HITACHI PROGRAMMABLE CONTROLLER

HIDIC EH-150

CPU LINK MODULE (EH-LNK)
APPLICATION MANUAL

○ Warranty period and coverage

The product warranty period will be one year after the product has been delivered to the location designated in the order. If a malfunction occurs within the warranty period even though the product has been used within the range of correct conditions according to the product specifications given in this document, we will exchange or repair the defective part free of charge. However, the following conditions are not be covered by this warranty:

(1) Damage due to negligent handling or misuse by the user.

(2) When the cause of the malfunction is due to components other than those supplied.

(3) When the cause of the error is due to a modification or repair performed by an entity other than the supplier.

(4) When the cause of the error is due to weather or accidents that are out of the supplier's control.

Further, the warranty here refers to that of the product itself, and does not include any damage caused by the malfunction of the product.

○ General repair

Investigations and repairs outside the warranty period (1 year) will be charged. Also, we will repair damages caused by any reason not covered by the warranty and investigate the cause of malfunctions for a charge within the warranty period. Please contact the place of purchase or one of our service stations. (Research may not be possible, depending on the area of malfunction.)

○ Ordering parts or asking questions

When contacting us for repair, ordering parts or inquiring about other items, please have the following details ready before contacting the place of purchase or service station.

(1) Model

(2) Manufacturing number (MFG no.)

(3) Details of the malfunction

Warning

(1) This manual may not be reproduced in its entirety or any portion thereof without prior consent.

(2) The content of this document may be changed without notice.

(3) This document has been created with utmost care. However, if errors or questionable areas are found, please contact us.

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Safety Precautions

Read this manual and related documents thoroughly before installing, operating, performing preventive maintenance or performing inspection, and be sure to use the unit correctly.   Use this product after acquiring adequate knowledge of the unit, all safety information, and all cautionary information.   Also, make sure this manual enters the possession of the chief person in charge of safety maintenance.

Safety caution items are classified as "Danger" and "Caution" in this document.

⬥ DANGER ： Cases where if handled incorrectly a dangerous circumstance may be created, resulting in possible death or severe injury.

⚠ CAUTION ： Cases where if handled incorrectly a dangerous circumstance may be created, resulting in possible minor to medium injury to the body, or only mechanical damage.

However, depending on the circumstances, items marked with ⚠ CAUTION may result in major accidents.

In any case, they both contain important information, so please follow them closely.

Icons for prohibited items and required items are shown below:

🚫 ： Indicates prohibited items (items that may not be performed).   For example, when open flames are prohibited, is shown.

❗ ： Indicates required items (items that must be performed).   For example, when grounding must be performed, is shown.

1. Attachments

⚠ CAUTION

- To be used in environments stipulated in the catalogue and in this document.
  Usage in environments that subject the equipment to high temperatures, high humidity, dirt and dust, corrosive gas, vibrations and shocks may result in electric shocks, the outbreak of fire and malfunctions.
- Ensure that all attachments are made in accordance with the instructions provided in the instruction manual. If the attachment procedures are ill-prepared, it may result in dropped equipment, damage and malfunctions.
- Ensure that cable clippings and other foreign objects do not enter the equipment. Failure to observe this may result in the outbreak of fire, damage and malfunctions.

2. Wiring

⚠ CAUTION

- Ensure that the equipment is connected to a rated power supply.
  Connecting the equipment to non-rated power supplies may result in the outbreak of fire.
- Ensure that all wiring procedures are performed by qualified technicians.
  Wrong wiring may result in the outbreak of fire, damage and electric shocks.
- Ensure that the coaxial cable is shielded when installing the link module.
  As only one side of the shielded cable is to be earthed as a basic principle, attach the earth to the RXD (receiving side.)
- Cover coaxial cables for transmitting between CPU link modules with cloth using a different route than that used by other dynamic or signal cables. If it is not possible to establish a different route, use metal pipes when connecting the wiring.

3. Maintenance

⊘ PROHIBITED

- Never dismantle or remodel the equipment.
  Failure to observe this may result in the outbreak of fire, damage and malfunctions.

⚠ CAUTION

- Ensure that the power supply to the modules and units that are to be disconnected has been switched off.
  Failure to observe this may result in electric shocks, malfunctions and damage.

CONTENTS

Appendix. Processing the ends of the coaxial cable	Appendix-1 to Appendix -6

Chapter 1 Foreword

Thank you for using the Hitachi EH-150 Programmable Controller series (hereinafter known as the PLC.)
This manual explains how to use the CPU link module (hereinafter known as the EH-LNK) with the Hitachi EH-150 Programmable Controller. Read this manual thoroughly and use if when performing installation operations, maintenance checks and other procedures. The following documentation related to PLC is also available and should be used together with this manual.

Table 1.1 List of Explanatory Documentation

Items	Name of documentation	Manual Number
Main system of EH-150	EH-150 Application Manual	NJI-280*X
Programming Software	LADDER EDITOR (for MS-DOS)	NB-325*X
	LADDER EDITOR for Windows®(Windows®95/98/NT4)	NJI-206*X/299*X
CPU Link module	CPU Link module (EH-LNK) Application Manual	NJI-381*X

* The end of the manual number will differ in accordance with upgraded versions, etc.

* Note that the contents of this manual are subject to amendment without prior notice.

1.1   Before use

Great care has been taken in the manufacture of this product, but it is advised that the following points are checked immediately after purchase.

1. Is the model the same one that you ordered?
2. Has the product been damaged in any way?
3. Are any of the accessories listed in table 1.2 missing?

Contact your dealer in the event of any defects being discovered.

Table 1.2 List of Accessories Supplied with the EH-LNK

No.	Products name	Model number	Outlook	Pcs	Remarks
1	CPU Link Module	EH-LNK		1	
2	Insulated cable connector tube			2	
3	Instruction manual	NJI-376		1	
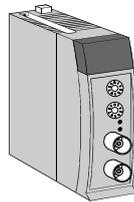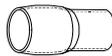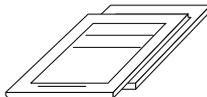
* Attach the insulated cable connector tube in accordance with the instructions provided in section 5.1.5 (Using the Insulated Cable Connector Tube Supplied.)

1.2　Precautions during use

1. Link modules can only be installed in slots #0 to #2 on the basic base.

2. A maximum of two modules that have been I/O assigned as "CPU Links" can be installed in each CPU.

3. Do not plug in and unplug the coaxial cable until the power supply to the base on which the link module has been installed has been switched off.

4. Do not attach or detach the link module until the power supply to the base on which the module has been installed has been switched off.

5. The rechargeable metal fitting on the coaxial cable's BNC connector is exposed. Although the recharging voltage is too low to give electric shocks when touched, the static electricity contained within the human body may affect the transmission signals and result in malfunctions. For this reason, avoid touching the connector during communications.

6. Note that the module will be damaged if the coaxial cable's BNC connector comes into contact with other circuits, such as 100V AC current circuits.

7. Note that bringing the coaxial cable's BNC connector into contact with other objects may result in malfunctions.

8. Do not plug in or unplug the transmission cable or other cables during communications.

1.3　Usable CPU modules

The EH-LNK CPU link module (coaxial cable) can be used in combination with the following types of CPU module. Note that the link data will become unstable and access to other stations with peripheral devices will not be possible if the EH-LNK is mistakenly used in combination with CPU modules other than those listed below.

Table 1.3　CPUs that can be used with the EH-LNK

CPU Type	Support Version	Remarks
EH-CPU104 / 208	---	The EH-LNK cannot be used.
EH-CPU308	From ROM VER. A200 and later	Modules produced from October
EH-CPU316	From ROM VER. B200 and later	2000 and later.
EH-CPU448	From ROM VER. C322 and later From ROM VER. C404 and later	

Side view of the CPU module
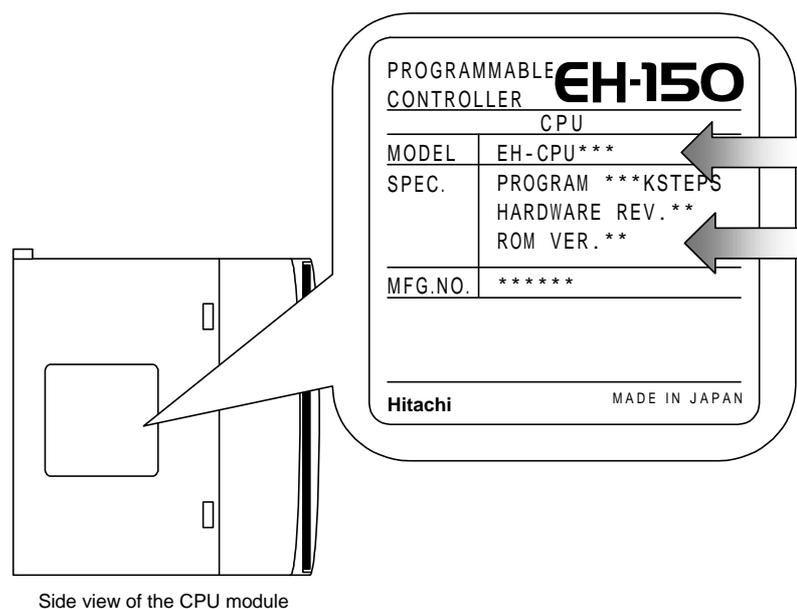
Figure 1.1　CPU ROM version display

Chapter 2 Specifications

2.1 General specifications

Table 2.1 General specifications

Item		Specification
General Specification	Operating temperature	0 to 55 °C
	Preserving temperature	-10 to 75 °C
	Operating humidity	No condensation 20 to 90% RH
	Preserving humidity	No condensation 10 to 90% RH
	Current consumption	5V DC approx. 480mA
	I/O assignment	CPU Link
	Earth	D-type earth

2.2 Function specifications

Table 2.2 Function specifications

Item		Specification
Function Specification	No. of connected Link module	Max. 64 units per Link system
	No. of mounted units	Max. 2 units per CPU (2 Link systems per CPU)[1]
	No. of Link points	1,024 words per Link system (2,048 words per CPU)[2]
	Data delivery system	Common data area system
	Send / Receive distinction on data area allocation	parameter setting from peripheral device
	Designation of station No.	0 to 63: designated by rotary switch
	Communication speed	1.0 Mbps
	Transfer method	Half-duplex serial transfer, frame synchronization
	Communication method	Token passing
	Modulation method	Base band
	Refresh time	At the time of transfer of 1,024 words with 64 stations connected --- approx. 390ms[3]
	Error check	CRC, overrun check, time-out, open circuit, parameter error (dual designation of station No., overlapped Link area, etc.)
	Self-diagnosis	System ROM / RAM check, watchdog timer check, transfer loop back check.

*1: Link modules can only be installed into slots #0 to #2 on the basic base.
*2: Storage during power cuts is not possible.
*3: Apart from when peripheral devices are performing simultaneous access with the use of the link.

2.3 Transmission route specifications

Table 2.3 Transmission route specifications

Item		Specification
Transmission specifications	Transfer path form	Loop type
	Cable length	Between stations	Max. 500 m
		Total extension	Max. 1,000 m
	Error station processing	Bypass system
	Recommended cable	5D-2V with shield or equivalent
	Recommended connector	Link module : 413631-1 (AMP)

2.4　Differences with upper level H series equipment

Table 2.4 shows the differences between the EH-LNK and the LINK-SH CPU link module (single-slot, coaxial cable) and the LINK-H (twin-slot, coaxial cable) for use with large upper level H series equipment, and the LINK-02H CPU link module (coaxial cable) for use with the medium H series.

Table 2.4　Differences with upper level H series equipment

<table>
<tr><th colspan="2">Item</th><th>EH-LNK</th><th>LINK-02H</th><th>LINK-H / LINK-SH</th></tr>
<tr><td rowspan="10">Hardware Specifications</td><td>Usable CPU module</td><td>EH-CPU308[1],
EH-CPU316[1],
EH-CPU448[1]</td><td>CPU22-02HB,
CPU22-02HC,
CPE22-02HC</td><td>CPU3-40H,
CPU2-20H, CPU-20Ha,
CPU2-10H,
CPU2-07H, CPU-07Ha,
CPU2-03H, CPU-03Ha</td></tr>
<tr><td>Slot width</td><td>1 slot</td><td>2 slots
(in case bypass module is used)</td><td>1 slot (LINK-SH)
2 slots (LINK-H)</td></tr>
<tr><td>Bypass relay</td><td>Exist
(No bypass cassette or bypass module)</td><td>Fitted with a bypass Module as standard</td><td>Fitted with a bypass cassette as standard.</td></tr>
<tr><td>7 segment display</td><td>None</td><td>None</td><td>displays error information</td></tr>
<tr><td>Module information display LED</td><td>RUN, ERR, TXD, RXD</td><td>RUN, ERR</td><td>ERR, SEND, REC</td></tr>
<tr><td>Error indication select switch</td><td>None</td><td>None</td><td>Select error indication</td></tr>
<tr><td>Check mode select switch</td><td>None</td><td>None</td><td>Selects check mode</td></tr>
<tr><td>Mount position</td><td>Can be installed in slots #0 to #2 on the basic base.</td><td>Can be installed in any slot on the basic base.</td><td>Can be installed in any slot on the basic base. [3]</td></tr>
<tr><td>Mount units</td><td>Max. 2 units per CPU[2]</td><td>Max. 2 units per CPU</td><td>Max. 2 units per CPU</td></tr>
</table>

*1: There are cases where support is not yet available depending on the CPU version. Refer to section 1.3 for further details.

*2: A maximum of two modules that have been I/O assigned as "CPU Links" can be installed. When modules other that this module (EH-RMP, etc.,) are assigned as "CPU Links" and installed, the number of CPU link modules that can be installed will be reduced in direct relation to the number installed.

*3: LINK-SH cannot be installed into slot #0.

Chapter 3 Configuration

3.1　Part names and functions

Name and function of each part			Type	EH-LNK
			Weight	Approx. 0.15 kg
			Dimensions(mm)	

1] Lock button

2] Module information display LED

3] Station No. setting switch (10-digits)

4] Station No. setting switch (1-digits)

5] Error display clearance switch

6] Reset switch

7] Transmission coaxial cable connector

8] Receiving coaxial cable connector

30　　95　　100

No.	Name	Function	Remarks
1]	Lock button	This is used when removing the module from the base unit. After it is installed to the base unit, the attachment can be reinforced using screws. In this case, use M4 x 10mm screws.	
2]	Module information display LED	Displays data transmission and receipt, error information and other details. Refer to the section on LED display for further details.	
3]	Station No. setting switch (10-digits)	This switch determines the number of the link station. The setting for this switch is validated when the power supply is switched on or when the reset switch is pressed. The setting range is between 00 and 63.　(Ex.) Station No. 18	- An out-of-range error for the station No. will be triggered when 64 or higher is set. - When station no. is duplicated, duplicate station No. error occurs. - When No.00 station is not exist in link system, it does not work normally.
4]	Station No. setting switch (1-digits)	10-digits … 1　　1-digits … 8	
5]	Error display clearance switch	Clears the contents of the ERR LED display (the error will be displayed again if the cause is not resolved.)	The ERR LED will be extinguished. The CPU error information will not be cleared.
6]	Reset switch	Performs the hardware reset procedure for the module.	*
7]	Transmission coaxial cable connector (TXD)	Transmits data from the local station. Establish a connection with the next station's RXD with a coaxial cable.	
8]	Receiving coaxial cable connector (RXD)	Receives data from other stations. Establish a connection with the next station's TXD with a coaxial cable.	

＊ The CPU module will detect a "Link Module Error (error code: 59H)" when the reset switch is pressed. Resolve the CPU module error after the link module resumes normal operations when the reset switch has been pressed.

3.2 Module information display LED

Descriptions of the module information display for all LEDs are provided in table 3.1.

Table 3.1   Module Status display LED

Outlook	Name	Color	Contents
CPU LINK EH-LNK RUN TXD ERR RXD	TXD	Green	Blinks when data is being transmitted.
	RXD	Green	Blinks when data is being received.
	RUN	Green	Illuminated when the link module is operating normally.
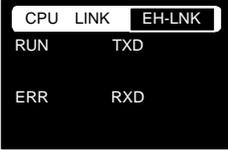
	ERR	Red	During normal operations:
			                    Extinguished
			During "data link possible" errors:
			                    Blinks (cycles of 1s)[*]
			During "data link not possible" errors:
			                    Blinks (cycles of 0.5s), illuminated[*]

 * Refer to section 5.2 (Error Displays) for further details on displays.

Chapter 4 Basic CPU Link Operations

4.1 System Configuration

An example of a CPU link module configuration is shown is figure 4.1.

It is possible to connect up the EH-LNK together with upper level H series CPU link modules (LINK-H, LINK-SH, LINK-02H, etc.) As indicated in figure 4.1, it is possible to use both upper level H series CPU link modules and CPU modules in a link system loop.
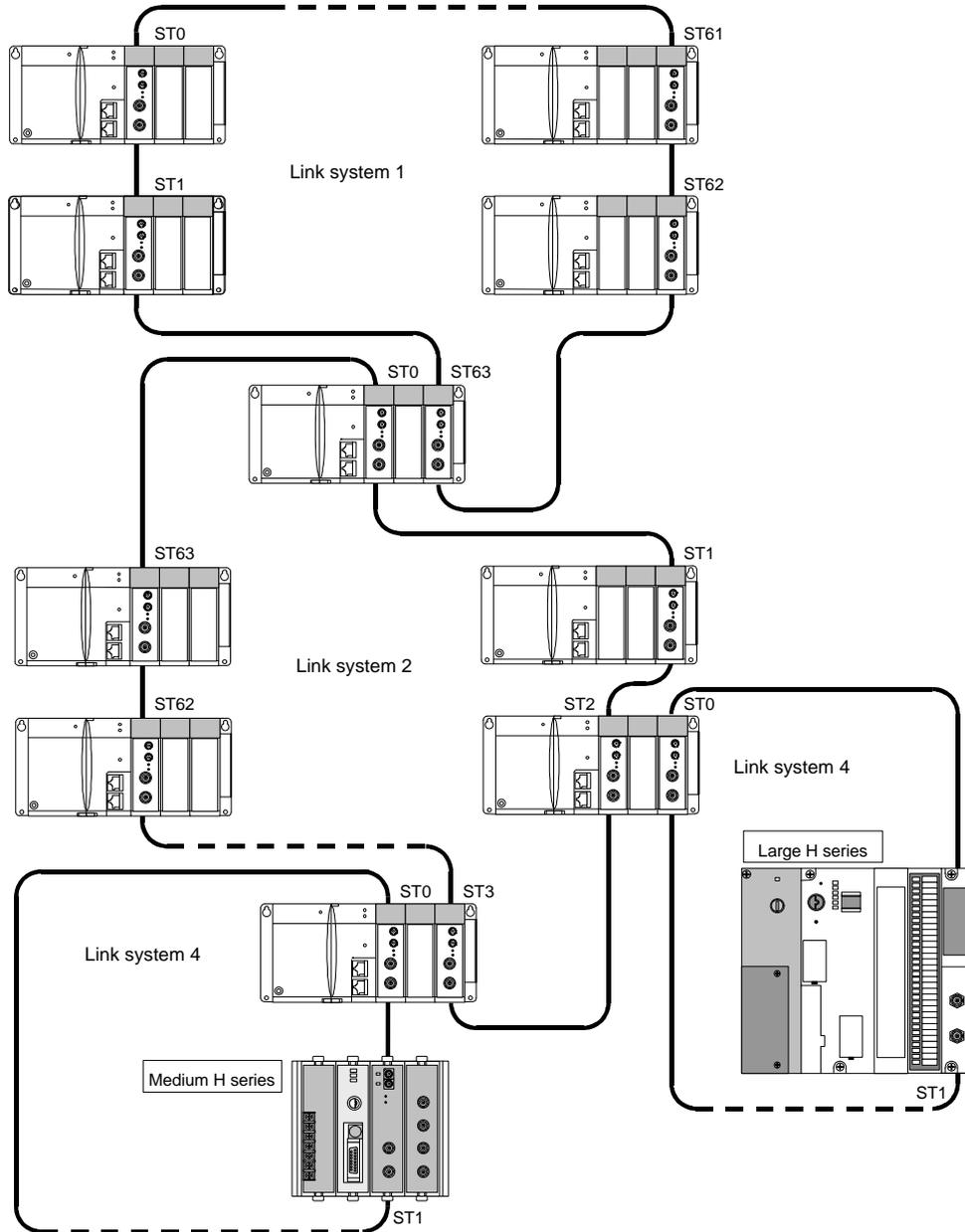
Figure 4.1   Example of a CPU Link System Configuration

A maximum of two link modules can be installed into any of the slots between #0 and #2 on a single basic base unit (although link modules cannot be installed onto additional bases.) It is also possible to connect a maximum of 64 units onto one link system. (At least one unit must be assigned as station No.0 (master station) on a link system.)

The length of the transmission route can be up to 500m between stations, and have a total length of 1,000m for the link system

  Caution

No.00 station(master station) must exist in link system. When No.00 station is not exist, and link operation and RUN LED turns off or ERR LED is flickering every 0.5s. When No.0 station is not exist, own station error information(WRF0E0, WRF140) remains H0000.(The information which No. station is not exist is not stored to own station error information.)

4.2   CPU link functions

A transmission area and a receiving area are assigned to the CPU's link area, and all link operations are performed via these areas. The link areas can be assigned arbitrarily in units of 16 points (1 word) for each CPU.

The link modules that perform the link operations are set between station No.s 0 to 63 with the rotary switch. As shown in figure 4.2, the link operations between stations establish the areas assigned in each station as the transmission area to other stations, and the other areas as the receiving areas from other stations.
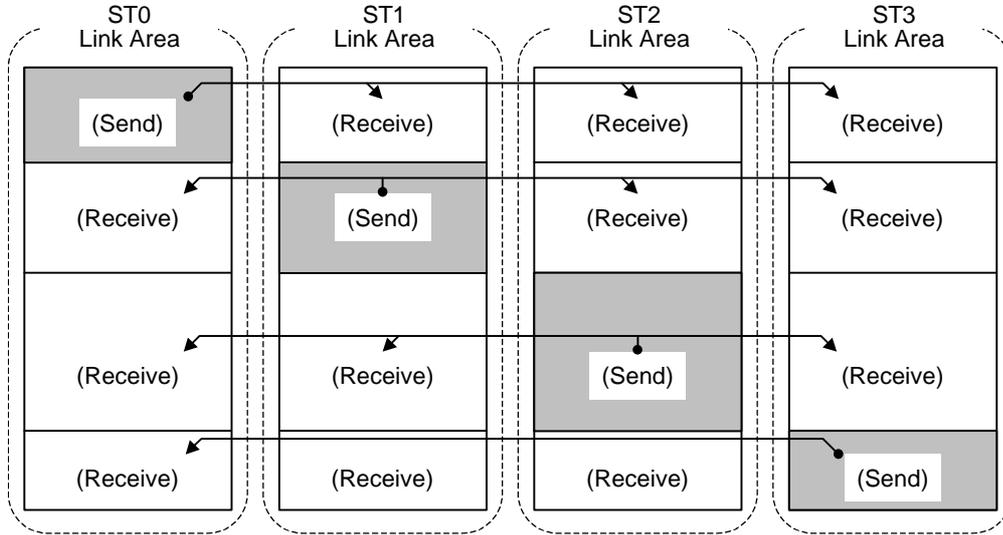
Figure 4.2   Concept behind link areas

(1) Link area assignment

A shown in figure 4.2, the CPU link areas are equipped to handle 1,024 words for each CPU link module. As a maximum of two CPU link modules can be installed for each CPU, this means that a single CPU possesses a link area for 2,048 words.

The link areas are assigned with the use of peripheral devices (LADDER EDITOR for Windows/Portable diagram programmer/Command language programmer, etc.) Refer to the manual for each relevant peripheral device for further details on usage methods.
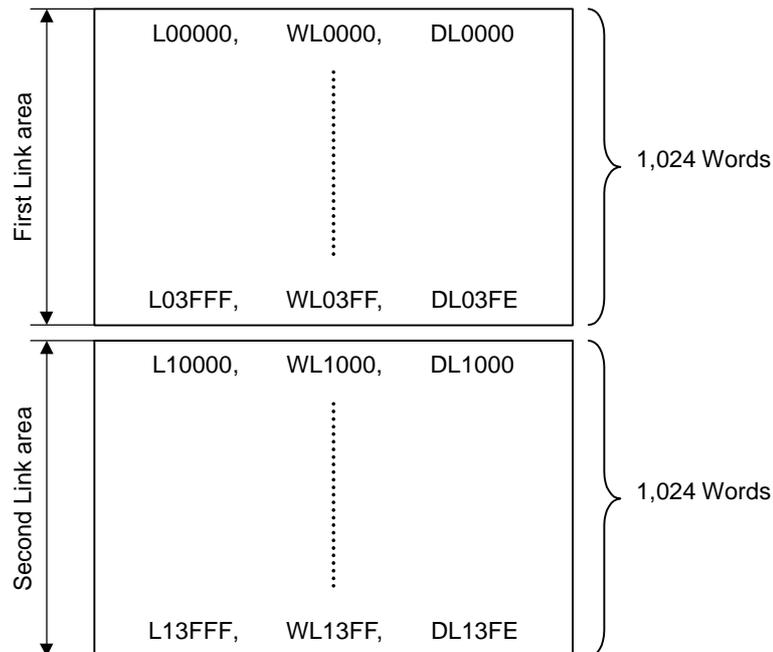
Figure 4.3   CPU module link areas

(2) Link area identification

When two CPU link modules have been installed, the first and second link areas are identified in accordance with their installation position. The slots are counted in 0, 1, 2 sequence from the right-hand side of the CPU, and the CPU link module with the smallest number is assigned as the first unit, with the other unit assigned as the second CPU link module. The first CPU link occupies the first link area, and the second CPU link occupies the second link area. When only one unit has been installed, it is assigned to the first CPU link area.

Note: Link modules can only be installed into slots #0, #1 and #2.
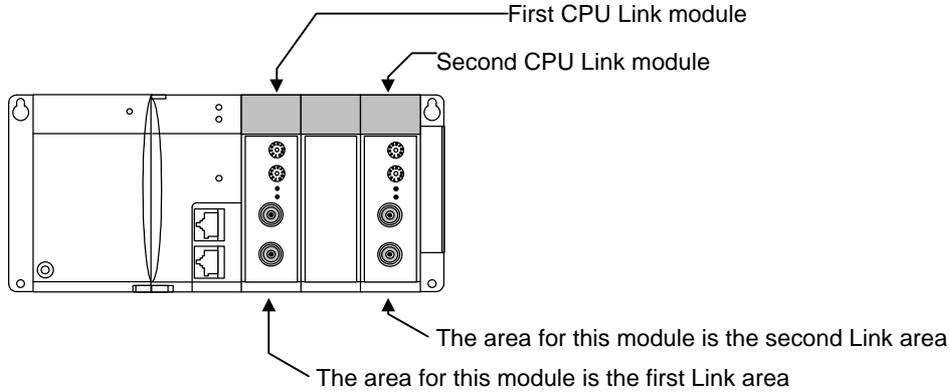
Figure 4.5. Link area identification

An example of a CPU link system configuration is shown in figure 4.5.

In the system configuration shown in figure 4.5, the CPU (A) CPU link module (ST1) is located in the first CPU link position, and link data assignment with CPU (A) is carried out within the first CPU link area. In addition to this, link data assignment for the CPU (B) link module (ST2) is also carried out in the first link area when viewed from CPU (A).

As the CPU (B) CPU link module (ST2) is also in the second CPU link position, link data assignment with the CPU (B) is carried out in the second link area. Also, link data assignment for the CPU (A) link module (ST1) is carried out in the second link area when viewed from CPU (B).
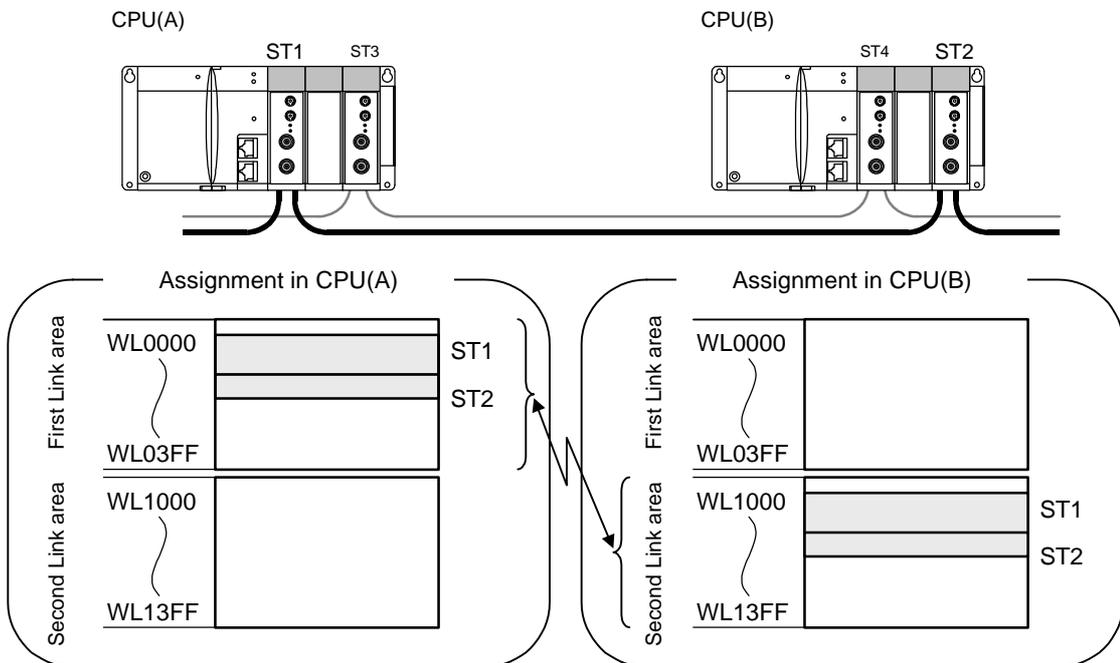
Figure 4.6. Example of link data assignment

4-3

(3) Precautions related to assignment duplication

Link areas assigned in local stations will become the areas for transmitting to other stations, and the remaining area will become the area for receiving from other stations, in accordance with link area assignment. Owing to this, it is not possible to duplicate assigned areas on the same link system. A link area duplication error will be trigger is duplication does occur.

The same applies to link systems in which the first link and second link area are mixed. In this event, ensure that the first digit of the L, WL and DL numbers are not duplicated.

A duplication error will be triggered if the link areas are duplicated owing to a link started up after link operations are in progress, and link operations for the station in which the duplicated link area has been assigned will be terminated. The link operation status flag will be set at OFF in this case, but the link participation flag will not be set at OFF. Also, the link area data existing immediately prior to the error will be saved.

(4) Link area data

Data is read into the local station area in accordance with user programs during normal operations. This data can be amended if necessary and transmitted to other stations at refresh time intervals.

On the other hand, the contents of other station areas will be updated by the data transmitted from other stations at refresh time intervals. The details of the data transmitted from other stations are notified to the user when the contents are read with the user program.

Note: that it is not possible to set the link area for power cut storage.

(5) Precautions related to link area data

1) When the power supply to the local station is switched on

All data in the link area will be cleared by the system when the power supply is switched on. In addition to this, the execution timing of the user program started with the CPU's RUN command and the CPU's link module will participate in the link, and the data first transmitted from the local station to other stations at the start of operations will differ in accordance with the timing for transmitting from the local station to other stations and the time difference involved. The program should therefore be created while monitoring the special internal output link's operation status flag and the CPU status flag.

2) When the local station's CPU is RUN

The transmission area's data will commence from the value first updated. As the receiving area's data updates the data transmitted from other stations when the CPU is stopped during link operations in other stations, the data will commence from the value received from other stations when the RUN command is started.

Note: It is possible to clear the link area when the system is switched between RUN and STOP with the CPU module's special WRF07E internal output setting. The data in the transmission area when this setting is performed will commence from 0. (Refer to the CPU Module Application Manual for further details on the WRF07E setting.)

3) When the local CPU is stopped

The transmission area will save the value most recently updated with the user program. In addition to this, the link area in other stations will continue to update the data transmitted from other stations when the link module is performing link operations. However, the area in other stations will save the data most recently received if the link module stops link operations.

Note: It is possible to clear the link area when the system is switched between RUN and STOP with the CPU module's special WRF07E internal output setting. The data in the transmission area when this setting is performed will save 0. (Refer to the CPU Module Application Manual for further details on the WRF07E setting.)

4) When the power supply to the other stations is set at OFF, and when link operations are halted in other stations

The receiving area in the local station will save the data most recently transmitted from the other stations without amendment.

4.3 Function for accessing other stations

It is possible to read, white and control the operations of monitor programs for other stations from peripheral devices connected to the CPU via the CPU link module.

An example of this is shown in figure 4.6. This enables a peripheral device connected to the EH-150 communication port to operate and monitor a different CPU's program connected to the same link system.
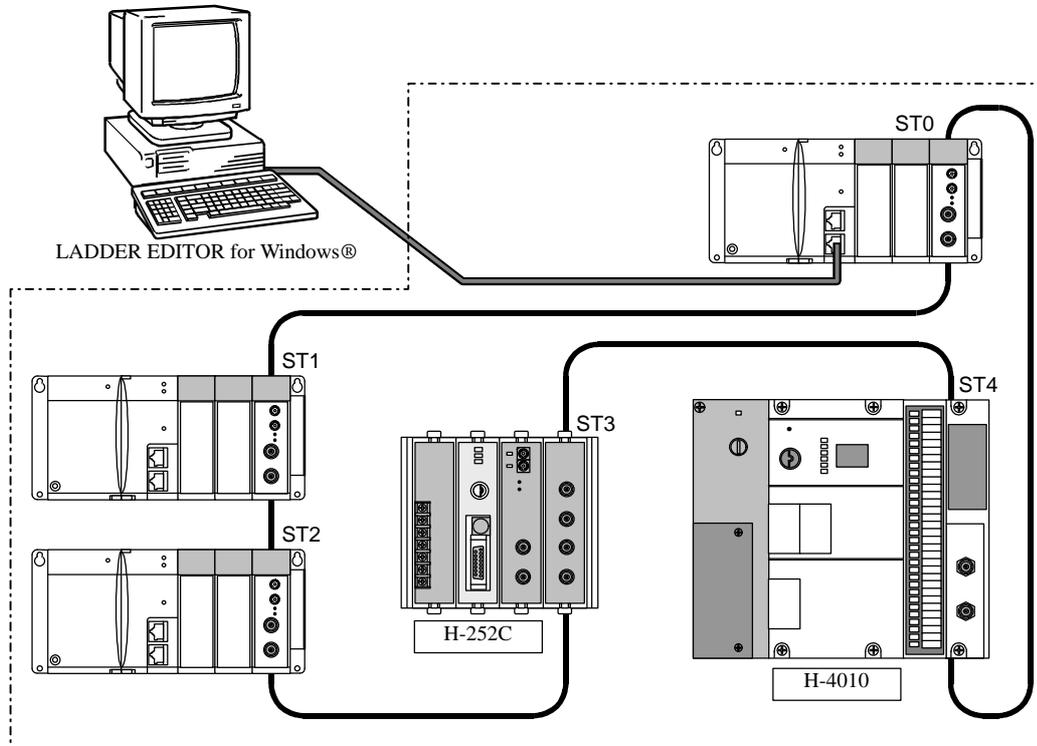
Figure 4.7. Accessing another station via the link module

However, peripheral devices can only access CPUs that are on the same link system (the same loop.)
Note: There are cases where another station's CPU cannot be accessed if an error occurs in the link module of the station connected to the peripheral device.

4.4 Link data refresh time

The amount of time required for the EH-150 link module to update link data is calculated in the following manner. However, this is only a rough estimate and does not necessarily apply when transmission errors and other errors are triggered. As the refresh time is extended in these cases, close consideration must be applied when designing the system.

Link data refresh time =
Transmission CPU scan time + receiving CPU scan time + A + B x all station's assigned word count + C x slave station count + 20 (ms) *

* Slave station confirmation time (fixed): The slave station confirmation time is only added to the calculation if the number of participating units is less that 64.

The A to C values in the above equation are as follows:

Sign	Meaning	Time (ms)
A	Master station processing time	25
B	Processing time / word	0.04
C	Slave station fixed processing time	3.7

(Calculation example)

When ten links exists and each link area is assigned 50 words (scan time for each CPU 20ms, link transmission speed 1Mbps)

Link data refresh time = 20 + 20 + 25 + (0.04 x 50 x 10) + (3.7 x 9) + 20 = 138ms

4.5 Method of confirming link data validation

4.5.1 Link Error Flag Area

When reading area data assigned to other stations, it is necessary to confirm that each station's link module is operating normally and that the CPU is running correctly at the very least. The method for doing this is by monitoring the link operation station flags (WRF05E to WRF08E and WRF145 to WFR148) and the CPU status flags (WRF0E9 to WRF0F8 and WRF149 to WFR158) and confirming all are set at ON (normal operations) before reading the assigned area data.

Further details on the link error flag areas are provided below.

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	[1]
Local station error information[2]	Undefined	(a)	(b)	(c)	(d)	(e)	(f)		Undefined		Disconnected station number						WRF0E0 / 140
	15						to									0	WRF0E1 / 141
Link participation flag (g)	31						to									16	WRF0E2 / 142
	47						to									32	WRF0E3 / 143
	63						to									48	WRF0E4 / 144
	15						to									0	WRF0E5 / 145
Link operation status flag (h)	31						to									16	WRF0E6 / 146
	47						to									32	WRF0E7 / 147
	63						to									48	WRF0E8 / 148
CPU status flag (i)		3				2				1				0			WRF0E9 / 149
		63				62				61				60			WRF0F8 / 158
Error status flag (j) [3]	15						to									0	WRF0F9 / 159
	31						to									16	WRF0FA / 15A
	47						to									32	WRF0FB / 15B
	63						to									48	WRF0FC / 15C
Station 0 to 63 Error detail information	(k)	(l)	(m)		Undefined				Number of times transmission errors [4]								WRF0FD / 15D
	(k)	(l)	(m)		Undefined				Number of times transmission errors [4]								WRF13C / 19C
Refresh time (maximum)	(Unit: ms)																WRF13D / 19D
Refresh time (minimum)	(Unit: ms)																WRF13E / 19E
Refresh time (present)	(Unit: ms)																WRF13F / 19F

(a): System bus error (1-error, 0-no error)   (b): Undefined

(c): Area error (1-error, 0-no error)   (d): Duplicate area error (1-error, 0-no error)

(e): Station number error (1-error, 0-no error)   (f): Transmission path disconnected (1-error, 0-no error)

(g): Number indicates the station number (1-participation, 0-non-participation)

(h): Number indicates the station number (1-operating, 0-stopped)

(i): Number indicates the station number (of the 4 bits,   1] 1-CPU error, 0-normal   2] Undefined
3] 1-HALT status, 0-other than HALT status   4] 1-running, 0-stopped)

1]	2]	3]	4]

(j): Number indicates the station number (1-error, 0-no error)

(k): Time out error (1-error, 0-no error)

(l): Frame error (1-error, 0-no error)

(m): Abnormal between CPU and link (1-abnormal, 0-normal)

*1: The error information for link area #1 is stored in WRF0E0 to WRF13F, and the error information for link area #2 is stored in WRF140 to 19F.

*2: These are cleared when the special internal output error clearance bit (R7EC) is set at ON, but the error information is not erased even when cleared with R7EC if the cause of the error is not resolved in the link module. In this event, resolve the cause of the error in the link module, press the reset switch on the module's main unit, and then clear the information with R7EC.

*3: "1" is set in the error status flag's and error properties' (k), (l) and (m) when an error is triggered. "1" is set in (k), (l) and (m) when an error occurs during communication with another station's CPU with the use of a peripheral device.

*4: The [Transmission Error Count] is the total amount of (k) or (1) error occurrences.

4.5.2 Example of Effective check of Link Data

Figure 4.7 shows the example which CPU module of link station No.0 checks the effective of link data (receive area) from other stations.
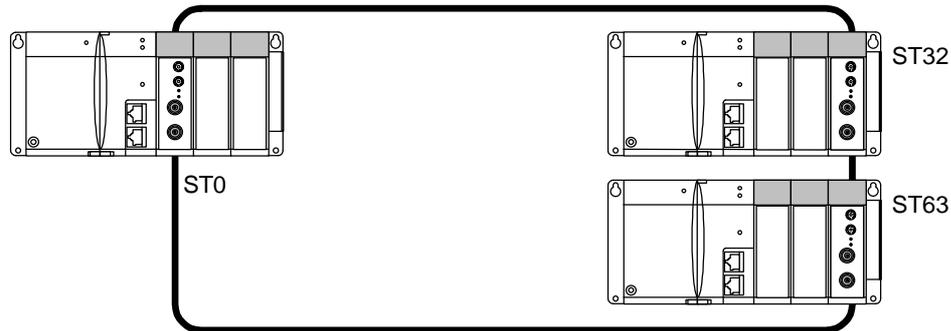
Figure 4.7   CPU link configuration
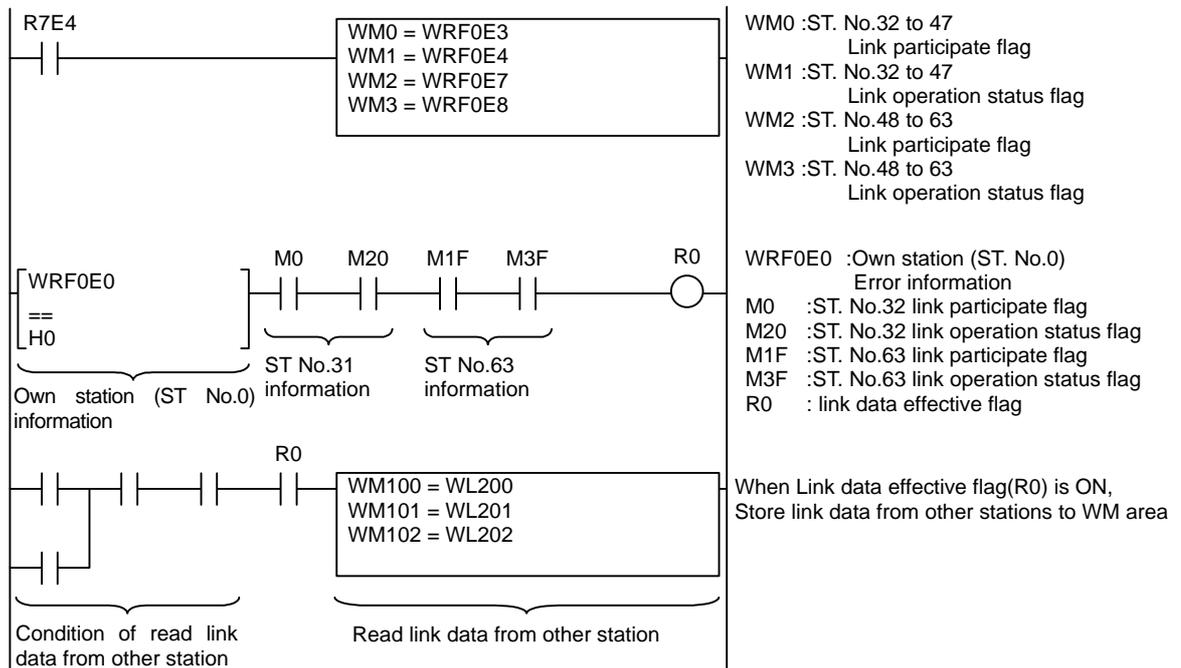
Figure 4.8   Program example of Link data effective check

< Program explanation>

of the link modules flag to WM0 to WM3.

AND circuits with own station error information.

effective flag(R0) turns ON.

is under operation by connecting the link data effective flag as AND circuit.

Read always the participate flag and link operation status

Extract information of stations used No. and construct

When ST No.0, 32, 63 are under normal operation, link

You can read link data from other station when link system

(Caution)

the same.

This is one of example. You do not need your program as

When a link station power off and link module is in by-pass mode, you do not read link data at the circuit including link data effective flag,   The link data(WL, L) is renewed(the data from the link station which by-pass mode is kept the data when it moved by-pass mode), but it is not stored to WM area

When a transmission route cut-off error occurs, the station No. which is cut is stored in own station error information(WRF0E0, WRF140). Even the error is disappeared, the information of the station No. is remained. To clear the error information of a transmission route cut-off error, eliminate the reason of error and push a reset switch of link module, then set R7EC ON.

Chapter 5 Installation and start-up

5.1   Installation

5.1.1 Installation position

The CPU link module is installed into either the 0, 1 or 2 slots on the basic base (base onto which a CPU has been mounted.) (It is not possible to install the module into slots other than 0 to 2, or on additional bases.) A maximum of two modules can be installed onto one base.
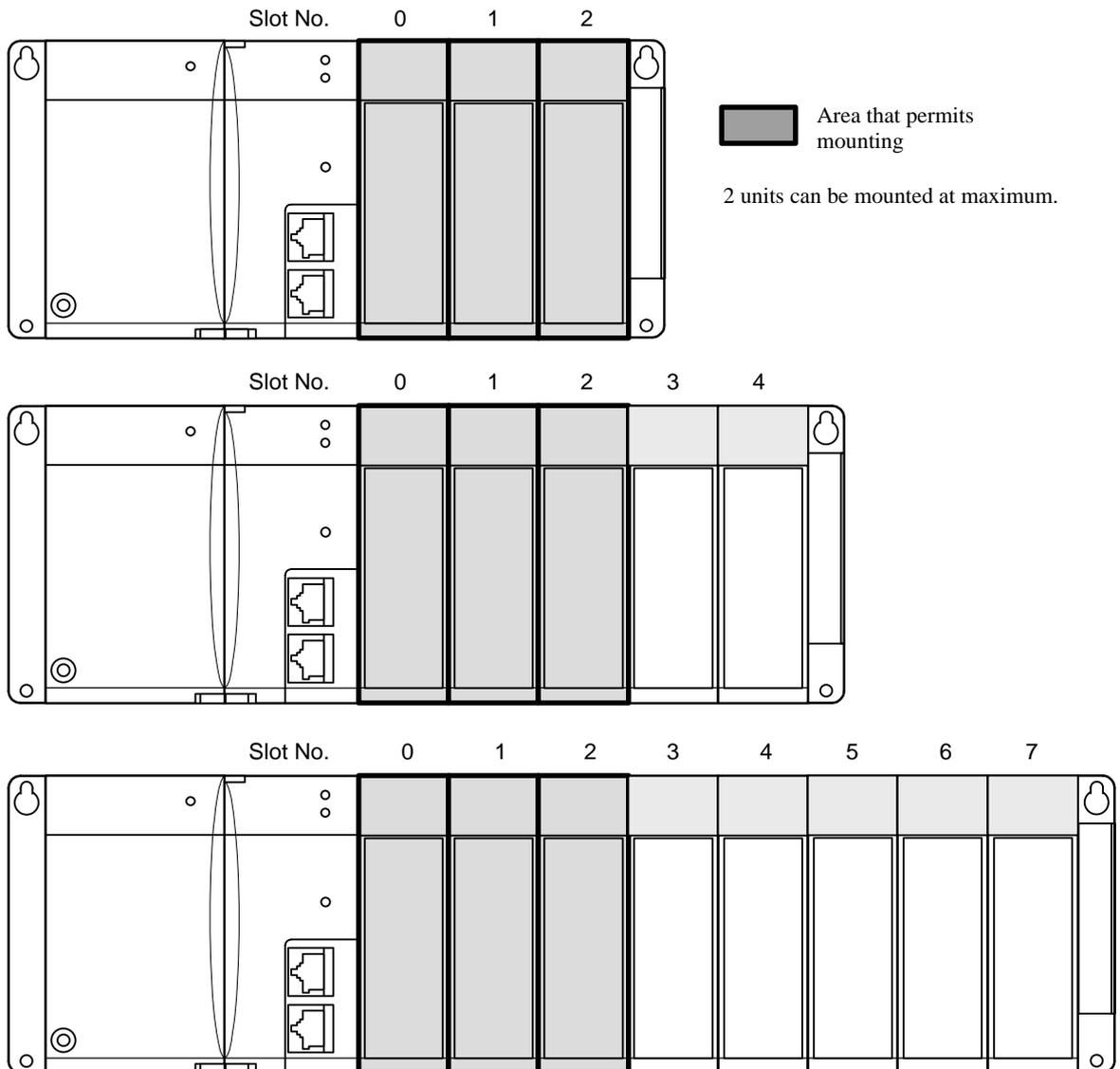
Figure 5.1 Example of a CPU link system configuration

Note: A maximum of two EH-150 modules for which the I/O assignment is [CPU Link] can be installed. In other words, for systems that require modules that are I/O assigned as [CPU Link] apart from CPU link modules (EH-RMP, etc.,) it is only possible to install one module.

5.1.2 Loading the Module

(1) Installing
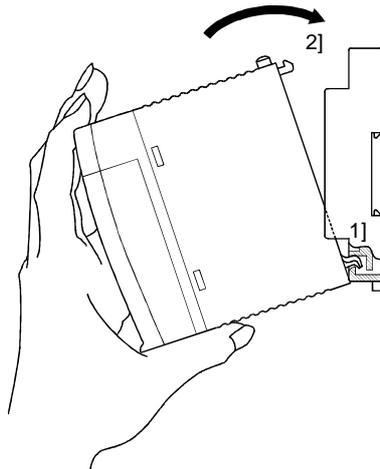
1] Hook the claw at the lower section of the module to the hole in the base.

2] Press in the upper side of the module until it clicks.

Note 1: After loading the module, check to make sure it does not come out.

Note 2: Load the power module at the leftmost side of the base unit.

Note 3: Load the CPU module and I/O controller to the left of the power module.

(2) Removing
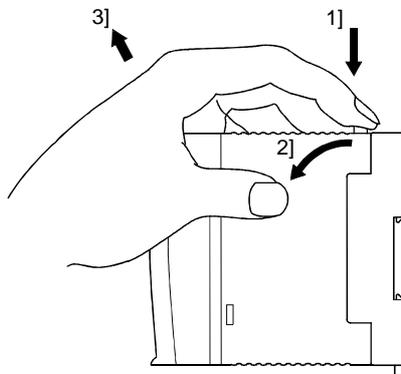
1] Push in the lock button.

2] With the lock button pushed in, pull the top of the module toward the front.

3] Raise it toward the top and pull it out.

Note: For the power module, pull it out while pushing down the two lock buttons.

5.1.3 Precautions during installation

As shown in figure 5.2, when coaxial cables are connected to the link module, they will protrude by approximately 75mm from the link module' front panel. Take care to ensure that the door or other areas do not come into contact with the cable when designing the control panel. Also, ensure that the weight of the cable is not applied directly to the connector during connection.

Approx. 75mm

Enclose the coaxial cables with the insulation tube supplied to avoid touching it.

Fix the cable in place with the cable clamp.
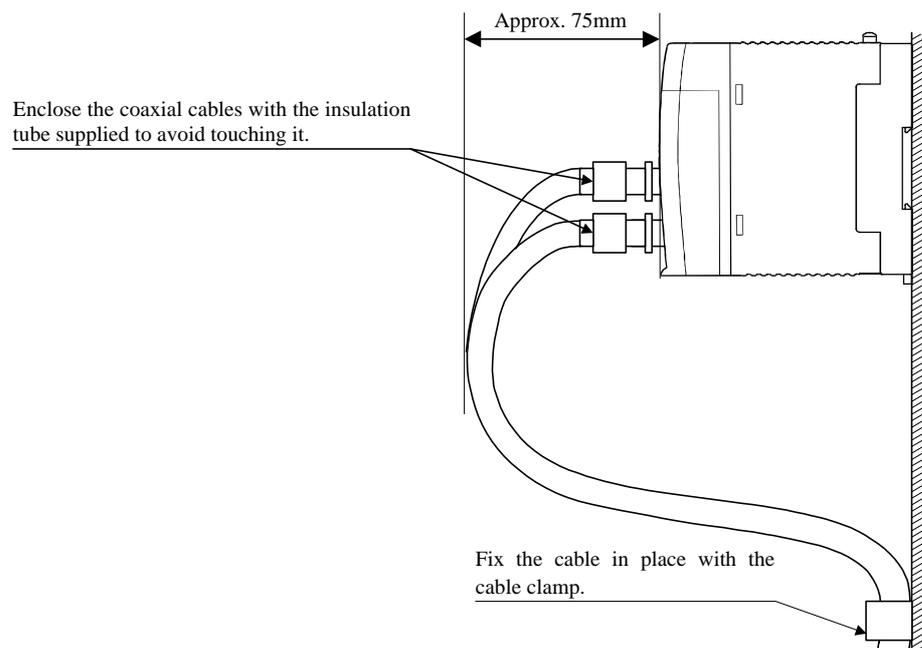
Figure 5.2   Link modules connected with coaxial cables

5.1.4 Cable connections

The coaxial cable connections between CPUs are shown in figure 5.3.

As shown in figure 5.3, the TXD is connected to the opposing RXD to ensure that only one cable is sued for the entire link system. The maximum length of the coaxial cable between stations is 500m. The overall length of the cable (the total length of the cable between each station) is 1,000m
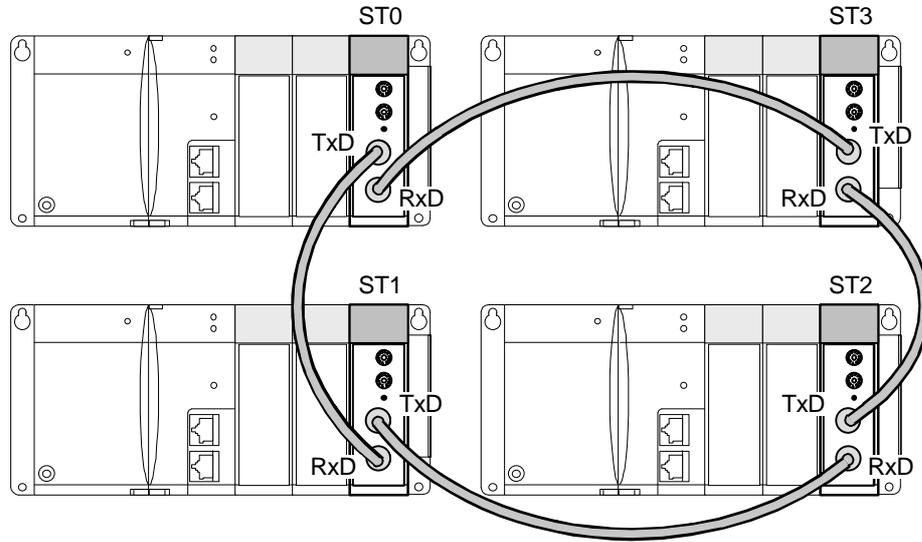
Figure 5.3   Coaxial cable connection diagram

5.1.5 Using the insulated cable connector tube

Ensure that the insulated cable connector tube supplied covers the entire BNC connector.
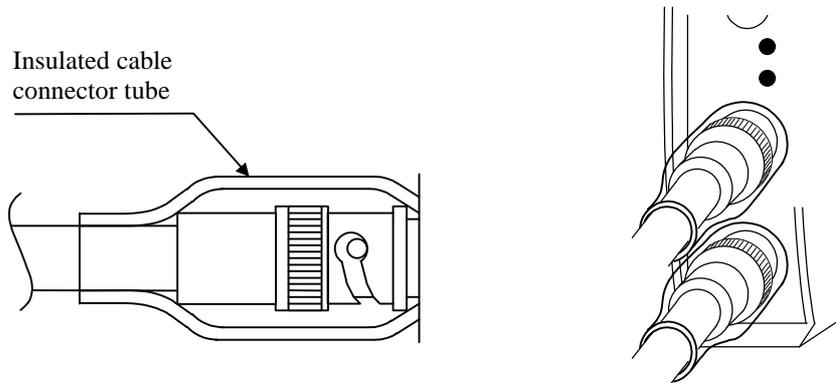
Figure 5.4 External view of the insulation tube covering the coaxial connector

Note: If the BNC connector in use is not the recommended model and has a larger diameter preventing it from being inserted into the insulation tube, cut the tube as shown below.

Secure the insulation tube in place from the top with insulation tape to prevent it from falling of.

Cut in a straight line.
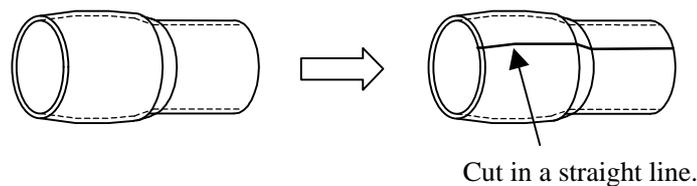
5.1.6 Coaxial cable shielding process

Figure 5.5 shows the shielding line of a shielded coaxial cable when two EH-LNK units are installed on the basic base (EH-BS3.) The shielding line is only earthed on the RXD (receiving) side as a basic principle. However, this depends on the noise environment prevalent with the user, so the cable on the TXD (transmission) side may also be used without cutting off the shielding line. Insulate the ends of non-shielded lines with the use of insulation tape
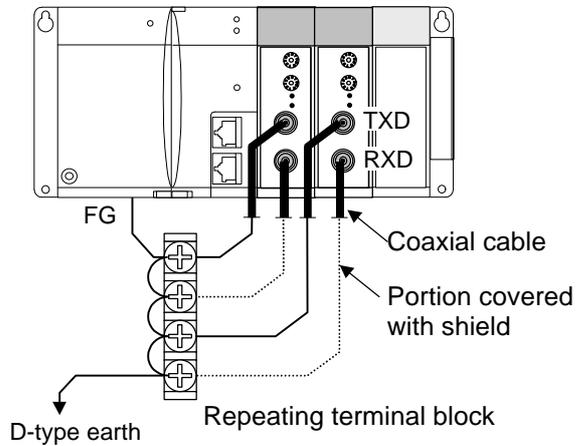
Figure 5.5   Example of shielding lines

Strip off approximately 1m of the shielding from the module (refer to Figure.5.6) Also, ensure that the stripped area is located well away from power lines and other types of cable.
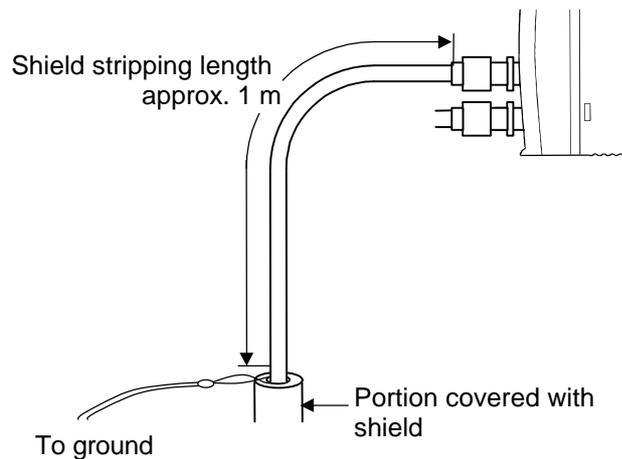
Figure 5.6   Stripped transmission cables

5.1.7 Precautions when wiring coaxial cables

Observe the following precautions when wiring coaxial cables for transmission purposes between CPU link modules to avoid the effects of noise and to increase reliability.

(1) Use a different route to power lines and signal cables when wiring coaxial cables for transmitting between CPU link modules.

Space apart by 300 mm or longer

Coaxial cables of CPU link modules

Other signal lines

Power lines
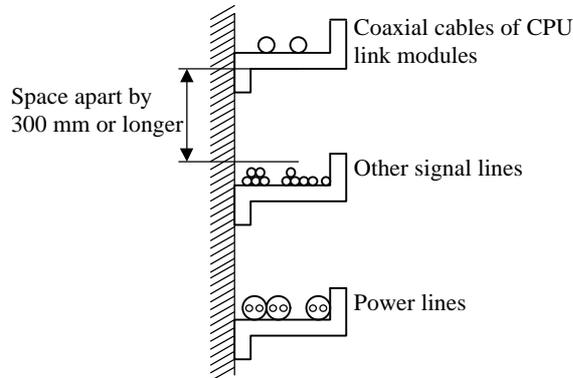
Figure 5.7   Separating lines with conduits and ducts

(2) If cable layouts using different routes as explained in item #1 are not possible, then use metal pipes, as shown in the diagram.

Metal pipes:
    Weld the areas joining the metal pipes together.
    Also, ensure that a D-type earth is established
    with metal pipes.

Other power lines

Coaxial cables of CPU link modules
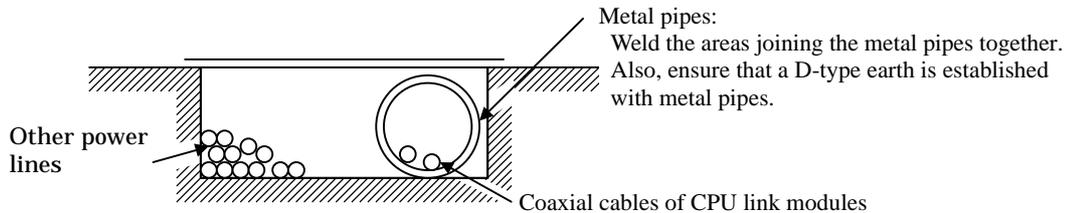
Figure 5.8   Separating lines with metal pipes

5.1.8 CE Marking

Carry out the below installation for CE marking EMC directive according to Figure5.9.

(1) Metal **Panel**

(2)

Ferrite core

(4)   To RXD   To TXD   (3)

Cable shield

External shield

Relay terminal

Earth

To relay terminal on panel
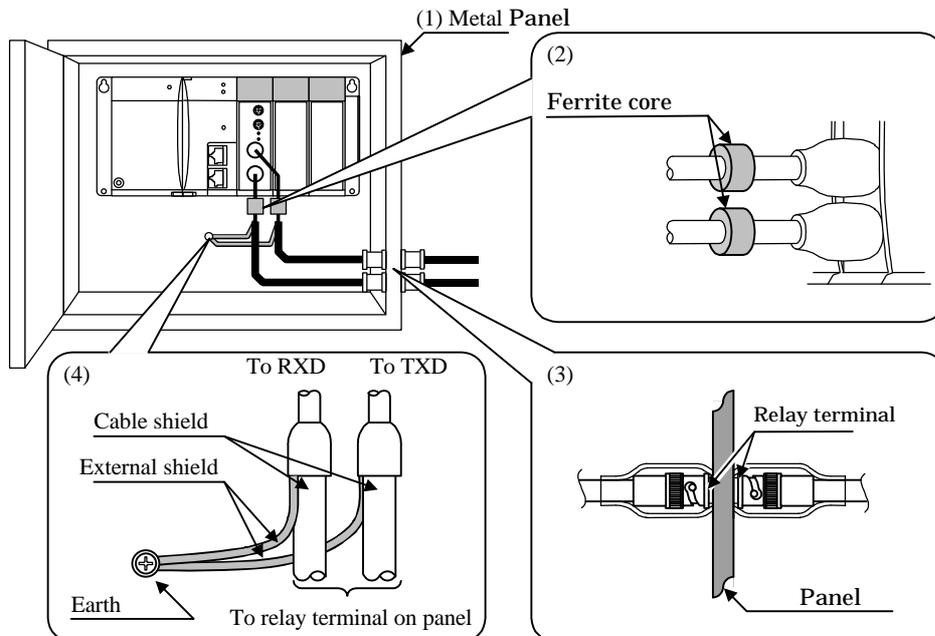
Panel

Figure 5.9 CE marking EMC directive

(1) Install PLC into the metal panel or plate.
(2) Attach a ferrite core(dimensions:19.0×19.0×30.0mm) on coaxial cable near EH-LNK.
(3) Isolate the panel and relay terminal.
(4) Connect shield of cable to the earth as short at possible.
(5) Route the coaxial cables as close as possible to grounded surfaces such as cabinet elements, metal bars and cabinets panels.

5.2   Start-up

The procedure for starting up a link system is explained below.

1. Although there are no restrictions on the order in which the power supply to each station must be switched on when starting up a link system, link operations will not commence until the power has been switched on to station No.0 (the master station.) Create the program used for controlling and computing the link data after the master station's participation flag has been set at ON.

2. In order to check for duplications in the setup station No.s when starting up a link system for the first time, switch on the power supply to all stations other than No.0 first of all, and then switch on the power to station No.0 lastly. An error will be displayed for the duplicated station.
Link operations will not be carried out if a duplication occurs in the station No.s. Eradicate the duplicated station No., and then switch on the power to the link module base.

Note #1: There are cases where the following operations are performed when the power is switched on during link system startup if duplicated station No.s exist. Eradicate the duplicated station No., and then switch the power on again.
   a) When station No. 0 (master station) is duplicated
   • None of the link modules will execute link operations.
   • Only one of the duplicated stations will perform normal operations, and the ERR LED will blink at intervals of 0.5 seconds with the other station (link operations will not be performed.)
   b) When a station other than station No. 0 (master station) is duplicated
   • The ERR LED in the stations for which the duplication exists will blink at intervals of 0.5 seconds.
   • Only one of the duplicated stations will perform normal operations, and the ERR LED will blink at intervals of 0.5 seconds with the other station (link operations will not be performed.)
Note #2: There are cases where operating stations will detect a transmission route cut-off error if the power to multiple stations is switched off or cut off simultaneously, but this will be automatically restored and link operations resumed. Create a program to monitor the link participation flags and prevent the link data from being used during the period that participation flags are set at OFF.

5.3   Participating in and leaving link systems

If the number of the station connected to a link system and the link assignment settings are correct, it is possible for a link module to participate and leave the link during link operations.
Although participating in and leaving link systems is possible regardless of the master/slave station relationship, if the master station leaves the link using the wrong procedure, the station will effectively disappear and link operations will be terminated.
The procedures for leaving and joining the ling during link operations, and the precautions that must be observed are listed below.

1) If the power supply to station No.0 (master station) is switched off after link operations have started, the master station transition process will be performed, and link operations will resume when this has been completed.
The No.0 master station authority will then be moved across to the next station with the smallest station No. (temporary master station in this event, and this will be repeated, with the next smallest station becoming station No.0 (temporary master station) whenever the power to the master station at that time is switched off. However, if the power supplies to the master station and the station with the next smallest station No. (temporary master station) are switched off simultaneously during operations, link operations will be terminated. In order to prevent the termination of link operations, it is therefore necessary to ensure that each station is switched off one by one when leaving the link system.

2) If station No.0 (master station) leaves the link by having its power switched off and then rejoins the link again, it will become a slave station (the temporary master station at that time will remain as the master station.) However, if the power to the temporary master station is switched off, station No.0 will become the master station as it has the smallest station No. of all slave stations.

Chapter 6 Errors and error recovery

6.1   Errors

If an error occurs with the link module or an abnormality arises with the transmission route, the status display LED will indicate the error. The error information will also be set in the special CPU internal output related to the relevant link module (R7DE, WRF007, WRF0E0 to WRF19F.)

"1" will be set in the special R7DE internal output when the ERR LED for the link module is illuminated. The link module slot number on which the error occurs will be set in the special WRF007 internal output at this point. If multiple error modules or transmission routes exist, the small slot number will be reflected back. Note that once these values have been set in place, there will remain in existence until cleared with an enforced set/reset function from a user program or peripheral device. (As the special internal output stored in WRF0E0 to WRD19F is controlled by the system, it will not remain in existence.) Error information detected in the CPU module will be cleared by setting "1" is the special R7EC internal output.

Table 6.1   Description of Error displays

Contents	ERR LED	Error Information of own station WRF0E0*2 WRF140*3	Details of errors in each station*1 WRF0FD+St.No. *2 WRF15D+St.No. *3	Timing of error detection	Timing of clearing error
Watchdog errors	Light	--	--	During microcomputer errors	- Switch on the power supply again. - Press the [RESET] switch.
ROM/RAM errors	Light	--	--	When the power is switched on, when ROM/RAM errors occur	
Transmission route cut-off	Blink (0.5s)	bit 8 ON	--	When the transmission route is cut off	- Switch on the power supply again. - Press the [RESET] switch. - During transmission route recovery.
Duplicate station No.	Blink (0.5s)	--	--	When station No.s are duplicated	- Switch on the power supply after the cause of the error has been resolved.
Station No. outside of range	Blink (0.5s)	bit9 ON	--	When the dip-switch settings are outside of the 0 to 63 range	- Press the [RESET] switch after the cause of the error has been resolved.
Duplicate link area assignment	Blink (0.5s)	bit10 ON	--	When link assignment areas are duplicated	- Switch on the power supply after the cause of the error has been resolved. - Press the [RESET] switch after the
Link area outside of range	Blink (0.5s)	bit11 ON	--	When the link area specification from the CPU is outside of the range	cause of the error has been resolved. - When the link modules detects that the error has been resolved.
Transmission error	Blink (1s)	--	bit14 ON	When a transmission frame error occurs	- Switch on the power supply again - Press the [RESET] switch.
Peripheral data receiving timeout	Blink (1s)	bit13 ON	bit13 ON	When a transmission time-out occurs during peripheral data transmission	- Press the [E.CRL] switch. - When the link modules detects that the error has been resolved.
Peripheral data sum error	Blink (1s)	bit13 ON	bit13 ON	When an abnormality occurs with the peripheral data sum value from the CPU	
Peripheral data address error	Blink (1s)	bit13 ON	bit13 ON	When an abnormality exists with the transmitting station No.	
Peripheral data response time-out	Blink (1s)	--	bit15 ON	When a response time-out occurs	

*1: Error information will be set separately for each station. Refer to section 4.5 for further details.
*2: The first link error information will be set.
*3: The second link error information will be set.

Table 6.2   Description of Error displays (Monitoring from CPU module)

I/O No.	Name	Contents
R7DE	Link module is abnormal	0 Normal 1 Abnormal
WRF007	Link abnormal slot number	I/O slot number different from parameter setting is stored 15 12 11 8 7 4 3 0 | "0" | a | b | "0" | a : Unit number (0 to 2) b : Slot number (0 to 2)

6.2   Error displays

The LED displays when the following errors occur are explained below.

(1) During normal operations (LED display status and module status)

	Status of LED display & Condition of Link Module
CPU LINK EH-LNK RUN TXD ERR RXD	The RUN LED will be illuminated, and the TXD and RXD LEDs will blink during the sending and receiving of data. Communications with other link modules will be performed The same display will apply when a [data link possible] error occurs.

(2) During module errors (when watchdog timer errors and ROM/RAM errors occur)
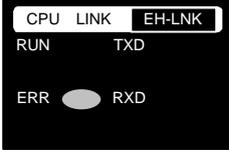
	Status of LED display & Condition of Link Module
CPU LINK EH-LNK RUN TXD ERR RXD	The ERR LED will be illuminated. Communications with other link modules will not be performed.

(3) During severe defects (duplicated station No.s, station No.s outside of the permissible range, etc.)
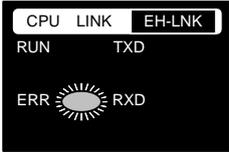
	Status of LED display & Condition of Link Module
CPU LINK EH-LNK RUN TXD ERR RXD	The ERR LED will blink at intervals of 0.5 seconds. Communications with other link modules will not be performed.

(4) During minor defects (transmission errors, peripheral data receiving errors, etc.)

	Status of LED display & Condition of Link Module
CPU LINK EH-LNK RUN TXD ERR RXD	The ERR LED will blink at intervals of 1 second. Communications with other link modules temporarily suspended. (Communications with other link modules will not be performed if the same error occurs frequently.)

6.3   Clearing errors

The link module error will be displayed in the ERR LED and the CPU module's special internal output (WRF0E0 to WRF19F.) The methods of clearing each of these errors are explained below.

(1) Clearing the ERR LED display
Eradicate the cause of the error, and then press the error display clearance switch or the reset switch on the front of the link module.
Note #1: The ERR LED will not be extinguished if the error display clearance switch is pressed without eradicating the cause of the error. Also, the error display clearance switch is only for clearing the ERR LED display, and it will not clear the CPU's special internal output area explained in item #2.
Note #2: The CPU module will detect a [Link Module Error] when the reset switch is pressed.

(2) Clearing the CPU module's special internal output
The information relating to errors contained in the special internal output is cleared by setting the CPU module's special R7EC internal output to ON when errors occur. The link module's local station error information (WRF0E0 and WRF140) is cleared in the same way.
Note #3: If the cause of the error is not resolved, the information remaining in the link module will not be cleared even when R7EC is set at ON because it is overwritten into the CPU module. In this event, resolve the cause of the error in the link module, press the reset button, and then set R7EC at ON.

6.4   Troubleshooting

This section provides a flowchart on the procedures for troubleshooting when recovering errors and when errors occur.

As the EH-LNK is equipped with e bypass function, it is possible to replace modules with units other than link modules without amending the architecture of the link system. (Note that it is necessary to terminal link system operations temporarily when replacing link modules.)

6.4.1   Self-diagnosis errors

It is possible to detect errors and make recovery decisions with the use of the link module's ERR LED when errors occur with link modules. In addition to this, '59H' (link module error) is set in the special WRF000 internal output (self-diagnosis error code) of the CPU module onto which the link module has been installed when errors occur.

6.4.2   Error troubleshooting by error

The procedures for resolving each type of error are explained below.

When station No.0 is not exist, the link operation will not start but own error information(WRF0E0, WRF140) is H0000. Namely, the information of no station No.0 is not stored in own error information.
At this time, RUN LED turns off or flickers every 0.5 s.

Before the check by below flow chart, confirm if station No.0 exists.

(1) Watchdog timer errors, ROM/RAM errors
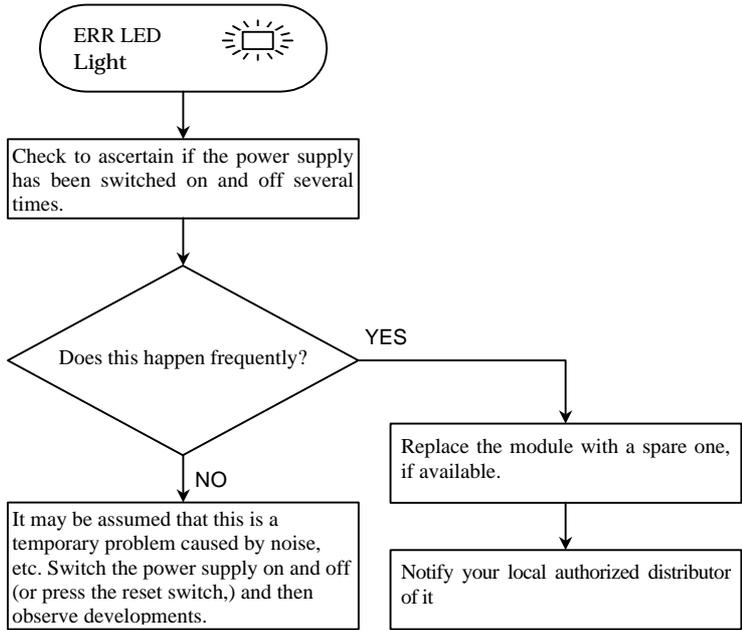
ERR LED Light

Check to ascertain if the power supply has been switched on and off several times.

Does this happen frequently? — YES → Replace the module with a spare one, if available. → Notify your local authorized distributor of it

NO → It may be assumed that this is a temporary problem caused by noise, etc. Switch the power supply on and off (or press the reset switch,) and then observe developments.

* The CPU module will detect a "Link Module Error (error code: 59H)" when the reset switch is pressed. Resolve the CPU module error after the link module resumes normal operations when the reset switch has been pressed.

(2) Transmission route cut-off

```
        ┌─────────────────────────┐
        │  ERR LED      ☐          │      ⎰ - Error information of own station : bit8 ON
        │  Flicker at 0.5 sec      │      ⎱ - Cut-off station No. : bit0 to bit7
        │  intervals               │
        └─────────────────────────┘
                    │
        ┌─────────────────────────┐      * The local station error information
        │ Check to ascertain if   │        (bits 0 to 7) are displayed in the cut-
        │ the transmission route  │        off station No.. Check there.
        │ has been cut off.       │
        └─────────────────────────┘
                    │
                    ▼
              ╱─────────╲                         YES
             ╱ Is it cut ╲──────────────────────────────┐
             ╲   off?    ╱                               │
              ╲─────────╱                                ▼
                    │ NO                    ┌─────────────────────────┐
                    ▼                       │ Connect the severed     │
              ╱─────────────╲               │ location.               │
             ╱ Is the RUN LED ╲    NO        └─────────────────────────┘
            ╱  on station No.0 ╲──────────────────┐
            ╲   illuminated?   ╱                  │
             ╲────────────────╱                   ▼
                    │ YES               ┌─────────────────────────┐
                    ▼                   │ Switch the power supply  │
        ┌─────────────────────────┐     │ to the entire link system│
        │ Replace the module with │     │ off and then on again.   │
        │ a spare one, if         │     └─────────────────────────┘
        │ available.              │
        └─────────────────────────┘
                    │
                    ▼
        ┌─────────────────────────┐
        │ Notify your local       │
        │ authorized distributor  │
        │ of it.                  │
        └─────────────────────────┘
```

1) The data prevalent immediately prior to cut-off located in the receiving area assigned by other stations will be saved when a cut-off occurs.

2) Check the transmission route (between the RXD and other station) displayed in bits 0 to 7 of the local station's error information.

3) The transmission route cut-off error is not only triggered by the transmission route being cut off, it can also be triggered by the power supplies to link modules that share duplicated stations numbers being switched off simultaneously.

4) There are cases where a transmission route cut-off is detected by operating stations during cut-offs caused by the power supplies to multiple stations being switched off simultaneously, resulting in suspended link operations, but this will be automatically restored and operations resumed.

5) If the power supply to station No.0 (master station) is not switched on when the link is started up, the other stations will detect a transmission route cut-off error and link operations will not commence. The transmission route cut-off error will be cleared when the power to station No.0 (master station) is switched on, and link operations will commence.

(3) Duplicated station No.s
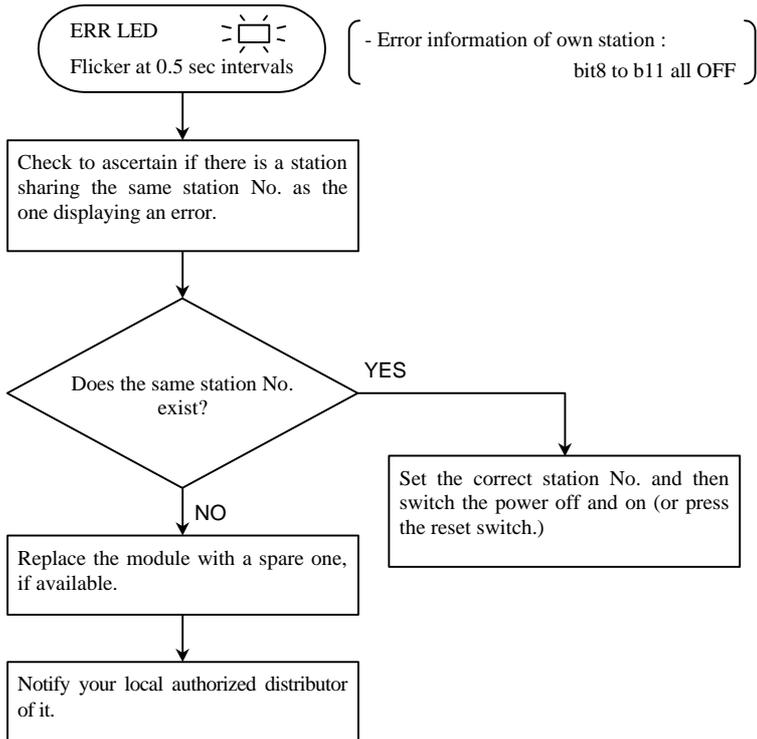
ERR LED — Flicker at 0.5 sec intervals

- Error information of own station :
  bit8 to b11 all OFF

Check to ascertain if there is a station sharing the same station No. as the one displaying an error.

Does the same station No. exist?

YES → Set the correct station No. and then switch the power off and on (or press the reset switch.)

NO ↓

Replace the module with a spare one, if available.

Notify your local authorized distributor of it.

* The CPU module will detect a "Link Module Error (error code: 59H)" when the reset switch is pressed. Resolve the CPU module error after the link module resumes normal operations when the reset switch has been pressed.

1) A station No. error will be detected if the power to a link module that shares the same station No. with a link module that is operating normally is switched on.

2) The station No. duplication error will not be detected if the power supplies to link modules that share the same station No. are switched on simultaneously. In this event, a transmission route cut-off error will be detected.

(4) Outside the station No. range
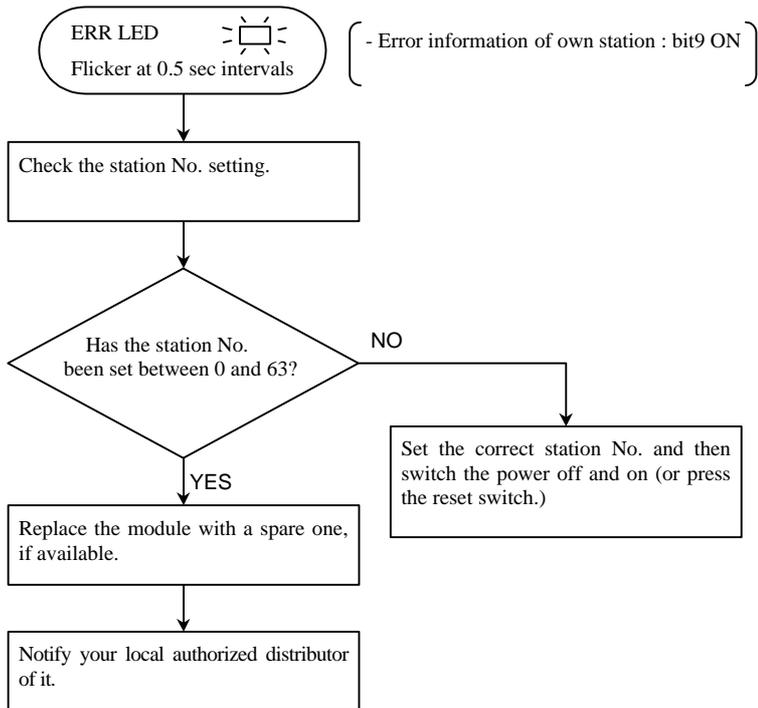
ERR LED — Flicker at 0.5 sec intervals

- Error information of own station : bit9 ON

Check the station No. setting.

Has the station No. been set between 0 and 63?

NO → Set the correct station No. and then switch the power off and on (or press the reset switch.)

YES ↓

Replace the module with a spare one, if available.

Notify your local authorized distributor of it.

* The CPU module will detect a "Link Module Error (error code: 59H)" when the reset switch is pressed. Resolve the CPU module error after the link module resumes normal operations when the reset switch has been pressed.

(5) Link area assignment duplication

ERR LED — Flicker at 0.5 sec intervals
[- Error information of own station : bit9 ON]

Check to ascertain if the ERR LED on other stations is illuminated or blinking.

Is the ERR LED on other stations illuminated or blinking?

YES → Set the value so that the link area assignment is not duplicated.

NO → Replace the module with a spare one, if available.

Notify your local authorized distributor of it.

(6) Outside the link area assignment range

ERR LED — Flicker at 0.5 sec intervals
[- Error information of own station : bit9 ON]

Check the link area assignment setting.

Is the ERR LED on Other stations illuminated or blinking?

YES → Correctly set the assignment range between WL0000 to 03FF or WL1000 to WL13FF.

NO → Replace the module with a spare one, if available.

Notify your local authorized distributor of it.

Note: As a check is run on link area assignments being outside of the permissible range in programming devices when assignment is performed, this error will not occur under normal circumstances.

(7) Transmission error (CRC error, overrun)

```
        ┌─────────────────────────┐         ┌──────────────────────────────────────┐
        │ ERR LED          ⌑       │         │ - Error information of each station : bit14 ON │
        │ Flicker at 1 sec intervals │       └──────────────────────────────────────┘
        └─────────────────────────┘
                     │
        ┌─────────────────────────┐
        │ Run a loop-back check   │
        │ (refer to section 7.3.) │
        └─────────────────────────┘
                     │
                     ▼
YES            ◇ Has an error occurred
◄──────────────  in the loop-back check? ◇
                     │ NO
                     ▼
               ◇ Does it happen frequently? ◇ ──NO──►  ┌────────────────────────────────┐
                     │                                  │ It may be assumed that this is a │
                     │ YES                              │ temporary problem caused by noise, etc. │
                     ▼                                  │ Observe developments for a while. │
               ◇ Is the cable correctly connected? ◇ ─NO─► ┌──────────────────────────┐
                     │                                      │ Reconnect the cable correctly. │
                     │ YES                                  └──────────────────────────┘
                     ▼
          ◇ Is the cable firmly secured in place? ◇ ─NO─► ┌──────────────────────────┐
                     │                                     │ Separate the noise source from the cable │
                     │ YES                                 │ and unit. │
                     ▼                                     └──────────────────────────┘
               ◇ Is there a noise source
                 nearby the transmission cable
                 or unit? ◇ ──YES──► ┌──────────────────────────┐
                     │               │ Secure the cable firmly in place. │
                     │ NO            └──────────────────────────┘
                     ▼
               ◇ Has the transmission
                 cable been wired together with
                 a dynamic power source? ◇ ─YES─► ┌──────────────────────────┐
                     │                            │ Install the dynamic power source in │
                     │ NO                         │ accordance with the instructions provided │
                     ▼                            │ in section 5.1.7, such as ensuring that it │
               ◇ Are the specifications           │ is at least 0.3m distant, etc. │
                 of the transmission cable within └──────────────────────────┘
                 the permissible range? ◇ ──NO──► ┌──────────────────────────┐
                     │                            │ Use the transmission cable within the │
                     │ YES                        │ range of the specifications (distance, etc.) │
                     ▼                            └──────────────────────────┘
               ◇ Is something touching
                 the BNC connector? ◇ ──YES──► ┌──────────────────────────┐
                     │                         │ Cover the connector with the insulated │
                     │ NO                      │ tube supplied in accordance with the │
                     ▼                         │ instructions provided in section 5.1.5. │
        ┌─────────────────────────┐           └──────────────────────────┘
        │ Replace the module with a spare one, │
        │ if available.           │
        └─────────────────────────┘
                     │
        ┌─────────────────────────┐
        │ Notify your local authorized distributor │
        │ of it.                  │
        └─────────────────────────┘
```

(8) Peripheral data receiving time-out, sum error, address error, response time-out

```
          ┌─────────────────────────┐        ┌─ - Error information of own station : bit13 ON
          │ ERR LED          ☐      │        │  - Error information of each station : bit13 ON
          │ Flicker at 1 sec intervals │      │    or
          └─────────────────────────┘        │  - Error information of own station : bit13 ON
                      │                        └─ - Error information of each station : bit15 ON
          ┌─────────────────────────┐
          │ Run a loop-back check (refer to │
          │ section 7.3.)           │
          └─────────────────────────┘
                      │
         YES   ◇ Has an error occurred
          ◄────  in the loop-back check?
                      │ NO
                      │
              ◇ Does it happen frequently?  ── NO ──┐
                      │ YES                          ▼
                      │              ┌─────────────────────────┐
                      │              │ It may be assumed that this is a │
                      │              │ temporary problem caused by noise, etc. │
                      │              │ Observe developments for a while. │
                      │              └─────────────────────────┘
              ◇ Is the power supply
                to the station displayed as the ── NO ──┐
                opposing station on?                    ▼
                      │ YES          ┌─────────────────────────┐
                      │              │ Switch on the power supply to the │
                      │              │ station.                │
                      │              └─────────────────────────┘
              ◇ Has an error occurred
                in the station displayed as the ── YES ──┐
                opposing station?                         ▼
                      │ NO           ┌─────────────────────────┐
                      │              │ Locate the error on the station in which │
                      │              │ the error occurred.     │
                      │              └─────────────────────────┘
              ◇ Is the transmission
                cable coming loose?  ── YES ──┐
                      │ NO                      ▼
                      │              ┌─────────────────────────┐
                      │              │ Secure the transmission cable firmly in │
                      │              │ place.                  │
                      │              └─────────────────────────┘
          ┌─────────────────────────┐
          │ Replace the module with a spare one, │
          │ if available.           │
          └─────────────────────────┘
                      │
          ┌─────────────────────────┐
          │ Notify your local authorized distributor │
          │ of it.                  │
          └─────────────────────────┘
```

A transmission time-out error is triggered in the peripheral device when an error occurs or the power is switched of in the opposing link module during the sending and receiving of data with other stations.

(9) Link power supply cut-off
The data prevalent immediately prior to the power supply being switched off contained in the receiving area of other stations that are receiving data from the cut-off station will be saved when the cut-off error occurs during operations.

Chapter 7 Maintenance and Inspections

7.1   Daily inspections

Check the following items to ensure the operational status of the equipment. Refer to Chapter 6 (Error Displays and Troubleshooting) for further details on errors.

Table 7.1   Daily inspection items

Item	Inspection method	L E D	Normal	Abnormal	Cause for error
Link system participation status	Eye observation	RUN LED	Illuminated	Extinguished	Depending on each error display.
Error display LED confirmation	Eye observation	ERR LED	Extinguished	Illuminated / Blinking	
Data transmission and receiving	Eye observation	TXD LED RXD LED	Blinking	Illuminated Extinguished	

7.2   Regular inspections

Switch off the power supply to the base onto which the CPU link modules are installed, and the power to the external I/O circuit and check the following items.

Table 7.2   Regular inspection items

Item	Method
Looseness in the transmission cable connector	Tighten
Removal of dirt and dust around the case and connector	Remove with a vacuum cleaner

Perform the regular inspections once every six months. The inspection cycle may be speeded up in accordance with the environment in which the modules are installed.

7.3   Loop-back check

Run a loop-back check in accordance with the procedure explained below when normal operations are not possible during test operations of the link system, and when errors occur after start-up, resulting in link system operations being suspended. Note that <u>link system operations must be suspended before the loop-back check can be run. The cable used for the loop-back check must be prepared by the user</u>.

1)   Set the station No. setting switch on the link module to be checked at "90".

2)   Connect the loop-back check cable.
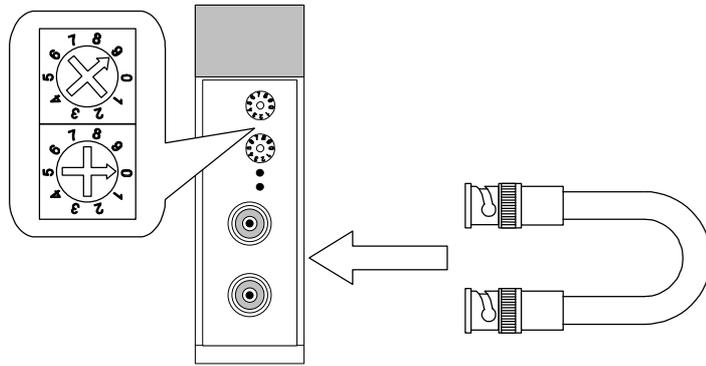
Table 7.1   Loop-back check preparations

3)   Switch on the power supply, and then switch the reset switch from ON to OFF while pressing the link module's error display clearance switch. The RUN LED will blink twice if the loop-back check mode has started up normally.

4)   The link module's RUN LED and ERR LED will change as follows.
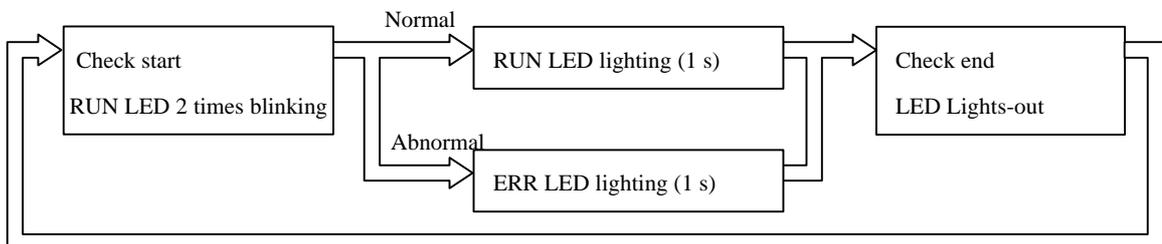
Figure 7.2   Loop-back check operations

* Contact our service department if an error is detected.

Appendix Processing the ends of the coaxial cable

It is recommended that a product equivalent to the shielded 5D2VTXE (manufactured by Fujikura Densen) is used as the transmission coaxial cable with EH-150 CPU link modules. The method of processing the ends of this cable is explained below. Note that this chapter is only to be used as reference material. For further information, contact the manufacturers of the cables and connectors directly. Also, refer to guidelines on soldering available on the open market when performing all soldering tasks.

Appendix 1 Outline of coaxial cables

The recommended coaxial cable is a twin coaxial cable, and the configuration of this is the same as the standard 5D2V coaxial cable that is fitted with a shield and wound with an external earth shown in Appendix.1. The end processing consequently requires two procedures for the inner shield and the outer shield. As signals are transmitted with the use of the internal semi-conductor and the inner shield with CPU link modules, the actual shielding is performed with the outer shield.

Internal conductor   Insulator   External shield

Internal shield   Internal sheath   External sheath

Same as those of 5D2V
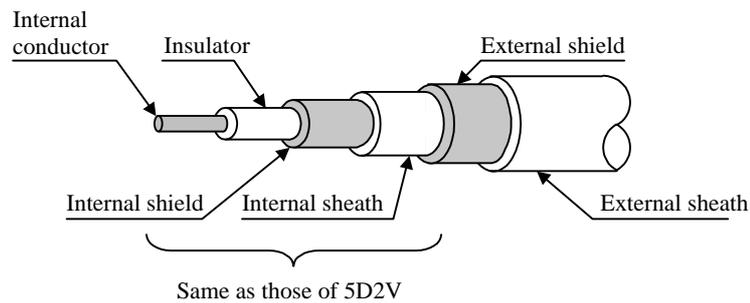
Figure   Appendix.1   Configuration chart of the inside of the 5D2V external shield

A diagram showing an outline of the BNC plug mounted on the coaxial cable is shown in Appendix.2.

Insulated cable connector tube
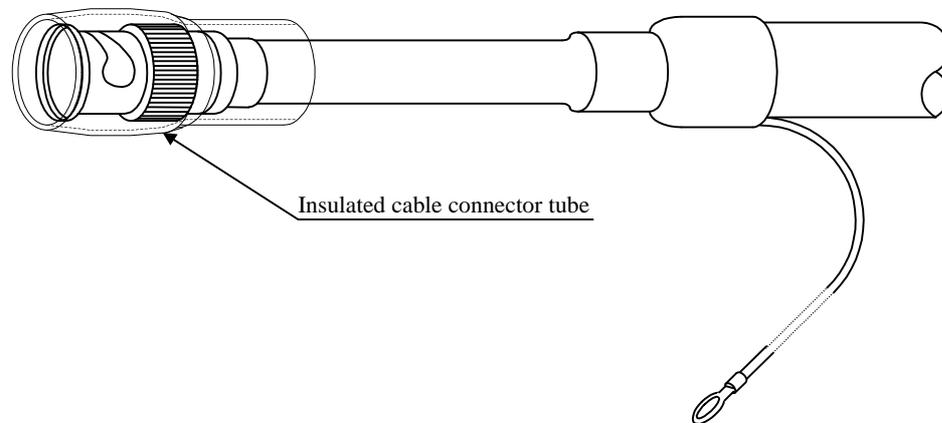
Figure   Appendix.2   Configuration chart of the inside of the 5D2V external shield

Appendix 2 Processing the outer sheath and outer shield

No.	Working STEP	Description of work	Remark
1	External shield pre-processing	(1) Remove the cable covering as shown in the diagram below, and expose the external semi-conductor. External shield External sheath Approx. 1m	
		(2) Knead the outer shield and stretch it. External shield	
		(3) Gather together the bottom of the stretched outer shield and twist it as shown in the diagram below, and then twist it once at the root. Twist once Twist once	
		(4) Cut off approximately 2mm to 5mm of the outer shield. 2mm to 5mm	
2	Attaching the vinyl wire	(5) Prepare the vinyl tube and vinyl wire as shown in the diagram below. Vinyl tube Approx. 25mm Approx. 9mm Vinyl wire 5mm 2mm^2 or larger * Keep the length of the vinyl wire as short as possible in alignment with the actual earth wiring.	
		(6) Solder the outer shield that was cut in procedure #2 to the vinyl wire. Solder Locate the vinyl wire along the core wire as much as possible	
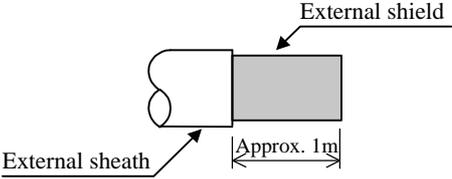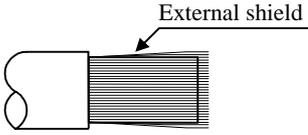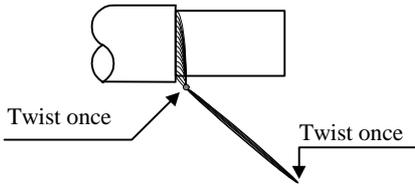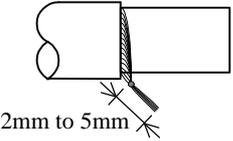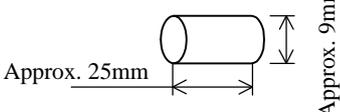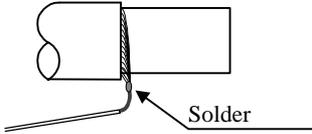
No.	Working STEP	Description of work	Remark
2	Attaching the vinyl wir	(7) Cover it with the vinyl tube as shown in the diagram below. L L / 2	
3	Processing the end of the vinyl wire	(8) Peel back 5mm of the vinyl wire. 5mm	
		(9) Attach a compression terminal. Use the terminal that was used on the earth's power cable and earth terminal.	
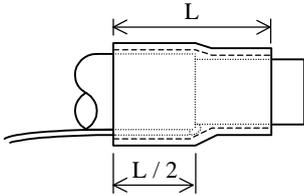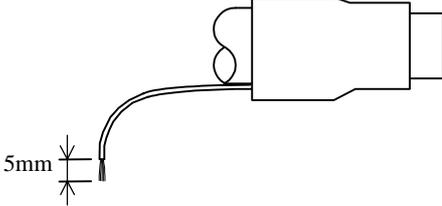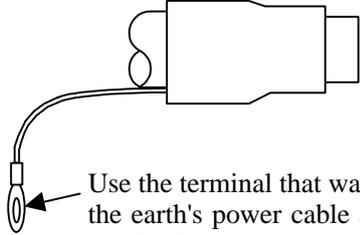
Appendix 3 Processing the inner sheath and inner shield

The method of connecting and attaching the coaxial cable connector to the coaxial cable is shown below. It is recommended that a product equivalent to the BNC-P-5DV (Manufactured by Hirose Inc.) is used. (Refer to the diagram in Appendix.3.)

Plug (BNC-P-5DV)
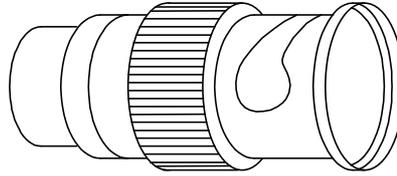
Figure   Appendix.3 Coaxial cable connector

Details on processing (the BNC-P-5DV) are provided below.

No.	Working STEP	Description of work	Remark
1	Preparations	(1) Insert the tightening nut, the washer and the gasket in that order into the coaxial cable. 	
2	End processing	(2) Remove the outer covering from the coaxial cable. Remove the covering with a knife while taking care not to damage the shielding. 	
		(3) Insert the clamp. Insert the clamp from the top of the shielding so that it reaches the outer covering of the coaxial cable. 	
		(4) Attach the shielding to the top circular part of the clamp evenly while taking care not to bend it back. Cut off the shield braid with a minor clearance left in area A shown on the right. 	

No.	Working STEP	Description of work	Remark
2	End processing	(5) Remove the insulation. Remove the insulation, but leave approximately 5mm from the end of the clamp. Approx. 5mm (insulator) Approx. 5mm (center conductor) *Take care not to damage the central semi-conductor when removing the insulation.	
3	Attaching the terminals	(6) Prepare the central semi-conductor for soldering. Take care not to apply heat to the insulation when preparing it for soldering. Insulator Center conductor Soldering iron	Soldering iron 100W
		(7) Insert the terminal in the central semi-conductor. Fit	
		(8) Solder the central semi-conductor to the terminal. Heat the terminal and solder from the hole on the side of the terminal. Solder Soldering iron	
		(9) After soldering. Remove any excess solder with a solder wick or knife if it has leaked outside the terminal. Terminal Coaxial cable Remove excess solder	
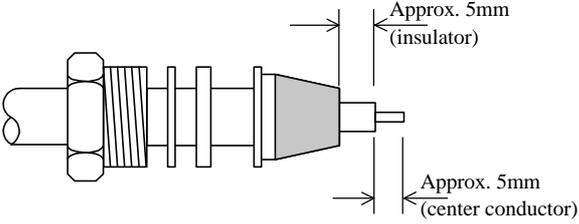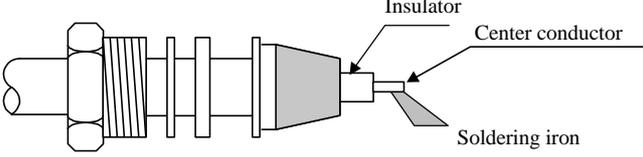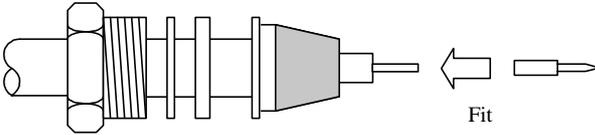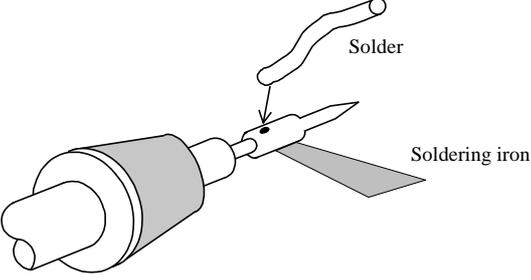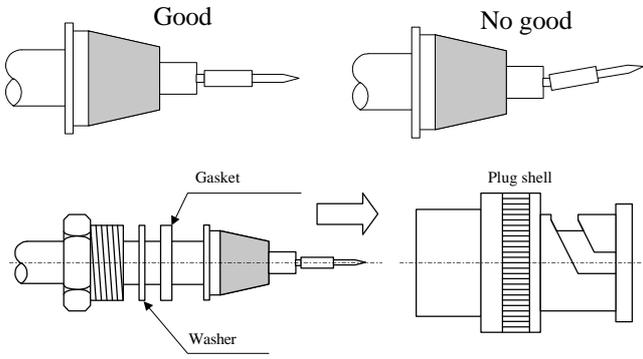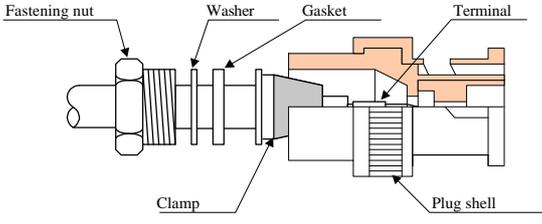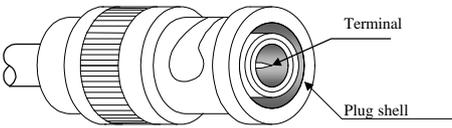
No.	Working STEP	Description of work	Remark
4	Attaching the plug shell	(10) Insert it in the plug shell after soldering. Check to ascertain that the connection areas on the central semi-conductor and the terminal are not bent when inserting them. Good No good Gasket Plug shell Washer	
		(11) Insert the gasket, the washer and the nut in that order after the cable has been inserted into the plug shell. Fastening nut Washer Gasket Terminal Clamp Plug shell Take care not to damage the end of the terminal when inserting it into the plug shell.	
		(12) Check to ascertain that the end of the terminal has not been pushed to the very back of the plug shell. Terminal Plug shell	
5	Attaching the insulation tube supplied	(13) Cover the BNC connector with the insulation tube. Insulated cable connector tube If the BNC connector in use is not the recommended model and has a larger diameter preventing it from being inserted into the insulation tube, cut the tube as shown below. Secure the insulation tube in place from the top with insulation tape to prevent it from falling of. Cut in a straight line.	