HITACHI PROGRAMMABLE CONTROLLER

HIDIC EH-150

Compact link module (EH-TLNKE)
APPLICATION MANUAL

(SERVICE MANUAL)

NJI-562C (X)

○ Warranty period and coverage

The warranty period is the shorter period either 18 months from the date of manufacture or 12 months from the date of installation.
However within the warranty period, the warranty will be void if the fault is due to;
 (1) Incorrect use as directed in this manual and the application manual.
 (2) Malfunction or failure of external other devices than this unit.
 (3) Attempted repair by unauthorized personnel.
 (4) Natural disasters.
The warranty is for the PLC only, any damage caused to third party equipment by malfunction of the PLC is not covered by the warranty.

○ Repair

Any examination or repair after the warranty period is not covered. And within the warranty period any repair and examination which results in information showing the fault was caused by any of the items mentioned above, the repair and examination cost are not covered. If you have any questions regarding the warranty please contact either your supplier or the local Hitachi Distributor. (Depending on failure part, examination might be impossible.)

○ 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.
 (1) Model
 (2) Manufacturing number (MFG no.)
 (3) Details of the malfunction

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 : Identifies information about practice or circumstances, which may lead to personal injury or death, property damage, or economic loss.

⚠ CAUTION : Identifies information about practice or circumstances, which may lead to personal injury, property damage, or economic loss.

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

The both marks show important information. Be sure to follow the instructions.

Icons for prohibited items and required items are shown below:

🚫 : Identifies prohibition. For example, when open flames are prohibited, ⊗ is indicated.

❗ : Identifies requirement. For example, when grounding must be performed, ⏚ is indicated.

1. Installation

⚠ CAUTION

- Use this product in an environment as described in the catalog and this document.
  If this product is used in an environment subject to high temperature, high humidity, excessive dust, corrosive gases, vibration or shock, it may result in electric shock, fire or malfunction.

- Be sure to install the PLC according to this manual. Failure to do so could result in damage by falling off, failure or malfunction.

- Do not allow foreign objects such as wire chips to enter the unit.
  They may become the cause of fire, malfunction or failure.

2. Wiring

⏚ REQUIRED

- The PLC must be grounded (FE terminal).
  Failure to do so could result in injury to personnel or causing it to malfunction.

⚠ CAUTION

- Always use the power supply voltage listed in specifications. Using other voltage may damage the equipment or present a risk of fire.

- The wiring operation should be performed by a qualified personnel.
  Failure to do so could result in fire, damage or electric shock.

3. Precautions when using the unit

◇ DANGER

- Do not touch the terminals while the power is on.
  There is risk of electric shock.

- Appropriate emergency stop circuit, interlock circuitry and similar safety measures should be added to the PLC system to ensure safety in the event of incorrect, missing or abnormal signals caused by broken signal lines, momentary power interruptions or other causes. Do not share the power supply of relay output module and interlock circuitry because relay output might not work properly due to switching noise from interlock circuitry.

⚠ CAUTION

- When performing program change, forced output, RUN, STOP, etc., while the unit is running, be sure to check system safety carefully. Failure to do so could lead to damage to equipment.

- Supply power according to the power-up order.
  Failure to do so could lead to damage to equipment or malfunction.

⚠ CAUTION

USE POWER SUPPLY UNIT OF EH-PS SERIES FOR SUPPLYING ELECTRIC POWER.

⚠ CAUTION

DO NOT CONNECT EH-PSD DIRECTLY TO LINE VOLTAGE. LINE VOLTAGE MUST BE SUPPLIED BY A SUITABLE, APPROVED ISOLATING TRANSFORMER HAVING SHORT CIRCUIT CAPACITY NOT EXCEEDING 150 VA MAXIMUM.

4. Preventive maintenance

◇ DANGER

- Do not connect the ⊕, ⊖ of the battery in reverse polarity. Do not recharge, disassemble, heat, place in fire, or short circuit the battery. There is a risk of explosion or fire.

⃠ PROHIBITED

- Do not attempt to disassemble, repair or modify any part of the PLC.
  Electric shock, malfunction or failure may result.

⚠ CAUTION

- Turn off power to the PLC before mounting or dismounting the module.
  Electric shock, malfunction or failure may result.

MEMO

Revision History

No.	Description of Revision	Date of Revision	Manual Number
1	First edition	Nov. 2010	NJI-562 (X)
2	Terminator is added in list of accessories, Section5.4(4) is added, Figure6.5.2 is added, and so on.	Dec. 2010	NJI-562A (X)
3	Correction of the mention contents about the overlap error.	Apr. 2011	NJI-562B (X)
4	Changes in Safety Precautions and Table 2.1.1.	Dec. 2012	NJI-562C (X)

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MEMO

Chapter 1　Introduction

Thank you very much for choosing Hitachi Programmable Controller (hereinafter referred to as PLC) EH-150 series. This manual explains how to use the compact link module with the Hitachi EH-150 Programmable Controller. Read this manual thoroughly and keep for 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 Description materials

Items		Title of document	Manual number
EH-150 (EHV) series	Main system of EH-150	EH-150 EHV-CPU APPLICATION MANUAL	NJI-481*(X)
		EH-150 EHV-CPU PROGRAMMING MANUAL	NJI-482*(X)
	Programming software (Standard Edition)	EH-150 EHV series Ladder Programming software Control Editor INSTRUCTION MANUAL	NJI-537*(X)
	Programming software (Variable Name Edition)	EH-150 EHV series Ladder Programming software Control Editor INSTRUCTION MANUAL	NJI-486*(X)
EH-150 series	Main system of EH-150	EH-150 APPLICATION MANUAL	NJI-281* (X)
	Programming software	H-SERIES LADDER EDITOR for Windows® INSTRUCTION MANUAL	NJI-342* (X)

* A final number of the manual number may change according to updating version.

1.1　The use combination of the products

1.1.1　Supported CPU modules and programming software

Compact link module EH-TLNKE can be used with CPU and programming software shown in Table1.1.1.

Table 1.1.1 Supported CPU modules and supported versions of programming software

CPU modules		Programming software			
Model name	Supported version	Product name		Model name	Supported version
EHV-CPU128	Not depend on the software version of CPU.	Control Editor	Standard Edition	EH-CTE-E	There is limitation in a part of programming software. (Note 1)
EHV-CPU64					
EHV-CPU32			Variable Name Edition	EH-CTE-EVN	
EHV-CPU16					
EH-CPU548	Not depend on the software version of CPU.	LADDER EDITOR for Windows®		HLW-PC3E	Not depend on the software version of programming software.
EH-CPU516					
EH-CPU316A					
EH-CPU208A					
EH-CPU104A					

(Note 1) Can use compact link modules without restriction by setting I/O assignment as the next page.

■ I/O assignment by Control Editor and the Ladder Editor

When setting I/O assignment of modules by programming software, notation of I/O information to choose at I/O assignment is different from Control Editor and Ladder Editor.

With the following manuals, the I/O information is mentioned in "LINK" and "X4Y4W".

Table 1.1.2   I/O information notation by the programming software

Programming software	I/O information to choose at I/O assignment setting	
Control Editor	"LINK"	"X4Y4W"
Ladder Editor	"CPU LINK"	"4W/4W"

■ I/O assignment for link modules with Control Editor

In the case of Control Editor you can set I/O assignment by selecting model name. But you can't select EH-TLNKE (LINK) or EH-TLNKE (X4Y4W) with Control Editor. So, in the case of setting "LINK", you must select EH-(O)LNK in "Others" tag. In the case of "X4Y4W", you must select EH-UKW (X4Y4W) in "Distributed I/O" tag.

Figure1.1.1 I/O assignment for link module with Control Editor (in the case of "LINK")

Figure1.1.2 I/O assignment for link module with Control Editor (in the case of "X4Y4W")

There is a mode appointing an I/O assignment directly without appointing a model by the control editor. When appoint I/O assignment directly, please choose "LINK" and "X4Y4W" among the classification of "I/O Config" tag like figure 1.1.3 and figure 1.1.4.
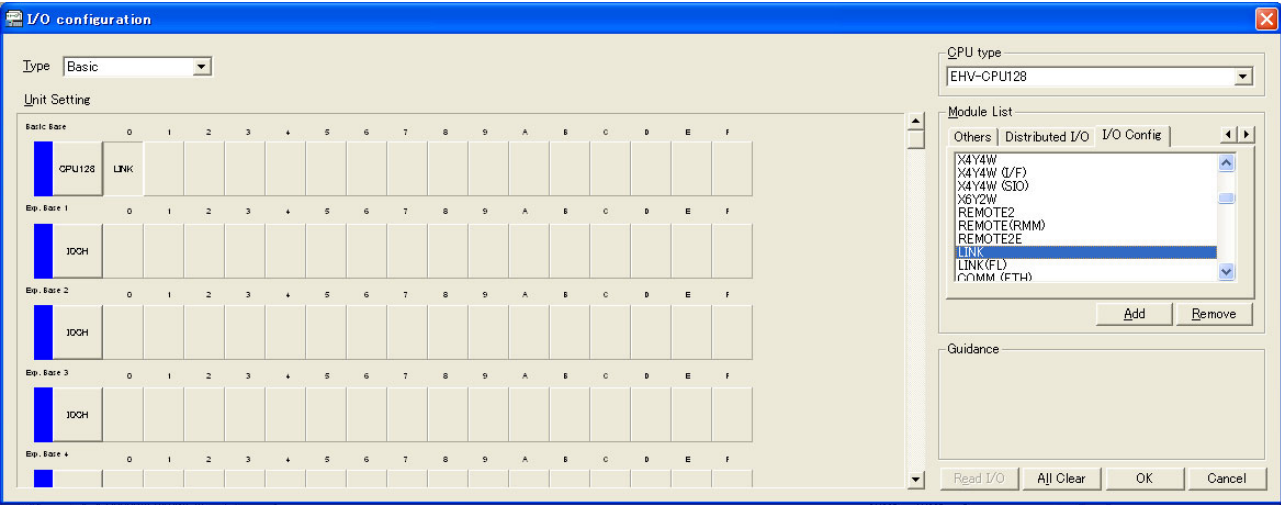
Figure1.1.3 I/O assignment for link module with Control Editor (in the case of "LINK")
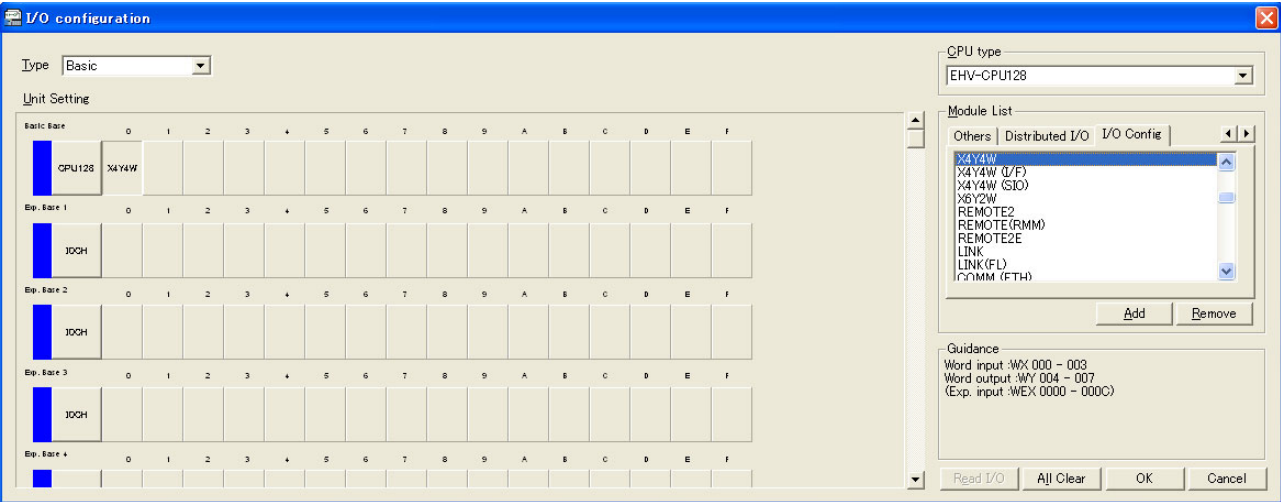
Figure1.1.4 I/O assignment for link module with Control Editor (in the case of "X4Y4W")

1.1.2   Combination of CPU modules and base units

Use EH-TLNKE with products to show in Table 1.1.2.

Table 1.1.2 Supported CPUs and base units

| CPU modules | Base units | Limit of mounting for I/O assignment | | Remarks |
		"LINK"	"X4Y4W"	
EHV-CPU128 EHV-CPU64 EHV-CPU32 EHV-CPU16	EH-BS3/BS5/BS8			Not usable. (Note 1)
	EH-BS3A/5A/6A/8A/11A	0 to 7 slots	There is not limitation.	Refer to Table 1.1.3.
EH-CPU548 EH-CPU516	EH-BS3/BS5/BS8	0 to 2 slots	There is not limitation.	
	EH-BS3A/5A/6A/8A/11A	0 to 7 slots	There is not limitation.	Refer to Table 1.1.3.
EH-CPU316A	EH-BS3/BS5/BS8 EH-BS3A/5A/6A/8A	0 to 2 slots	There is not limitation.	
	EH-BS11A			Not usable. (Note 2)
EH-CPU208A EH-CPU104A	EH-BS3/BS5/BS8 EH-BS3A/5A/6A/8A	Not usable	There is not limitation.	
	EH-BS11A			Not usable. (Note 2)

(Note 1) EHV-CPU*** can be not used with EH-BS3/BS5/BS8.
(Note 2) EH-BS11A can be not used with EH-CPU104A/208A/316A.

See Table 1.1.3 about specifications of base unit. When using EH-TLNKE by I/O assignment of "LINK", mount EH-TLNKE on slot that can mount communication modules in the basic base.

Table 1.1.3 Specifications of base units

Base units	Number that can mount modules	Slot that can mount communication modules	Remarks
EH-BS3	3 modules	0 to 2 slots	End of sale
EH-BS5	5 modules		End of sale
EH-BS8	8 modules		End of sale
EH-BS3A	3 modules		
EH-BS5A	5 modules	0 to 4 slots	
EH-BS6A	6 modules	0 to 5 slots	
EH-BS8A	8 modules	0 to 7 slots	
EH-BS11A	11 modules		
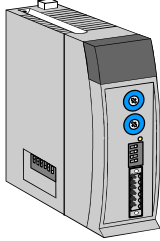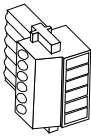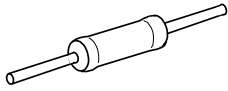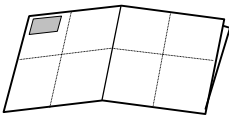
1.2   Before use

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

    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 1.2.1 missing?

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

Table 1.2.1 List of accessories supplied with the EH-TLNKE

No.	Product name	Model name	Appearance	Numbers	Remarks
1	Compact link module	EH-TLNKE		1	
2	Connector	BL3.5/6F		1	Plugged in the connector for communication. Made by Weidmuller
3	External terminator	100Ω		1	Connect it when you use fallback operation. (Note2)
4	Instruction manual	NJI-560* (X)		1	(Note1)

(Note1) * A final number of the manual number may change according to updating version.
(Note2) Please refer to Section 6.5 for fallback operation, and refer to Section 5.4 for connection.

1.3   Features

(1) Total economy

It is possible to lead to a reduction in total cost for system including wiring because the standard price of modules is reasonable and an affordable twisted cable can be used.

(2) Compatibility with current models

EH-TLNKE has communication-compatibility with the link modules for EM/EM-II and H-200/250/252B/252C, and you can use an existing cable. Therefore, you do not need to rewire the cable and the replacement to EH-150/EHV is easy.

(3) Large-scale link system

When setting EH-TLNKE in normal mode, link system can use up to 1,024 words (16,384 points, 32 units/ system) and can build a large-scale link system.

(4) Partial and step-by-step replacement

Since EH-TLNKE can be used with current models, it is possible to replace PLC units of the link system step-by-step and partially.

(Note) The link module (TLINK-02H) for H-252B/252C cannot be used with EH-TLNKE because communication I/F is different. When you replace TLINK-02H by EH-TLNKE, do not replace step-by-step. Replace the whole link system.

(5) Fast response and high reliability

The link refresh time is approximate 100ms (setting to high-speed mode (HS) and 1,024 words). A reliable link system can be built because improper communication data is discarded by the reverse double-transmission check function that has high performance as before.

(6) I/O hold function

Since link modules have the function that holds received data from the other link modules, these modules are applicable to the process control.

(7) Easy handling

The cable for these modules is easily available due to the twisted cable and easy to handle.

The configuration example of the link system is shown below.

(1) Large-scale link system (EHV-CPU16/32/64/128, EH-CPU316A/516/548)

You can build the large-scale system of 1,024 word / systems in EHV/EH-150 series by the compact link module which a cheap twisted pair cable can use at low cost.

EHV: 8 systems
EH-150: 2 systems

EHV   EHV   EH-150   EHV

No.1 LINK

EH-150   EHV   EHV

No.2 LINK

No.3 LINK

No.4 LINK

Large-scale link system
 Modules counts: max. 32 units /system
 Link points: max. 1,024 words /system

No.5 LINK

No.6 LINK

No.7 LINK

EHV   EHV   EH-150

No.8 LINK
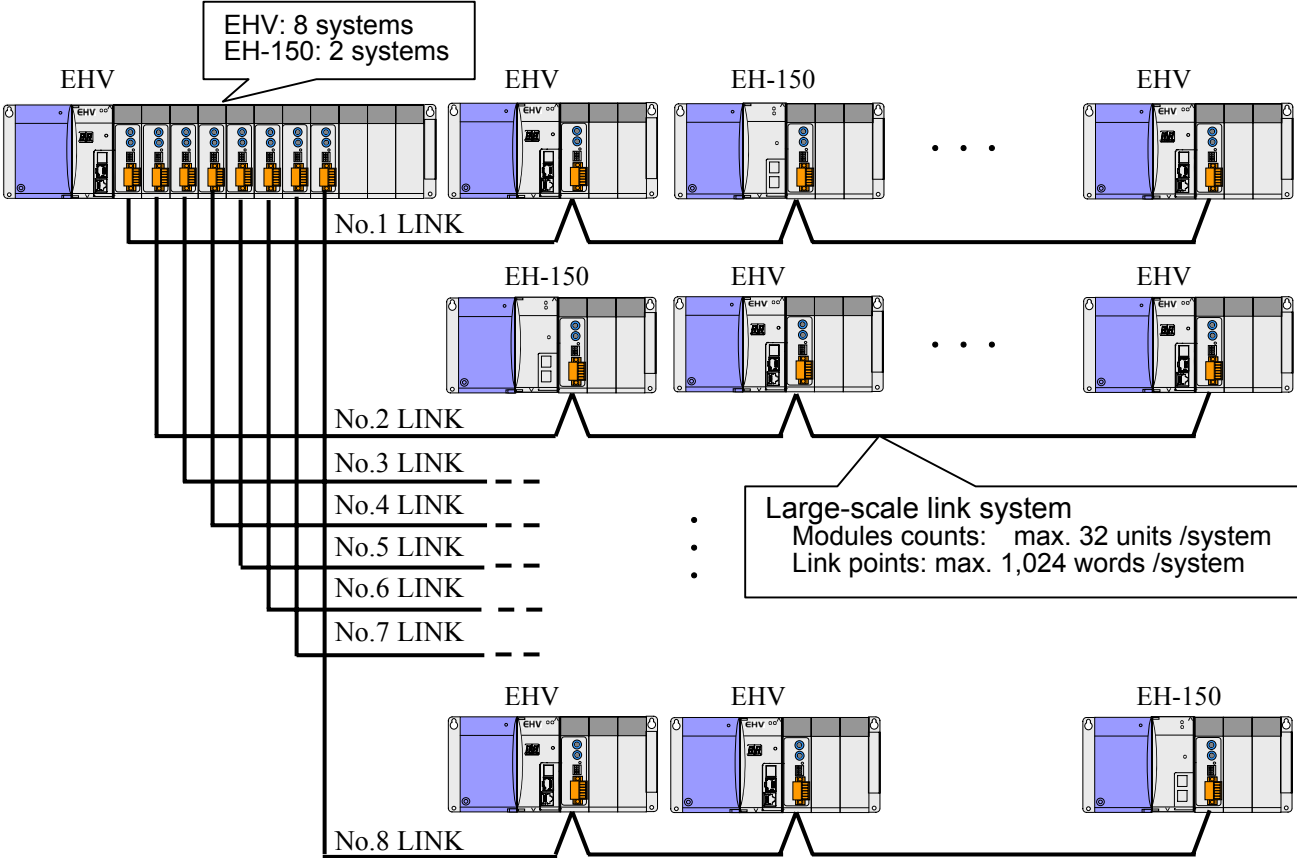
Figure 1.3.1 System configuration example of compact link module

(2) Small-scale link system of low cost (EH-CPU104A/208A)

The CPU (EH-CPU104A/208A) for small-scale control was not able to use a link module, compact link module can build a link system (4 word / systems) by the CPU.

Because the I/O assignment is not "LINK", there are not the mountable restrictions.

EH-CPU208A   EH-CPU104A   EH-CPU208A   EH-CPU104A

Small-scale link system
 Modules counts: max. 8 units /system
 Link points: max. 4 words /system
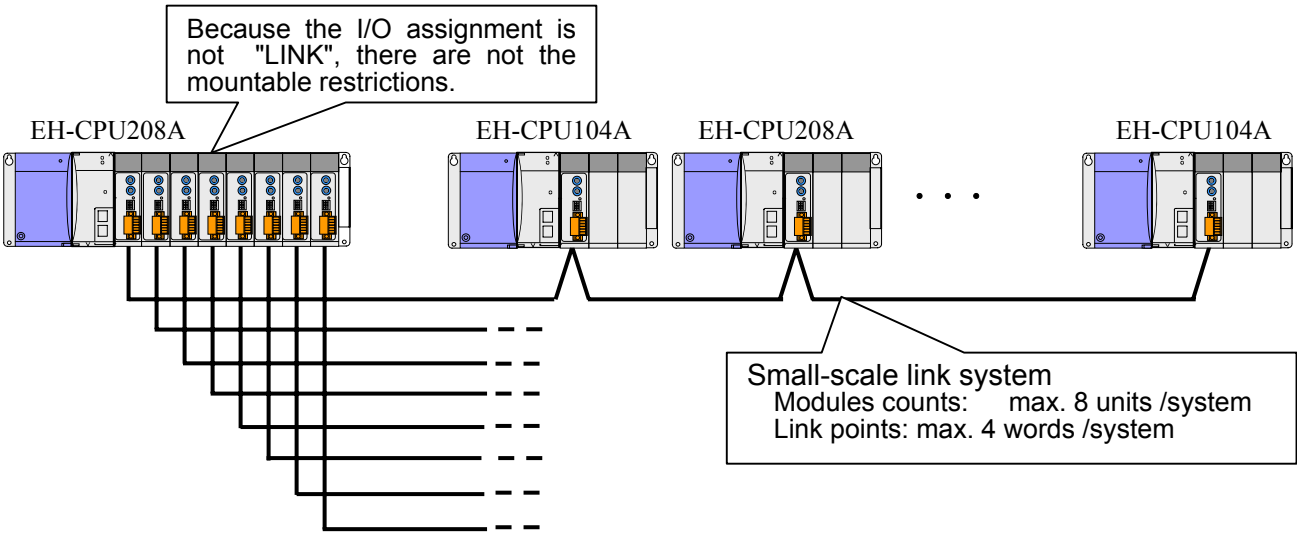
Figure 1.3.2 System configuration example of EH-CPU104A/208

(3) Mixture link system with existing small PLC

Compact link module has communication compatibility for IOLH-T and IOLM-T that are the conventional products, and you can replace by the EHV/EH-150 series. Therefore you can build a mixture link system in existing small PLC link system.

The system constitution example that replaced a part of the H-200/250/252B/252C series in the EHV/EH-150 series is shown below.
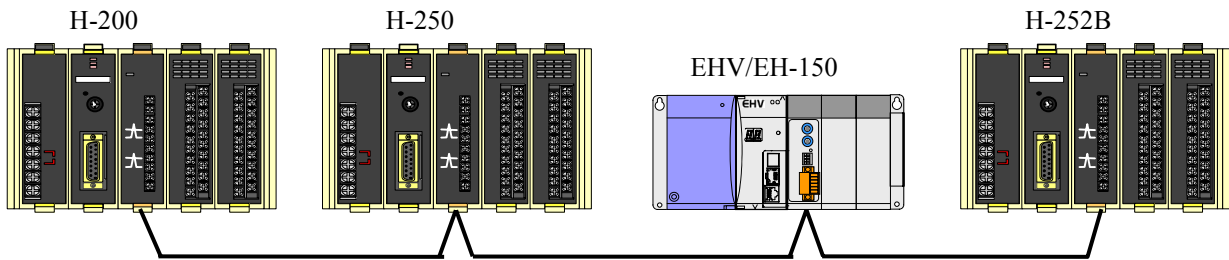
Figure 1.3.3 System configuration example for replacement of H-200/250/252B/252C series

The system constitution example that replaced a part of the EM/EM-Ⅱ series in the EHV/EH-150 series is shown below.
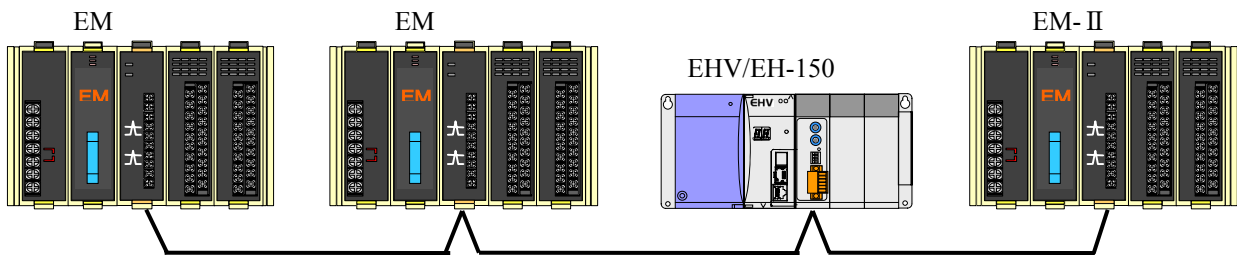
Figure 1.3.4 System configuration example for replacement of EM/EM-Ⅱ series

Refer to the details of the usage after Chapter 2.

Chapter 2   Specifications

2.1   General specifications

General specifications are shown in Table 2.1.1. These specifications are common in EH-150 series.

Table 2.1.1 General specifications

Item	Specifications
Operating ambient temperature	0 to 55°C (0 to 45 °C if used as UL certified product)
Storage ambient temperature	−10 to 75°C
Operating ambient humidity	5 to 95% RH (no condensation)
Storage ambient humidity	5 to 95% RH (no condensation)
Vibration resistance	Conforms to IEC 60068-2-6
Noise resistance	○ Noise voltage 1,500Vpp Noise pulse width 100 ns, 1μs (Noise created by the noise simulator is applied across the power supply module's input terminals. This is determined by this company's measuring method.) ○ Based on IEC61131-2 ○ Static noise: 3,000V at metal exposed area
Insulation resistance	20MΩ or more between the AC external terminal and case ground (FE) terminal (based on 500V DC)
Dielectric withstand voltage	1,500V AC for 1 minute between the AC external terminal and case ground (FE) terminal
Grounding	Class D grounding (ground with power supply module)
Usage environment	No corrosive gases, no excessive dust
Structure	Open, wall-mount type
Cooling	Natural air cooling

2.2   Functional specifications

Functional specifications are shown in Table 2.2.1. The compact link modules have functions almost equal to link modules (IOLH-T) for H-200/250/252B/252C series and link modules (IOLM-T) for EM/EM-II series.

EH-TLNKE has communication-compatibility with IOLM-T and IOLH-T, and you can use an existing cable.

Therefore, you do not need to rewire the cable in replacement from these series.

Table 2.2.1 Functional specifications

Item		Specifications
Functional specifications	Usable CPU	EH-CPU104A/208A/316A/516/548, EHV-CPU16/32/64/128
	No. of mounted units — EHV-CPU***	MAX 8 units per CPU (8 loops per CPU) (I/O assignment: "LINK")
	No. of mounted units — EH-CPU***	MAX 2 units per CPU (2 loops per CPU) (I/O assignment: "LINK") (Note 1)
	No. of connected link modules — Normal mode	MAX 32 units per system
	No. of connected link modules — Compatible mode	MAX 8 units per system (Connectable mode to IOLH-T and IOLM-T)
	Number of link points — Normal mode	1024 words per system (I/O assignment: "LINK")
	Number of link points — Compatible mode	8 words per system (I/O assignment: "LINK") 4 words per system (I/O assignment: "X4Y4W")
	Refresh time (Note 2)	Approx. 100msec/1024 words (HS: ON), Approx. 55msec/8 words (HS: OFF)
	Self-diagnosis	SRAM check, WDT check, Loop back check
	Fallback operation	Available (Even if some slave stations are failed or powered off, it is possible to continue communication between other stations.) (Note 4)
	I/O assignment	"LINK" or "X4Y4W"
	Consumption current	Approx. 270mA
Transmission specifications	Transmission speed	768kbps
	Transmission mode	Half-duplex serial transfer, frame synchronization
	Insulation, modulation method	Trans insulation, bipolar pulse modulation
	Transmission error check	Reverse double-transmission, time-out
	Error display	LED, special internal output
Transmission line	Connection mode	Multi-drop system
	Cable length (Compatible mode) (Note 3)	Between stations: 150m ($0.3mm^2$) / 300m ($0.5mm^2$, $0.75mm^2$) Total length: 150m ($0.3mm^2$) / 300m ($0.5mm^2$, $0.75mm^2$)
	Error station processing	Slave station: Bypass system
	Cable	Shielded twisted pair cable
	Recommended cable (Made by Hitachi cable) — Existing	$0.3mm^2$ cable: CO-SPEV-SB(A)-1P-0.3SQ (Terminator 100Ω) $0.75mm^2$ cable: CO-EV-SX-1P-0.75SQ (Terminator 150Ω)
	Recommended cable (Made by Hitachi cable) — New	$0.3mm^2$ cable: CO-SPEV-SB(A)-1P-0.3SQ LF (Terminator 100Ω) $0.5mm^2$ cable: CO-SPEV-SB(A)-1P-0.5SQ LF (Terminator 100Ω)
	Applicable connector	BL3.5/6F attached (made by Weidmuller)

(Note 1) "LINK" is unavailable to EH-CPU104A/208A. Always use "X4Y4W" for these.
(Note 2) Refresh time is transmission refresh time between the link module.
(Note 3) Maximum-length of cable seems below by number that connected stations in the case of normal mode setting.

No. of connected stations	$0.3mm^2$ cable	$0.5mm^2$, $0.75mm^2$ cable
2 to 8 stations	150m	300m
9 to 16 stations	130m	260m
17 to 32 stations	100m	200m

(Note 4) Please connect external terminator to communication connectors of end link modules connected through a twisted-pair cable when you use fallback operation. Refer to Section 5.4 (3) (4) for details.

2.3　Link units that can be connected to EH-TLNKE

Link units that can be connected to EH-TLNKE are shown in Table 2.3.1.

Table 2.3.1 Unit list that can be connected to EH-TLNKE

Series of PLC	Product name	Model name	Specifications (Maximum link points)	Remarks
EH-150/EHV	Link module	EH-TLNKE	Linkage capacity: 128points (8words)	
H-200/250/252B/252C	Link module	IOLH-T	Linkage capacity: 128points (8words)	End of sale
EM/EM-II	Link module	IOLM-T	Linkage capacity: 128points (8words)	End of sale
H-board type	Unit with linkage function	HL-40DR	Linkage capacity: 128points (8words)	End of sale
		HL-64DR	Linkage capacity: 128points (8words)	End of sale

(Note 1)　When you use EH-TLNKE with link unit of production abolition, set switch by "compatible mode" and "the low speed refresh mode".

2.4　Specifications difference with the conventional products

EH-TLNKE is a link module that use with twisted pair cable. The specifications difference with the conventional products that use with the twisted pair cable are shown in Table 2.4.1.

Table 2.4.1 Specifications difference with IOLH-T, IOLM-T, HL-40DR and HL-64DR

Item			IOLM-T	IOLH-T	HL-40DR HL-64DR	EH-TLNKE	Remarks
Operation mode	Normal mode	HS:ON	Not usable			Available	
		HS:OFF	Not usable			Available	
	Compatible mode	HS:ON	Not usable			Available	
		HS:OFF	Usable				
Number of connected link modules	Normal mode		−			MAX 32 units per system	
	Compatible mode		MAX 8 units per system				
Number of link points per system	Normal mode		−			16,384 points (LINK)	(I/O assignment)
	Compatible mode		128 points (Unnecessary)	128 points (LINK)			
				−		64 points (X4Y4W)	
Refresh time	Normal mode　(HS:ON)		−			Approx. 100ms	16,384 points, 32 units
	Compatible mode　(HS:OFF)		Approx. 80ms			Approx. 55ms	128 points, 8 units
Fallback operation			Available (Except for link master station) (Note 3)				(Note 1)
I/O assignment			Unnecessary	"LINK"		"LINK" "X4Y4W"	
Reset switch			Not usable			Available	
Link error flag	Module information		Not usable			Available	
	Link participation flag		Not usable			Available	
	Link operating status flag		Not usable			Available	
	Transmission error count		Not usable			Available	
	Refresh time		Not usable			Available	
Station number overlap check			Possible			Possible (Note 2)	
Peripheral device functions			Not usable (There is no peripheral device functions.)				
Terminator			100Ω (built in), 150Ω (Attach externally)			100Ω/150Ω (built in) (Note 3)	Change by switch

(Note 1) The module that set a station number to 0 is a link master station. There is no the master station move processing.
(Note 2) When EH-TLNKE is used with conventional products, they will detect the overlap error. When link system made construction only in EH-TLNKE, there is a possibility that the area overlap error can not detect.
(Note 3) Please connect external terminator to communication connectors of end link modules connected through a twisted-pair cable when you use fallback operation.

TLINK-02H for H-252B/252C is the CPU link module with a twisted pair cable. The link module (TLINK-02H) for H-252B/252C cannot be used with EH-TLNKE because communication I/F is different. When you replace TLINK-02H by EH-TLNKE, do not replace step-by-step. Replace the whole link system. When EH-TLNKE is set the normal mode, the communication specifications difference are shown in Table 2.4.2.

Table 2.4.2 Specifications difference with TLINK-02H

Item		TLINK-02H	EH-TLNKE	Remarks
No. of connected link modules		MAX 32 units per system		
Number of link points		16,384 points (1,024 words)		
Refresh time		Approx. 200msec (1Mbps)	Approx. 100msec	16,384 points,32 units
Fallback operation		Available (Except for link master station)		(Note 1)
I/O assignment		「LINK」		
Error clear switch		Available	Not usable	
Reset switch		Available		(Note 2)
Error flag (Special internal outputs)		Available		(Note 3)
Area overlap check		Available	Not usable	(Note 4)
Station number overlap check		Available	Available	
Peripheral device functions		Available	Not usable	
Terminator		100Ω (built in)	100Ω/150Ω (built in) (Note 5)	Change by switch
Transmission speed		125k/250k/500k/1Mbps	768kbps fixation	
Transmission mode		Half-duplex serial transfer, frame synchronization		
Modulation method		Base band	Bipolar pulse modulation	Trans insulation
Connection mode	Connection form	Multi-drop system		
	Outside interface	Terminal	Connector terminal	Putting on and taking off is possible
Cable length (Recommended cable)		1km/800/400/240m (Change by transmission speed)	100 to 150m (Change by connection module count)	
Recommended cable		CO-SPEV-SB(A)-1P-0.3SQLF		

(Note 1) The module that set a station number to 0 is a link master station. There is no the master station move processing.
(Note 2) The link area is not cleared by reset switch.
(Note 3) Content of the special internal outputs are different.
(Note 4) Overlap check of the link area is not possible. Confirm that an area set in the link parameter of each station does not overlap enough.
(Note 5) Please connect external terminator to communication connectors of end link modules connected through a twisted-pair cable when you use fallback operation.

2.5   Operation mode and function

EH-TLNKE can choose operation mode. Normal mode has 1,024 words (16,384 points) per system, and can connect 32 modules in the system. So, we recommend this mode to new design for compact link system.

Because the compatible mode has communication-compatibility with the conventional products, this mode is able to use with conventional-products. At the time of the replacement, we recommend this mode. But TLINK-02H cannot use with EH-TLNKE because communication I/F and maximum link points are different. When you replace TLINK-02H by EH-TLNKE, do not replace step-by-step. Replace the whole link system to use normal mode.

Comparison of the function about each operation mode is shown in Table 2.5.1. See to do the choice of operation mode.

Table 2.5.1 Comparison of the function

Operation mode		Normal mode	Compatible mode (Communication-compatibility mode)			
Functional specifications	I/O assignment	LINK	LINK	X4Y4W	DBW(S)6	X1Y1W
	No. of mounted units	MAX 8 units per CPU (Note 1)	Non limit (Be depend to the CPU)			
	No. of connected link modules	MAX 32 units per system	MAX 8 units per system			
	Maximum link points	1,024 words	8 words	4 words	8 words	
Use (Purpose of use)	When newly-designed	Available (Recommend)	Available			
	When I/O assignment of "LINK" is not enough	Not usable		Available (Note 2)		
	When module mounted on an expansion base unit	Not usable		Available (Note 2)		
	At the time of graded Replacement (When module connect with conventional products)	Not usable	Available (Recommend) (Note 3)	Not usable	Available (Note 4)	
	At the time of replacement of the whole system	Available (Note 5)	Available (Recommend) (Note 3)	Not usable	Available (Note 4)	
	When you want to use the CPU link module in EH-CPU104A/208A	Not usable		Available	Not usable (Note 6)	
Note		Refer to Section 4.3.1	Refer to Section 4.3.2	Refer to Section 4.3.3	Refer to Section 8.1.1	Refer to Section 8.1.2

(Note 1) Compact link modules can mount maximum two modules per CPU as EH-CPU316A/516/548.
(Note 2) Can use the I/O assignment of "X4Y4W" with all CPU modules. Can use the I/O assignment of "DBW(S)6" only with CPU module of EHV series. Can use the I/O assignment of "X1Y1W" with EH-CPU316A/516/548.
(Note 3) When you replace IOLH-T, IOLM-T, HL-40DR, HL-64DR by EH-TLNKE, you can use it. However, H board series have communication function, you may need to change external inputs and outputs in user's program.
(Note 4) The change of I/O assignment and I/O number is necessary about a user's program.
(Note 5) When you replace a link system of TLINK-02H by EH-TLNKE, it is effective.
(Note 6) Cannot use compact link modules, because there are not the FUN200 and FUN201 commands in EH-CPU104A/208A.

MEMO

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Chapter 3   Name and function of each part

3.1   Name and function of each part in link module

Name and function of each part				Model name	EH-TLNKE
				Weight	Approx. 0.12kg (0.26lb.)
				Consumption current (5VDC)	Approx. 270mA
				Dimensions (mm (in.))	

1] Lock button
2] LED display
3] Rotary switch (upper)
4] Rotary switch (lower)
5] Reset switch
6] Front DIP switch
7] Connector (socket)
8] Side DIP switch

30 (1.18)   95 (3.74)   100 (3.94)

No.	Name	Function	Remarks
1]	Lock button	This is used when removing the module from base unit. After it is installed to the base unit, the fixation can be reinforced using screws. In this case, use M4 × 10 mm (0.39 in.) screw.	
2]	LED display	The status of module is displayed on this LED.	See a table shown below.
3]	Rotary switch (upper)	This is a switch to set station number or station count for link module.	See next page.
4]	Rotary switch (lower)	There are different from setting contents by operation mode (normal mode or compatible mode).	
5]	Reset switch	Pressing this switch when abnormal error occurred can reset the module.	
6]	Front DIP switch	This is a switch to set an operation mode (HS refresh mode, etc.).	See next page.
7]	Connector	This is a connector to connect a twist-pair cable for connecting other stations.	See next page or later.
8]	Side DIP switch	This is a switch to set number of stations or an operation mode of the module. The contents change by the mode setting.	See next page or later.

■ Description of LED display

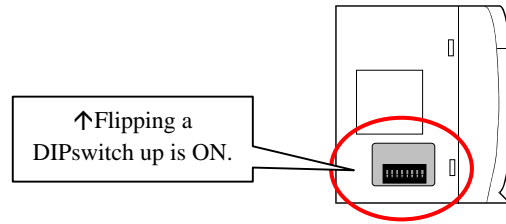| LED	LED name	Indication	Details
CPU LINK EH-TLNKE POW RUN TxD RxD HERR CERR	POW	Power supply	Light up when 5V DC power is supplied to the module.
	RUN	Normal communication	Light up in proper communication. (Light is turned off due to time out error when the communication is discontinued for 500ms or more.)
	TxD	Transmission data	Light up according to transmission data on the module.
	RxD	Received data	Light up according to received data from other stations.
	HERR	Hardware error	Light up when hardware failure in link module is detected.
	CERR	Communication error	Light up during communication error. (Light is turned off automatically when communication is recovered.)

■ Description of Rotary switch

Rotary switch		Communication mode	Symbol	Meaning	Details of setting
U **MODE** **L**		Normal mode	U (Upper)	Station number	Set the station number of the module. Set it in 00h to 1Fh (Hex two digits) ranges.
			L (Lower)		
		Compatible mode	U (Upper)	Station number	Set the station number of the module. Set it in 0 to 7 ranges.
			L (Lower)	Number of stations	Set the number of connected modules. Set it in 2 to 8 ranges.
[Default setting: U=0, L=0]		Set the station number with the continued number. If setting number was beyond a range, EH-TLNKE becomes the hardware error.			

■ Description of Front DIP switch

Symbol	Setting description	Details
HS	HS (Refresh mode) selecting HS 4 MODE 3 HOLD 2 TERM 1 → ON 	MODE	HS	Transmission interval
Normal mode	OFF	Approx. 100μs
	ON	Approx. 6μs
Compatible mode	OFF	Approx. 700μs
	ON	Approx. 6μs | [Default setting: OFF]	Refresh operation mode on link communication is set (High-speed or Low-speed). In the case of all station is EH-TLNKE the high-speed refresh mode can be selectable. Refer to section 4.6 about the calculation method of link refresh time. | HS	Position	Remote refresh mode selection
OFF		Low-speed refresh mode
ON		High-speed refresh mode (for high-speed EH-TLNKE)	
MODE	MODE (Communication mode) selecting HS 4 MODE 3 HOLD 2 TERM 1 → ON [Default setting: OFF]	Operation mode on link communication for the module is set. Compatible mode (HS:OFF) allows link module (EH-TLNKE) to connect with link modules for series other than EH-150. 	MODE	Position	Communication mode selection
OFF		Normal mode
ON		Compatible mode	
HOLD	HOLD (Input hold function) selecting HS 4 MODE 3 HOLD 2 TERM 1 → ON [Default setting: OFF]	When the communication timeout error occurred, it is selected whether the input data from other stations is held or not. (Hold means the last data received properly is fixed.) 	HOLD	Position	Input hold function selection
OFF		Disable the input hold function (Turn off all received data from other stations at the communication error.)
ON		Enable the input hold function (At the communication error, received data from other stations is held with last data received properly.)	
TERM	TREM (Terminator insertion / Non-insertion) selecting HS 4 MODE 3 HOLD 2 TERM 1 → ON [Default setting: OFF]	It is selected whether the terminator build in the link module is inserted between A and B terminals of the communication connector. The terminator has to be inserted in both ends of link modules connected through a twisted pair cable. 2 types of terminators (100Ω and 150Ω) are built in link module. It is possible to select which to insert by the side Dipswitch. The built-in terminator is disconnected when power supply is turned off. So, please set TERM off and connect external terminator to communication connector when you use fallback operation. 	TERM	Position	Selection of insertion / non-insertion of terminator
OFF		Not insert a built-in terminator. (An unnecessary, if it is not both ends of a twisted pair cable.)
ON		Insert a built-in terminator. (When it is both ends of a twisted pair cable)	

■ Description of Side DIP switch
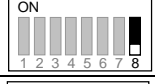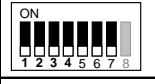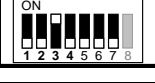
When flipping a Dipswitch up, it means ON
as the figure shown in the right side.

↑Flipping a
DIPswitch up is ON.

See the list below about setting the DIPswitch in the normal mode.

No.	Setting description	Details
1	Select the built-in terminator value [Default setting: OFF]	100Ω or 150Ω terminators build in a link module, it chooses which terminator is inserted between A and B terminals of communication connector.

Bit8	Position	Selection of built-in terminator
OFF		100 Ω (For recommended 0.3mm² and 0.5mm² twisted pair cable)
ON		150 Ω (For recommended 0.75mm² twisted pair cable)

No.	Setting description	Details
2	Setting the number of connected modules Upper [Default setting: All OFF]	Set the value of Hex two digits for the number of connected modules on the same link system. Set it in 02h to 20h ranges. Bit 7 is undefined. Always turn off Bit 7.

Bit7	Position	Description
OFF		Undefined (Always turn Bit7 off.)

Set an upper digit of the number of connected modules by Bit5 and Bit6 of DIP switch.

Bit5	Bit6	Position	Set value	Bit5	Bit6	Position	Set value
OFF	OFF		0	OFF	ON		2
ON	OFF		1	ON	ON		Undefined

No.	Setting description	Details
3	Setting the number of connected modules Lower [Default setting: All OFF]	Set a lower digit of the number of connected modules from Bit1 to Bit4 in DIPswitch.

Bit1	Bit2	Bit3	Bit4	Position	Set value	Bit1	Bit2	Bit3	Bit4	Position	Set value
OFF	OFF	OFF	OFF		0	OFF	OFF	OFF	ON		8
ON	OFF	OFF	OFF		1	ON	OFF	OFF	ON		9
OFF	ON	OFF	OFF		2	OFF	ON	OFF	ON		A
ON	ON	OFF	OFF		3	ON	ON	OFF	ON		B
OFF	OFF	ON	OFF		4	OFF	OFF	ON	ON		C
ON	OFF	ON	OFF		5	ON	OFF	ON	ON		D
OFF	ON	ON	OFF		6	OFF	ON	ON	ON		E
ON	ON	ON	OFF		7	ON	ON	ON	ON		F

See the list below about setting the DIPswitch in the compatible mode.

No.	Setting description	Details								
1	Select the built-in terminator value [Default setting: OFF]	100Ω or 150Ω terminators build in a link module, it chooses which terminator is inserted between A and B terminals of communication connector.								
		Bit8		Position			Selection of built-in terminator			
		OFF					100 Ω (for recommended 0.3mm^2 and 0.5 mm^2 twisted pair cable)			
		ON					150 Ω (for recommended 0.75mm^2 twisted pair cable)			
2	Select the I/O assignment [Default setting: All OFF]	Set the I/O assignment of the module.								
		Bit1	**Bit2**	**Bit3**	**Bit4**	**Bit5**	**Bit6**	**Bit7**	Position	I/O assignment
		OFF	OFF	OFF	OFF	OFF	OFF	OFF		LINK
		OFF	OFF	ON	OFF	OFF	OFF	OFF		X4Y4W

See the list below about the CPU modules and I/O assignments.

Refer to chapter 4 about the details of the usage.

I/O assignment	EH-CPU104A EH-CPU208A	EH-CPU316A EH-CPU516 EH-CPU548	EHV-CPU16 EHV-CPU32 EHV-CPU64 EHV-CPU128	Link points (Note 1)
LINK	Not available	Available	Available	16,384 points / loop (Normal mode) 128 points / loop (Compatible mode)
X4Y4W	Available	Available	Available	64 points / loop

(Note 1) By I/O assignment except "LINK", the external outputs are send data area. In addition, external inputs are received data area.
Therefore, received link data from other stations are stored away in the external inputs area.

If do not set a switch definitely, be careful as EH-TLNKE does not operate normally.

Chapter 4 Basic functions and System configuration

4.1   Selection of CPU module for compact link system

There are two methods to use compact link system by I/O assignment selecting.

(1) "LINK" method

(2) "X4Y4W" method

Differences between these methods are shown in Table 4.1.1. When selecting CPU model and I/O assignment of link module, it is determined the mountable maximum number of link modules on basic unit, the maximum number of stations per system, and maximum link points. "LINK" method has 16384 points per system, and is free to use send data area and received data area in module. And I/O assignment "LINK" is supported by EHV-CPU16/32/64/128, EH-CPU316A, and EH-CPU516/548. So, we recommend these CPU for compact link system. But in the case of using EH-CPU104A/208A for cost reduction, please set "X4Y4W" for I/O assignment of link module.

In the case of "X4Y4W" I/O assignment there is a disadvantage of not using internal outputs indicating link refresh cycle time and so on. But in this case there is an advantage of not limiting it to the number of mounting of link modules per CPU. So, you can construct large-scale link system with twisted pair cable by use many link modules per CPU.

Table 4.1.1 Using method of compact link for each CPU

Using method of compact link		"LINK" method		"X4Y4W" method
CPU module		EHV-CPU16/32/64/128	EH-CPU316A/516/548	EHV-CPU16/32/64/128 EH-CPU104A/208A/316A/516/548
I/O assignment		"LINK"		"X4Y4W" (Note 1)
Number of mountable link module		8 modules/CPU	2 modules/CPU	Not limited (According to CPU)
Number of connectable modules	Normal mode	32 modules / system		
	Compatible mode	8 modules / system		8 modules / system
Link points	Normal mode	1,024 words		
	Compatible mode	8 words		4 words (Note 2)
Special internal outputs for link function		Available (Note 3)		Available (Note 4)
Operation parameters for link function		Available		Not available
Reference section	Basic system	Section 4.3.1, 4.3.2		Section 4.3.3
	Replace of H-200	Section 4.4		—
	Replace of EM	Section 4.5		—

(Note 1) Can use the I/O assignment of "X4Y4W" only with compatible mode.
(Note 2) The send area uses the external outputs area. The received area from other stations uses the external inputs area.
(Note 3) Refer to section 6.2 about the available special internal outputs for link function.
(Note 4) There is information of special internal outputs in status area of link module.

4.2   Basic functions of compact link

4.2.1   Link area

(1) Link system number

In the case of setting I/O assignment of "LINK" for link module, maximum eight compact link modules (EH-TLNKE) can be mounted on slots that are 0 to 7 slots shown as Figure 4.2.1. In this case link system number is sequentially allocated from one near CPU from 1 to 8.

Compact link modules can mount maximum two modules per CPU as EH-CPU316A/516/548.
For details, refer to EH-150 application manual.
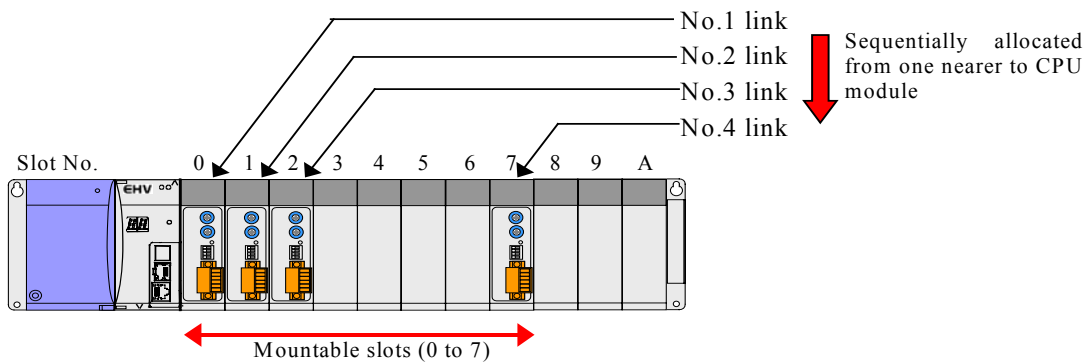
Figure 4.2.1 Mounting position and link system number of compact link module

(2) Link area

In the link system, I/O number of link area is expressed to 4 digits by hexadecimals shown in Figure 4.2.2. And link area is bit/word common type. The link areas are equipped to handle 1,024 words (Hex 3 digits; 000 to 3FF) for each link module. And the link areas are identified in accordance with their installation position; I/O number of the link area is different depending on link system number.
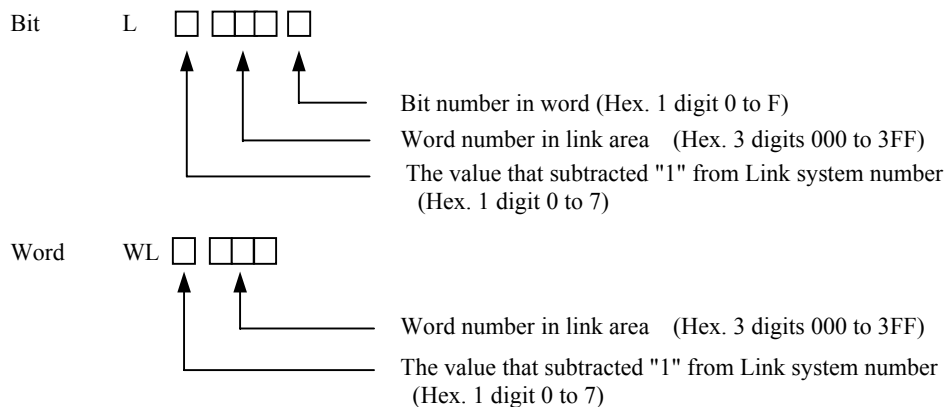
Figure 4.2.2 I/O number of link area

Data is read into the local station area in accordance with user programs during normal operations. This data can be updated 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 station 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) It is not possible to set the link area for retentive area.

(3) 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.

2) When the local station's CPU is RUN

The send area data will commence from the last update value. As the received 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.

3) When the local CPU is stopped

The send area will save the last update value 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 last received data if the link module stops link operations.

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 last send data from the other stations without amendment. When the communication error (time-out error; The state that cannot receive data more than 500ms from the other stations) is detected, received data from other stations are processed based on setting "HOLD" of a front DIPswitch.

5) The synchronism of data

About IC memory in the link module that CPU module reads and writes link data, the data are updated every a word. Therefore the data synchronism is not guaranteed about link data of the send area in each station. The data synchronism is guaranteed every 16 bits (one word).

Depending on the timing of CPU's data refresh and the link communication refresh, the delay that link data are updated will occur in the send data area. And the delay is same as link refresh time.

It is possible to clear the link area when the system is switched between RUN and STOP with the setting of WRF07E that is special internal output in EH-150 CPU modules. When this setting is performed, the send area data will commence from 0.

Refer to the EH-150 Application Manual for further details on the WRF07E setting.

And in the case of EHV CPU modules, this function is possible to set by link parameter setting of Control Editor. Refer to section 4.2.2.

4.2.2 Link parameter setting

(1) Link parameter

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 area of the same system is set the data area that each station transmits as a link parameter. And the link areas of every system are assigned send area like Figure 4.2.3. The send areas can be assigned arbitrarily in units of 16 points (1 word) for each CPU.
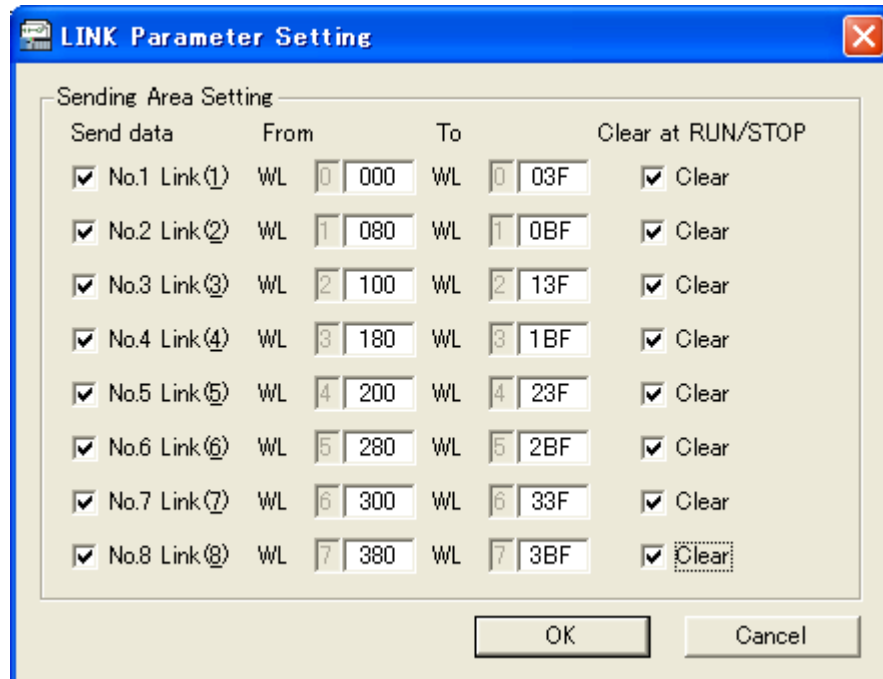
Figure 4.2.3 Link parameter setting by Control Editor

(2) Send area

About a link area, Figure 4.2.4 is the example that set a send area in each station. The area to occupy by a link system is a total of the send area of stations connected to the same system. The send area data will clear at the time of RUN and STOP of the CPU when check in "Clear at RUN/STOP" of the link parameter. In the case of "LINK" method, set the send area not to duplicate assigned areas of each station. If each send area is duplicated, the received area data in other links are updated to their send area data sequentially.

(3) A transmission range of the link communication

By link operations, each station transmits data sequentially from the data where the I/O number of the send area in station is small. On the other hand, the received area will be updated by the data transmitted from other stations. The unused link area is not intended in the link operations, and the data is not transmitted. The link refresh time is calculated by equations (4.2) of section 4.6, and depends on total send area.
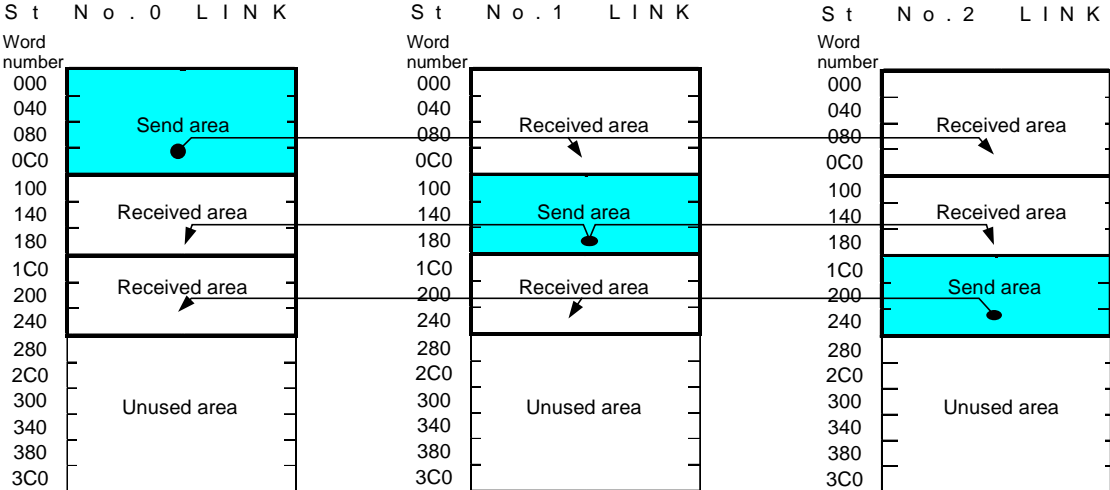
Figure 4.2.4 Send area and a link communication

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4.2.3 Station number and station count

(1) Station number

Set a station number by rotary switches for station identification in compact link module (EH-TLNKE). Then set the station number that continued and does not repeat. The station that was set station number 0 (St No. 0) becomes the link master, and starts the link communications. Therefore, set a link master by all means. The other stations become the link slaves. The link master transition process is not performed in the compact link system. When a link master became communications error or broke down; the system will stop the link communications.

The setting method of the station number is different from normal mode and compatible mode. Refer to section 3.1 about the details.

St No.0   St No.1   St No.2
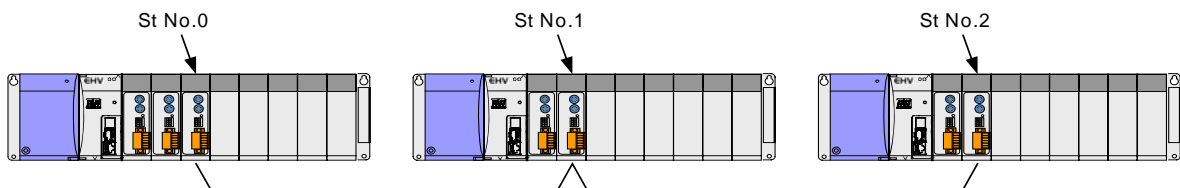
Figure 4.2.4 Station number (St No.)

(2) Station count

In the compact link (EH-TLNKE), set the station count connected in a system by switches in the link master. Set the value of a setting range in the other stations. When you add a station, change the station count setting of the link master station. It does not need to change the other stations.

The setting method of the station count is different from normal mode and compatible mode. Refer to section 3.1 about the details.

4.2.4 Communication mode

Compact link (EH-TLNKE) can set the compatible mode to communicate with link modules for H-200/250/252B series and EM/EM II series or the normal mode for EH-150/EHV series. The communication mode is set by the DIP switch of the module front.

(1) Normal mode

When the system consisted only of the compact link modules (EH-TLNKE), this mode is able to use. The I/O assignment of the module becomes "LINK" if communication mode is set the normal mode. In this case the usable link points are 1,024 words. Refer to section 4.3 for the details of the usage method.

(2) Compatible mode

When the system is used to mixture with link modules of EM/EM II series and H-200/250/252B series, this mode is able to use. The I/O assignment of the module can set "LINK" and "X4Y4W" if communication mode is set the compatible mode. If I/O assignment is set "LINK", the usable link points are 8 words. And in the case of "X4Y4W", the usable link points are 4 words. Refer to section 4.3, 4.4 and 4.5 for the details of the usage method.

4.2.5 Function for accessing other stations

There is not this function.

4.3   Basic system configuration

Basic system configurations consist from the compact link modules (EH-TLNKE) are shown in Section 4.3.1 to 4.3.3.

4.3.1   System configuration example (Normal mode, "LINK" method)

Figure 4.3.1 is the system configuration example that compact link modules were set to normal mode. When the compact link module was set to normal mode, I/O assignment becomes "LINK". Refer to section 3.1 for the setting method of the normal mode.
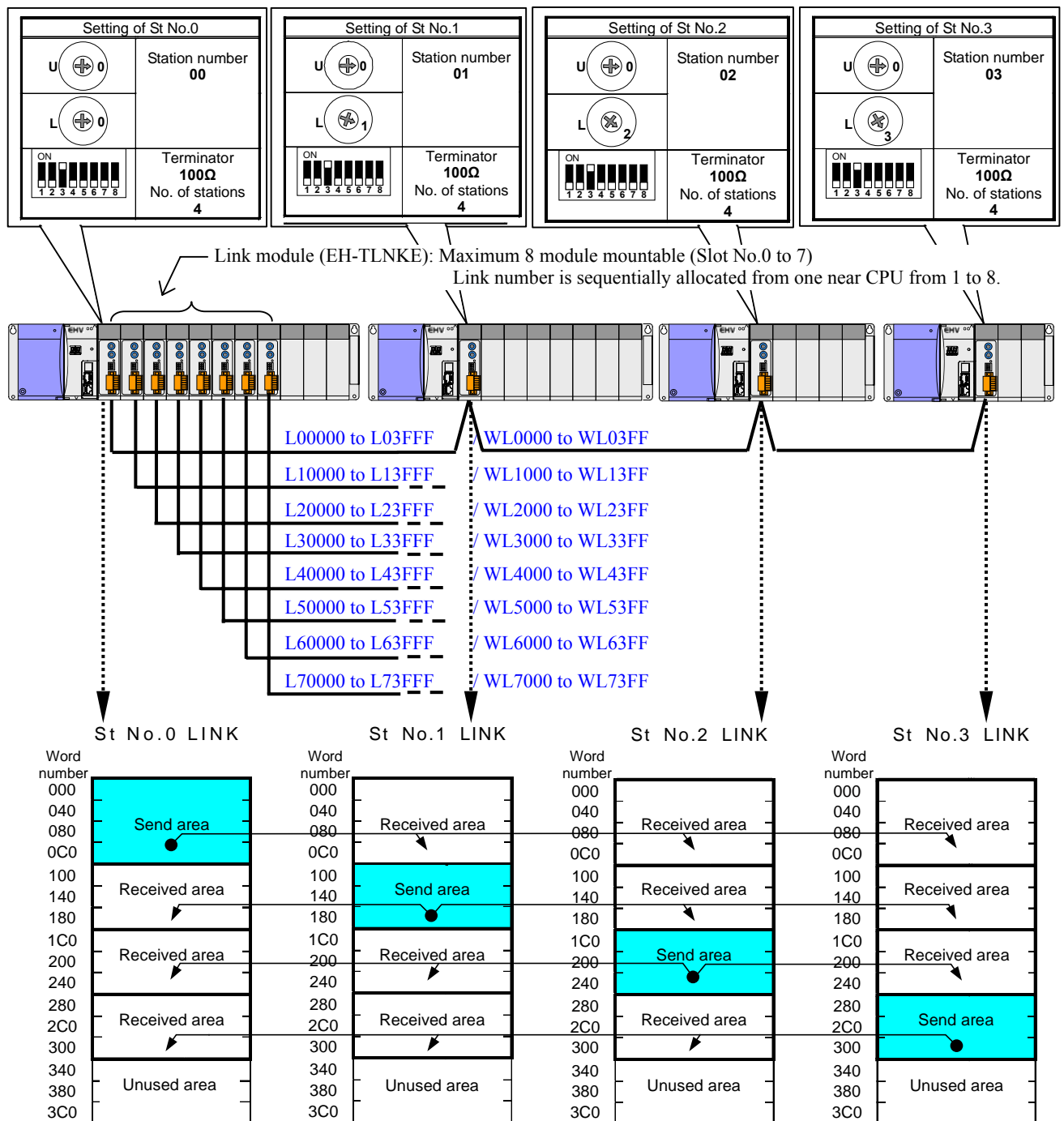
Figure 4.3.1 System configuration example-1 (I/O assignment of "LINK")

[Explanations]

1) There is the link area of 1,024 words (000 to 3FF) in the compact link module (EH-TLNKE). Depending on a link parameter set by CPU mounted on the basic unit, each station is assigned the send area like section 4.2.2.

2) Link area except for send area is received area from the other stations.

3) Normal mode can connect to maximum 32 stations per system. (Figure 4.3.1 is the example that 4 stations were connected.)

   Depending on station count, the maximum cable length is limited like Table 4.3.1.

Table 4.3.1 Station count and maximum cable length

Station count	In case of using 0.3mm^2 cable	In case of using 0.5mm^2 or 0.75mm^2 cable
2 to 8 modules	150m	300m
9 to 16 modules	130m	260m
17 to 32 modules	100m	200m

4) Compact link modules can mount maximum 8 modules per CPU to the base unit depending on combination with CPU. The link modules are assigned No.1 LINK to No.8 LINK in the order that is near to CPU. Refer to section 4.2.1 (1) for the details.

5) The slots that can mount the compact link modules are 0 to 7 slots. There is a limit according to combination with using CPUs and base units. Refer to section 1.1 for the details.

6) There are rotary switches and DIPswitch in the compact link module, and the switches are set a station number, the station count and etc.. Refer to section 3.1 for the details of each switch.

   In addition, change the value of the terminator according to a use cable.

7) I/O assignment is set to CPU by programming software.

4.3.2   System configuration example (Compatible mode, "LINK" method)

Figure 4.3.2 is the system configuration example that compact link modules were set to compatible mode and I/O assignment "LINK". Refer to section 3.1 for the setting method of the compatible mode.
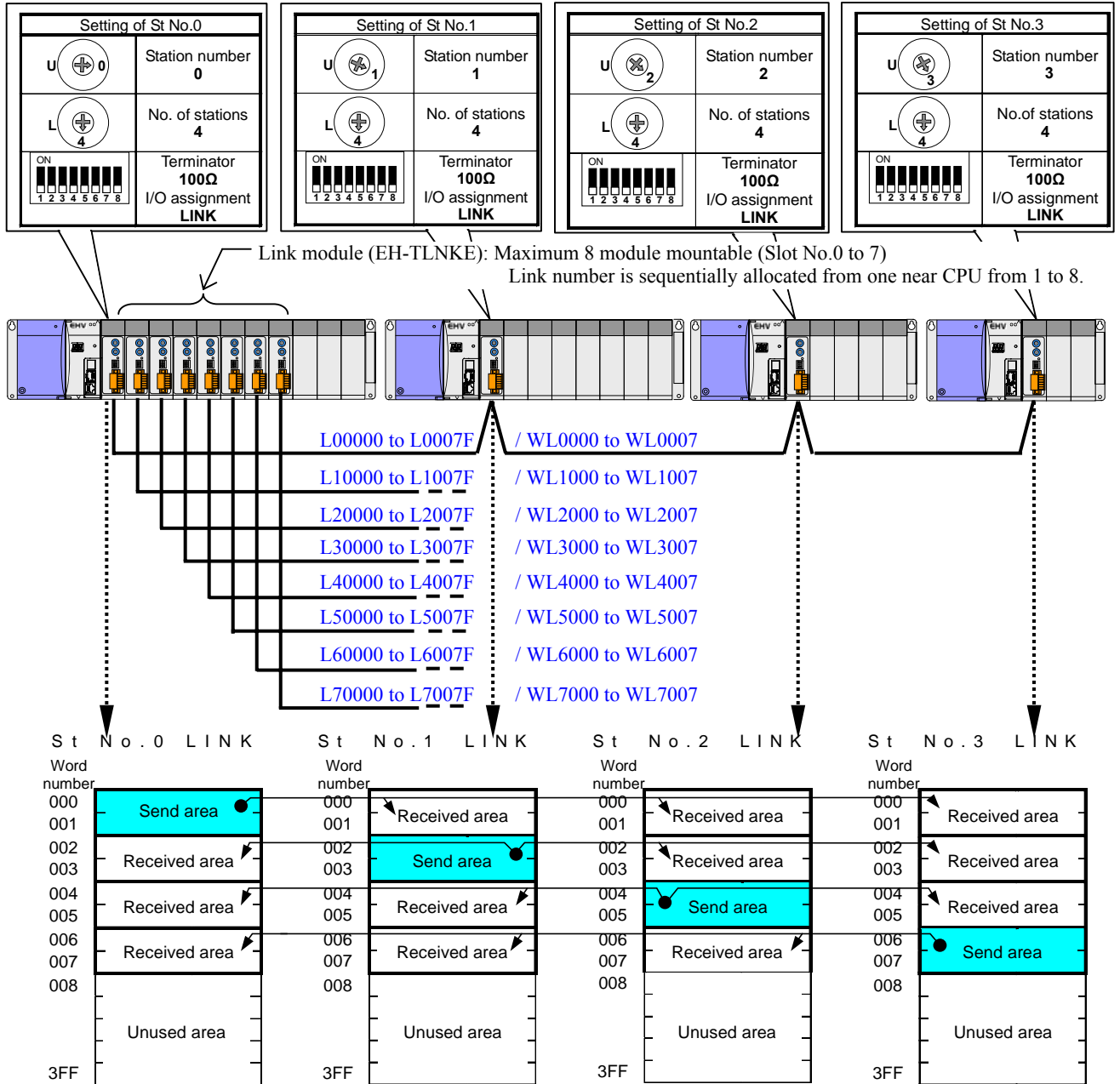
Figure 4.3.2 System configuration example-2 (I/O assignment of "LINK")

[Explanations]

1) EH-TLNKE with the compatible mode can use 8 words (000 to 007) in the link area of 1,024 words (000 to 3FF). Depending on a link parameter set by CPU mounted on the basic unit, each station is assigned the send area like section 4.2.2.

2) Link area except for send area is received area from the other stations.

3) Compatible mode can connect to maximum 8 stations per system. (Figure 4.3.2 is the example that 4 stations were connected.)

4) Compact link modules can mount maximum 8 modules per CPU to the base unit depending on combination with CPU. The link modules are assigned No.1 LINK to No.8 LINK in the order that is near to CPU. Refer to section 4.2.1 (1) for the details.

5) The slots that can mount the compact link modules are 0 to 7 slots. There is a limit according to combination with using CPUs and base units. Refer to section 1.1 for the details.

6) There are rotary switches and DIPswitch in the compact link module, and the switches are set a station number, the station count and etc.. Refer to section 3.1 for the details of each switch.
In addition, change the value of the terminator according to a use cable.

7) I/O assignment is set to CPU by programming software.

4.3.3   System configuration example (Compatible mode, "X4Y4W" method)

Figure 4.3.3 is the system configuration example that compact link modules were set to compatible mode and I/O assignment "X4Y4W".
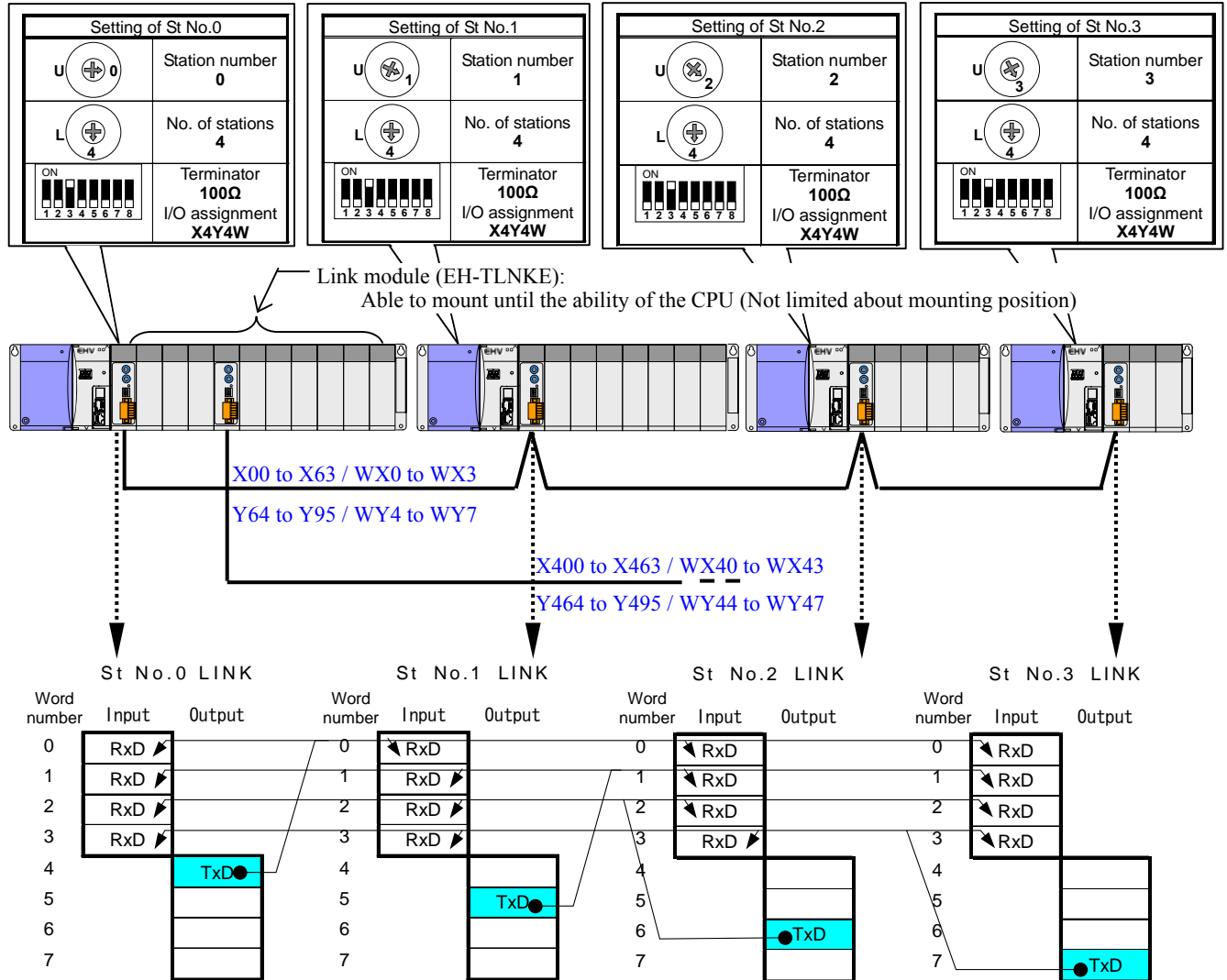
Figure 4.3.3 System configuration example-4 (I/O assignment of "X4Y4W")

[Explanations]

1) When compact link modules are set to I/O assignment "X4Y4W" like Figure 4.3.3, they are assigned I/O numbers according to the slot position. In this case compact link modules can use maximum 4 words per system in link area. And the send area uses the external output area (Words number 4 to 7), and received area uses external input area (Words number 0 to 3).

2) The data of external output area are stored in the external input area of each station. In external I/O area, word numbers is paired each from 0 to 3 and from 4 to 7. Output the send data to the external output area by user program.

3) The external input area of module can refer to all data of link system, because the data that oneself sent is stored in the external input area of oneself.

4) Compact link modules can mount until the module count that CPU can control.

5) The slot positions do not have the limit, and it can mount compact link modules on expansion base unit too.

6) In "X4Y4W" method I/O numbers of link area are as follows. CPU accesses compact link module as not link module but as I/O module because I/O assignment of module is "X4Y4W". So, I/O number for link area becomes I/O number that mounted compact link module on slot of base unit.

Bit   Input   X   □ □ □□
Bit   Output   Y   □ □ □□

         Bit number in module (0 to 95)
         Slot number (0 to A)
         Unit number (0 to 5)

Word   Input   WX   □ □ □
Word   Output   WY   □ □ □

         Word number in module (0 to 7)
         Slot number (0 to A)
         Unit number (0 to 5)
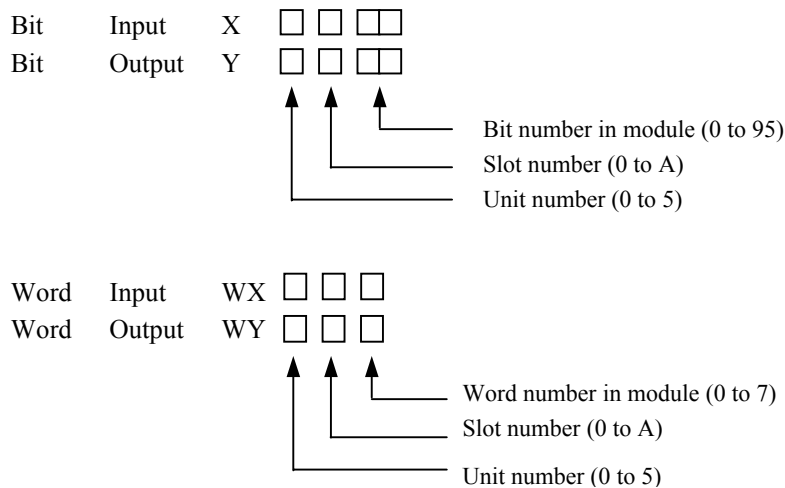
Figure 4.3.4 I/O number of link area in the "X4Y4W" method

7) Bit number in module is from 0 to 95. Therefore, use the word number as WY6 and WY7 in Figure 4.3.3 for the number that exceeds 95. In the case of using these numbers as coil or contact in ladder program, use internal output like as M/WM temporarily and transfer these data to external output later as shown in Figure 4.3.5.
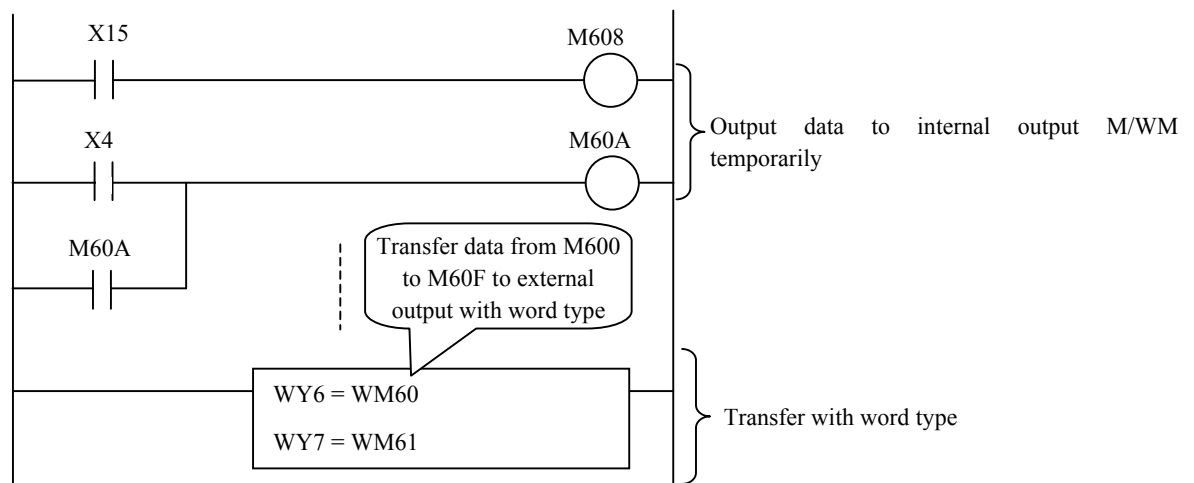
Figure 4.3.5 Sample program with bit I/O numbers that exceed 95

8) There are rotary switches and DIPswitch in the compact link module, and the switches are set a station number, the station count and etc.. Refer to section 3.1 for the details of each switch.

In addition, change the value of the terminator according to a use cable.

9) When compact link modules are set to I/O assignment "X4Y4W", CPU accesses compact link module as not link module. In this case the link parameter function cannot use, refer to the status area of compact link module in substitution for link function of the special internal outputs. Refer to section 6.2 for the details.

10) In the case of I/O assignment "X4Y4W", output area is done data compaction in the module, and assignment becomes the word number 0 to 3 shown to Figure 4.3.6. But there are not the word numbers 4 to 7 in the module, the area transmit zero data by the link communication.

Data configuration in CPU

Word number	Input	Output
0		
1		
2		
3		
4		
5		
6		
7		

Data configuration in LINK

Word number	Input	Output
0		
1		
2		
3		
4		
5		
6		
7		
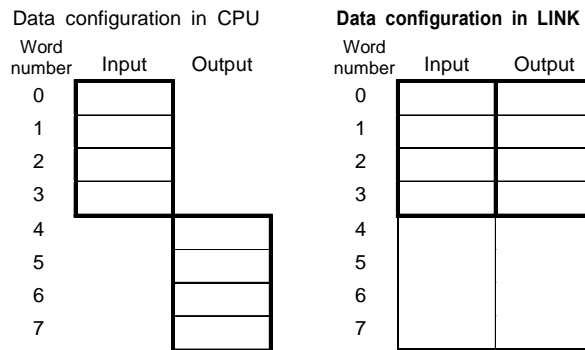
Figure 4.3.6 Data configuration with the I/O assignment

4.3.4   Link status area

In the case of compatible mode and I/O assignment "X4Y4W" methods, refer to the status area of compact link module in substitution for link function of the special internal outputs. Refer to the following about the access method of the link status area. Refer to section 6.2.2 for the details of the link status area.

(1) In the case of EH-150 CPU

When access the status area of the compact link, use FUN201 (SCRW) command. Refer to example program of Figure 4.3.7. Refer to EH-150 application manual about the details of FUN 201 command.
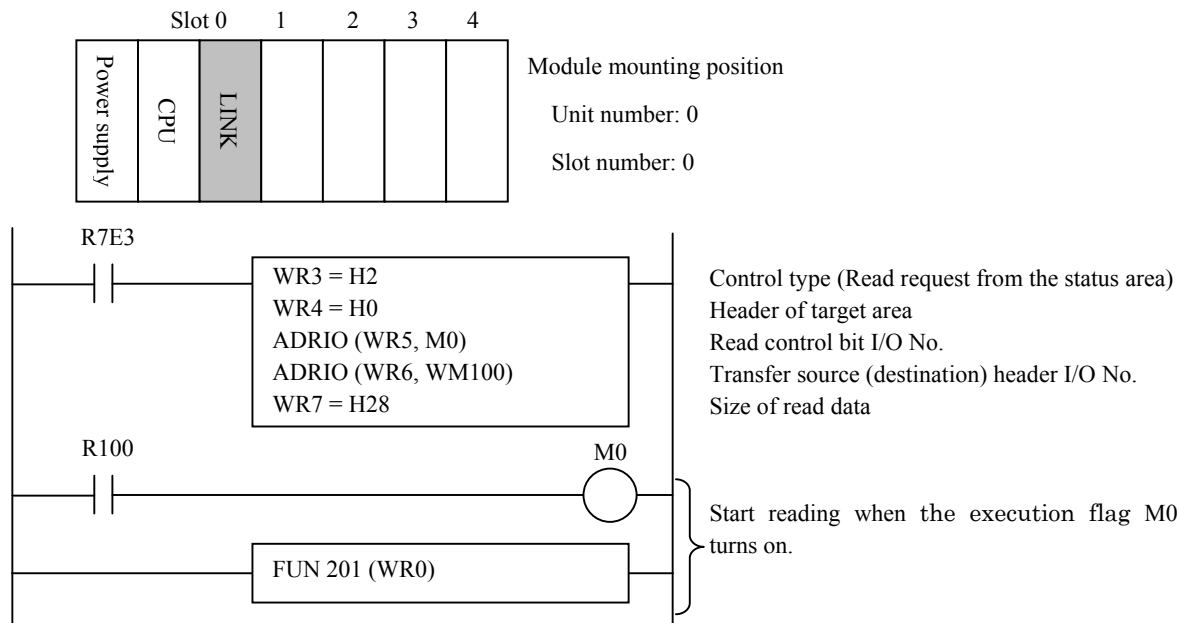
Figure 4.3.7 Program 1 for reading status area in the "X4Y4W" method

(2) In the case of EHV-CPU

When access the status area of the compact link, use SCRW command. Refer to example program of Figure 4.3.8. Refer to EHV-CPU programming manual about the details of SCRW command.
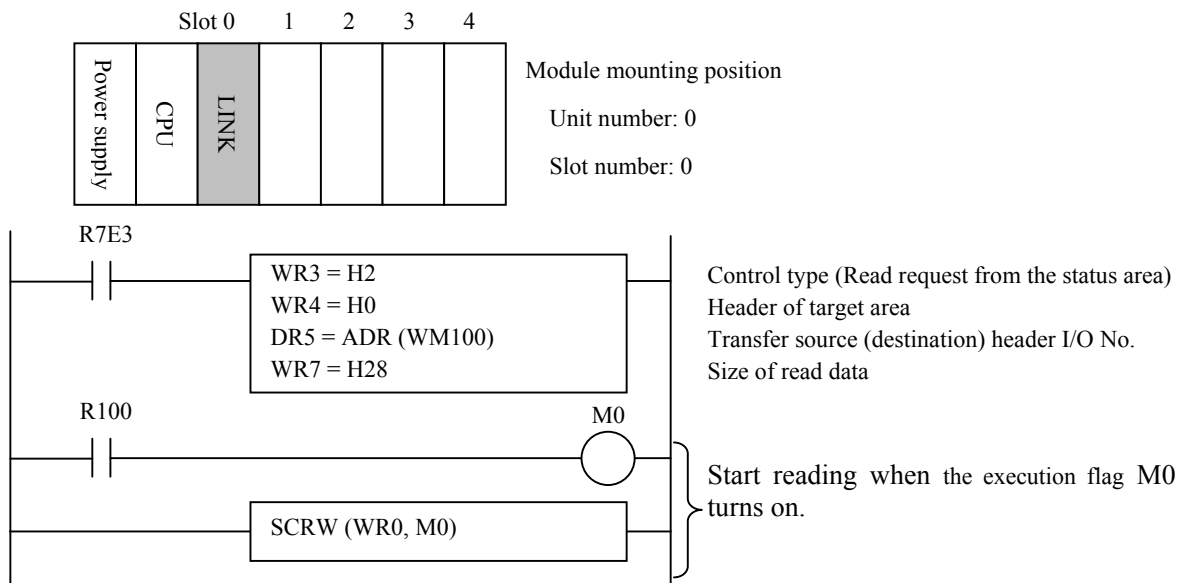
Figure 4.3.8 Program 2 for reading status area in the "X4Y4W" method

4.4   Replacement from H-200/250/252B/252C series

This compact link module has communication-compatibility with link module for H-200/250/252B/252C; you can use an existing cable in replacement.

But there are differences with lineup of I/O modules, specifications, dimensions, I/O assignment, and support of commands, please consider these differences in replacement. And in the combination to use of CPU and base unit, enough consideration is necessary because the mountable slots for compact link are different.

It explains around the content concerning the replacement of a link system as follows.

Figure 4.4.1 shows the system configuration example of the H-200 series. Figure 4.4.2 shows the replaced system configuration example of the EH-150 series.

Figure 4.4.2 is an example of replacing all of link system with the EH-150 series. It is also possible to leave all or partially stations of the H-200 series in order to postpone the wiring work of stations. In this case, please turn on communication mode (MODE), and turn off high-speed refresh mode (HS) of a front DIPswitch of the compact link modules.
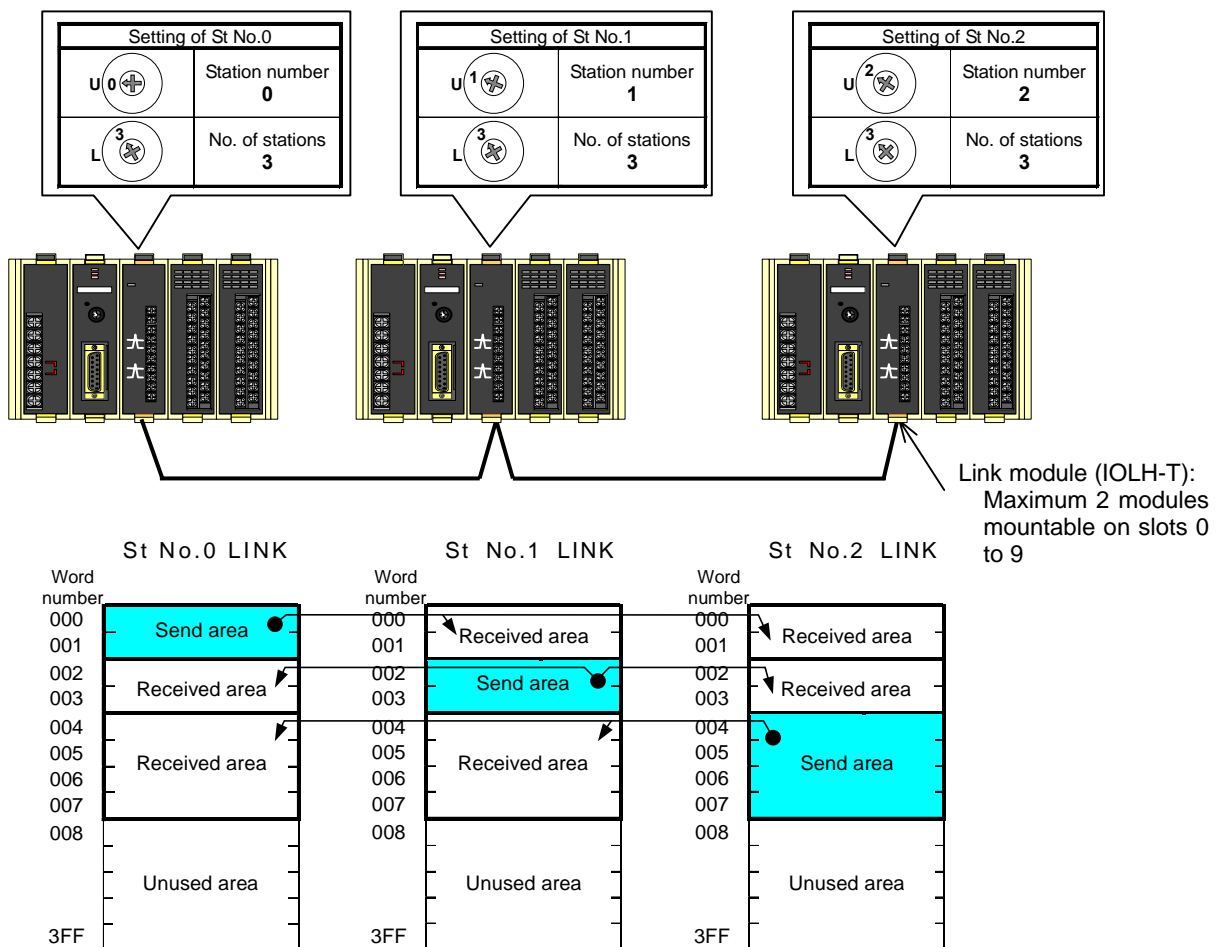
Figure 4.4.1 System configuration example-4 of the H-200 series

Setting of St No.0		Setting of St No.1		Setting of St No.2	
U ⊕ 0	Station number **0**	U ⊕ 1	Station number **1**	U ⊗ 2	Station number **2**
L ⊗ 3	No. of stations **3**	L ⊗ 3	No. of stations **3**	L ⊗ 3	No. of stations **3**
ON 1 2 3 4 5 6 7 8	Terminator **100Ω** I/O assignment **LINK**	ON 1 2 3 4 5 6 7 8	Terminator **100Ω** I/O assignment **LINK**	ON 1 2 3 4 5 6 7 8	Terminator **100Ω** I/O assignment **LINK**

Link module
(EH-TLNKE)

St No.0 LINK

Word number	
000 001	Send area
002 003	Received area
004 005 006 007	Received area
008 ⋮ 3FF	Unused area

St No.1 LINK

Word number	
000 001	Received area
002 003	Send area
004 005 006 007	Received area
008 ⋮ 3FF	Unused area

St No.2 LINK

Word number	
000 001	Received area
002 003	Received area
004 005 006 007	Send area
008 ⋮ 3FF	Unused area

Figure 4.4.2 Replaced system configuration example-5 of the EH-150

Change the value of the terminator at a use cable.

4.5   Replacement from EM/EM-II series

This compact link module has communication-compatibility with link module for EM/EM-II series; you can use an existing cable in replacement.

But there are differences with lineup of I/O modules, specifications, dimensions, I/O assignment, and support of commands, please consider these differences in replacement. And in the combination to use of CPU and base unit, enough consideration is necessary because the mountable slots for compact link are different.

It explains around the content concerning the replacement of a link system as follows.

Figure 4.5.1 shows the system configuration example of the EM series. Figure 4.5.2 shows the replaced system configuration example of the EH-150 series. In the case of EM/EM-II series, it is not necessary to set I/O assignment for link modules. But it is necessary to set I/O assignment "LINK" for link module in replaced system with EH-150.

Figure 4.5.2 is an example of replacing all of link system with the EH-150 series. It is also possible to leave all or partially stations of the EM series in order to postpone the wiring work of stations. In this case, please turn on communication mode (MODE), and turn off high-speed refresh mode (HS) of a front DIPswitch of the compact link modules.
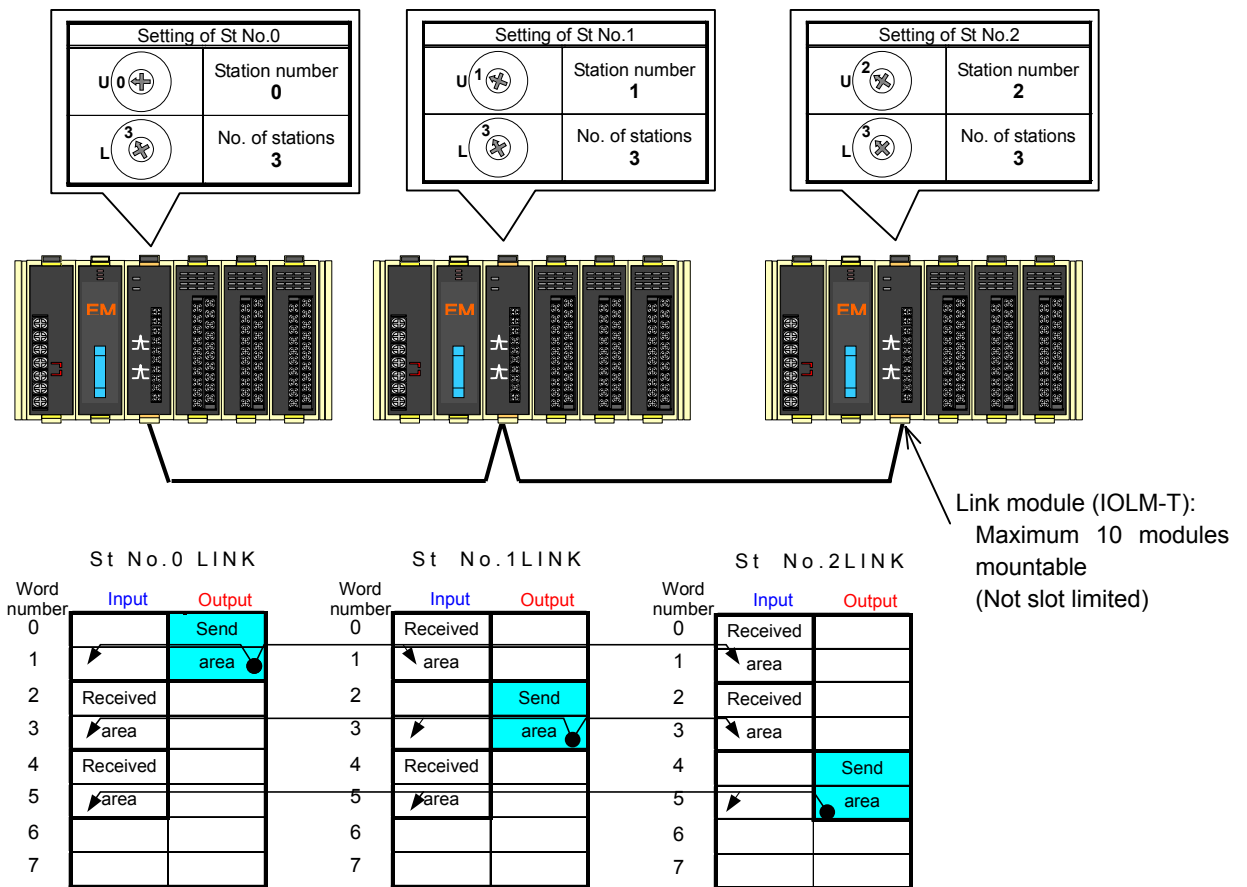
Figure 4.5.1 System configuration example-6 of the EM/EM-II
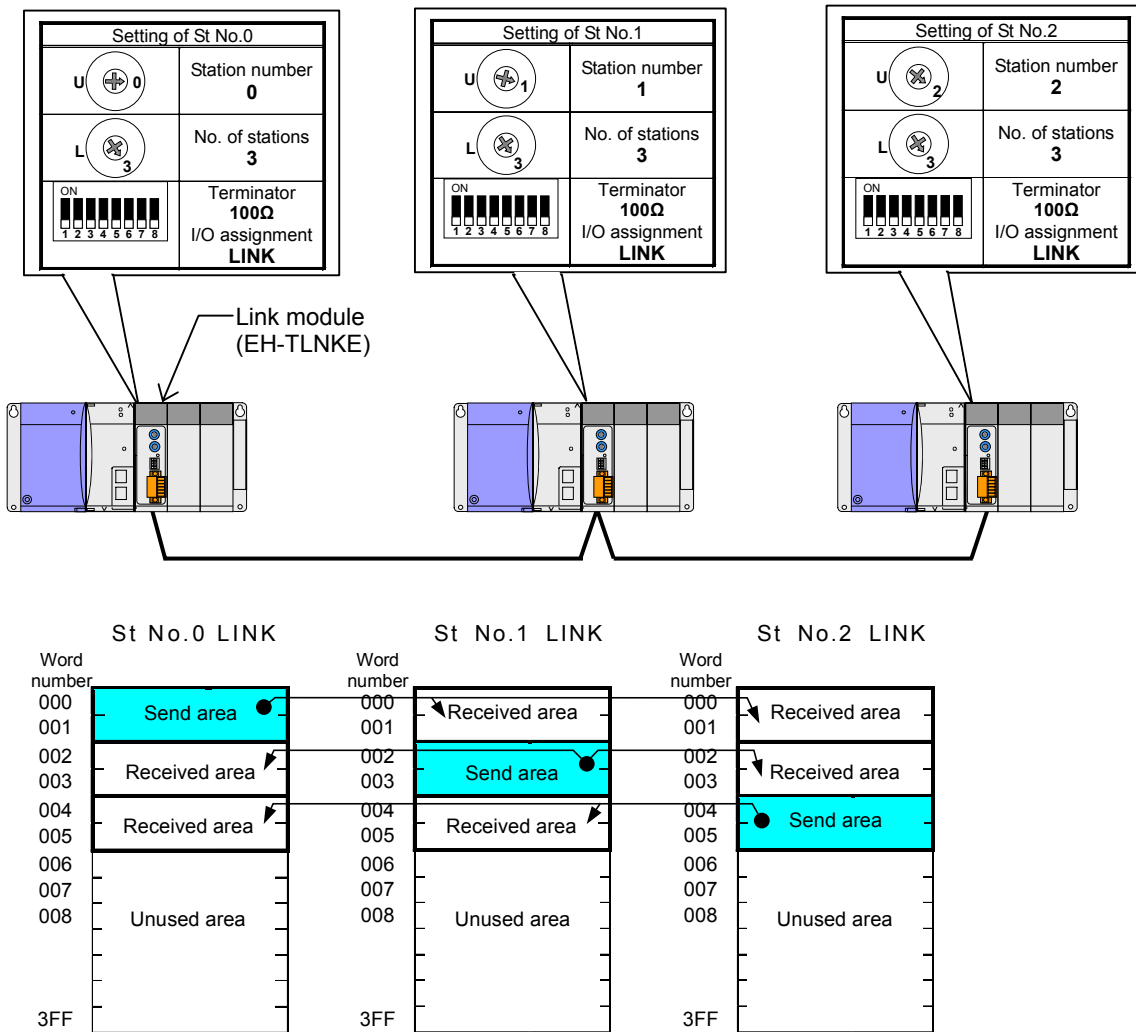
Figure 4.5.2 Replaced system configuration example-7 of the EH-150

Change the value of the terminator at a use cable.

4.6   Response time

The response time of link system is calculated as follows. However, this is only a rough estimate and does not necessarily apply when transmission errors and other errors are triggered.

■Equivalent of response time

Response time: Ta [ms] = [Transmission CPU scan time] + [Receiving CPU scan time]
+ [refresh time in link system]···(4.1)

[CPU scan time]:

The actual measurement value of scan time is stored in internal output as shown in Table 4.6.1.
Refer to EH-150 EHV-CPU PROGRAMMING MANUAL or EH-150 APPLICATION MANUAL for execution time of each command.

[Link refresh time]:

The link refresh time changes by setting of communication mode (MODE) and refresh mode (HS).
When there are link stations of conventional models, MODE switch on and HS switch off.

The link refresh time is calculated as follows.

Link refresh time= (A + B) * ([all station's assigned word count] + [Station count])···········(4.2)

The A to B values in the above equation are as follows. But station's assigned word count is eight words fixation per a station when setting compatible mode.

Table 4.6.1 Transmission interval and processing time for one word

Sign	Meaning	Setting			Time (μs)
		MODE	HS	Operation mode	
A	Transmission interval	OFF	OFF	Normal mode / Low speed	100
			ON	Normal mode / High speed	6
		ON	OFF	Compatible mode / Low speed	700
			ON	Compatible mode / High speed	6
B	Processing time / word	OFF	–	Normal mode	84
		ON	–	Compatible mode	63

The actual measurement value of link refresh time is stored in special internal input of CPU module as shown in Table 4.6.2 when I/O assignment of link module is "LINK".

■ Reverse double-transmission check and response time

Compact link system executes the check to the unit of one word (=16 bits) by reverse double-transmission.
It is a mechanism that only illegal word data is abandoned when the error is detected and correct data before is maintained. In this case, one link refresh time is added to response time in the detected word data. Moreover, the display of communication error (CERR) doesn't appear to a link module in this case.

Therefore the delay might occur even if LED in link module shows no error, and have enough margin for response time in designing the system.

■ Station number and the link refresh-time

When all station number set link modules with the number that continued, it is calculated in (4.2) in link refresh time.

When you set less connection station count than real connection station count, a timeout error occurs because there is not the response from the station of the missing number. In this case link refresh time becomes long because link master waits to 3ms for response from the link slave. Therefore, link refresh time is added "station count of missing number * 3ms".

Set the station count that added 1 to the maximum value of the station number to set. Link operation is executed until link slave of station number that subtracted 1 from set station count. Therefore, be careful because the link slave which is set as station number more than the set station count cannot participate in a link system.

■ Link refresh time when a stations leave link system

　　If the link slave stops communication and leaves link system after link operations have started, a timeout error occurs because there is not the response from the station. In this case link master waits to 3ms for response from the leaving station, and starts operation for link slave of next station number. For example, if processing time only for the station that left link system was 10ms, link refresh time of the link system becomes 7ms short.

Table 4.6.2 Special internal outputs in CPU concerned with link response time

Items	Internal output	Name	Description	Setting condition	Resetting condition
Scan time of CPU	WRF010	Scan time (maximum value)	The maximum value, present value, and minimum value of execution time of normal scan are stored in the unit of 1ms. (Note 1)	Set by system	Cleared by system (when RUN starts)
	WRF011	Scan time (present value)			
	WRF012	Scan time (minimum value)			
No.1 LINK	WRF13D	Link refresh time (maximum value)	The maximum value, present value, and minimum value of link refresh time of each link station are stored in the unit of 1ms. (Note2)	Set by system	Cleared by system (when power-up)
	WRF13E	Link refresh time (minimum value)			
	WRF13F	Link refresh time (present value)			
No.2 LINK	WRF19D	Link refresh time (maximum value)			
	WRF19E	Link refresh time (minimum value)			
	WRF19F	Link refresh time (present value)			
No.3 LINK	WRF1FD	Link refresh time (maximum value)			
	WRF1FE	Link refresh time (minimum value)			
	WRF1FF	Link refresh time (present value)			
No.4 LINK	WRF25D	Link refresh time (maximum value)			
	WRF25E	Link refresh time (minimum value)			
	WRF25F	Link refresh time (present value)			
No.5 LINK	WRF2BD	Link refresh time (maximum value)			
	WRF2BE	Link refresh time (minimum value)			
	WRF2BF	Link refresh time (present value)			
No.6 LINK	WRF31D	Link refresh time (maximum value)			
	WRF31E	Link refresh time (minimum value)			
	WRF31F	Link refresh time (present value)			
No.7 LINK	WRF37D	Link refresh time (maximum value)			
	WRF37E	Link refresh time (minimum value)			
	WRF37F	Link refresh time (present value)			
No.8 LINK	WRF3DD	Link refresh time (maximum value)			
	WRF3DE	Link refresh time (minimum value)			
	WRF3DF	Link refresh time (present value)			

(Note 1) Time base of scan time in EH-CPU104A, 208A, and 316A is 10ms.
(Note 2) The link refresh times are stored in link status area when "X4Y4W" is set with the I/O assignment of link module (EH-TLNKE). But cannot refer to link status area in EH-CPU104A/208A. Refer to Section 6.2.2 for the details.

■ Response time when link module send a reply for received data

　　If link refresh time of station is longer than scan time of CPU module, CPU module will update the send area transmitting the link data by link module. In this case, it becomes shorter than the response time that is calculated in (4.1).

■ Example of calculation

Example of calculation for response time is as follows when scan time of each CPU is 20ms. In this case MODE and HS turns on switches in system configuration below.
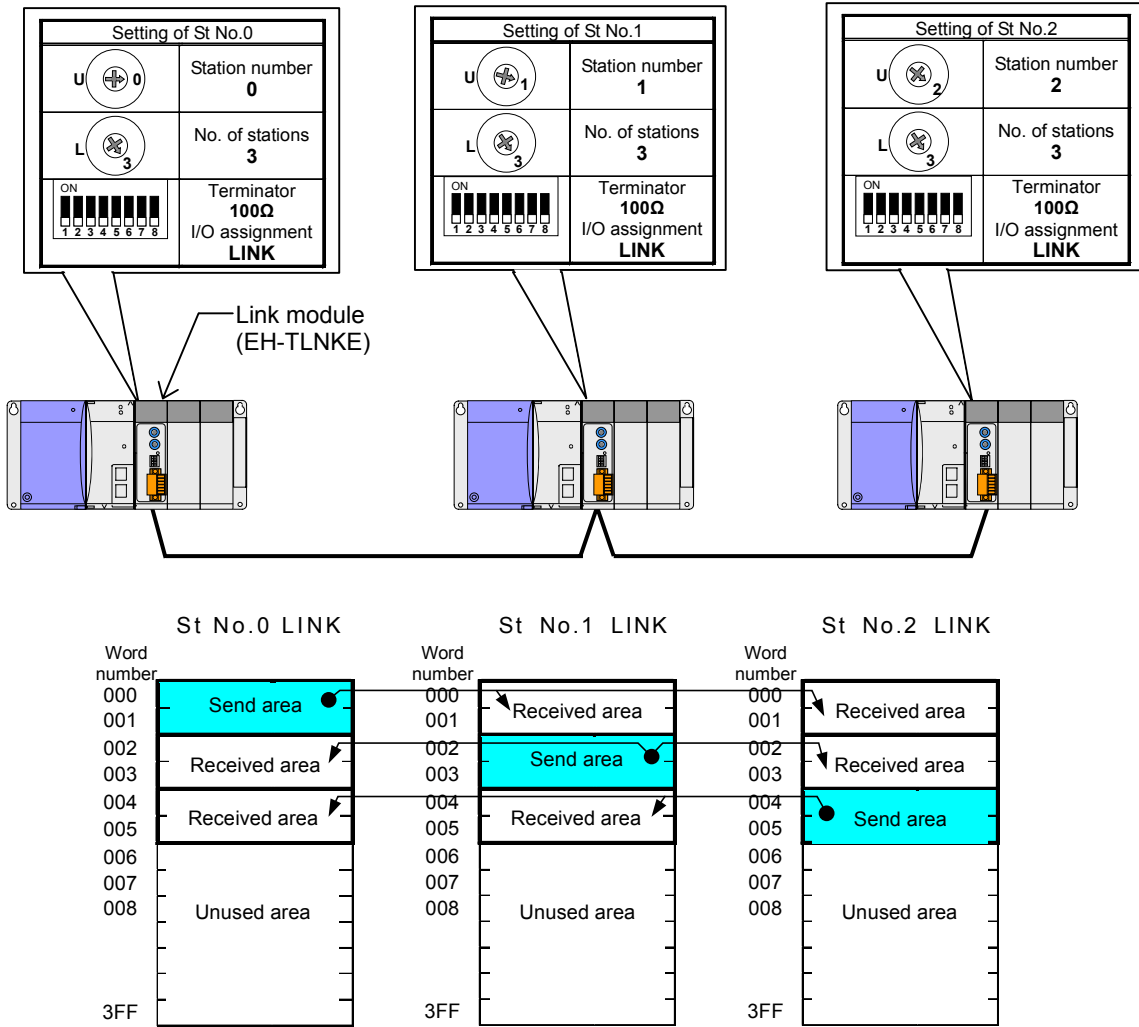
According to equation (4.2),

Link refresh time = (0.006 + 0.063)*((8*3) + 3) = about 1.9 [ms]

Station count

All station's assigned word count

Processing time / word

Transmission interval
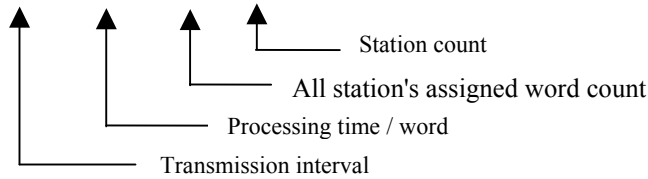
Because link area is 8 words fixation as compatible mode, the unused area is transmitted as data zero.

According to equation (4.1),

Response time = (20 + 20 + 1.9) = about 41.9 [ms]

Link refresh time

Receiving CPU scan time (in the case of 20ms)

Transmission Scan time of CPU (in the case of 20ms)
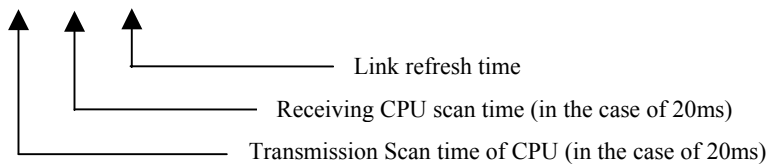
Figure 4.6.1 Example of calculation for response time

Chapter 5 Installation and Turning power supply on

5.1   Loading the module

(1) Installing
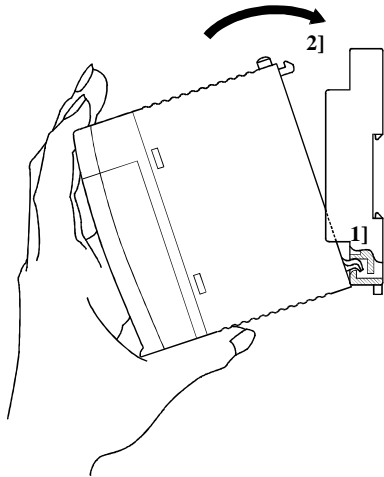
Figure 5.1.1 Installing the module

1] Hook the bottom part 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.

It can reinforce with the screw after installation.

Use M4× 10mm screws in this case.

(2) Removing
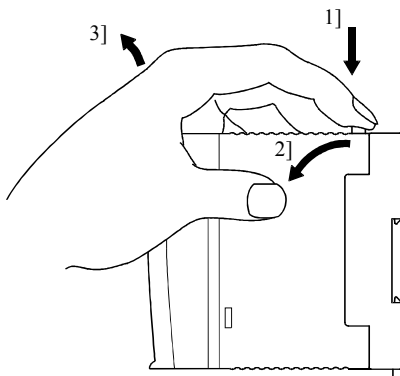
Figure 5.1.2 Removing the module

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: Pull the power module out while pushing down the two lock buttons.

5.2   Mountable slots for link module

(1) In the case of EHV-CPU16/32/64/128

Maximum 8 link modules (EH-TLNKE) can be mounted on slots that's slot number are 0 to 7 as shown as Figure 5.2.1 in the case of setting I/O assignment of link module "LINK".

There is no limit in the number of mountable link modules when I/O assignment of link module is "X4Y4W", and link module can be mountable on any slots on basic base and expansion bases.

Please note that the link module cannot mount on old model base (EH-BS3, EH-BS5, EH-BS8).
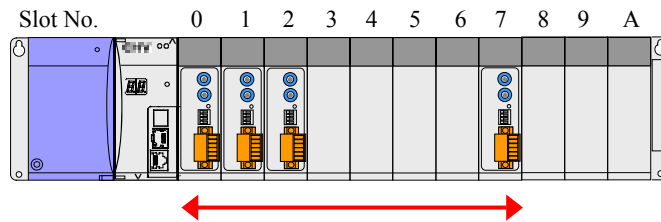
Figure 5.2.1 Mountable slots for link module with I/O assignment "LINK"

(2) In the case of EH-CPU316A/516/548

If link module was set the "LINK" as I/O assignment, maximum 2 link modules can be mounted on slots that are slot number are 0 to 7 in the basic base unit for EH-CPU516/548. It is possible to mount in EH-BS3A/BS5A/BS6A/BS8A/BS11A. And maximum 2 link modules can be mounted on slots that slot number are 0 to 2 in the basic base unit for EH-CPU316A. When it uses EH-BS3/BS5/BS8, it is the position of slot 0 to 2 in a basic base unit. And when compact link modules are set to I/O assignment "X4Y4W", there is not limiting it to the number of mounting of link modules per CPU. Refer to section 1.1.2 for the details.

(3) In the case of EH-CPU104A/208A

In the case of EH-CPU104A/208A, set the I/O assignment "X4Y4W" for compact link module. There is not limiting it to the number of mounting of link modules per CPU.

5.3   How to prepare of twisted pair cables

Prepare the twisted pair cables according to the procedure below and attach them to the connector.

[Procedure 1] Peel approximately 40 mm of the coating off the end of the cable.

Approx.40mm
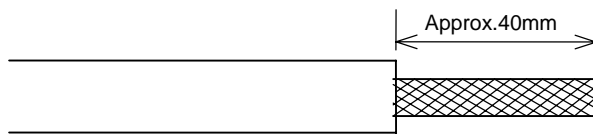
[Procedure 2] Loosen the mesh of the shielding, and twist it.

Twist the shielding
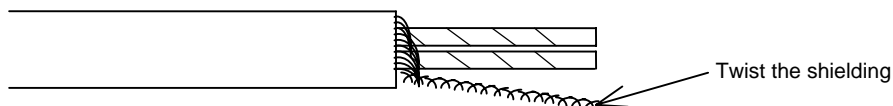
[Procedure 3] Peel approximately 6 mm of the coating in the signal line, cover the shielding in the insulator from the cut end of the coating so that a wiring dreg does not appear.

Approx.6mm   Peel the coating

Cover the shielding
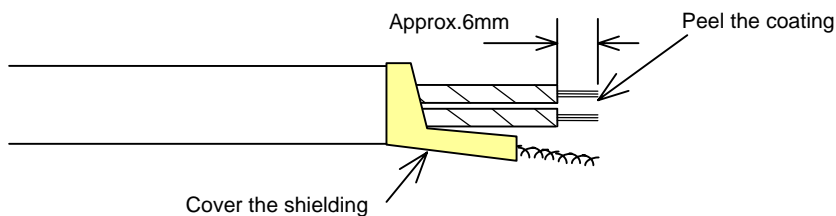
Do not perform the wiring until the cable has been attached to the clamp terminals. If signal lines and shielding touch, the communication error may occur. Use clamp terminal that there is insulation coating.
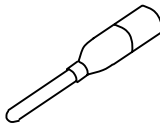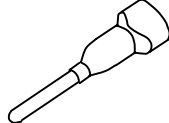
Table 5.3.1 Example of applicable clamp terminals

Type		Electric wire size	Clamp terminals	Remarks
Single	Use to insert 1 cable	0.3 to 1.65 mm^2	TGVTC-1.25-11T	Made by Nichifu
Double	Use to insert 2 cables	0.3 to 1.65 mm^2	TGWVTC-1.25-11T	Made by Nichifu
Single	Use to insert 1 cable	0.34mm^2	H0.34/10	Made by Weidmuller
		0.5mm^2	H0.5/12	Made by Weidmuller
		0.75mm^2	H0.75/12	Made by Weidmuller
Double	Use to insert 2 cables	0.5mm^2	H0.5/15	Made by Weidmuller
		0.75mm^2	H0.75/15	Made by Weidmuller

Table 5.3.2 Applicable clamp tools

Electric wire size	Clamp tools	Remarks
0.3 to 0.5 mm^2	NH-5	Made by Nichifu
0.3 to 2 mm^2	NH-32	Made by Nichifu
0.3 to 0.5 mm^2	NH-60	Made by Nichifu
0.5 to 2.5mm^2	Stripax® plus2.5	Made by Weidmuller
0.14 to 6 mm^2	PZ 6rote	Made by Weidmuller
0.25 to 6 mm^2	PZ 6/5	Made by Weidmuller

Table 5.3.3 The outline shape of clamp terminal

Use to insert 1 cable	Use to insert 2 cables

Push in the coating of the electric wire in the resin cover in clamp terminal surely, and choose the clamp terminal, which matched the using electric wire. Choose the appropriate tool for the using electric wire size and clamp terminal.

5.4   Connection of twisted pair cables

(1) Description of Communication connector

Terminal configuration	No.	Signal	Signal name	Internal circuit
	1]	A *	Transmitted and received data A	
	2]	B *	Transmitted and received data B	
	3]	SHD *	Grounding for cable	
	4]	A *	Transmitted and received data A	
	5]	B *	Transmitted and received data B	
	6]	SHD *	Grounding for cable	
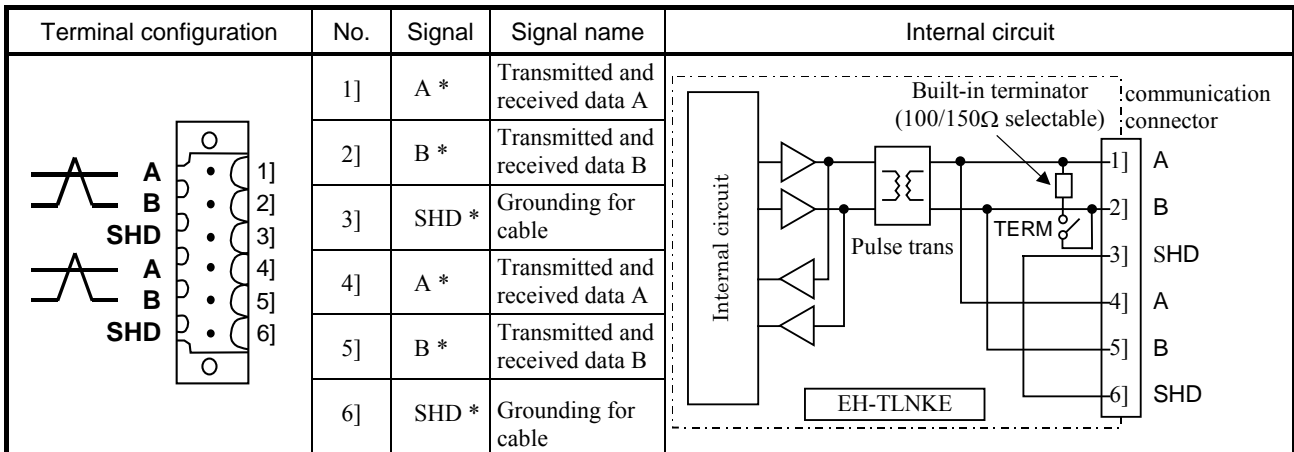
   2 pairs of A, B, and SHD terminals are internally connected. Therefore, even if a link module is powered off, it is possible to continue connection between the link master and other stations while operating. However, cables connected to the connector are disconnected (a disconnected state) because of connection inside module if the connector is unplugged. If the module is replaced while operating when the module breaks down, connect 2 cables to same terminals beforehand, following the connection method 2 shown in the next page or later.

   When you connect twisted pair cables to the communication connector, do not intersect between the parts of peeled cables. If the cables intersected, link module may become the communication error.

   The built-in terminator is disconnected when power supply is turned off. So, <u>please set TERM off and connect external terminator to communication connector of end slaves instead of a built-in terminator when you use fallback operation.</u> (Please refer to (4) for connection of external terminator)

(2) Installation method of communications cable

   When signal lines are inserted in clamp terminal, regulate length that peel coating by the shape of the using clamp terminal. Use the equivalency Screw Driver (Minus) that is recommended by maker to the driver of straight type shown in Table 5.4.1 for the communication connector. The torque for clamping screw is 0.2 to 0.25Nm.
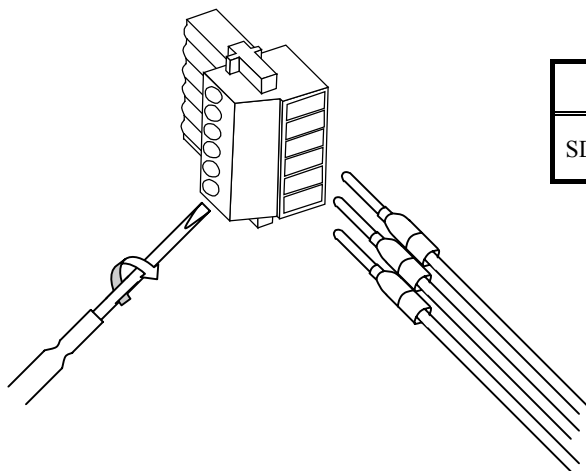
Figure 5.4.1 Installation example of communications cable with the clamp terminal

Table 5.4.1 Screw Driver of maker recommendation

Model	Shape of the tip	Remarks
SD 0.4× 2.5× 75	Thickness: 0.4mm Width: 2.5mm	Made by Weidmuller

(3) Connection of Communication cable

Use a shielded twisted pair cable for communication and ground the shielded cable at single end as a general rule. However, ground the cable appropriately according to noisy environment because the effect may depend on how to ground. Branch of cable is not allowed. If link master station becomes communication abnormality or breaks down, other link stations stop communication.

[Connection method 1] Normal connection method

When disabling the replacement of link module while operating, the following connection is convenient because the connection to each terminal is one.
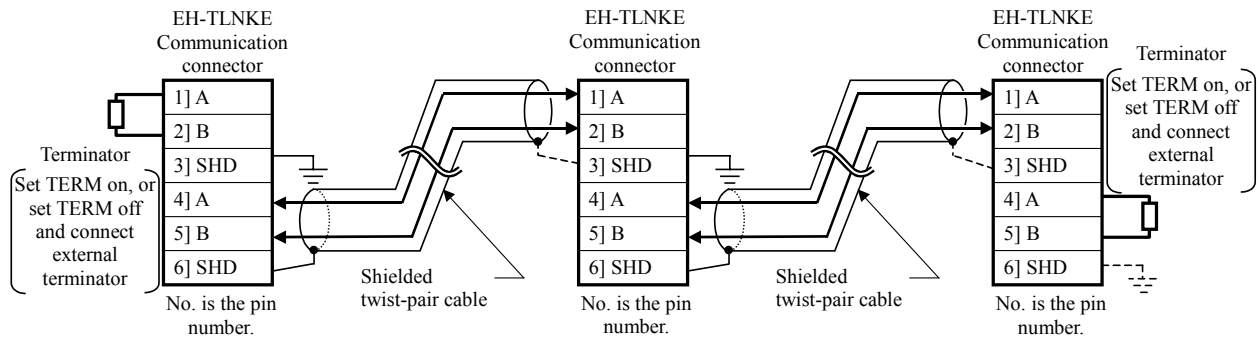
Figure 5.4.2 Normal connection method

[Connection method 2] Connection method when enabling the replacement of link slave while operating

By plugging 2 cables to the connector beforehand, the disconnected state can be prevented and the operation can be continued even if the connector is pulled out of the link slave. Please connect external terminator and signal wire to same terminal of connector in end stations.
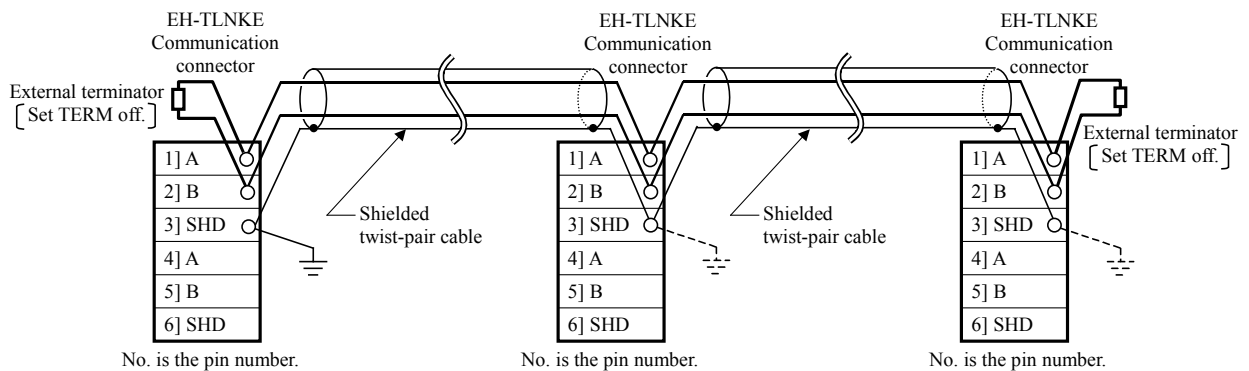
Figure 5.4.3 Connection method when enabling the replacement of link slave while operating

Please use clamp terminals for double cables insertion in order to plug 2 cables to connector and in order to plug cable and external terminator to connector as Figure 5.4.3.

In Figure 5.4.2 and Figure 5.4.3, Signal A is connected to signal A and signal B is connected to signal B. But you can connect signal A to signal B without trouble in link communication.

(4) Insertion of terminator

The terminator has to be inserted in end link modules connected through a twisted pair cable. Please select the value of terminator according to recommended cable as Table2.2.1 in Section 2.2.

Figure 5.4.4 shows example of connecting external terminator. Attached external terminator with product is 100Ω. When you use 0.75SQ recommended cable, Please use existing external terminator of 150Ω, or prepare and connect new external terminator of 150Ω.

External terminator (Bend the lead)

Insert lead and wire into same clamp terminal
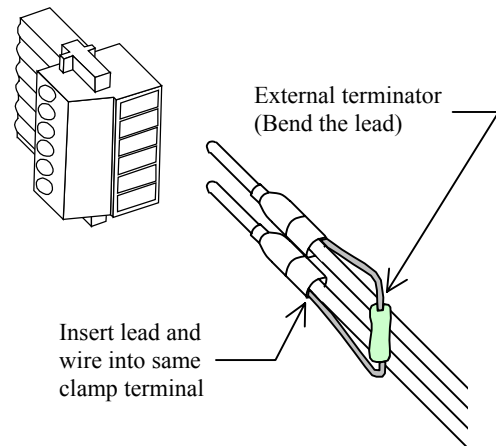
Figure 5.4.4 Example of connecting external terminator

⚠ CAUTION

- Always insert terminators in end link modules connected through a twisted pair cable. If there is no terminator in end of twisted pair cable network, communication error may occurs and link operation may stop.
- Do not remove the communication plug of end stations using built-in terminator while operating, and do not turn off the power supply of them. The communication error might occur because it enters the state that the terminator is not exist in the link system.
- Cover shielding of twisted pair cable with the insulator so that the signal wire should not come in contact with the shield line. The contact of these lines causes communication error.

---

(5) Precautions when Connecting to the Network

- When you connect the twisted pair cable to communication connector, do not intersect between the parts of cables, which peeled coating. In the case that cables intersect, a communication error may occur.
- Do not put the communication cable in a duct same as other power lines and a wiring duct of the I/O.
- Separate and lays the communication cables on around 300mm from other ducts.

⚠ CAUTION

- Always turn off the power supply of devices when connecting a communication cable.
- It is recommended to use clamp terminals when plugging a communication cable into a connector. If simply twisting the wires connects the communication cable, it may result in the product malfunction due to cable disconnection.
- Be sure that the connector will not be pulled out by the weight of the cable. Pay full attention to wiring, so that neither signal lines nor the shielding line will be pulled out during communication.
- After wiring the communication cable, be careful not to put excessive stress on the communication cable as well as the connector. It may cause the connector to be pulled out or a broken cable.
- Allow enough bending radius for the communication cable. If forcibly bent, the connector may be pulled out or a broken cable.

5.5   The order of turning on power supply

It is not necessary to care about the order of turning on the power supply of link master and link slave for normal operation. But be careful to the following matters.

(1) If you turn on the power supply of link master before link slave, communication time-out error (CERR) is detected in the link master because there is no response from the link slave even if the link master begins communicating. In this case CPU can start operation without error, but history of detection with communication error remains in the special internal output in CPU as shown in Section 6.2. Only turning on again the power supply clears these histories. Therefore please turn on power supply of link slaves before turning on power supply of link master in order to start operation without that history of error detection.

(2) If you turn on power supply of all system at the same time, the link master may begin communicating before link slave because the time that CPU modules start RUN operation after turning on power supply is no same. Then communication time-out error (CERR) is detected in the link master.

(3) Table 5.5.1 shows the typical time until communication error (CERR) of link module disappears when I/O assignment of link module is "LINK". The communication error (CERR) of slave module doesn't light even in the same case when I/O assignment of link module is "X4Y4W"

Table 5.5.1 Typical time until communication error (CERR) of
link module disappears after turning on power supply

CPU model	I/O assignment of master: "LINK"	
	Normal status	After turning power supply off during writing to FLASH memory (Note 1)
EH-CPU316A	5 seconds	6 seconds
EH-CPU516	7 seconds	9 seconds
EH-CPU548	8 seconds	11 seconds
EHV-CPU16	5 seconds	12 seconds
EHV-CPU32	6 seconds	16 seconds
EHV-CPU64	6 seconds	17 seconds
EHV-CPU128	7 seconds	20 seconds

(Note 1) When the power supply will be turned on next time, the writing processing of the backup memory is executed when the power supply is turned off before finish of writing process of the backup memory in program uploading. Therefore the time until CERR disappears becomes long because communication cannot start until writing process of the backup memory is finished.

MEMO

Chapter 6 Error indication and Countermeasure

6.1 Error indication

The error indications of LED light when error is detected with link modules and transmission lines.

Table 6.1.1 shows error indication of link module.

Table 6.1.1 Error indication of link module (EH-TLNKE)

Error display LED	LED	Name of error	Contents of error	Check timing (clear timing)	Counter measure
CPU LINK EH-TLNKE POW RUN TxD RxD HERR ▉ CERR ▉	HERR	Wrong setting of switch	It lights when setting value to switches is not permitted. (Note 1)	(a) When turning on power supply (b) When pushing reset switch	Set switches correctly.
		Hardware error	It lights when hardware error of link module are detected.		Exchange link module.
	CERR	Communication error	It lights when timeout error occurs. The timeout error is detected when there is no response from other stations during 500ms. (Note 2)	Always (Note 3)	Please check the setting and wiring, etc. according to the trouble shoot.

(Note 1) Set value of rotary switch U (Upper), rotary switch L (Lower) and DIP switches correctly.
And when a watch dog timer error occurred to a module, HERR turns on.

(Note 2) When the communication error (time-out error) is detected, received data from other stations are processed as follows according to setting "HOLD" of a front DIP switch.
1) HOLD ON: The last input data received correctly from other stations are maintained in link module, and CPU read these data.
2) HOLD OFF: All input data from other stations are cleared in link module, and CPU read these data.

If module receives data during send operation by the station number overlap and the send area overlap, it will become the area overlap error. When the error occurs, CERR flashes on and off by a 500ms period.

(Note 3) If the communication returns normally, communication error (CERR) is automatically turned off.
Compact link system executes the check to the unit of one word (=16 bits) by reverse double-transmission.
It is a mechanism that only illegal word data is abandoned when the error is detected and correct data before is maintained.
And in this case communication error (CERR) is not displayed.
After removed an error factor if you push reset switch in the link module or turn on a power supply again, link module will restore the station number overlap error.

6.2 Special internal outputs in CPU module

When compact link modules are set to I/O assignment "LINK", the error information for each stations, link refresh times, etc are stored to the special internal outputs of CPU for link module. And when compact link modules are set to I/O assignment "X4Y4W", the special internal outputs for link module are stored to the status area of module. Refer to the below for the details.

6.2.1 Link error flag area

When compact link modules are set to I/O assignment "LINK", refer to the error flag except for the netted parts of link error flag area to show in Table 6.2.1. Because stored information is different from the link modules of the coaxial cable type and optical cable type, be careful.

Table 6.2.1 Link error flag are in CPU

Internal output number (Note 1)	Name	Contents of each bit number															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
+00	Local station error information	I/O assignment				c	d	e	f	FPGA Version							
+01	Link participation flag (g)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
+02		31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
+03		47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
+04		63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
+05	Link operation status flag (h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
+06		31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
+07		47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
+08		63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
+09	CPU status flag	3				2				1				0			
≀		≀															
+18		63				62				61				60			
+19	Error status flag	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
+1A		31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
+1B		47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
+1C		63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
+1D	Station error information (Station 0 ~ 63)	Undefined				Number of times transmission error (Note2)											
≀		≀															
+3C		Undefined				Number of times transmission error (Note2)											
+3D		Undefined				Number of times transmission error (Note2)											
≀		≀															
+5C		Undefined				Number of times transmission error (Note2)											
+5D	Refresh time (Maximum)	Link refresh time (Maximum) (Unit: ms)															
+5E	Refresh time (Minimum)	Link refresh time (Minimum) (Unit: ms)															
+5F	Refresh time (Current)	Link refresh time (Current) (Unit: ms)															

c: Area error (1-error, 0-no error)

      If the setting value by link parameter is out of link area, module will become the error.

      Link module will become the area error without send area unless you set link parameter, but in the case of normal mode the communication is performed normally.

d: Duplicate station number error (1-error, 0-no error)

      When the duplicate station number error occurs, CERR flashes on and off by a 500ms period, and the link error flag area is maintained. When link system made construction only in EH-TLNKE, there is the case that the duplicate station number error cannot detect. Also, if difference of the number of send data word is few, it may take time to detect the error. In these cases, the Number of times transmission error of the station is updated, refer to the link error flag area.

      Example] When you set number 3 to the station which should have been set number 4, the station of number 3 overlap. When you monitor the Number of times transmission error with number 0 station, the Number of times transmission error is updated in stations after number 3. On the other hand, the transmission error number of times is updated in number 3 stations except number 0 station.

e: Station number error (1-error, 0-no error)

      If the setting value is out of a range, module will become the error when the power supply turns on.

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

      The timeout error is detected when there is no response from other stations during 500ms. When a communication error occurred, a link participation flag and a link operation status flag are cleared. The other area is not cleared. If communication returns normally, error flag is cleared automatically, and the communication is performed normally afterwards.

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

      Link participation flags of the value same as the station count set in the link master station do ON.

      Even if the link module leaves link system, this flag is not cleared.

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

      When the transmission error occurred, it clear the flag of the station concerned. When a transmission error occurs, transmission error count is counted.

I/O assignment: The bit does ON   according to the setting of the I/O assignment.

      Bit15-"LINK", Bit14-"DBW(S)6", Bit13-"X4Y4W", Bit12-"X1Y1W"

(Note 1) The internal output numbers in Table 6.2.1 are the relative numbers. The link error flag area in each system are shown as follows. The area after No.3 can use only EHV-CPU***.

      ■ Special internal outputs number of each link system
        No.1 LINK: WRF0E0 to WRF13F
        No.2 LINK: WRF140 to WRF19F
        No.3 LINK: WRF1A0 to WRF1FF
        No.4 LINK: WRF200 to WRF25F
        No.5 LINK: WRF260 to WRF2BF
        No.6 LINK: WRF2C0 to WRF31F
        No.7 LINK: WRF320 to WRF37F
        No.8 LINK: WRF380 to WRF3DF

(Note 2) The transmission error is the detected timeout error when there is no response about the received data from other stations during 0.5 ms. The number of accumulated errors after the power supply on the base unit is turned on is stored. It returns to 0 when it exceeds to 4,096, and count is continued. The netted part is zero.

      In case of low speed refresh mode by compatible mode, detection time of the reception timeout is 7ms.

(Note 3) These error information are cleared by turning on again the power supply. Please note that these error information are not cleared by pushing the reset switch in link module.

6.2.2 Compact link status area

When compact link modules are set to I/O assignment "X4Y4W", refer to the compact link status area to show in Table 6.2.2 in substitution for the link error flag area. It stores to the internal output of CPU for the status area of the module with high function module command. Refer to Section 4.3.4 about the access method of the status area.

Table 6.2.2 Status area in compact link module

Word number (Note 1)	Name	Contents of each bit number															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
+00	Local station error information	I/O assignment				c	d	e	f	FPGA version							
+01	Link participation flag (g)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
+02		31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
+03	Link operating flag (h)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
+04		31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
+05	Station error information	Undefined				Number of times transmission error (Note2)											
⟩		⟩															
+24		Undefined				Number of times transmission error (Note2)											
+25	Refresh time (Maximum)	Link refresh time (Maximum) (Unit: ms)															
+26	Refresh time (Minimum)	Link refresh time (Minimum) (Unit: ms)															
+27	Refresh time (Current)	Link refresh time (Current) (Unit: ms)															

c: Area error (1-error, 0-no error)　　　　　　　　d: Duplicate station number 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)
　Link participation flags of the value same as the station count set in the link master station do ON.
h: Number indicates the station number (1-operating, 0-stopped)

I/O assignment : The bit does ON　according to the setting of the I/O assignment.
　　　　　　　Bit15-"LINK", Bit14-"DBW(S)6", Bit13-"X4Y4W", Bit12-"X1Y1W"

Refer to section 6.2.1 for the details of the error flag.

(Note 1)　The word numbers in Table 6.2.2 are the relative numbers. It stores to the internal output of CPU for the status area of the module with high function module command.

（Note 2）　The transmission error is the detected timeout error when there is no response about the received data from other stations during 0.5 ms. The number of accumulated errors after the power supply on the base unit is turned on is stored. It returns to 0 when it exceeds to 4,096, and count is continued.
　In case of low speed refresh mode by compatible mode, detection time of the reception timeout is 7ms.

（Note 3）　These error information are cleared by turning on again the power supply. Please note that these error information are not cleared by pushing the reset switch in link module. Because the command for high function modules cannot use about EH-CPU104A/208A, cannot refer to the link status area.

6.3 Operation parameters about the link module

Table 6.3.1 shows operation parameters related to link system.

Area error of link module is informed to CPU. You can set this parameter by programming software. When link module is set I/O assignment "LINK", link parameter is availability.

Table 6.3.1 Operation parameters related to link system

No.	Operation parameter	Contents	Operation of compact link	
			Error detection	Error information to CPU
1	Link parameters	The link module is set the send area in the link area.	When a setting value is out of a range, module stops by an area error.	Available (An error bit of the self-station status is set.)

The area set by link parameter is the send area to other stations, the remaining area is received area from the other stations. Therefore, please be careful not to duplicate the send area on the same link system.

6.4　　Function of reset switch

When hard error (HERR) occurs in link module (EH-TLNKE), you can reset the error by pushing reset switch in front side of the module. However error is indicated again if error factor is not removed.

The setting of the rotary switch and the DIPswitch is read when the power supply is turned on or pushing reset switch. Pushing reset switch allows link module to restart with new setting even if you don't turn on power supply again.

Please note that error information shown in Table 6.2.1 and 6.2.2 are not cleared by pushing the reset switch in link module. These error information are cleared by only turning on again the power supply. In addition, it is similar about the link data.

If you push reset switch of link module, the communication module transmission error (error code "55") may occurs in CPU module because of no response to CPU during restart processing. This error is warning in classification of error, and CPU can continue to running. Please clear the special internal output related to this error if necessary.

Reset switch

Compact link module
(EH-TLNKE)
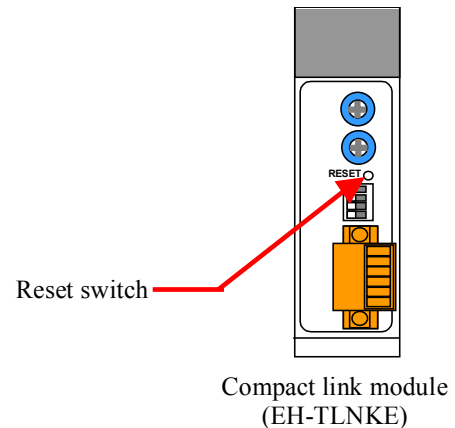
Figure 6.4.1 Reset switch of link module

6.5 Error detection and running of CPU

In the case of compact link system, link modules introduce information into the link error flag area when reverse double-transmission error or time-out error occurs.

The communication error indication (CERR) is automatically turned off, if the communication returns normally. And link operation is continued.

Because transmission line consists of multi-drop system as shown in Figure 6.5.1, even if the breakdown of a module occurs, the link operation between link master and the other normal modules continues and doesn't become a system down. When the power supply of link module is turned off, it is similar. However the built-in terminator is disconnected when power supply is turned off. So, please set TERM off and connect external terminators to communication connector in end link modules instead of a built-in terminator as shown in Figure 6.5.2.
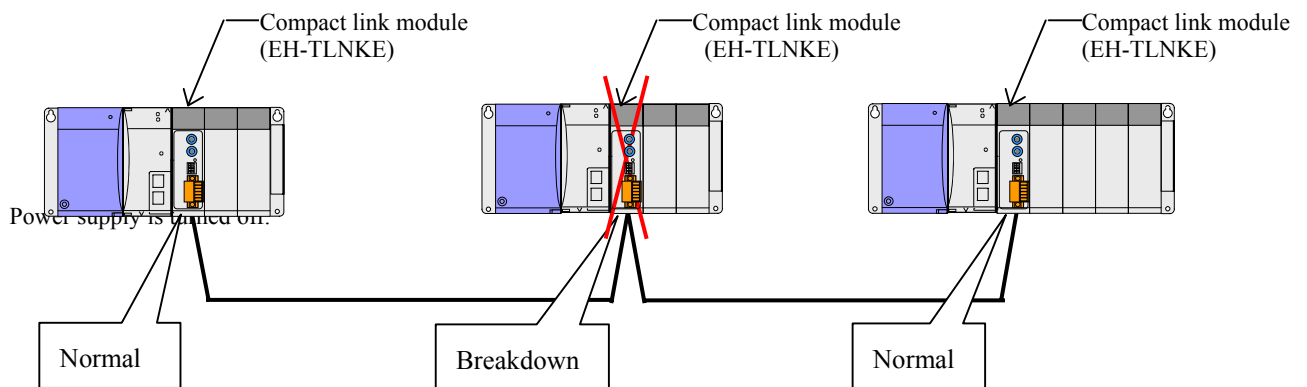
Figure 6.5.1 Fallback operation when breakdown in module occurs
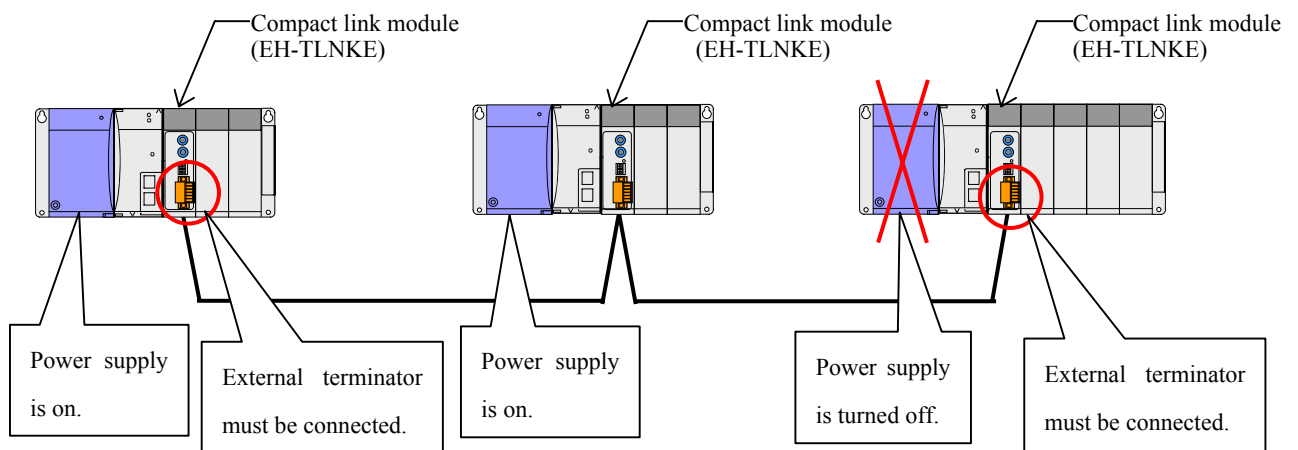
Figure 6.5.2 Fallback operation when power supply of end station is turned off

However when the inconvenience is caused in module breakdown, cable disconnection and power supply OFF in each station, please take the following means to detect these abnormalities.

■ Example of Effective check of Link Data

Figure 6.5.3 shows the example which CPU module of link station No.0 checks the effective of link data (Received area) from other stations.

St No.0 LINK (EH-TLNKE)   St No.1 LINK (EH-TLNKE)   St No.2 LINK (EH-TLNKE)

R7E4

WM0 = WRF0E0
WM1 = WRF0E1
WM2 = WRF0E5

WM0: Local station error information
WM1: Link participation flag
WM2: Link operation status flag

MB MA M9 M8 R1   R0

R0: Link data effective flag

M10 M11 M12 M20 M21 M22 R1

R0

WM100 = WL100

When the link data effective flag is set at ON, CPU is stored with the data that received from the other stations (WL100).

Figure 6.5.3 Program example of Link data effective check

6.6   Troubleshooting

The procedure about troubleshooting is shown by the following flow chart.

(1) POW LED: as turning off (5V DC power abnormality).

```
        ┌─────────────────────────┐
        │  POW LED of remote module│
        │       is turned off.     │
        └─────────────────────────┘
                    │
                    ▼
            ╱─────────────╲              N
          ╱   POW LED      ╲ ──────────────────┐
          ╲ of the power    ╱                  │
            ╲ module lights╱                   │
              ╲──────────╱                     │
                    │ Y                        ▼
                    ▼
```

Check the link module
a) Connection between the link module and base unit.
b) Check connecter of link module for base.

Check the power supply module
a) AC power supply voltage (at the input terminal)
b) Capacity of power supply module
c) DC power supply voltage (at the output terminal)
d) Supply power only for the power supply module
e) Connection between the power module and base unit

(2) HERR LED lights (hardware abnormality).

```
        ┌─────────────────────┐
        │   HERR LED lights    │
        └─────────────────────┘
                    │
                    ▼
            ╱─────────────╲              N
          ╱ Setting of      ╲ ──────────────────┐
          ╲ rotary switch    ╱                  │
            ╲ is correct    ╱                   │
              ╲──────────╱                      ▼
                    │ Y
                    ▼
            ╱─────────────╲              Y
          ╱ It occurs even  ╲ ─────────────────┐
          ╲ if turning on    ╱                 │
            ╲ power supply   ╱                  │
              ╲ again ─────╱                    ▼
                    │ N
                    ▼
```

Set rotary switch correctly. Refer to Chapter 3 for details.

It is thought the temporary error by the noise. Please investigate, and confirm the noise source.

Please exchange the link module.
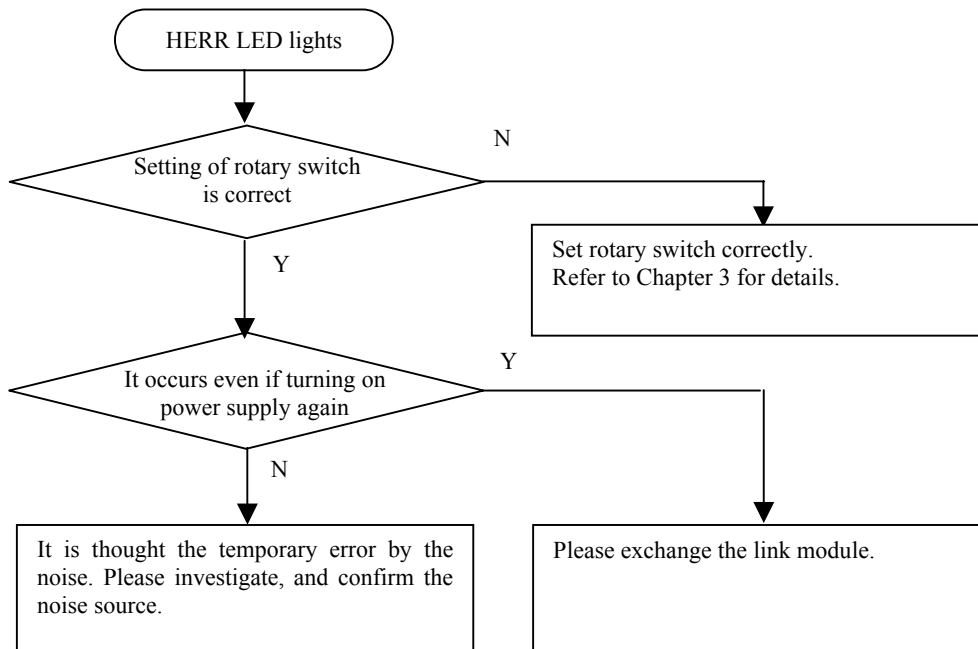
(3) CERR LED of link module lights. (transmission time-out error)

```
        ┌─────────────────────┐
        │   CERR LED of link   │
        │   module lights.     │
        └─────────────────────┘
                  │
                  ▼
        ┌─────────────────────┐           N
        │ Setting of switches  │──────────────────────┐
        │ in link module is    │                      │
        │ correct.             │                      ▼
        └─────────────────────┘         ┌──────────────────────────────┐
                  │ Y                    │ Set rotary switch and DIP     │
                  ▼                      │ switch of link module         │
        ┌─────────────────────┐  N      │ correctly.                    │
        │ I/O assignment and   │────┐    │ Refer to Chapter 3 for details.│
        │ I/O numbers in       │    │    └──────────────────────────────┘
        │ program is correct.  │    ▼
        └─────────────────────┘  ┌──────────────────────────────┐
                  │ Y            │ Set I/O assignment and I/O    │
                  ▼              │ numbers in program correctly. │
        ┌─────────────────────┐ └──────────────────────────────┘
        │ Power supply of      │  N
        │ slave is turning on. │────┐
        └─────────────────────┘    ▼
                  │ Y      ┌──────────────────────────────┐
                  ▼        │ Turn on the power supply of    │
        ┌─────────────────────┐    slave station.              │
        │ It happened many     │ N └──────────────────────────────┘
        │ times.               │──┐
        └─────────────────────┘  ▼
                  │ Y   ┌──────────────────────────────┐
                  ▼     │ It is thought the temporary one │
        ┌─────────────────────┐ by the noise. Please        │
        │ Connection of cables │ investigate, and confirm the │
        │ is correct.          │ N noise source.              │
        └─────────────────────┘ └──────────────────────────────┘
                  │ Y   ┌──────────────────────────────┐
                  ▼     │ Please connect the cable        │
        ┌─────────────────────┐ correctly.                  │
        │ Setting of           │ N └──────────────────────────────┘
        │ termination is       │──┐
        │ correct.             │  ▼
        └─────────────────────┘ ┌──────────────────────────────┐
                  │ Y           │ Set DIP switch in order to     │
                  ▼             │ insert correct value of        │
        ┌─────────────────────┐ resister for terminator in both │
        │ The other stations   │ Y ends of link modules          │
        │ indicated error.     │ connected in transmission line.│
        │ (Note 1)             │ └──────────────────────────────┘
        └─────────────────────┘ ┌──────────────────────────────┐
                  │ N           │ Check the other stations       │
                  ▼             │ indicated transmission error   │
        ┌─────────────────────┐ with special internal output.  │
        │ Shielded twisted     │ N └──────────────────────────────┘
        │ pair cable is        │──┐
        │ recommended cable.   │  ▼
        └─────────────────────┘ ┌──────────────────────────────┐
                  │ Y           │ Use recommended cable for      │
                  ▼             │ shielded twisted pair cable.   │
        ┌─────────────────────┐ Refer to Table 2.2.1 for       │
        │ Please exchange the  │ recommended cables.            │
        │ link module.         │ └──────────────────────────────┘
        └─────────────────────┘
```

(Note 1) You can know the station number where
time-out error occurs by checking special internal
output as shown in Table 6.2.1 and 6.2.2.

MEMO

Chapter 7 Daily and Periodic Inspection

7.1   Daily inspection

Verify the following items while the system is running. Please refer to Chapter 3 for detail of LED display, and Chapter 6 for detail of error indication and countermeasure.

Table 7.1.1 Items for daily inspection of link module

Item	Inspection method	LED	Normal status	Abnormal status	Main cause of error
Confirmation of operation	Watching	POW LED RUN LED	Lighting	Off	• Power LED off: 5V DC power malfunction • RUN LED off: communication is stopped
Confirmation of error	Watching	HERR LED CERR LED	Off	Lighting /blinking	• HERR LED lightning: breakdown of module • CERR LED lightning: time-out error
Confirmation of communication data	Watching	TxD LED RxD LED	Blinking /lighting thinly	Always lightning or off	• TxD LED off: breakdown of link module etc. • RxD LED off: disconnection of line etc.

7.2   Periodic inspection

Turn off the power for the external I/O circuits and link system, check the following items.

Table 7.1.2 Items for periodic inspection of link module

Item	Method
All screws of connecter for communication are tight.	Tighten surly.
Removal of dust on case and connecter.	Removal with cleaner etc.

Periodic inspection must be done once every 6 months at least. Please bring the check cycle forward with respondent to the installation environments such as the vibration and dust.

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Chapter 8 Special how to use

8.1 Special how to use compatible mode

When there are many modules with an I/O assignment of "LINK" and cannot add an I/O assignment of "LINK", the compact link has the mode which can use the link area of 8 words by an I/O assignment of excepting "LINK" if setting the compatible mode. Refer to following how to use.

■The I/O assignment by Control Editor and Ladder Editor

When setting I/O assignment of modules by programming software, notation of I/O information to choose at I/O assignment is different from Control Editor and Ladder Editor.

With the following manuals, the I/O information is mentioned in "DBW(S)6" and "X1Y1W" to show in Table 8.1.1.
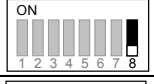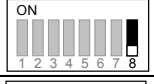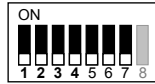
Table 8.1.1 I/O information notation by programming software

Programming software	I/O classification to choose at I/O assignment setting	
Control Editor	"DBW(S)6"	"X1Y1W"
Ladder Editor	—	"B1/1"
Notation of the following manual	"DBW(S)6"	"X1Y1W"

■Description of side DIP switch

I/O assignment of "DBW(S)6" and "X1Y1W" becomes effective only at the time of compatible mode setting. Refer to Table 8.1.2 for the setting method of DIP switch arranged on the module side. The setting method is same about other switches.

Table 8.1.2   Description of side DIP switch

No.	Setting description	Details								
1	Select the built-in terminator value [Default setting: OFF]	Built-in 100Ω and 150Ω terminator on module, it is chosen which terminator is inserted between A and B terminals of communication connector.								

Bit8	Position	Selection of built-in terminator
OFF		$100\ \Omega$ (for recommended 0.3mm^2 and 0.5mm^2 twisted pair cable)
ON		$150\ \Omega$ (for recommended 0.75mm^2 twisted pair cable)

No.	Setting description	Details
2	Set an I/O assignment [Default setting: OFF]	Set an I/O assignment of the module. (Note 1)

Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7	Position	I/O assignment
ON	ON	ON	OFF	OFF	OFF	ON		DBW(S)6
OFF	OFF	OFF	ON	OFF	OFF	OFF		X1Y1W

(Note 1) Refer to Table 8.1.3 about relations with CPU modules and I/O assignment.

Table 8.1.3 I/O assignment and available CPUs

I/O assignment	EH-CPU104A EH-CPU208A	EH-CPU316A EH-CPU516 EH-CPU548	EHV-CPU16 EHV-CPU32 EHV-CPU64 EHV-CPU128	Link points (Note 1)
DBW(S)6	Not available	Not available	Available	128 points / system
X1Y1W	Not available	Available	Available	128 points / system

(Note 1) By I/O assignment except "LINK", the external outputs are sent data area. In addition, external inputs are received data area.
Therefore, received link data from other stations are stored away in the external inputs area.

8.1.1 Access method of compact link in I/O assignment "X1Y1W" and "DBW(S)6"

When use compact link by I/O assignment "X1Y1W" and "DBW(S)6", CPUs cannot access modules by ladder program directly, because they use the second XY area that I/O numbers are not assigned. And, CPUs cannot access modules by a ladder program directly about status area of them. Therefore, use high function module commands. The commands can read received area of the modules, and write send area, and read status area. Refer to Table 8.1.4 about relations of CPUs and high function modules commands.

Table 8.1.4 CPUs and high function modules commands.

CPU models	High function modules commands (Note 1)		Remarks
	Second XY area	Status area	
EHV-CPU16/32/64/128	XYRW	SCRW	
EH-CPU316A/516/548	FUN200	FUN201	(Note 2)

(Note 1) Refer to section 4.3.4 about access method of status area.
(Note 2) Cannot use high function modules commands in EH-CPU104A/208A.

The XYRW command cannot use in combination with EHV-CPU16/32/64/128, if the compact link module is set to the I/O assignment of "DBW(S)6". Therefore use the I/O numbers of the second XY area that can access directly by EHV-CPU.
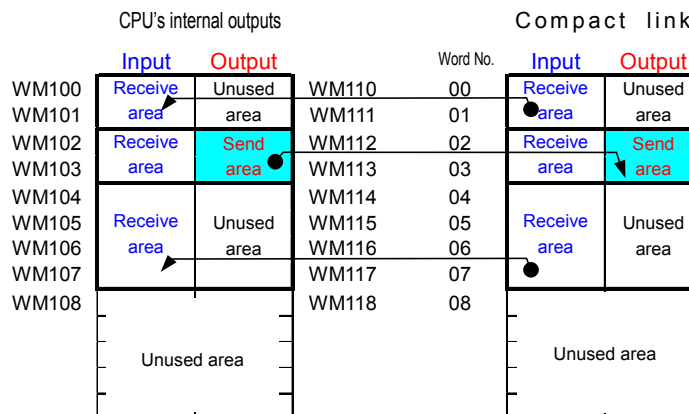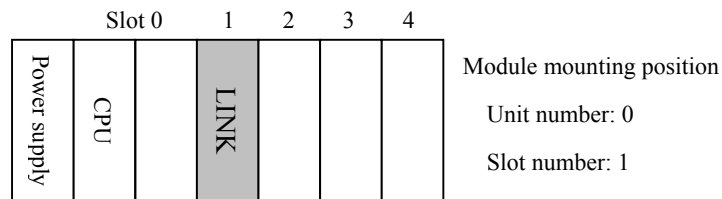
Figure 8.1.1 Access configuration to the second XY area

About the configuration shown in figure 8.1.1, refer to the following operating program to access the second XY area of the compact link module.

(1) In the case of EH-150 CPU

When access the second XY area of the compact link, use FUN 200 (XYRW) command. Refer to example program of Figure 8.1.2. Refer to EH-150 application manual about the details of FUN200 command.


```
          R7E3
           | |        ┌──────────────────────────┐
           ┤ ├        │ WR3 = H2                 │    Control type (Read request from the X area)
                      │ WR4 = H0100              │    Header of target area
                      │ ADRIO (WR5, M0)          │    Read control bit I/O No.
                      │ ADRIO (WR6, WM100)       │    Transfer source (destination) header I/O No.
                      │ WR7 = H8                 │    Size of read data
                      │                          │
                      │ WR13 = H4                │    Control type (Write request from the Y area)
                      │ WR14 = H0102             │    Header of target area
                      │ ADRIO (WR15, M10)        │    Write control bit I/O No.
                      │ ADRIO (WR16, WM112)      │    Transfer source (destination) header I/O No.
                      │ WR17 = H2                │    Size of write data
                      └──────────────────────────┘
          R100                                   M10
           ┤ ├                                  ( )       Start writing when the execution flag M10 turns
                      ┌──────────────────────────┐       on.
                      │ FUN 200 (WR10)           │
                      └──────────────────────────┘
          M11                                    M0
           ┤ ├                                  ( )       Start reading when the normal end flag M11 turns
                      ┌──────────────────────────┐       on.
                      │ FUN 200 (WR0)            │
                      └──────────────────────────┘
```

Header of target area

b15	b11	b7	b0
Unit Number	Slot Number	Word location	

Sets the unit number (0 to 7).

Sets the slot number (0 to A).

Sets the word location (from 0).

Figure 8.1.2 Access program 1 to the second XY area

(2) In the case of EHV-CPU

When access the second XY area of the compact link, use XYRW command. Refer to example program of Figure 8.1.3. Refer to EHV-CPU programming manual about the details of XYRW command.

```
      R7E3
      ─┤├─────┌──────────────────────────┐───      Control type (Read request from the X area)
              │ WR3 = H2                  │          Header of target area
              │ WR4 = H0100               │          Transfer source (destination) header I/O No.
              │ DR5 = ADR (WM100)         │          Size of read data
              │ WR7 = H8                  │
              │                           │
              │ WR13 = H4                 │          Control type (Write request from the Y area)
              │ WR14 = H0102              │          Header of target area
              │ DR15 = ADR (WM112)        │          Transfer source (destination) header I/O No.
              │ WR17 = H2                 │          Size of write data
              └──────────────────────────┘
      R100                            M10
      ─┤├──────────────────────────( )───        Start writing when the execution flag M10 turns
                                                   on.
       ──────┌──────────────────────┐───
             │ XYRW (WR10, M10)      │
             └──────────────────────┘
      M11                             M0
      ─┤├──────────────────────────( )───        Start reading when the normal end flag M11 turns
                                                   on.
       ──────┌──────────────────────┐───
             │ XYRW (WR0, M0)        │
             └──────────────────────┘
```
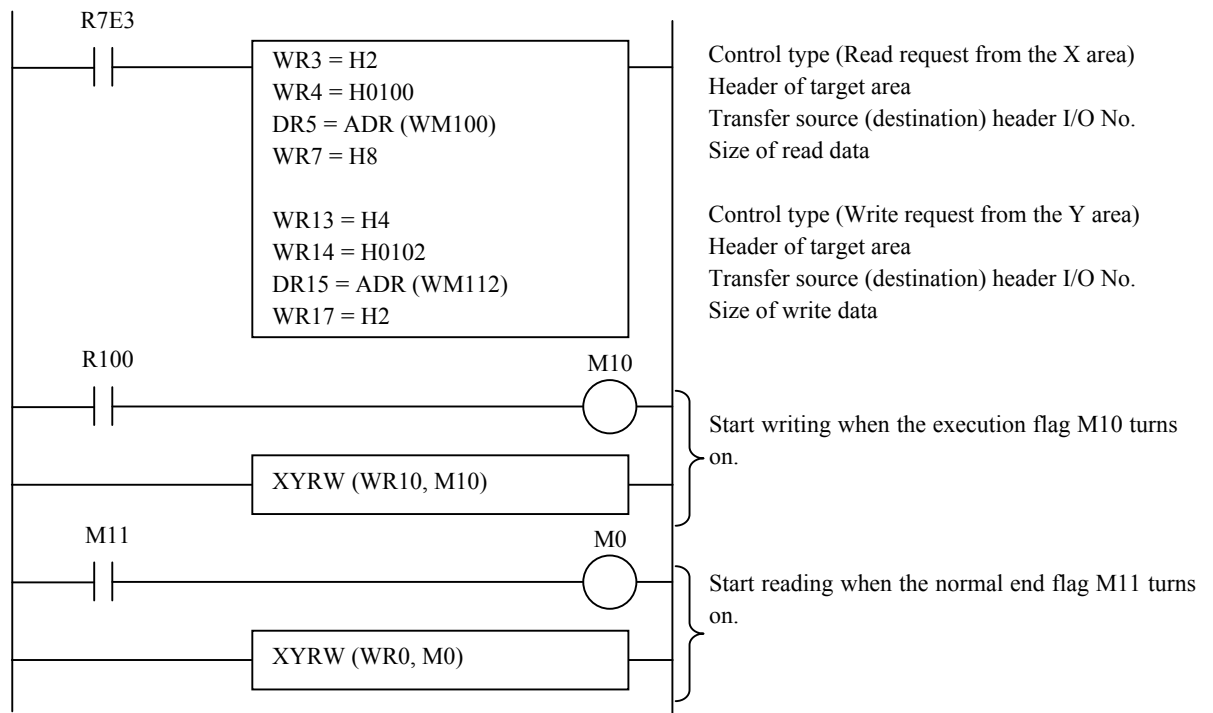
Figure 8.1.3 Access program 2 to the second XY area

Because EHV-CPU can access the second XY area directly when compact link was set in I/O assignment of "DBW(S)6", it does not need special program for I/O access. Appoint I/O number by the ladder program as follows.

When compact link module is set in I/O assignment of "DBW(S)6", use caution because the XYRW command cannot use in EHV-CPU.
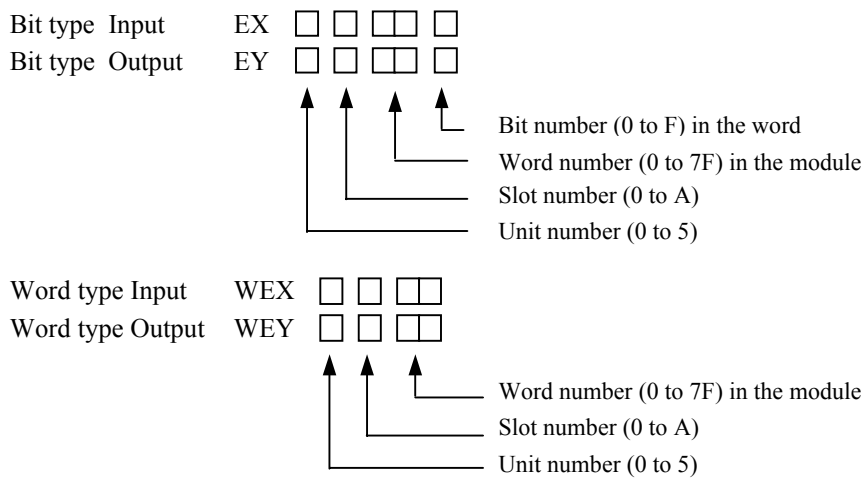
```
Bit type  Input    EX  □ □ □□ □
Bit type  Output   EY  □ □ □□ □
                    ↑  ↑ ↑  ↑
                    │  │ │   └─ Bit number (0 to F) in the word
                    │  │ └───── Word number (0 to 7F) in the module
                    │  └─────── Slot number (0 to A)
                    └────────── Unit number (0 to 5)

Word type Input    WEX □ □ □□
Word type Output   WEY □ □ □□
                    ↑  ↑ ↑
                    │  │ └───── Word number (0 to 7F) in the module
                    │  └─────── Slot number (0 to A)
                    └────────── Unit number (0 to 5)
```

Figure 8.1.4 I/O number of second XY area in the DBW(S)6 method

8.1.2 Usage of I/O assignment "X1Y1W"

Compact link module set the "X1Y1W" mode can use the second XY area for data communications to the other stations. CPU writes send data in the second Y area, and reads received data from the second X area. There are the link data of all station in the second X area, because send data is stored to the second X area.
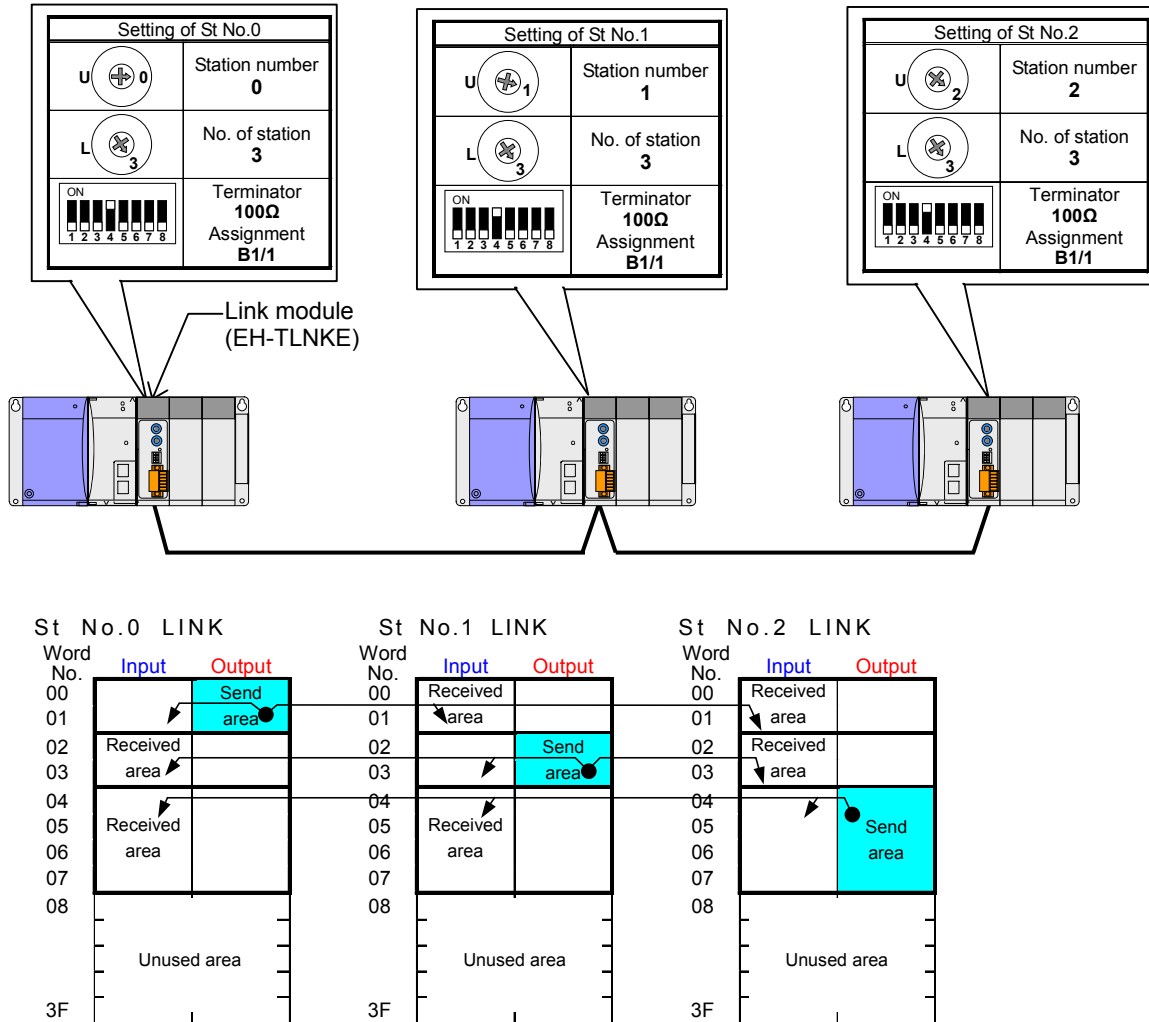

Figure 8.1.5 System configuration diagram of the "X1Y1W" mode

Match the terminator value with a use cable.

8.1.3 Usage of I/O assignment " DBW(S)6"

Compact link module set the " DBW(S)6" mode can use the second XY area for data communications to the other stations. CPU writes send data in the second Y area, and reads received data from the second X area. There are the link data of all station in the second X area, because send data is stored to the second X area.
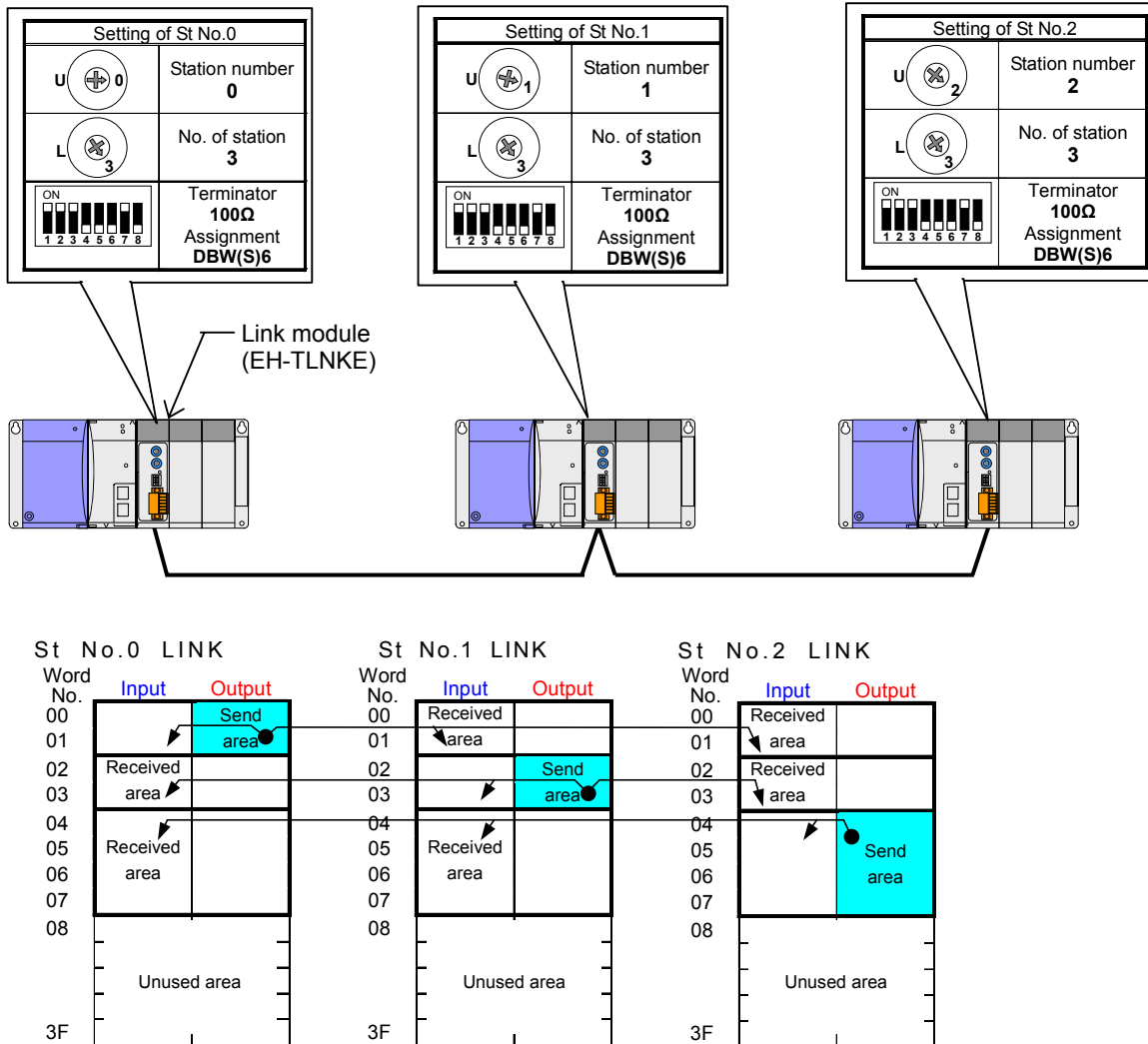

Figure 8.1.6 System configuration diagram of the " DBW(S)6"

Match the terminator value with a use cable.