory in the IR.LINK module (main module).	If this message does not disappear even after the CPU key switch has been reset once and then set to the original position again, replace the IR.LINK module.
	IRM □□□□	An error was detected in the IR.LINK module (main module) board.	See Subsection 6.3.2.
	IRMN ○○○○	An error was detected in the IR.LINK module (main module) network.	See Subsection 6.3.3.
	IRMS △△△△	An error was detected in the IR.LINK module (main module) station.	See Subsection 6.3.3.
Sub-module	IRLS @. @	The IR.LINK module (sub-module) was started normally.	This is not an error.
	EX93 PTY	A parity error was detected when the CPU read data from memory in the IR.LINK module (sub-module).	If this message does not disappear even after the CPU key switch has been reset once and then set to the original position again, replace the IR.LINK module.
	IRS □□□□	An error was detected in the IR.LINK module (sub-module) board.	See Subsection 6.3.2.
	IRSN ○○○○	An error was detected in the IR.LINK module (sub-module) network.	See Subsection 6.3.3.
	IRSS △△△△	An error was detected in the IR.LINK module (sub-module) station.	See Subsection 6.3.3.

- @. @: IR.LINK module version, revision
- □□□□: Any of the hardware error messages explained in Subsection 6.3.2, “Hardware errors”
- ○○○○: Any of the communication error codes explained in Subsection 6.3.3, “Communication errors”
- △△△△: Any of the communication error codes explained in Subsection 6.3.3, “Communication errors”

6.3.2 Hardware errors

When it detects a hardware error, the IR.LINK module displays an error message in the CPU LED. The module also turns on the error LED and collects error freeze information.
The module then stops.

Message	Error	User response
BUS	Bus error	The IR.LINK module may be faulty. Replace it.
ADDR	Address error	
ILLG	Illegal instruction error	
ZERO	Division by zero error	
PRIV	Privilege violation	
WDT	WDT error	
FMAT	Format error	
SINT	Spurious interrupt	
EXCP	Unused exception	
PTY	Parity error	
MDSW	MODU. No. switch setting error	Check MODU. No. switch setting.
BRSW	BIT RATE switch setting error	BIT RATE switch setting.
ROM1	ROM1 sum error	The IR.LINK module may be faulty. Replace it.
RAM1	RAM1 compare error	
RAM2	RAM2 compare error	
ROM3	ROM3 sum error	
ROME	ROM3 erase error	
ROMW	ROM3 write error	
WOVR	ROM rewrite count exceeded	The ROM rewrite count exceeded 50,000. Replace the module.
PRME	Parameter error	Set the parameter again.

6.3.3 Communication errors

(1) Network errors

When an error was found on the network of the IR.LINK module, the status error flag of the NET status and the ALM of the S-register is turned ON and write error code (see table below) into S-table.

The module also displays the error on the CPU LED.

Error code	Explanation	User response
7110	An undefined service was instructed.	• If this error recurs even after the CPU has been reset once and then set to the original position again, restart the IR.LINK module. • If this error still recurs, replace the IR.LINK module.
7120	The data length is incorrect.	
7130	The packet configuration is incorrect.	
2010	An error was detected during CRC check.	• Check whether the network line is normal. • Check whether SVPT setting matches station setting. • If this error still recurs, replace the IR.LINK module.
2020	The station number is from 128 to 254 or the received station number is incorrect.	
2030	An undefined service was specified.	
2040	The I-frame length is greater than or equal to 137 bytes or the UI-frame length is greater than or equal to 134 bytes.	
2041	No I-frame exists in the I-response.	
2042	An I-frame exists in the monitoring frame.	
2050	Data link procedure error	
2060	A timeout was detected (no response was made from the slave station within the specified time).	• Power on the station again. • Check whether the switches of the IR.LINK module and station are set correctly. • If this error still recurs even after the switches have been set correctly, replace the station.
2061	The error could not be recovered by retry.	
2070	No frame could be transmitted to the line or an error was detected during frame reception.	• Check the network line connection and terminating resistor connection. • Check whether SVPT setting matches station setting. • If this error recurs even after the CPU has been reset once and then set to the original position again, restart the IR.LINK module. • If this error still persists, replace the IR.LINK module.
2080	Other errors	• If this error recurs even after the CPU key switch has been reset once and then set to the original position again, restart the IR.LINK module. • If this error still recurs, replace the IR.LINK module.

(2) Station errors

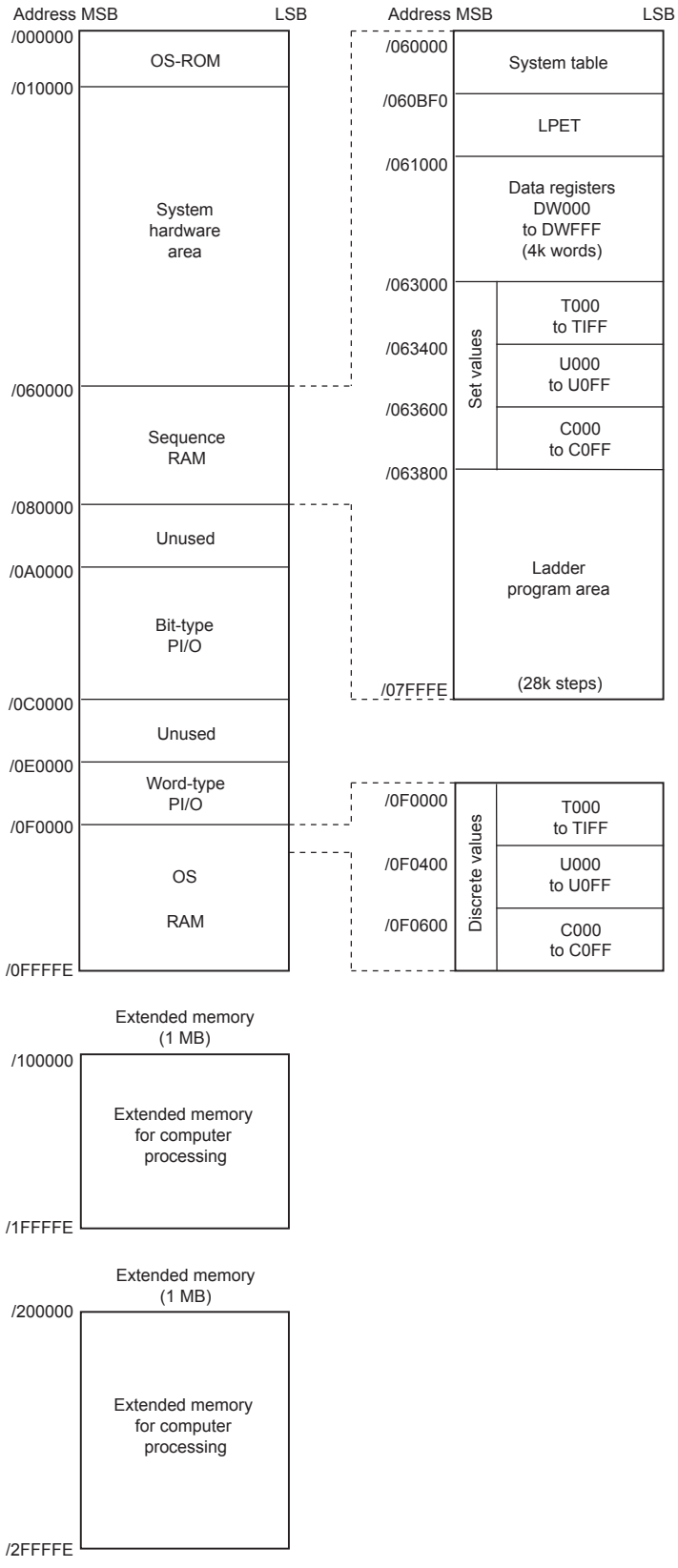
When an error is found in the IR.Station connected with the IR.LINK module, the error flag of the NET status and the ALM of the S-register are turned on and the error code is written in the S-table (shown below).

The module also displays the error in CPU LED.

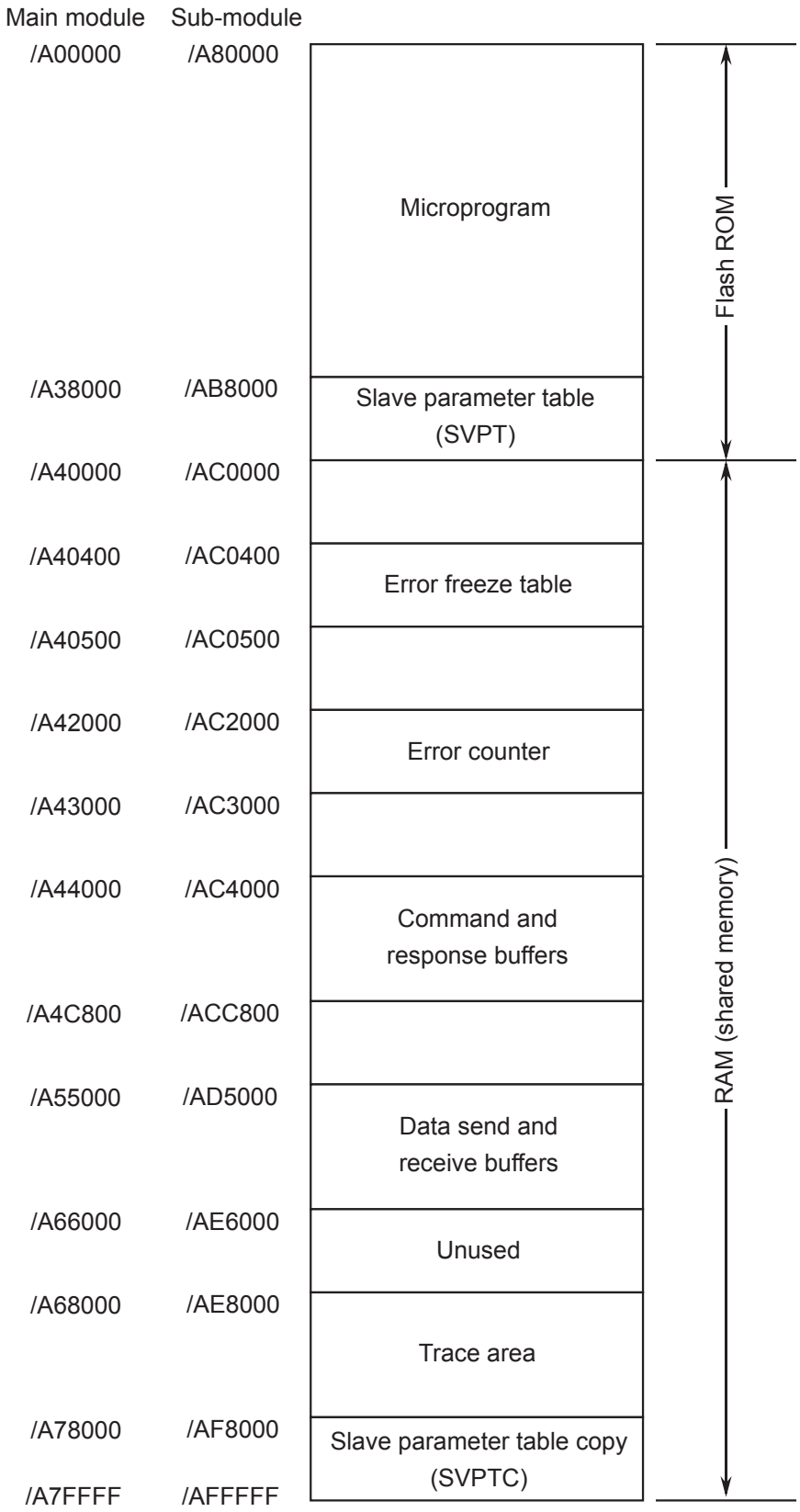
Error code	Explanation	User response
9001	The station is inactive.	• Power on the station again and then reset the CPU. • If this error still recurs, replace the station.
9002	The station is in an abnormal state. (An error was detected in the station.)	
9003	The station is inactive and also in an abnormal state.	
8020	The initialization instruction was rejected.	• SVPT setting does not match station setting. Set SVPT again to match station setting. • If this error still recurs, replace the station.
8081	When the AUTO mode is specified, the number of registered transfer bytes does not match the response I/O size from the station.	
8082	When a slot is specified, the number of registered transfer bytes does not match the response I/O size from the station.	

APPENDIX

A.1 CPU Memory Map



A.2 IR.LINK Module Memory Map



A.3 Error Freeze

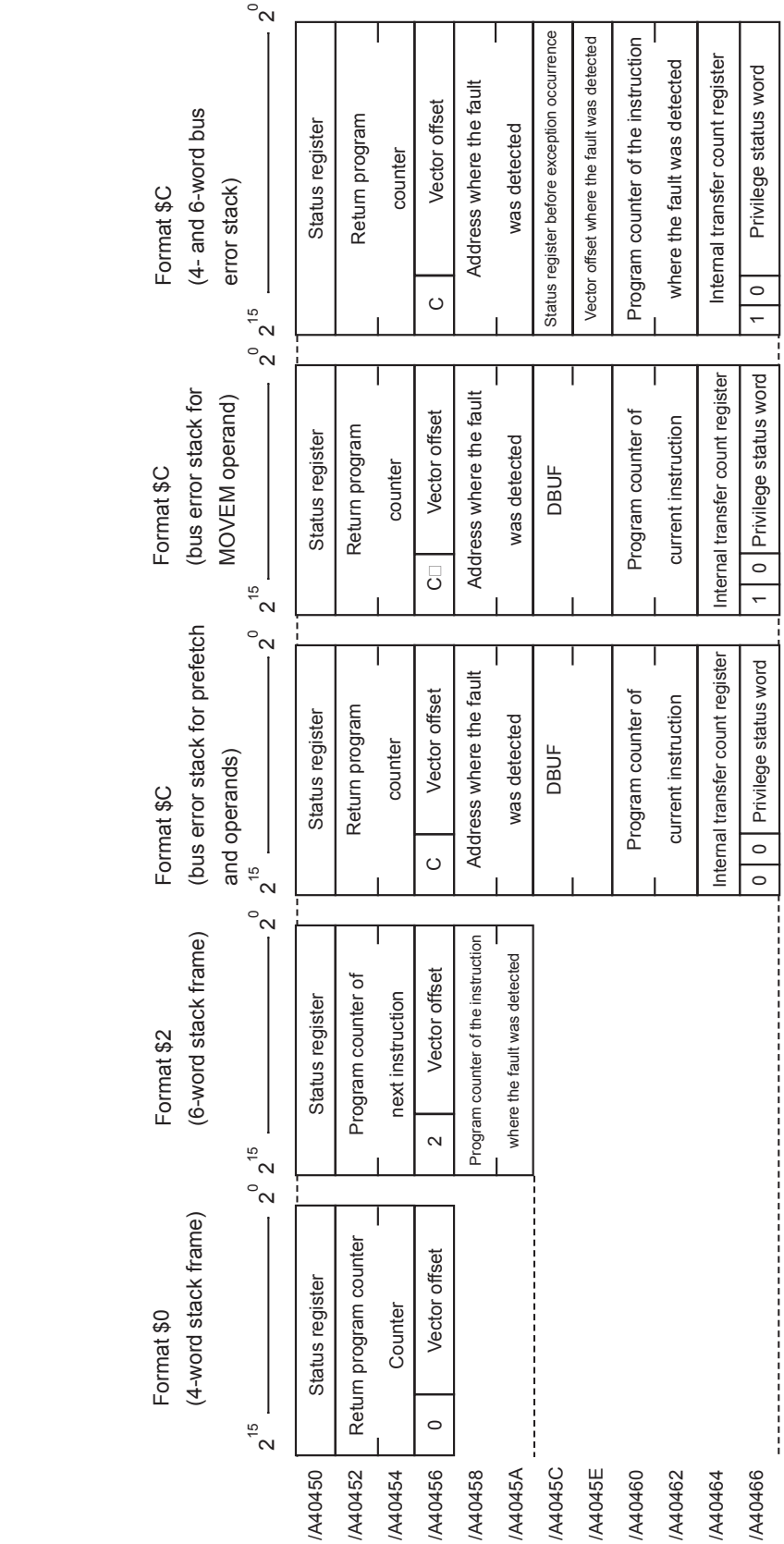
When it detects a hardware error, the IR.LINK module lights the error LED, stores error freeze information, and stops.

Main module	Sub-module	2^{31} ——— 2^{16} 2^{15} ——— 2^{0}
/A40400	/AC0400	Error code | –
/A40404	/AC0404	Time from reset (ms)
		–
/A40410	/AC0410	D0 register
/A40414	/AC0414	D1 register
/A40418	/AC0418	D2 register
/A4041C	/AC041C	D3 register
/A40420	/AC0420	D4 register
/A40424	/AC0424	D5 register
/A40428	/AC0428	D6 register
/A4042C	/AC042C	D7 register
/A40430	/AC0430	A0 register
/A40434	/AC0434	A1 register
/A40438	/AC0438	A2 register
/A4043C	/AC043C	A3 register
/A40440	/AC0440	A4 register
/A40444	/AC0444	A5 register
/A40448	/AC0448	A6 register
/A4044C	/AC044C	A7 register
/A40450	/AC0450	Stack frame (4 words, 6 words, bus error)
/A404FC	/AC04FC	

Note: The stack frame is explained on the next page.

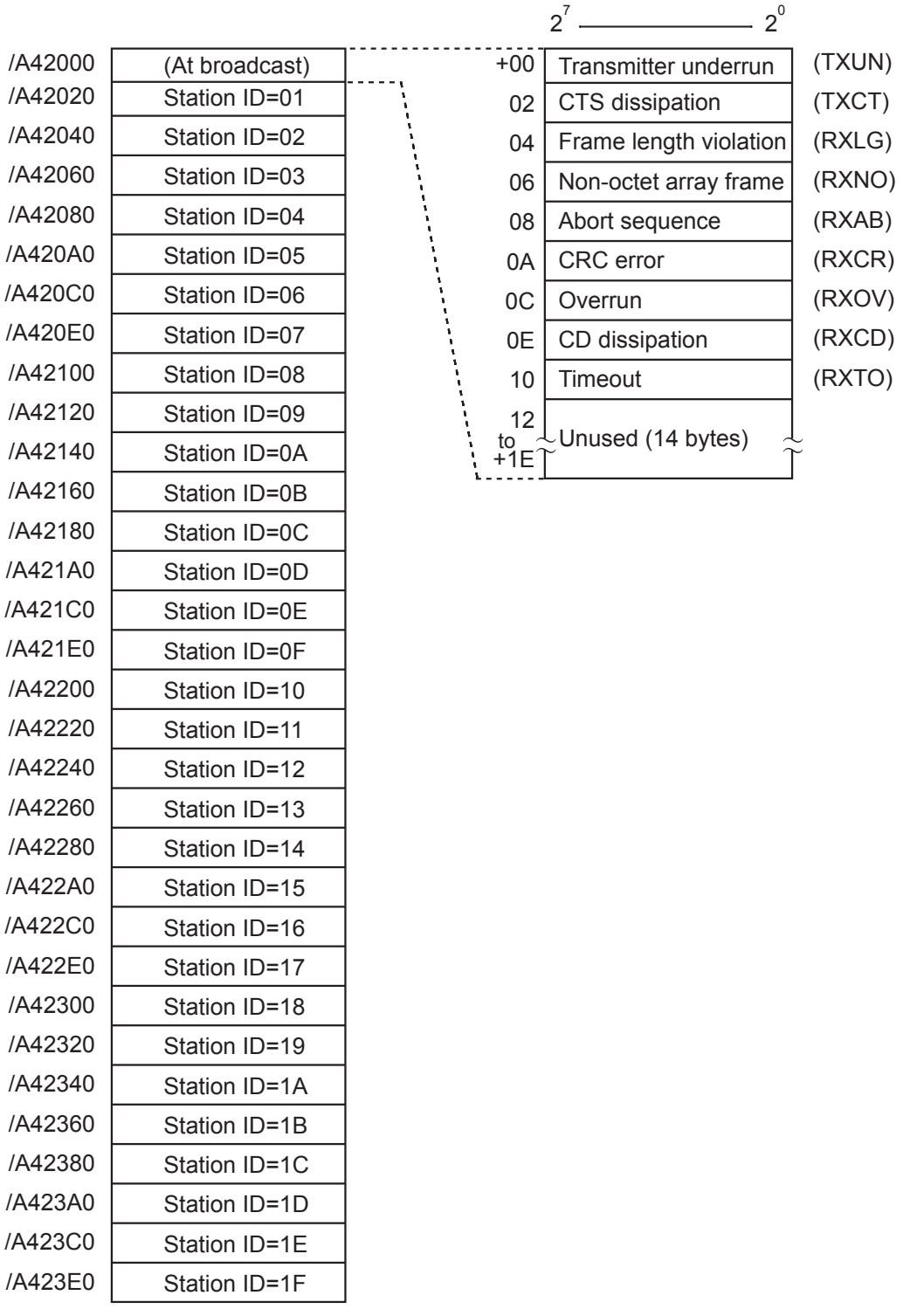
No.	Code	Error	Display
1	0010H	Bus error	BUS
2	0011H	Address error	ADDR
3	0012H	Illegal instruction error	ILLG
4	0013H	Division by zero error	ZERO
5	0014H	Privilege violation	PRIV
6	0015H	WDT error	WDT
7	0016H	Format error	FMAT
8	0017H	Spurious interrupt	SINT
9	0018H	Unused exception (e.g., CHK, TRAPV, L1010)	EXCP
10	0019H	Parity error	PTY
11	001AH	Power failure forecast	GR
12	0100H	MODU. No. switch setting error	MDSW
13	0101H	BIT RATE switch setting error	BRSW
14	0102H	ROM1 sum error	ROM1
15	0103H	RAM1 compare error	RAM1
16	0105H	RAM2 compare error	RAM2
17	0107H	DMA transfer error (IR.LINK module error)	
18	0108H		
19	0109H		
20	010AH		
21	010BH	ROM3 sum error	ROM3
22	010CH	ROM3 write error 2	
23	010DH		
24	010EH		
25	010FH		
26	0110H	Parameter rewrite count exceeded the limit	WOVR

Stack frames in the error freeze information table are explained below.



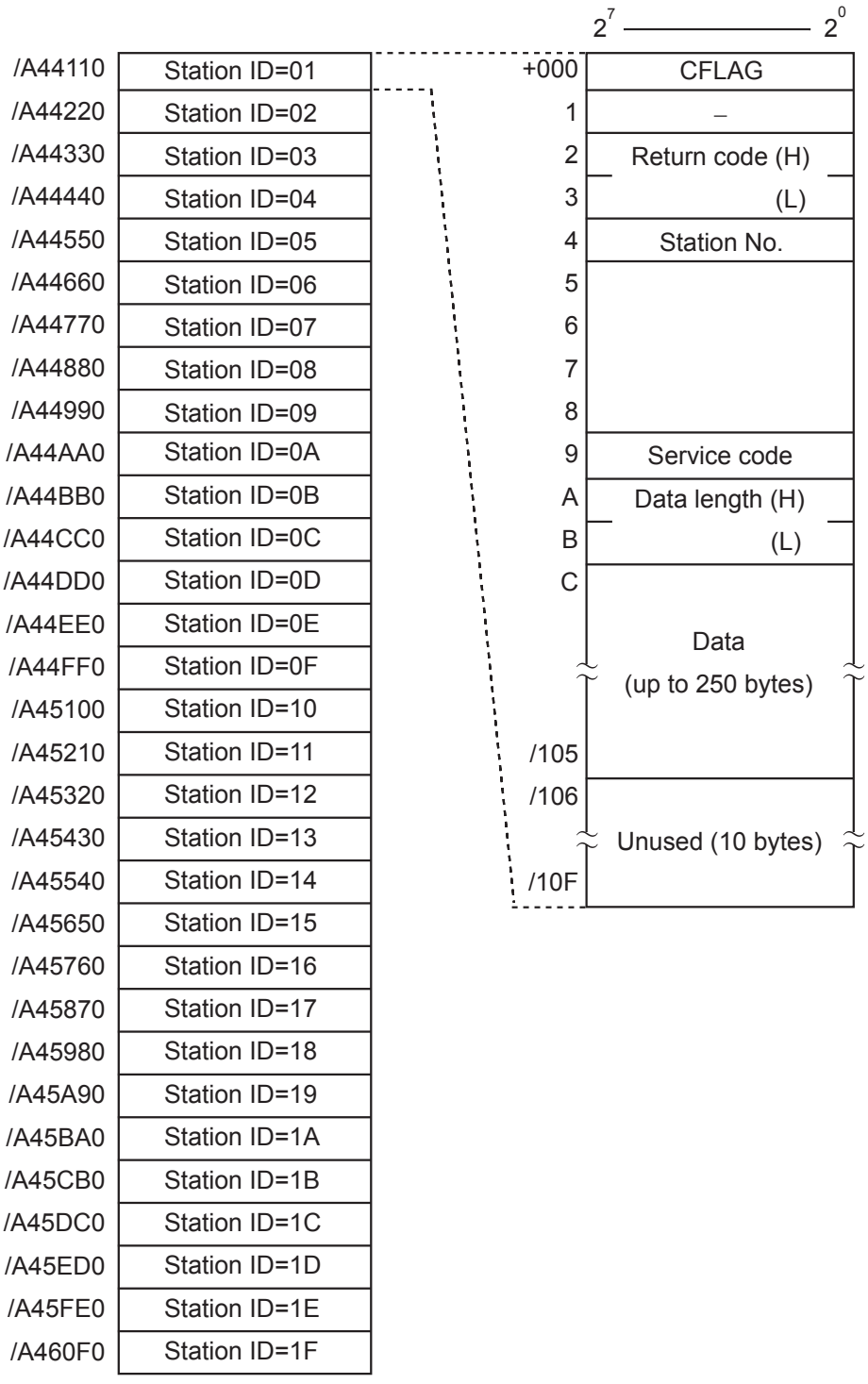
A.4 Error Counter

The error counter counts the communication errors that occur between the IR.LINK module (master) and station (slave). This counter is initialized when it is reset.

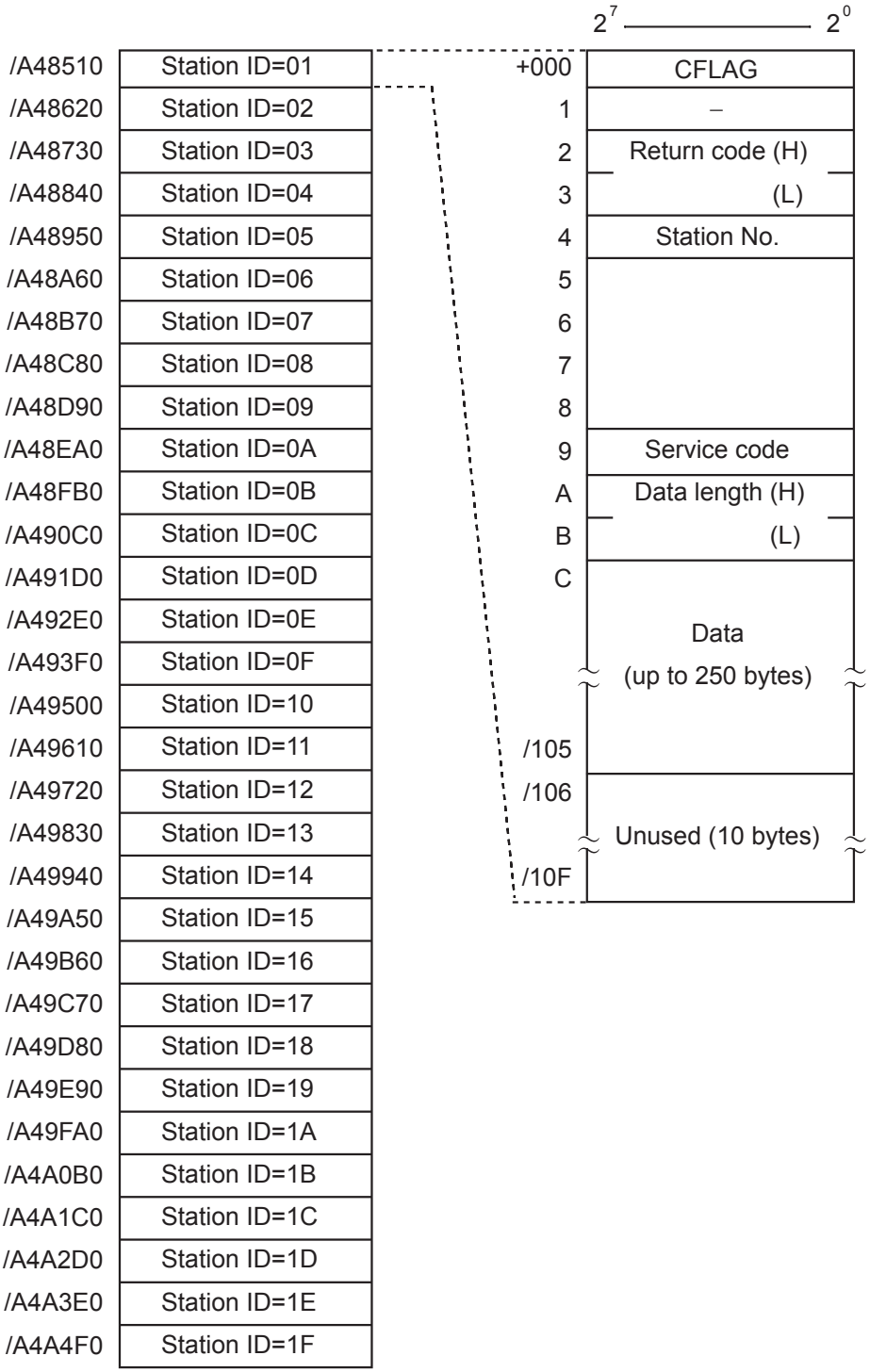


A.5 Command and Response Buffers

- Command buffer

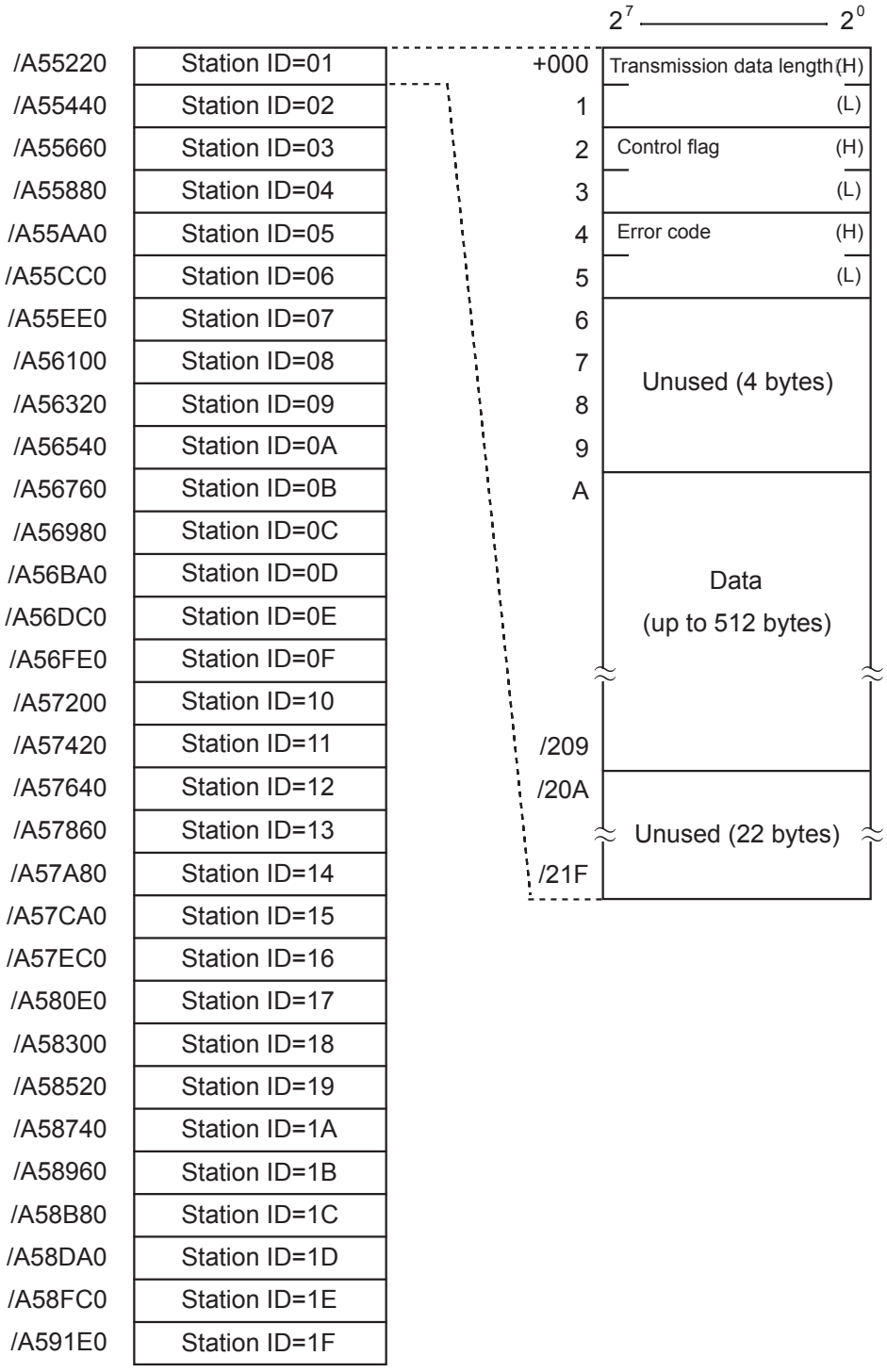


- Response buffer

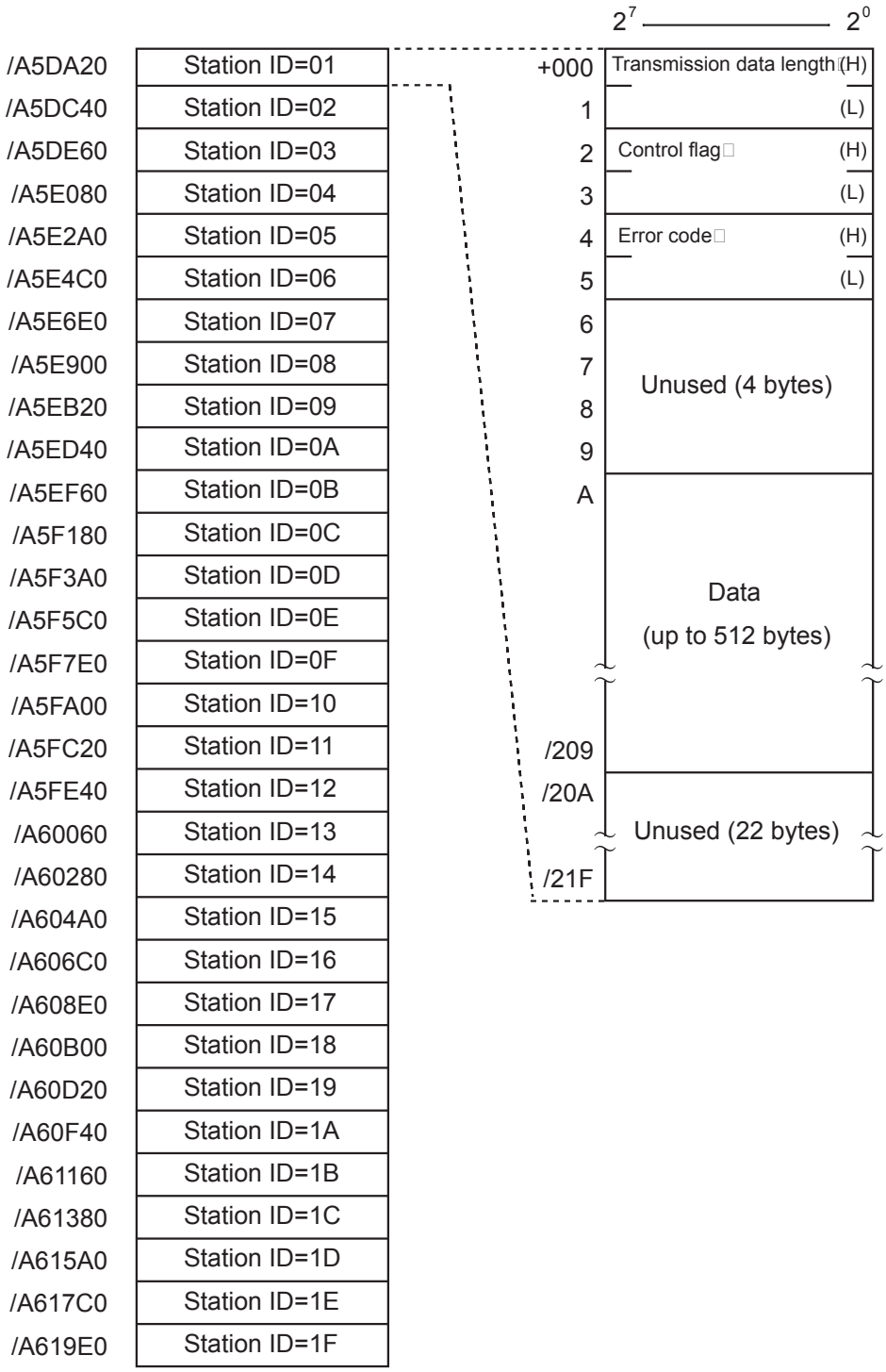


A.6 Data Send and Receive Buffers

- Data send buffer



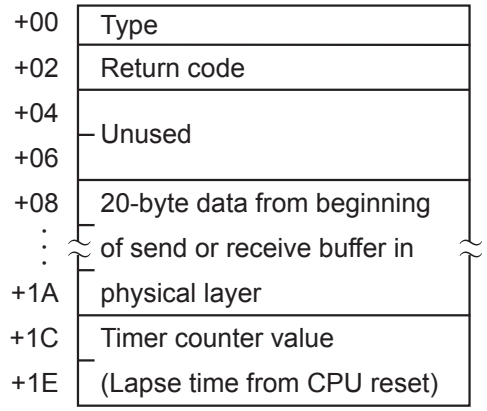
- Data receive buffer



A.7 Trace

Trace is started in the error stop mode (error occurrence, trace stop) when the CPU is reset or power is recovered. Trace data is recorded in transmission or reception units of each service.
The trace data structure is shown below.

Trace data structure



- Type

3030	Initialization service transmission error
3010	I/O service transmission error
4030	Initialization service reception error
4010	I/O service reception error

- Return code
  See Subsection 6.3.3, “Communication errors.”

- 20-byte data from beginning of send or receive buffer in physical layer (See the tables below.)

<When an Initialization service transfer error occurs>

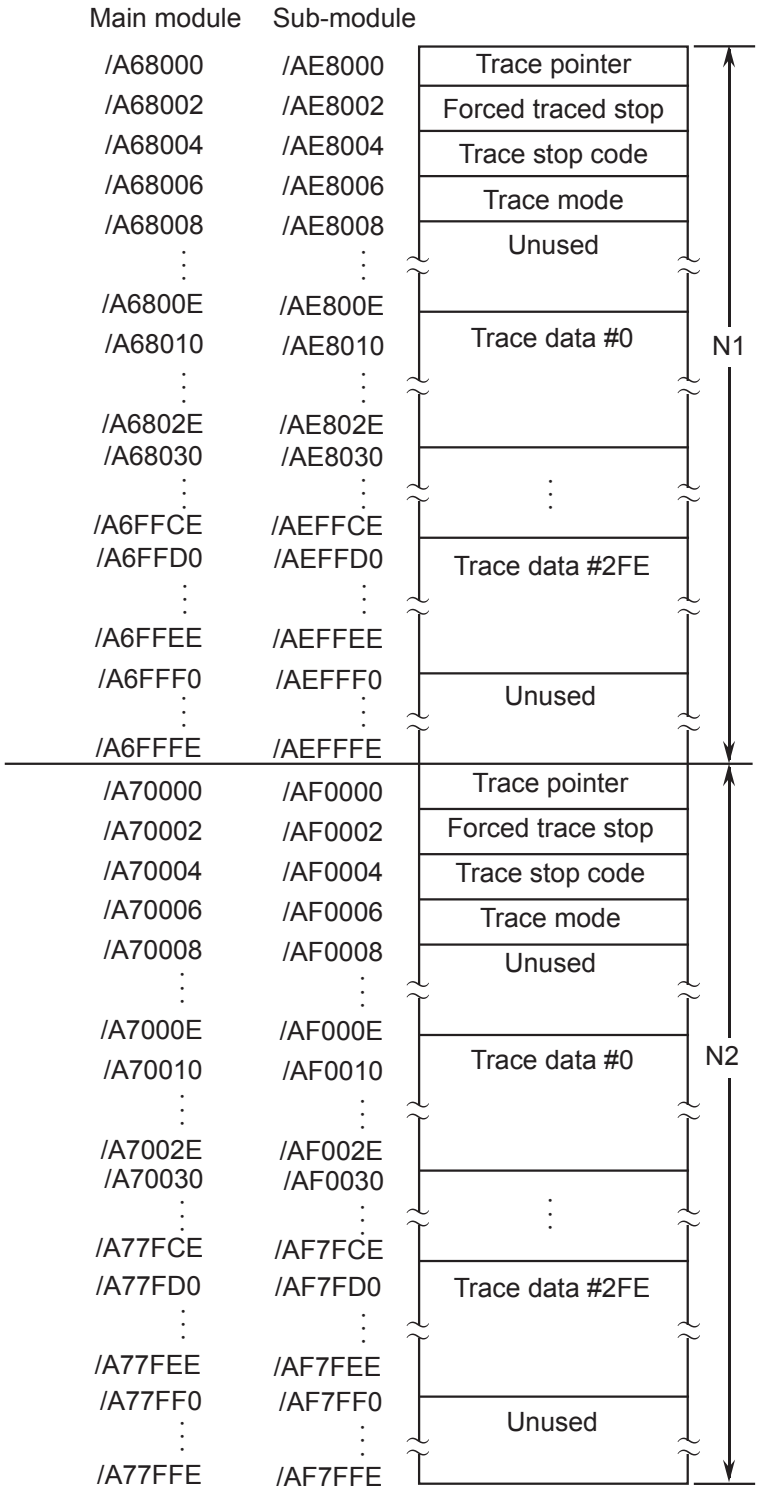
08	A: Station number
09	C: Control flag
0A	DL-SC: DL layer service code
0B	DL-len: DL layer length
0C	7L-hd: 7L layer header
0D	7L-sc: 7L layer service code
0E	7U-sc: 7U layer service code
0F	len(L): Low-order bytes of length
10	len(H): High-order bytes of length
11	data[0]: Data
⋮	⋮
1B	data[9]: Data

<When an I/O service transfer error occurs>

08	A: Station number
09	7L-sc: 7L layer service code
0A	7U-sc: 7U layer service code
0B	data[0]: Data
⋮	⋮
1B	data[15]: Data

- Timer counter value (1-ms unit)
  The timer count value, however, is updated in 4-ms units.

Trace area



- Trace pointer
  The trace pointer points to a value of from 0 to 2FE. The reference address of trace data from the trace pointer is calculated by the expression “reference address = /A68010+(trace pointer×/20)”. /AE8010 of the sub-module becomes the reference address.

- Forced trace stop
  0: Forced trace stop
  Other values: Stop release

- Trace stop code
  Set a trace data type as the trace stop code.

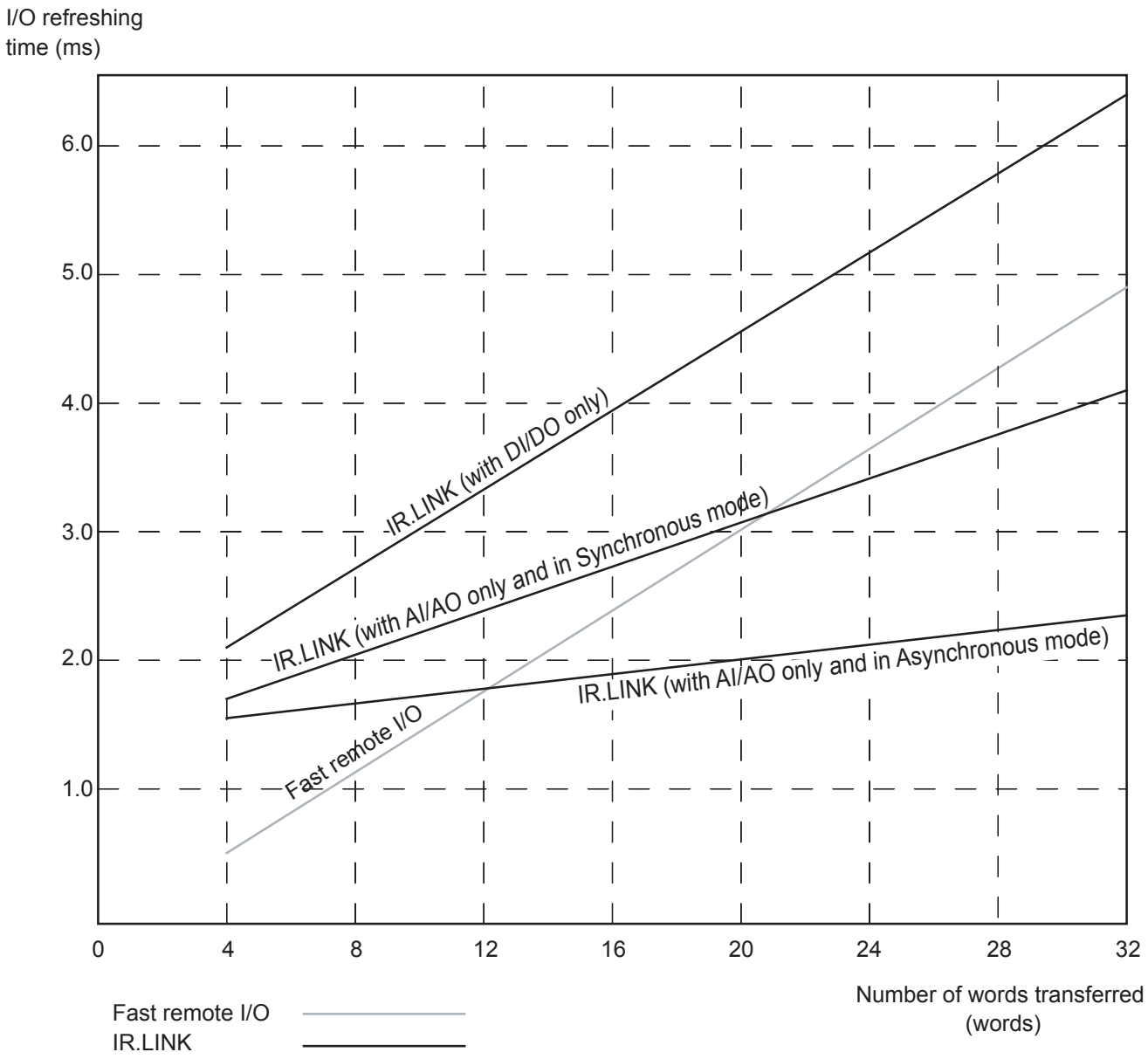
- Trace mode
  0: Trace stop
  1: Endless trace
  2: Stop on error occurrence
  (The trace mode when an error occurs is 0.)

- Trace data
  The trace data area is of ring structure. Data next to #2FE is #0.

A.8 Comparison of the Performance between High Speed Remote I/O for S10/2α Series and I/O Refresh Time of IR.LINK for S10mini

The graph shown below expresses the performance of the I/O refreshing time of the S10/2α series and the IR.LINK for the S10mini.

In this graph, the Bit Rate switch of the IR.LINK is set to "1.0 Mbps." The analog module is set to 4W per slot and the digital module is set to 64 points/slot.



A.9 Trouble Inspection Sheet

■ Trouble inspection sheet

Your company name			Person in charge	
Data and time of occurrence	(year / month / day / hour / minute)			
Where to make contact	Address			
	Telephone			
	FAX			
	E-mail			
Model of defective module			CPU model	
OS Ver. Rev.	Program name:		Ver.	Rev.
Support program	Program name:		Ver.	Rev.
Symptom of defect				
Connection load	Type			
	Model			
	Wiring state			
System configuration and switch setting				
Space for correspondence				