HITACHI PROGRAMMABLE CONTROLLER

HIDIC EH-150

Compact link module (EH-TRLLE) APPLICATION MANUAL

(SERVICE MANUAL)

NJI-563 (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	July 2011	NJI-563 (X)

Table of contents

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-TRLLE 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 the notation of the control editor to show to Table 1.1.2.

Table 1.1.2 I/O information notation by the programming software

I/O information to choose at I/O assignment setting	Programming software	
	Ladder Editor	Control Editor
CPU link	"CPU LINK"	"LINK"
Input 4 words/ Output 4 words	"4W/4W"	"X4Y4W"
Input 8 words	"X8W"	"X8W"
Output 8 words	"X8W"	"Y8W"

■ 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-TRLLE (LINK) or EH-TRLLE (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")

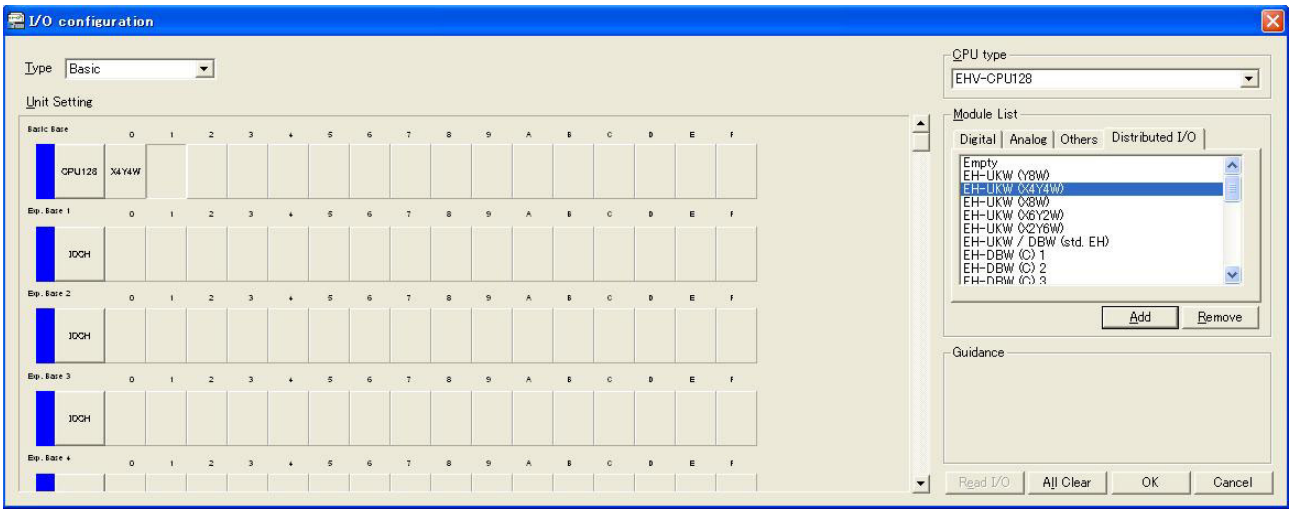


Figure1.1.2 I/O assignment for link module with Control Editor (in the case of "X4Y4W")

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.

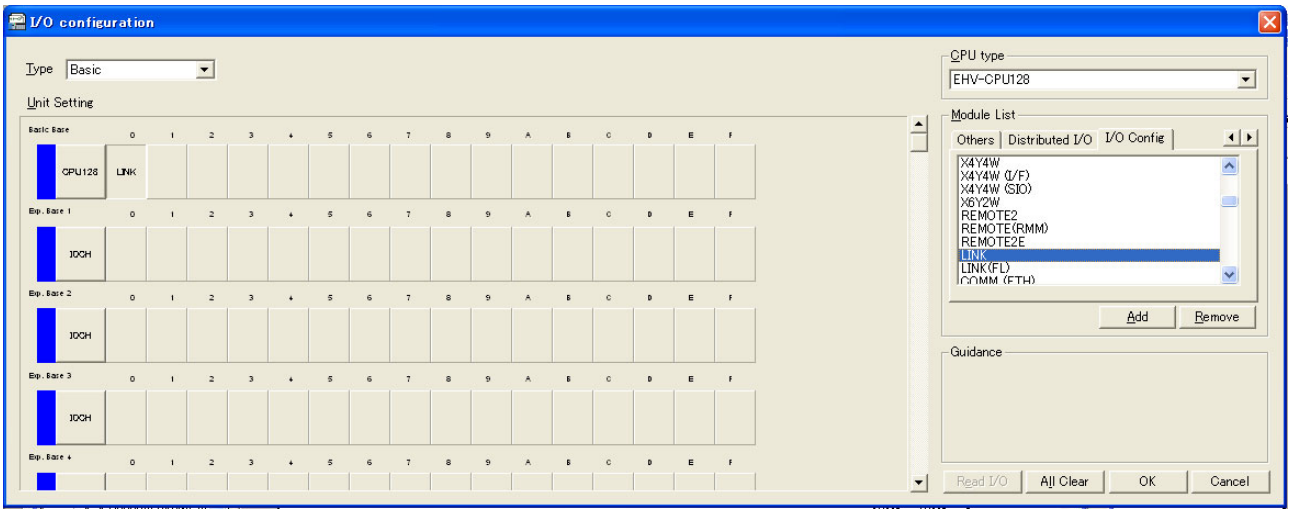


Figure1.1.3 I/O assignment for link module with Control Editor (in the case of “LINK”)

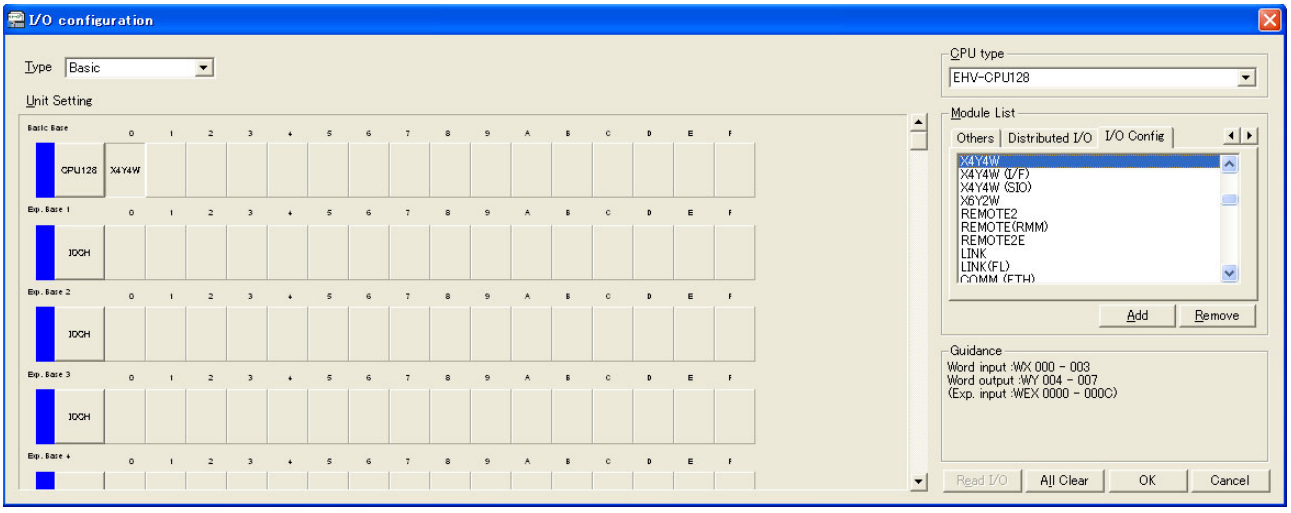


Figure1.1.4 I/O assignment for link module with Control Editor (in the case of “X4Y4W”)

Please choose "X8W" and "Y8W" among the classification of "I/O Config" tag.

1.1.2 Combination of CPU modules and base units

Use EH-TRLLE with products to show in Table 1.1.3.

Table 1.1.3 Supported CPUs and base units

CPU modules	Base units	Limit of mounting for I/O assignment		Remarks
		"LINK"	"Y8W" "X8W" "X4Y4W"	
EHV-CPU128 EHV-CPU64 EHV-CPU32 EHV-CPU16	EH-BS3/BS5/BS8			Not usable. (Note 1)
	EH-BS3A/5A/6A/8A/11A	Slot 0 to 7	No limitation	Refer to Table 1.1.4.
EH-CPU548 EH-CPU516	EH-BS3/BS5/BS8	Slot 0 to 2	No limitation	
	EH-BS3A/5A/6A/8A/11A	Slot 0 to 7	No limitation	Refer to Table 1.1.4.
EH-CPU316A	EH-BS3/BS5/BS8 EH-BS3A/5A/6A/8A	Slot 0 to 2	No limitation	
	EH-BS11A			Not usable. (Note 2)
EH-CPU208A EH-CPU104A	EH-BS3/BS5/BS8 EH-BS3A/5A/6A/8A	Not available	No 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 1.1.4 about specifications of base unit. When using EH-TRLLE by I/O assignment of "LINK", mount EH-TRLLE on slot that can mount communication modules in the basic base.

Table 1.1.4 Specifications of base units

Base units	The number of mounted modules	Available slot number for communication modules	Remarks
EH-BS3	3 modules	Slot 0 to 2	Discontinued
EH-BS5	5 modules		Discontinued
EH-BS8	8 modules		Discontinued
EH-BS3A	3 modules		
EH-BS5A	5 modules	Slot 0 to 4	
EH-BS6A	6 modules	Slot 0 to 5	
EH-BS8A	8 modules	Slot 0 to 7	
EH-BS11A	11 modules		

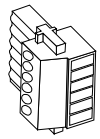
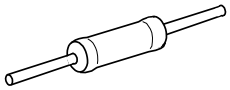
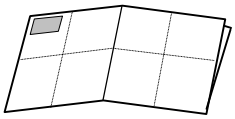
1.2 Before use

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-TRLLE

No.	Product name	Model name	Appearance	Numbers	Remarks
1	Compact link module	EH-TRLLE		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-561* (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-TRLLE has communication-compatibility with the remote I/O MINI modules for H series (Master: REM-MMH, Slave: REM-LMH, REM-LH2) and the remote slave module for H-200/250/252B/252C (Slave: RIOH-TL), 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 I/O link system

Link system can use up to 64 channels (2,048 points, 12 slave units/ system) and can build a large-scale I/O link system. Apart from the function of the compact link module as remote I/O, it has the function to link a master station CPU with a local station CPU (if the slave station is mode0). So, EH-TRLLE can use with the compact remote module (EH-TRMLE).

(4) Partial and step-by-step replacement

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

(5) Fast response and high reliability

The link refresh time is approximate 10ms (setting to high-speed mode (HS) and 64 channels). 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 I/O link system is shown below.

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

You can build the large-scale system of 64 channels / systems in EHV/EH-150 series by the compact link module which a cheap twisted pair cable can use at low cost.

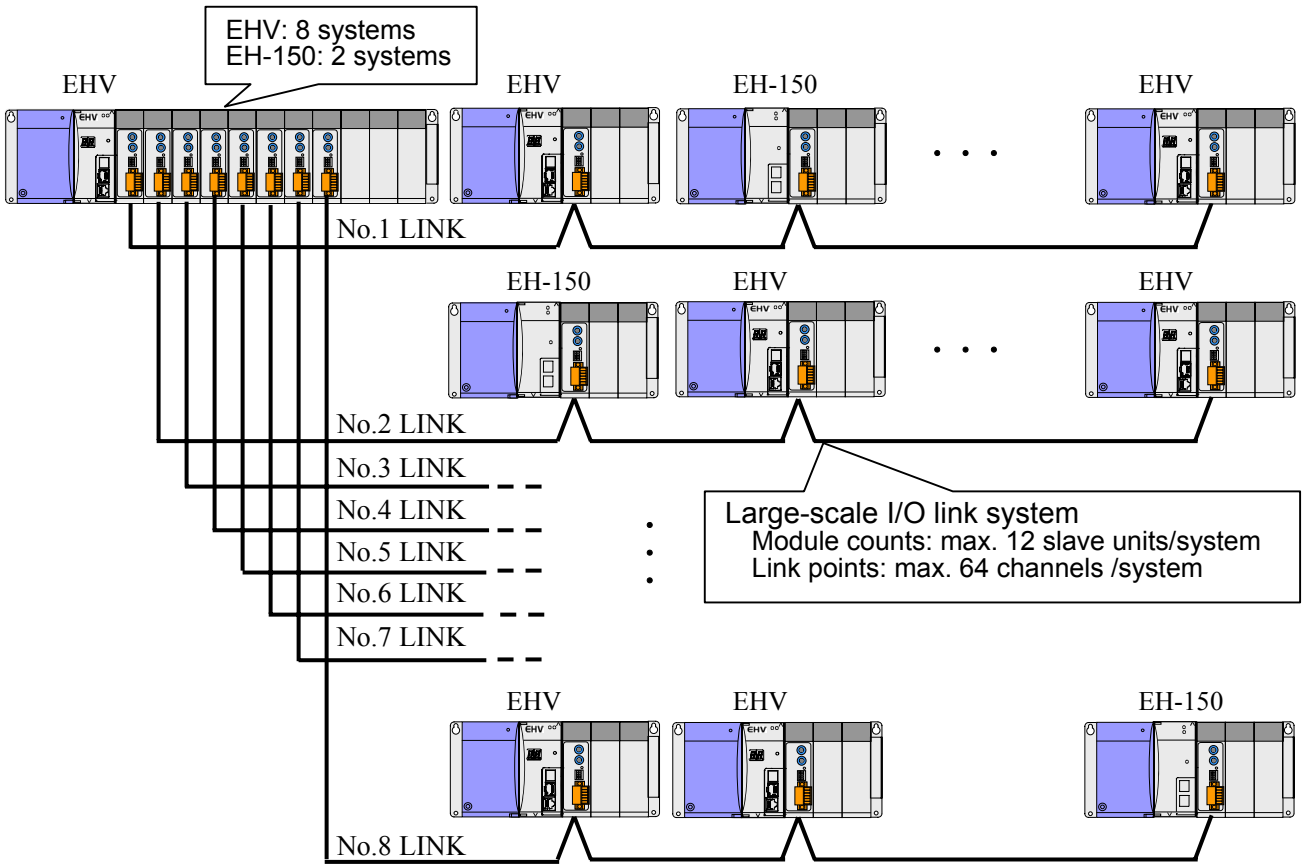


Figure 1.3.1 System configuration example of compact link module

(2) Low cost link system (EH-CPU104A/208A)

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

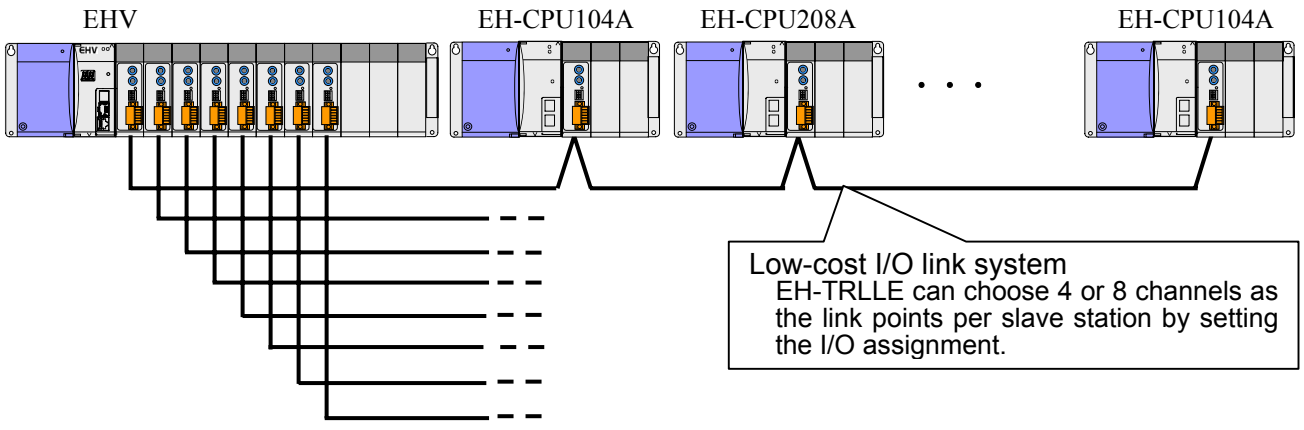


Figure 1.3.2 System configuration example 1 of EH-CPU104A/208A

(3) Small-scale I/O link system (EH-CPU104A/208A)

Only in EH-CPU104A/208A, you can build a link system (4 channels / system).

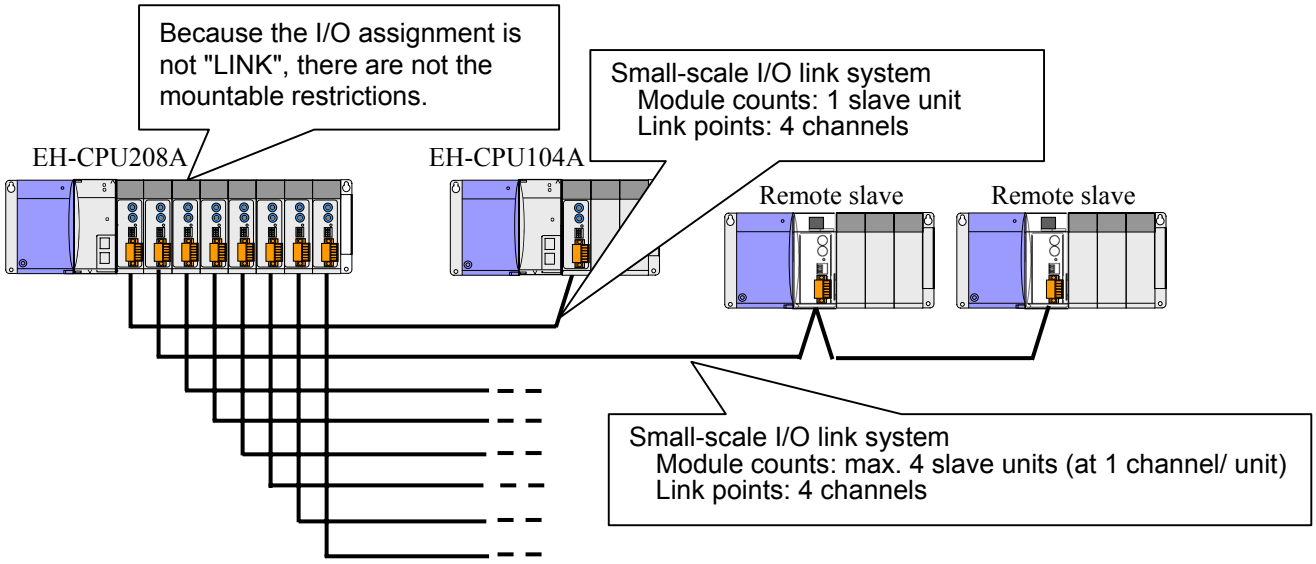


Figure 1.3.3 System configuration example 2 of EH-CPU104A/208A

(4) I/O link system with the existing PLC

Since EH-TRLLE has communication-compatibility with current models, it is possible to replace existing PLC by EH-150/EHV series. Therefore you can use compact link modules with I/O link system of the existing PLC.

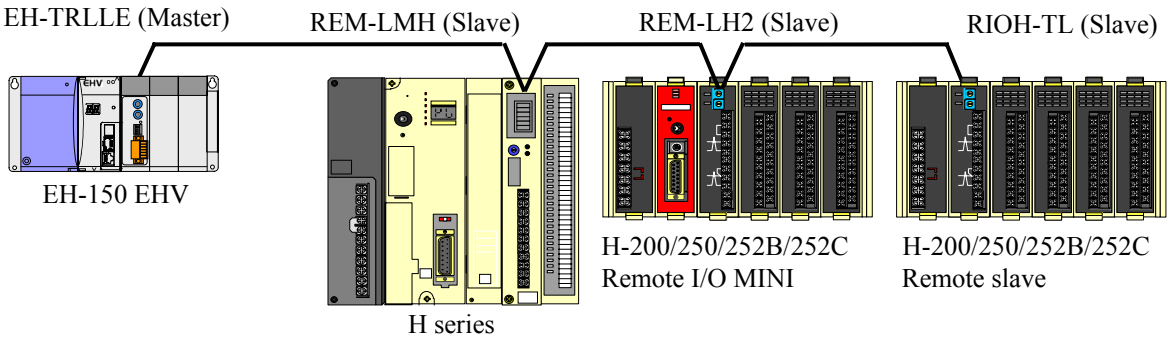


Figure 1.3.4 Replacement configuration example 1 of existing PLC

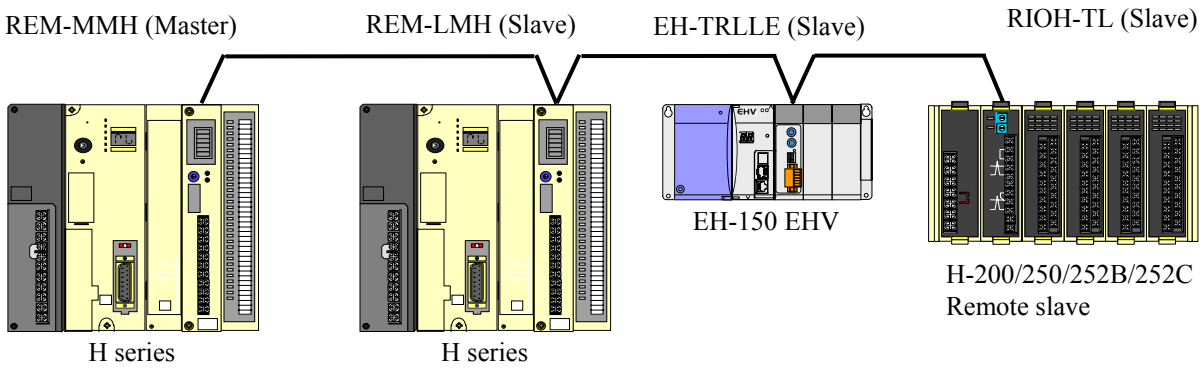


Figure 1.3.5 Replacement configuration example 2 of existing PLC

Refer to Chapter 2 or later for the details of the usage.

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 temperature	0 to 55°C (0 to 45 °C if used as UL certified product)
Storage temperature	－10 to 75 °C
Operating ambient humidity	20 to 90% RH (no condensation)
Storage humidity	10 to 90 % 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 minimum between the AC terminal and frame ground (FE) terminal (based on 500V DC)
Dielectric withstand voltage	1,500V AC for 1 minute between the AC external terminal and frame 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 module has almost equal functions to the remote I/O mini module (Master: REM-MMH, Slave: REM-LMH) for H series and the link module (Slave: REM-LH2) for H-200/250/252B/252C series.

EH-TRLLE has communication-compatibility with current modules, 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”)
		EH-CPU***	MAX 2 units per CPU (2 loops per CPU) (I/O assignment: “LINK”) (Note 1)
	No. of connected slave modules		MAX 12 units per system (Connectable mode to REM-MMH/LMH/LH2)
	Number of link points (Note 2)		64 channels (2,048 points) per system (I/O assignment: “LINK”)
	Refresh time (Note 3)		Approx. 10msec/ 64 channels (12 slaves, HS: ON) Approx. 22msec/ 64 channels (12 slaves, 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 “Y8W” or “X4Y4W” or “X8W”
	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		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) (Note 5)	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)
		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 “Y8W” or “X4Y4W” or “X8W” for these.

(Note 2) The number of data transferred between master and slave stations is called the "channel". A channel means that the pair of an input word (data sent to the master station by the slave station) and an output word (data sent to the slave station by the master station) is allocated to one address. Therefore, one channel is 32 points (2 words).

(Note 3) Refresh time is transmission refresh time between the link module.

(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.

(Note 5) Use the recommended cable. If you use the cable except for the recommended cable, choose the cable according as chapter 9.

2.3 Units that can be connected to EH-TRLLE

The units that can be connected to EH-TRLLE are shown in Table 2.3.1.

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

Series of PLC	Product name	Model name	Specifications (Maximum link points)	Remarks
EH-150/EHV	Compact link module	EH-TRLLE	Link points: 2,048 points	
H-302/702/2002/4010	Remote I/O MINI modules	REM-MMH REM-LMH	Remote I/O points: 2,048 points	
H-200/250/252B/252C	Link module	REM-LH2	Link points: 128points	Discontinued
H-board type	Units with communication function (Link)	HL-40DR	Link points: 128points	Discontinued
		HL-64DR	Link points: 128points	Discontinued
	Units with communication function (Remote slave)	HR-40DR	Remote I/O points: 40 points	Discontinued
		HR-64DR	Remote I/O points: 64 points	Discontinued
EH-150/EHV	Compact remote modules	EH-TRMME	Remote I/O points: 256 points	(Note 3)
		EH-TRMLE		
H-200/250/252B/252C	Remote slave modules	RIOH-TL	Remote I/O points: 128 points	Discontinued
		RIOH-DT	Remote I/O points: 32 points	Discontinued

(Note 1) When you use EH-TRLLE with the units of discontinued product, set switch by "the low speed refresh mode".
(Note 2) EH-TRLLE cannot communicate with compact link module "EH-TLNKE" for EH-150/EHV.
(Note 3) When EH-TRLLE is used with the compact remote master module "EH-TRMME", turn on high-speed refresh mode (HS) of the front Dipswitch.

In the conventional I/O link system, REM-MMH of the remote I/O MINI module is the master station, and other units are the slave stations. Apart from the function of the compact link module as remote I/O, it has the function to link a master station CPU with a slave station CPU (if the slave station is mode0).

EH-TRLLE has the function of both master station "REM-MMH" and slave station "REM-LMH" of remote I/O MINI. And EH-TRLLE has the compatible communication with the slave station "REM-LH2" for H-200/250/252B/252C, or the slave station "HL-40DR/64DR and HR-40DR/64DR" for H-board.

When EH-TRLLE is set to the master station, it can connect to the compact remote slave module "EH-TRMLE". In addition, when EH-TRLLE is set to the slave station, it can connect to the compact remote master module "EH-TRMME". However, when you connect EH-TRLLE to EH-TRMME, please turn on high-speed refresh mode (HS) of the front Dipswitch. If you turn off HS, communication error "CERR" will occur in EH-TRMME.

2.4 Specifications difference with the conventional products

EH-TRLLE is a link module that use with twisted pair cable. The specifications differences 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 REM-MMH/LMH, REM-LH2 and HL-40DR/64DR

Item			REM-MMH REM-LMH	REM-LH2	HL-40DR HL-64DR	EH-TRLLE	Remarks
Operation mode	High speed		Not usable			Available	
	Low speed		Available				
Number of connected slave modules			MAX 12	MAX 8		MAX 12	Units per system
I/O assignment and link points	LINK	Input	—	—		1,024 points	Operation mode: Mode0
		Output	—	—		1,024 points	
	LINK (Note 1)	Input	—	128 points		128 points	Operation mode: Mode0c
		Output	—			128 points	
	LINK (Note 1)	Input	—	64 points		64 points	Operation mode: Mode2c
		Output	—	64 points		64 points	
	X4Y4W	Input	1,024 points	—		—	Operation mode: Mode0
		Output	1,024 points	—		—	
	Y8W	Input	—	—		—	Operation mode: Mode1
		Output	128 points	—		128 points	
	X4Y4W	Input	64 points	—		64 points	Operation mode: Mode2
		Output	64 points	—		64 points	
	X8W	Input	128 points			128 points	Operation mode: Mode3
		Output	—	—		—	
Refresh time	High speed		—			Approx. 10ms	2,048 points, 12 units
	Low speed		Approx. 45ms			Approx. 22ms	
Fallback operation			Available (Except for master station) (Note 2) (Note 4)				
Reset switch			Available	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	
Overlap check			Available			Available (Note 3)	
Peripheral device functions			Not usable (There is no peripheral device functions.)				
Terminator			100Ω (built in), 150Ω (Attach externally)			100Ω/150Ω (built in) (Note 4)	Change by switch

(Note 1) The operation mode of REM-LH2 and HL-40DR/64DR assumes it Mode0c and Mode2c each to distinguish it from the operation mode of REM-MMH/LMH.

(Note 2) EH-TRLLE that is set to 80h by rotary switches is a link master station.

(Note 3) When EH-TRLLE is used with conventional products, they will detect the overlap error for duplicated channel number. When I/O link system made construction only in EH-TRLLE, there is a possibility that the area overlap error can't detect.

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

2.4.1 Operation modes for REM-MMH and REM-LMH

Mode of data transfer between the CPU module and Remote I/O MINI module (Master or Slave station) can be selected. The remote I/O MINI module can meet various using a large number of input/ output points at medium speed and a small number of input/ output points at high speed. Features of individual operation modes are shown in table 2.4.2.

Table 2.4.2 Features of individual operation modes for REM-MMH/LMH

Item \ Mode		Mode0		Mode1	Mode2	Mode3
Maximum number of I/O points	Input	Max. 1,024 points	64 channels (Variable)	0 (fixed)	64 (fixed)	128 (fixed)
	Output	Max. 1,024 points		128 (fixed)	64 (fixed)	0 (fixed)
I/O assignment		X4Y4W		Y8W	X4Y4W	X8W
Number of occupied channels		Max. 64		8	4	8
Maximum refresh time		Approx. 45ms		Approx. 6ms	Approx. 3ms	Approx. 6ms
Control method		Indirect refresh		Direct refresh		
User program		It is necessary to describe the details of control for refreshing in a user program.		A program to be input and output can be directly described in I/O number, and the input connected to a slave station can be programmed in a contact point image.		

2.4.2 Operation modes for REM-LH2 and HL-40DR/64DR

In REM-LH2 and HL-40DR/64DR, the I/O assignment is "LINK", and the I/O link system uses a link area. In the data communications with the remote I/O MINI modules, there are operation modes of Mode0c and Mode2c. Features of individual operation modes are shown in table 2.4.3.

Table 2.4.3 Features of individual operation modes for REM-LH2 and HL-40DR/64DR

Item \ Mode		Mode0c	Mode2c
Maximum number of I/O points	Input	128	64(fixed)
	Output		64(fixed)
I/O assignment		LINK	
Number of occupied channels		8	4
Maximum refresh time		Approx. 6ms	Approx. 3ms
Control method		Direct refresh	
User program		A program to be input and output can be directly described in I/O number, and the input connected to a slave station can be programmed in a contact point image.	

"Mode0c" of REM-LH2 and HL-40DR/64DR is the operation mode to connect with remote I/O MINI modules setting "Mode0" or "Mode1" or "Mode3". And "Mode2c" is the operation mode to connect with remote I/O MINI modules setting "Mode2".

It is necessary to set transmission area by a link parameter depending on the I/O assignment of the remote I/O MINI master station.

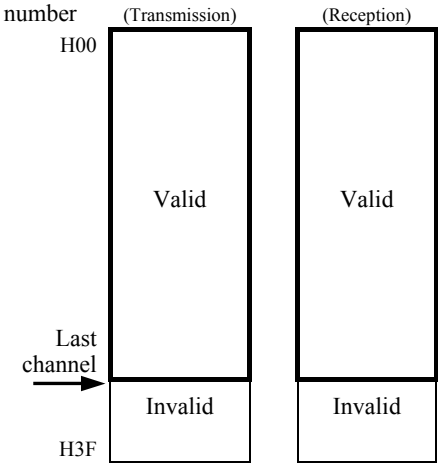
2.4.3 Channel number

The number of data transferred between remote I/O MINI module master and slave stations is called the "channel". A channel means that the pair of an input word (data sent to the master station by the slave station) and an output word (data sent to the slave station by the master station) is allocated to one address. Therefore, one channel is 32 points (2 words). The number of channels occupied by the master station is determined by the setting of mode for the master station. As seen from the slave station, the output area (transmission) from the master station is the input area (reception) to the slave station, and the input area (reception) to master station is the output area (transmission) from the slave station.

The assignment method of the output and input area is shown below. This is applied about the compact link module too. The number of occupied channels in each mode is shown below.

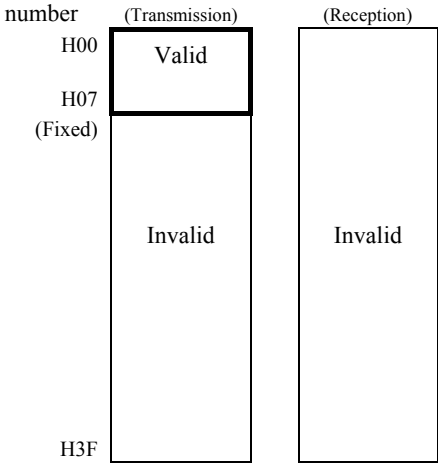
(1) Occupied channels in REM-MMH

Mode0
(I/O assignment "X4Y4W")



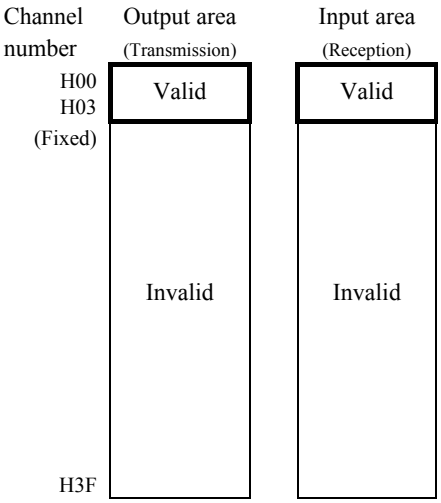
The I/O link area has H00 to H3F channels (64 channels). The area to be used is secured by setting the last channel number using the dipswitch on the module.

Mode1
(I/O assignment "Y8W")



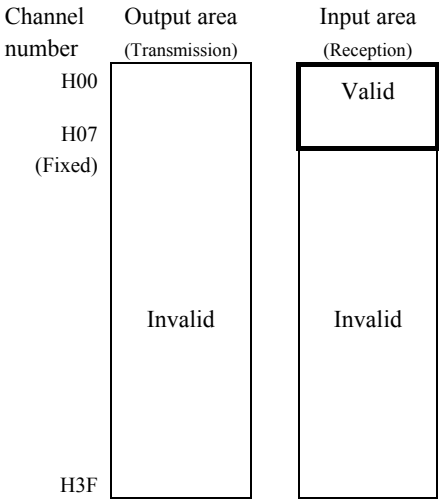
Only the output area uses 0 to 7 channels (8 channels). The number of channels and areas are fixed.

Mode2
(I/O assignment "X4Y4W")



Both input and output areas use 0 to 3 channels (4 channels). The number of channels and areas are fixed.

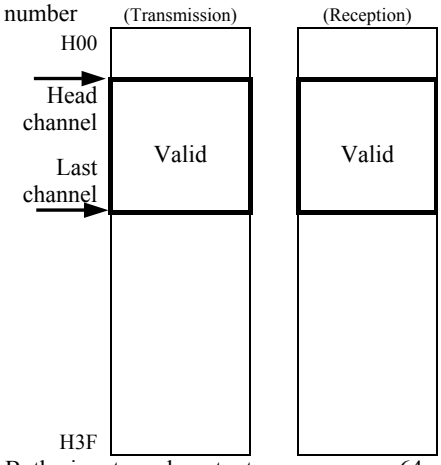
Mode3
(I/O assignment "X8W")



Only the input area uses 0 to 7 channels (8 channels). The number of channels and areas are fixed.

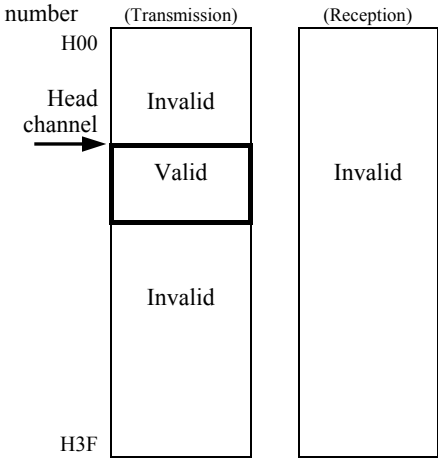
(2) Occupied channels in REM-LMH

Mode0
(I/O assignment "X4Y4W")



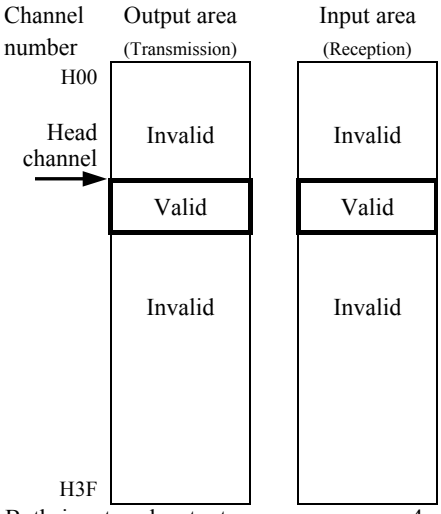
Both input and output area owns 64 channels from H00 to H3F. Using dipswitch on the module and user's application program, set the number of channels and secure valid areas.

Mode1
(I/O assignment "Y8W")



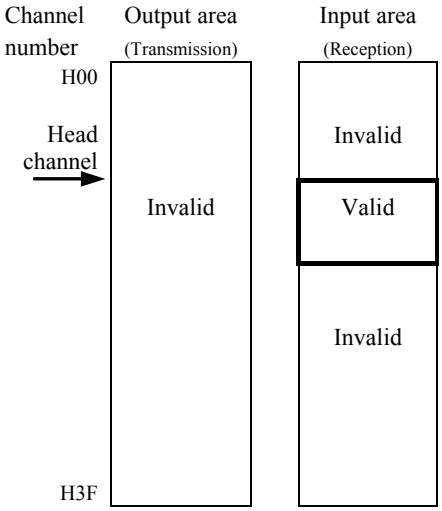
Only the output area secures any 8 channels from H00 to H3F.

Mode2
(I/O assignment "X4Y4W")



Both input and output area secures any 4 channels from H00 to H3F.

Mode3
(I/O assignment "X8W")



Only the input area secures any 8 channels from H00 to H3F.

Each operation mode of REM-MMH/LMH is usable in the compact link module. But, in the case of operation mode "Mode0", the I/O assignment of the compact link module sets it in "LINK". In this operation mode, the input area owns the link area from WL0 to WL3F. And the output area owns the link area from WL200 to WL23F. Each area owns 64 channels. The output area of the master station sets the area for using in the I/O link system by link parameter. And in the slave station, the occupied area sets the area by link parameter.

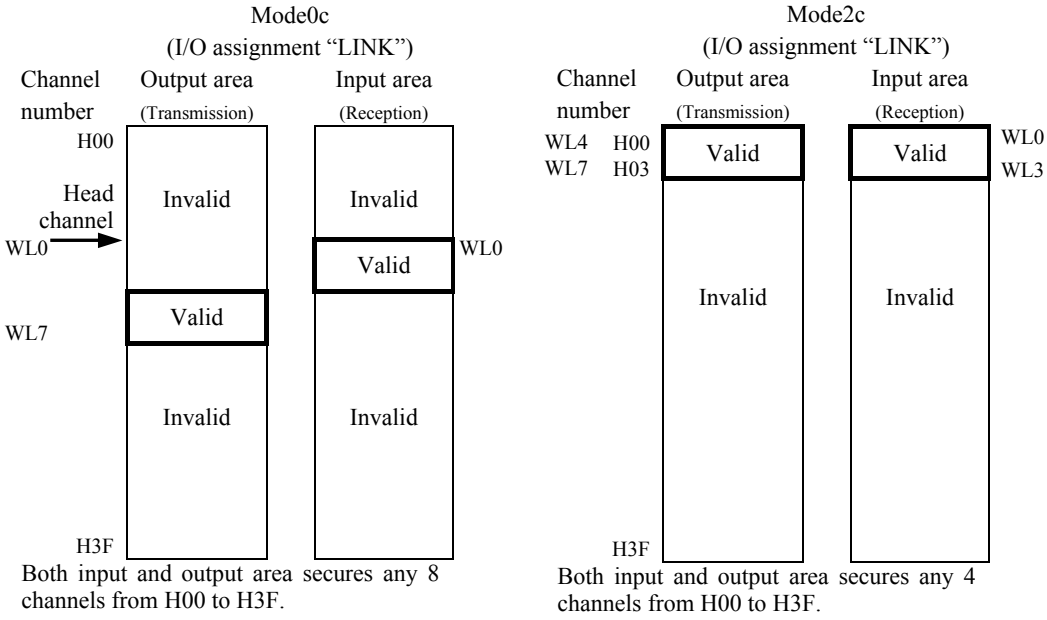
The channels are allocated to each pair of the link area from WL0 to WL3F and from WL200 to WL23F. Because the how to use of the operation modes "Mode1" or " Mode2" or "Mode3" is same, the change of the user program is not necessary. When EH-TRLLE is connected with REM-MMH/LMH, please turn off high-speed refresh mode (HS) of a front Dipswitch of the compact link modules.

(3) Occupied channels in REM-LH2 and HL-40DR/64DR

The CPU link area from WL0 to WL7 is used for the I/O link in REM-LH2 and HL-40DR/64DR. Set head channel number is allocated for WL0.

In this operation mode "Mode0c", the output area of the slave station is the link area set by link parameter. And others are input areas. The input area of the channels set the output area and the output area of the channels set the input area are invalid with this mode. And the CPU module can't write and read the data of the area.

In this operation mode "Mode2c", the output area of the slave station sets the link area from WL4 to WL7 by link parameter. So, the input area owns link area from WL0 to WL3. The output area and the input area are assigned to the same channel number. The input is the reception from the master station, and the output is the transmission to the master station. The each channel of link area means that the each pair of the input area from WL0 to WL3 and the output area from WL4 to WL7 is allocated to one address. This mode is usable, when the master station is set to the operation mode "Mode2".



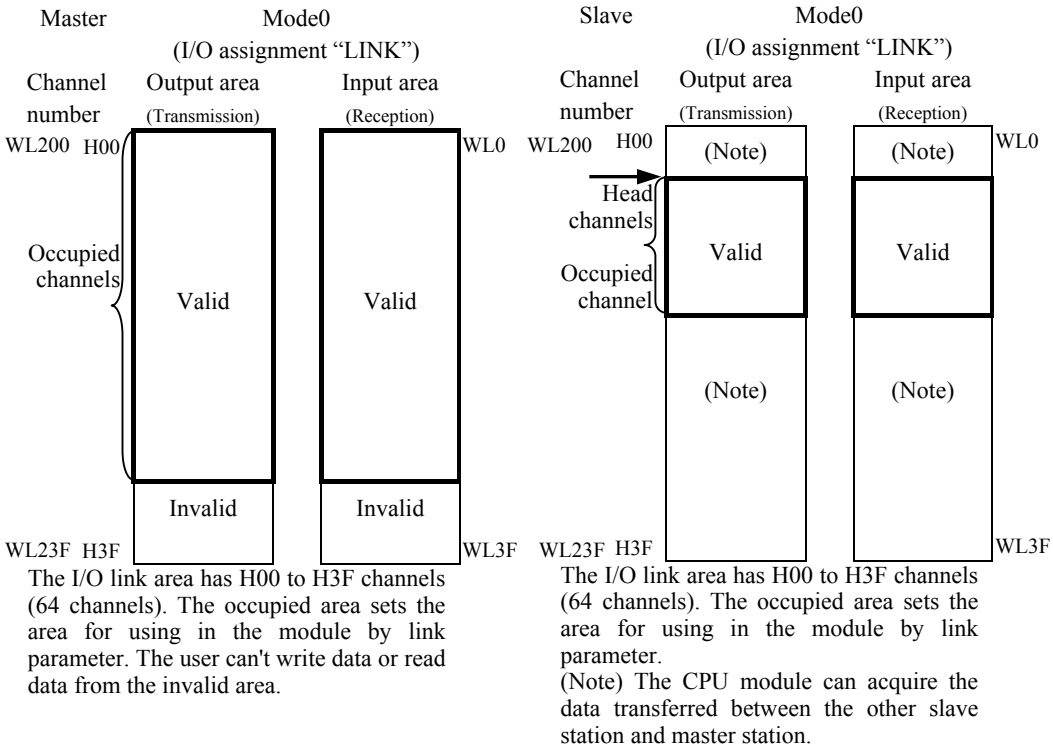
The compact link module is usable to each operation mode of REM-LH2 and HL-40DR/64DR. However, the change of the user program is necessary because the setting methods of the transmission area are different in Mode0c. Then, the user program change of the external input and output number is necessary in HL-40DR/64DR.

When EH-TRLLE is connected with REM-LH2 and HL-40DR/64DR, please turn off high-speed refresh mode (HS) of a front Dipswitch of the compact link modules.

(4) Occupied channels in EH-TRLLE

Each operation mode of the current products is usable in the compact link module.

Refer to below about the operation mode “Mode0” that is different from REM-MMH/LMH.



The output area and the input area are secured in the internal outputs of CPU module in REM-MMH/LMH of the current product. The control method of REM-MMH/LMH is an indirect refresh method to perform the internal output of the CPU module and the data refreshment of the module by the exclusive command in user's program. In contrast, because the I/O assignment of the compact link module is "LINK", the programming makes use of the link number in the user's program. Therefore, the exclusive control program is not necessary.

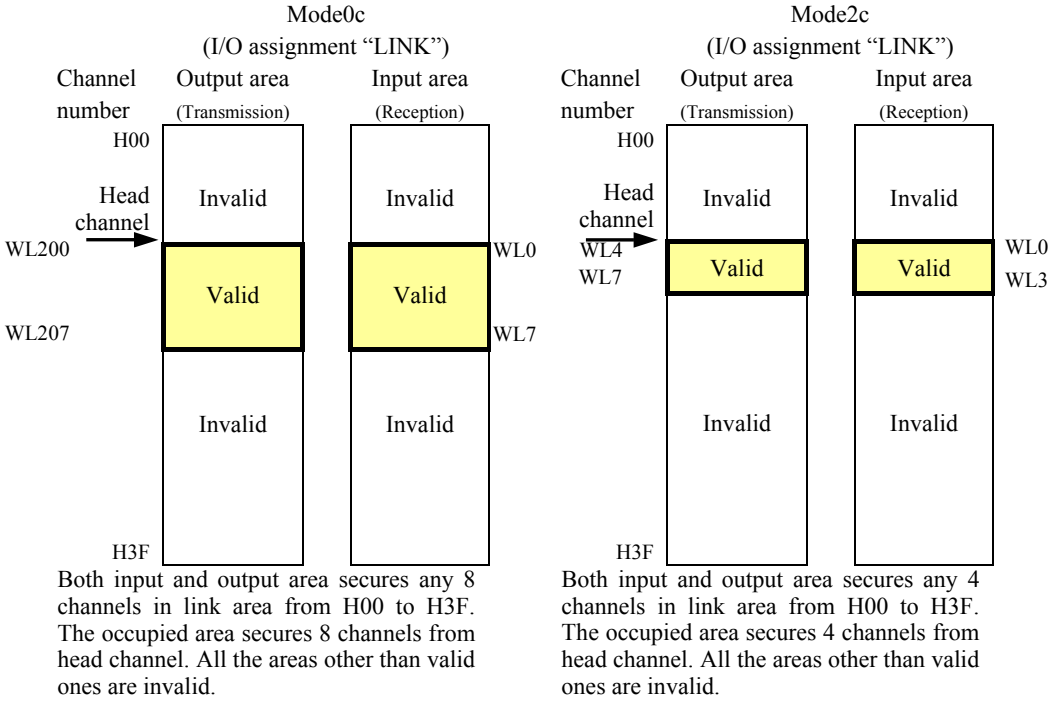
In the master and the slave station, the input area owns the link area from WL0 to WL3F. And the output area owns the link area from WL200 to WL23F. Each area owns 64 channels. The output area of the master station sets the area for using in the I/O link system by link parameter. And in the slave station, the occupied area sets the area by link parameter.

The output area data of the master station are stored in the input area of the slave station, and the output data of the slave station are stored in the input area of the master station. And the output data from other slave stations are stored in the output area that each slave station does not occupy. Therefore you can refer to the data that is sent from master station to other slave stations and from other slave stations to master station when CPU module reads the area that is not set by the link parameter in each slave station.

The data of the area that other stations occupy are updated as described below at the slave station.

When the slave station received the data of a master station and the other slave station, it stores data. And the slave station abandons the data when it received only data of either master station and slave station. Because it is detected an error as a transmission error then, it becomes the reception time-out error when this state continues more than 500ms. Therefore, the data of the input area are handled according to OUTPUT HOLD setting when the slave station leaves a system.

Refer to below about the operation mode “Mode0” and “Mode2c” that are different from REM-LH2 and HL-40DR/64DR.



Both input and output area secures any 8 channels in link area from H00 to H3F. The occupied area secures 8 channels from head channel. All the areas other than valid ones are invalid.

Both input and output area secures any 4 channels in link area from H00 to H3F. The occupied area secures 4 channels from head channel. All the areas other than valid ones are invalid.

Refer to below about a difference with REM-LH2 and HL-40DR/64DR.

In this operation mode "Mode0c", the input area (WL0 to WL7) and the output area (WL200 to WL207) own each 8 words. When you set the head channel number to module by the rotary switches, the head channel of the input area is assigned to WL0, and the head channel of the output area is assigned to WL200. And the occupied area owns 8 channels. The output area of the slave station sets any link area from WL200 to WL207.

Therefore, when the current products are replaced to compact link modules, the output area must change to the area after WL200 by the link parameter, and change the I/O numbers to the link numbers.

In this operation mode "Mode2c", the input area (WL0 to WL3) and the output area (WL4 to WL7) own each 4 words. And you can set any head channel number from H00 to H3F. When you set the head channel number to module by the rotary switches, the head channel of the input area is assigned to WL0, and the head channel of the output area is assigned to WL4.

2.5 Operation mode and function

EH-TRLLE can choose operation mode. Mode0 has 64 channels (2,048 points) per system, and can connect 12 modules in the system. So, we recommend this mode to new design for compact link system.

2.5.1 Function comparison of the operation 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			Mode0	Mode0c	Mode2c	Mode2	Mode1	Mode3	Mode0s
Functional specifications	I/O assignment		LINK			X4Y4W	Y8W	X8W	X1Y1W
	Function of master and slave station		Master/ Slave	Only slave		Master/ Slave			
	No. of mounted units		MAX 8 units per CPU (Note 1)			Non limit (Be depend to the CPU)			
	No. of connected slave modules		12 units per system						
	Maximum link points	Input	1,024	128	64	—	128	512	
		Output	1,024	128	64	128	—	512	
Use (Purpose of use)	When newly-designed		Available (Recommend)	Available					Available
	When I/O assignment of "LINK" is not enough		Not usable			Available (Note 2)			Available
	When module mounted on an expansion base unit		Not usable			Available (Note 2)			Available
	At the time of graded Replacement (When module connect with conventional products)		Available (Note 4)	Available (Note3)		Available			Available
	At the time of replacement of the whole system		Available (Note 4)	Available (Note3)		Available			Available
	When you want to use the CPU link module in EH-CPU104A/208A		Not usable			Available			Not usable (Note 5)
Remarks			Refer to section 4.3.1	Refer to section 4.3.3		Refer to section 4.3.2, from section 4.3.4 to 4.3.6			Refer to chapter 8

(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" and “Y8W” and “X8W” with all CPU modules.
(Note 3) When you replace REM-LH2, HL-40DR/64DR by EH-TRLLE, 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) Cannot use compact link modules, because there are not the FUN200 and FUN201 commands in EH-CPU104A/208A.

2.5.2 Operation mode combination of master station and slave station

Table 2.5.2 shows the use right or wrong when EH-TRLLE is set each operation mode as the master station and the slave station. See to do the choice of operation mode.

Table 2.5.2 Operation mode combination of master station and slave station

Operation mode		Slave station						
		Mode0	Mode0c	Mode2c	Mode2	Mode1	Mode3	Mode0s
Master station	Mode0	A	A	A	A	A	A	A
	Mode0c							
	Mode2c							
	Mode2	B	C	A	A	C	C	B
	Mode1	B	B	A	A		A	B
	Mode3	B	B	A	A	A		B
	Mode0s	A	A	A	A	A	A	A

A: Very effective EH-TRLLE can use all the occupation areas that set at the slave station.

B: Effective EH-TRLLE has few occupation areas that cannot use at the slave station.

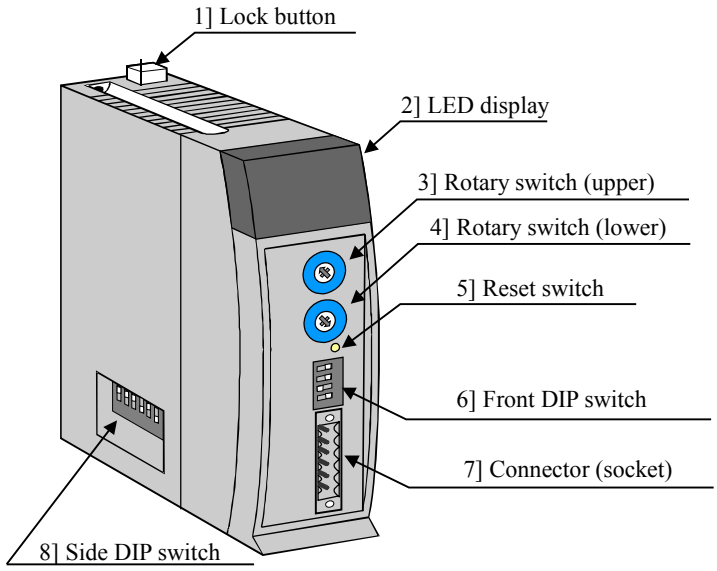
C: No effective EH-TRLLE has many occupation area that can't use at the slave station.

(Note 1) There is not the operation mode "Mode0c" and "Mode2c" to the master station.

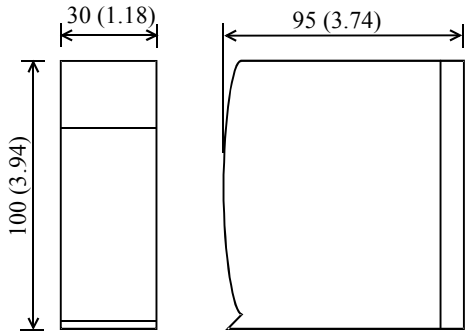
Chapter 3 Name and function of each part

3.1 Name and function of each part in link module

Name and function of each part



Model name	EH-TRLLE
Weight	Approx. 0.12kg (0.26lb.)
Consumption current (5VDC)	Approx. 270mA
Dimensions (mm (in.))	

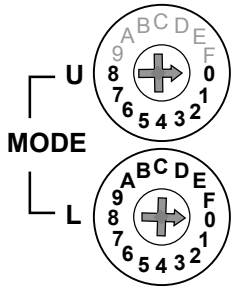


No.	Name	Function	Remarks
1]	Lock button	When dismounting the module from a base unit, press this button and lift up the module. The module can be fixed firmly by a screw (M4, 10mm (0.39 in.))	
2]	LED display	The status of module is displayed on this LED.	See a table shown below.
3]	Rotary switch (upper)	This is a switch to set head channel number for link module. The module that is set to 80h by rotary switches is a link master station.	See next page.
4]	Rotary switch (lower)		
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 an I/O assignment or set a value of terminators that built in link module.	See next page or later.

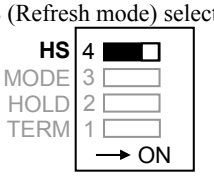
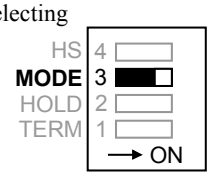
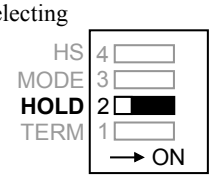
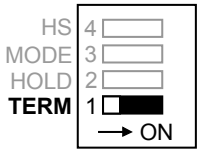
■ Description of LED display

LED	LED name	Indication	Details
CPU LINK EH-TRLLE 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

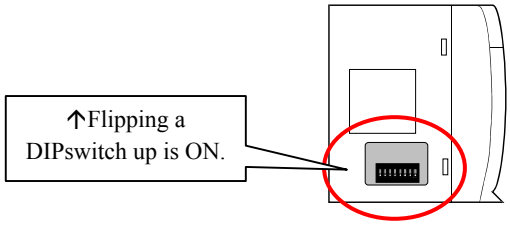
Rotary switch	Symbol	Meaning	Details of setting
 [Default setting: U=0, L=0]	U (Upper)	Head channel number/ master station setting	Set the head channel number of the link area that occupied in module. Set it in 00h to 3Fh ranges.
	L (Lower)		
	If setting number was beyond a range, EH-TRLLE becomes the hardware error.		

■ Description of Front DIP switch

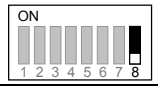
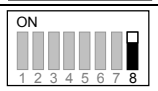
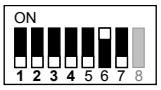
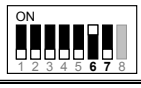
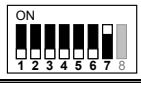
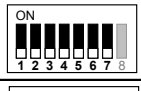
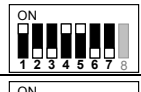
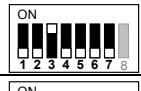
Symbol	Setting description	Details
HS	HS (Refresh mode) selecting  HS: Transmission interval OFF: Approx. 600µs ON: Approx. 6µs [Default setting: ON]	Refresh operation mode on link communication is set (High-speed or Low-speed). In the case of all station is EH-TRLLE and EH-TRMME/TRMLE the high-speed refresh mode can be selectable. When the conventional products are included in I/O link system, turn it off. The transmission interval of data changes by the setting of the refresh operation mode. Refer to section 4.6 about the calculation method of link refresh time. **HS** / Position / Link refresh mode selection OFF: Low-speed refresh mode ON: High-speed refresh mode
MODE	MODE (Communication mode) selecting  [Default setting: ON]	Always turn on this switch. **MODE** / Position / Communication mode selection OFF: Invalid ON: Compatible mode
HOLD	HOLD (Input hold function) selecting  [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 input area data at the communication error.) ON: Enable the input hold function (At the communication error, all input area data is held with last data received properly.)
TERM	TREM (Terminator insertion / Non-insertion) selecting  [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.



See the list below about setting the Dipswitch.

<table>
<tr><th>No.</th><th>Setting description</th><th>Details</th></tr>
<tr><td>1</td><td>Select the built-in terminator value
 
[Default setting: OFF]</td><td>100Ω or 150Ω terminators build in a link module, it chooses which terminator is inserted between A and B terminals of communication connector.
<table>
<tr><th>Bit8</th><th>Position</th><th>Selection of built-in terminator</th></tr>
<tr><td>OFF</td><td>  </td><td>100 Ω (for recommended 0.3mm^2 and 0.5 mm^2 twisted pair cable)</td></tr>
<tr><td>ON</td><td>  </td><td>150 Ω (for recommended 0.75mm^2 twisted pair cable)</td></tr>
</table></td></tr>
<tr><td>2</td><td>Select the I/O assignment
 
[Default setting: No.6 ON]</td><td>Set the I/O assignment of the module.
<table>
<tr><th>Bit1</th><th>Bit2</th><th>Bit3</th><th>Bit4</th><th>Bit5</th><th>Bit6</th><th>Bit7</th><th>Position</th><th>IO assignment</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>OFF</td><td>  </td><td>LINK (1)</td></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>  </td><td>LINK (2)</td></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>  </td><td>LINK (3)</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>  </td><td>Y8W</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>  </td><td>X4Y4W</td></tr>
<tr><td>OFF</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>OFF</td><td>OFF</td><td>  </td><td>X8W</td></tr>
</table></td></tr>
</table>

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	Operation mode	EH-CPU104A EH-CPU208A	EH-CPU316A EH-CPU516 EH-CPU548	EHV-CPU16 EHV-CPU32 EHV-CPU64 EHV-CPU128	I/O link points
LINK (1)	Mode0	Not available	Available	Available	Input: 1,024 points/ Output: 1,024 points
LINK (2)	Mode2c	Not available	Available	Available	Input: 64 points / Output: 64 points
LINK (3)	Mode0c	Not available	Available	Available	Input: 128 points / Output: 128 points
Y8W	Mode1	Available	Available	Available	Output: 128 points
X4Y4W	Mode2	Available	Available	Available	Input: 64 points / Output: 64 points
X8W	Mode3	Available	Available	Available	Input: 128 points

Mode0, Mode1, Mode2, Moder3: Compatible mode of REM-MMH/LMH
Mode0c, Mode2c: Compatible mode of REM-LH2

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 the master station are stored away in the external inputs area.

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

Chapter 4 Basic functions and System configuration

4.1 Selection of CPU module for compact link system

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

(1) “LINK” method Mode0, Mode0c, Mode2c

(2) “Y8W” method Mode1

(3) “X4Y4W” method Mode2

(4) “X8W” method Mode3

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 2,048 points per system, and is free to use sends 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 "Y8W" or "X4Y4W" or "X8W" for I/O assignment of link module.

In the case of "Y8W" or "X4Y4W" or "X8W" I/O assignment 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		Mode0	Mode0c	Mode2c	Mode1 (Note1)	Mode2 (Note1)	Mode3 (Note1)
CPU module	EHV-CPU16/32/64/128	Usable					
	EH-CPU316A/516/548	Usable					
	EH-CPU104A/208A	Unusable			Usable		
I/O assignment		“LINK”			“Y8W”	“X4Y4W”	“X8W”
Number of mountable link module		8 modules/CPU			Not limited (According to CPU)		
Number of connectable slave modules		8 modules / system					
Link points	Input	1,024	128	64	—	64	128
	Output	1,024	128	64	128	64	—
Special internal outputs for link function		Usable (Note 2)			Usable (Note 3)		
Operation parameters for link function		Usable			Unusable		
Reference section	Basic system	Section 4.3.1, 4.3.3			Section 4.3.2, 4.3.4 to 4.3.6		
	Replace of REM-LH2	Section 4.5			—		
	Replace of REM-MMH/LMH	Section 4.4			—		

(Note 1) The send area uses the external outputs area. The received area from other stations uses the external inputs area.

(Note 2) Refer to section 6.2 about the available special internal outputs for link function.

(Note 3) 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-TRLLE) 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 section 1.1.2 of this manual or EH-150 application manual.

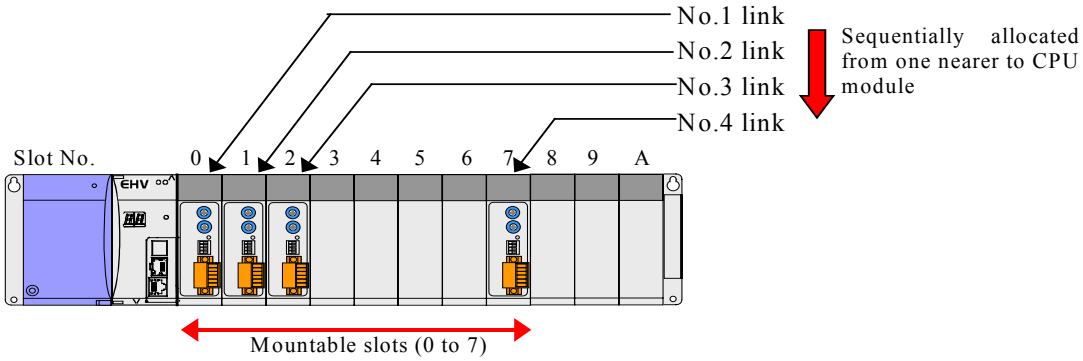


Figure 4.2.1 Mounting position and link system number of compact link module

(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.

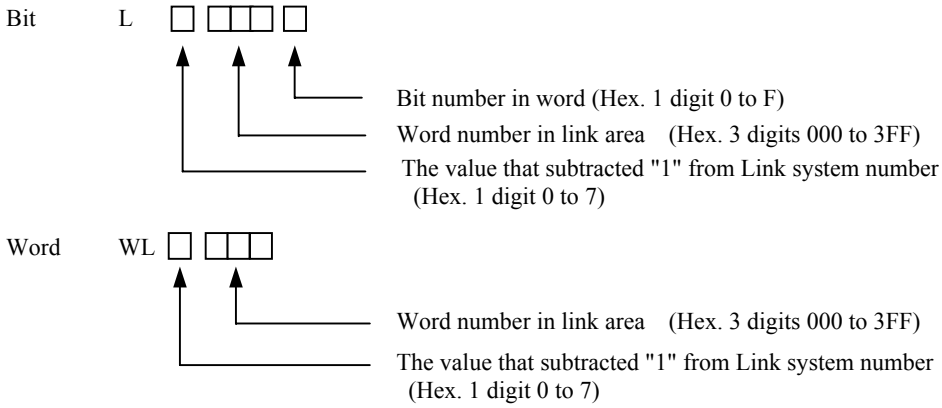


Figure 4.2.2 I/O number of link area

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.

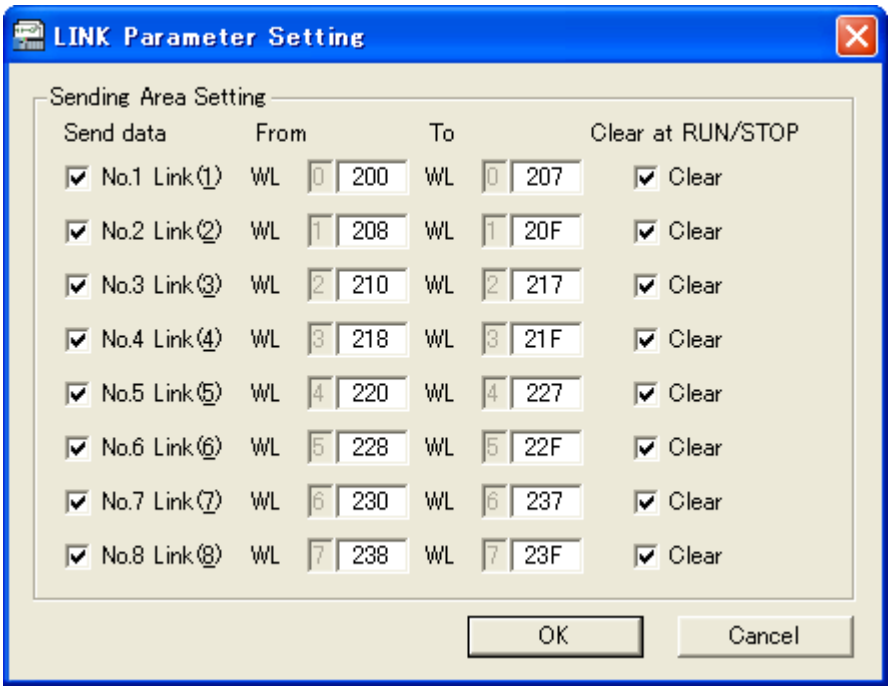


Figure 4.2.3 Link parameter setting by Control Editor

The send area of the station that changed the link parameter is changed when you change the link parameter of EH-TRLLE after communication was started. Then the data of link data and the link operation status flag are shown in Table 4.2.1.

Table 4.2.1 Operation at the time of the link parameter change

Parameter change		Link data and link operation status flag		Remarks
Target station	Area	Master station	Slave station	
Master station	Increase	The data of the increased area are updated.		
	Decrease	The data of the decreased area are held.	The data depend on the decreased area.	(Note 1)
Slave station	Increase	The data of the increased area are updated.		
	Decrease	The data of the decreased area are cleared.		(Note 2)

(Note 1) The operation of slave station occupying the decreased area is shown as follows. The data are held in the master station and the other slave stations.

- When there is the channel which the target slave station occupies in the send area of the master station, the data are held. On the other hand, when there is not the occupied channel, the data are cleared.

(Note 2) The cleared range of link data is an input area. (at setting "HOLD:OFF") The input area is held at setting "HOLD:ON". The data of the output area are held.

When the operation mode of the slave station is set in Mode0 or Mode0s, the send area of the slave station decreases for the change of the link parameter. Then the decreased area is the received area from other stations. However, the data of the decreased area are cleared at setting "HOLD:OFF" because the send area disappears from slave stations.

When the send area increases, the link participation flag of the increased area are updated. However, these flag are held until a power supply is OFF. When you want to clear the held data about the link participation flag and the link operation status flag, turn on a power supply again.

(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. In the case of the operation mode "Mode0", set the transmission area of the master station and the slave station after WL200. 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 sends area is duplicated, the received area data in other links are updated to their send area data sequentially.

In the case of the operation mode “Mode0c or Mode2c”, it is different of the used area.

(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.

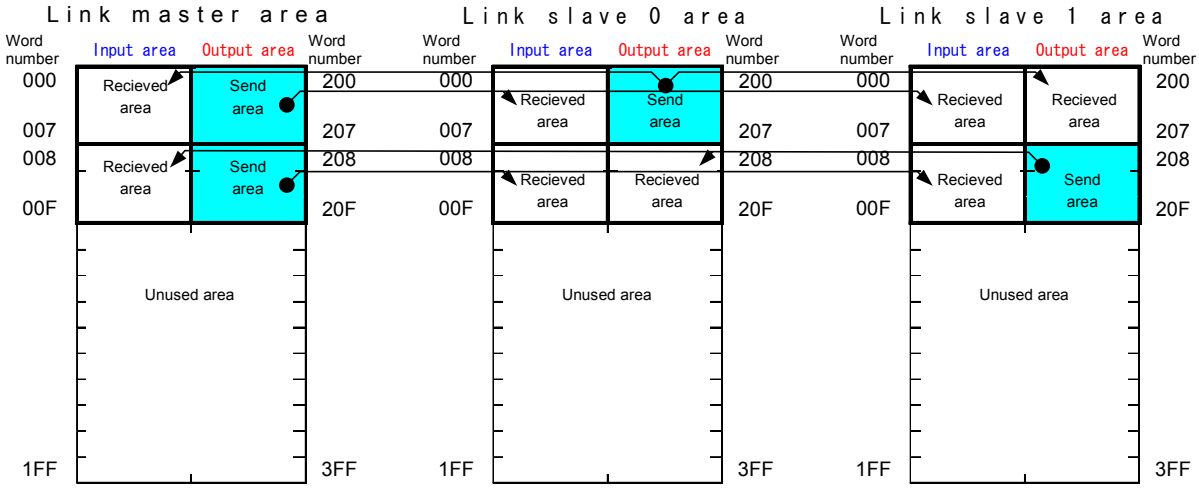


Figure 4.2.4 Send area and a link communication

4.2.3 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-TRLLE) are shown in Section 4.3.1 to 4.3.6.

4.3.1 System configuration example (Master/ Slave: Mode0)

Figure 4.3.1 is the system configuration example that compact link modules were set to Mode0. When the compact link module was set to Mode0, I/O assignment becomes "LINK". Refer to section 3.1 for the setting method of the Mode0.

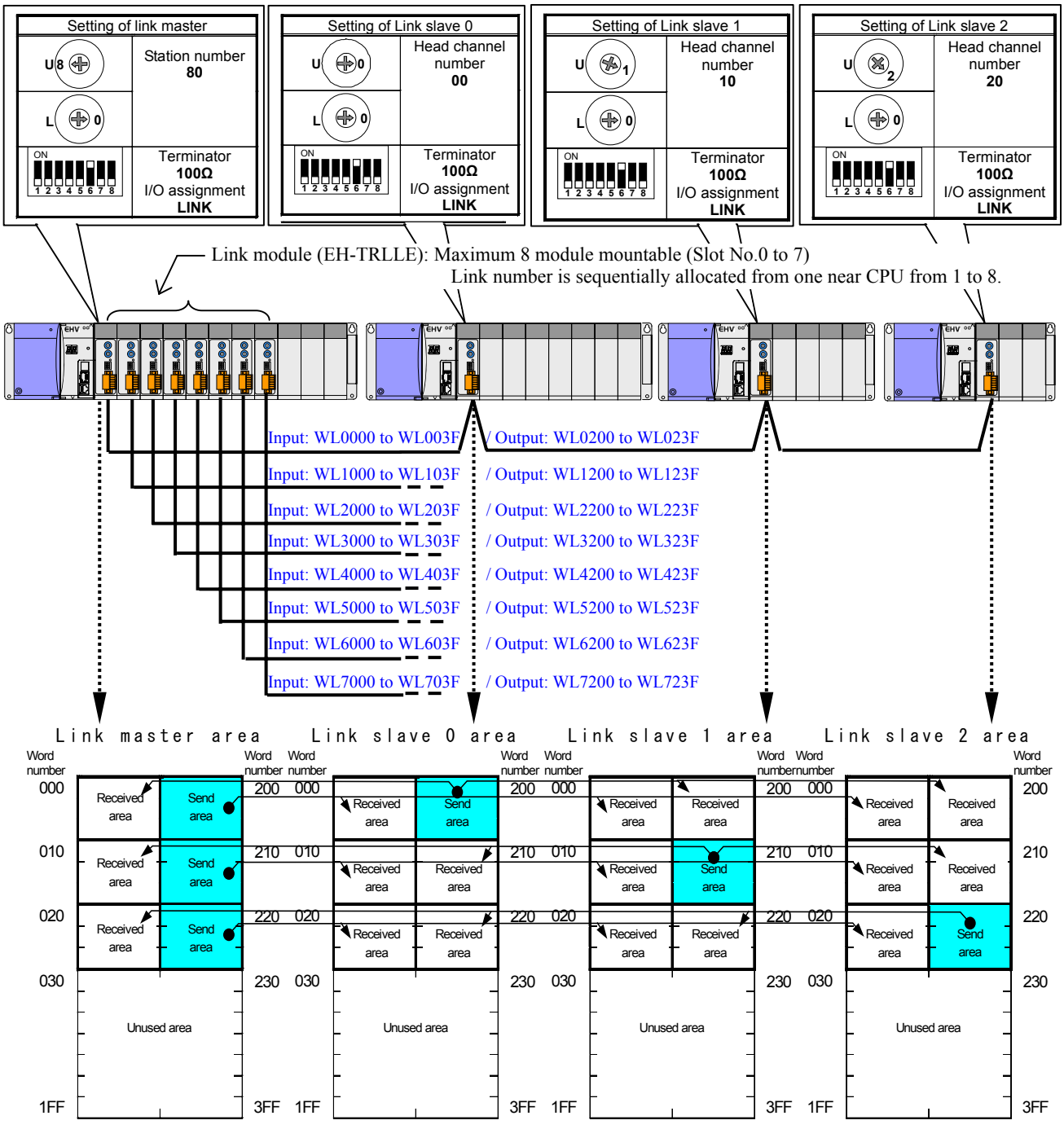


Figure 4.3.1 System configuration example (Master/ Slave: Mode0)

[Explanations]

1) There is the link area of 1,024 words (000 to 3FF) in CPU module. Link area is used as the input area from WL0 to WL3F and as the output area from WL200 to WL23F. 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) The output area of the master station sets the area for using in the I/O link system by link parameter. The input area is the received data area from the slave stations.
3) In slave station, the output area except the send data area is the received data area from other slave station and the input area is the received data area from master station.
4) This operation mode can connect to maximum 12 slave stations per system. (Figure 4.3.1 is the example that 3 slave stations were connected.)
5) Compact link modules can mount maximum 8 modules per CPU to the base unit depending on combination with CPU. The link modules are assigned LINK from No.1 to No.8 in the order that is near to CPU. Refer to section 4.2.1 (1) for the details.
6) Mountable slots on the compact link modules are slots from 0 to 7. There is a limit according to combination with using CPUs and base units. Refer to section 1.1 for the details.
7) There are rotary switches and dipswitch in the compact link module, and set the switches to the head channel number, operation mode 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.
8) I/O assignment is set to CPU by programming software.
9) The data of the area that other stations occupy are updated as described below at the slave station.
   When the slave station received the data of a master station and the other slave station, it stores data. And the slave station abandons the data when it received only data of either master station and slave station. Because it is detected an error as a transmission error then, it becomes the reception time-out error when this state continues more than 500ms. Therefore, the data of the input area are handled according to OUTPUT HOLD setting when the slave station leaves a system.
   Example: If the slave station 2 leaves a system, the link data are updated below.

   The data of the input area (WL20 to WL2F) are handled according to OUTPUT HOLD setting at master station.

   The data of the input area (WL20 to WL2F) are handled according to OUTPUT HOLD setting at slave station 0 or 1. And the data of the output area (WL220 to WL22F) hold the data that they received just before that if it does not become the reception time-out error.

   The data of the input area (WL0 to WL2F) are handled according to OUTPUT HOLD setting at slave station 2. And the data of the output area (WL200 to WL21F) hold the data that they received just before that if it does not become the reception time-out error.

4.3.2 System configuration example (Slave: Mode1/ Mode2/ Mode3)

Figure 4.3.2 is the system configuration example that master station is set to Mode0 and slave stations are set to Mode1 or Mode2 or Mode3 as operation mode. Refer to section 3.1 for the setting method of the compatible mode.

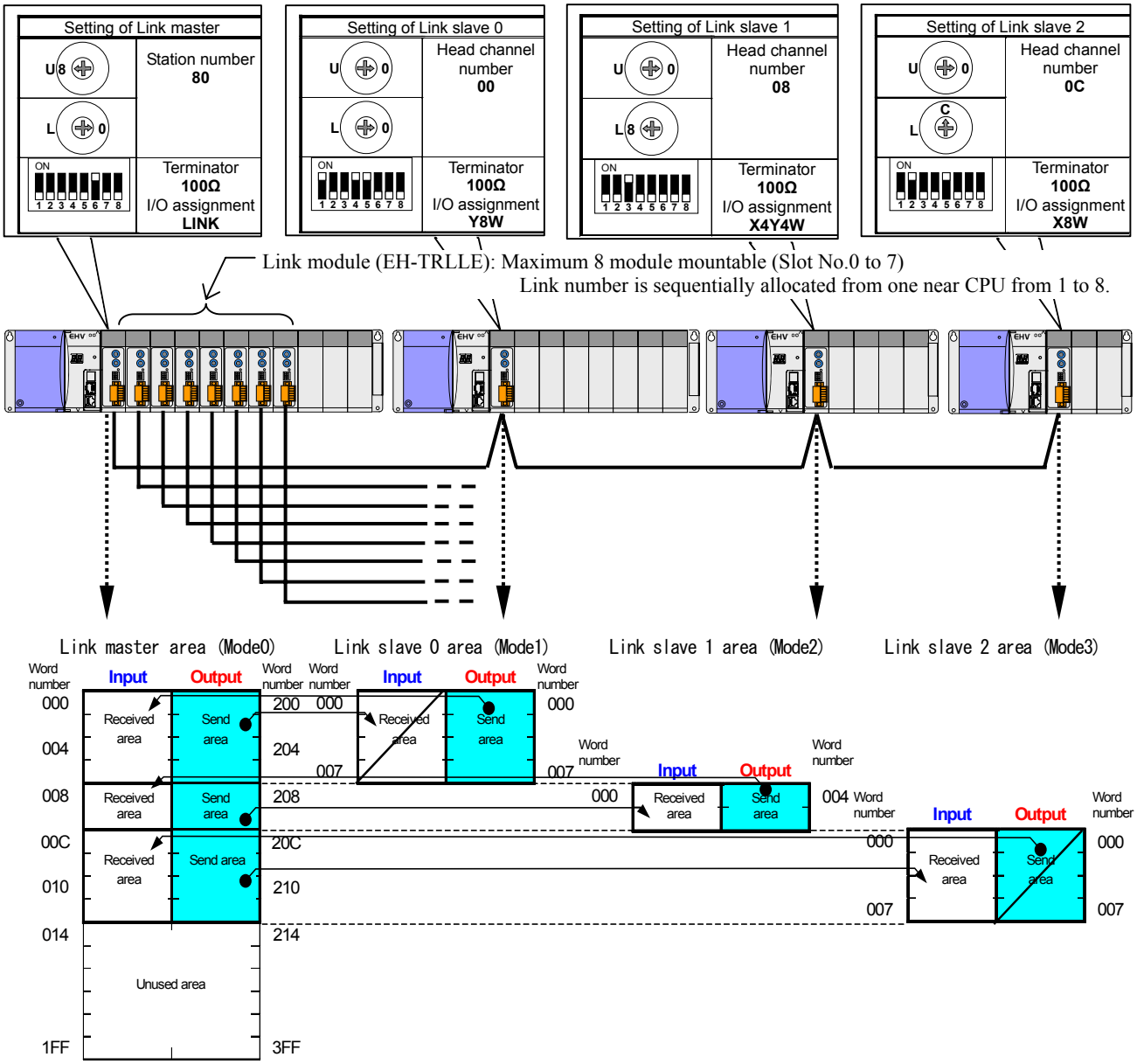


Figure 4.3.2 System configuration example (Slave: Mode1/ Mode2/ Mode3)

[Explanations]

1) In the case of operation mode "Mode0" of the master station, the slave stations can set the operation modes of Mode1 or Mode2 or Mode3.
2) When the slave station is set the rotary switches to the operation mode "Mode1", the head channel number is the head I/O number (in the case of figure 4.3.2: WY0), and the module occupies 8 channels from head channel. This mode is the operation mode that there are the outputs of 128 points. CPU module can't read the input area of the compact link module.
3) When the slave station is set the rotary switches to the operation mode "Mode2", the head channel number is the head I/O number (in the case of figure 4.3.2: WX0 and WY4), and the module occupies 4 channels from head channel. This mode occupies 4 channels as the pair of each input and output, and there are the inputs of 64 points and the outputs of 64 points.
4) When the slave station is set the rotary switches to the operation mode "Mode3", the head channel number is the head I/O number (in the case of figure 4.3.2: WX0), and the module occupies 8 channels from head channel. CPU module can't write the output area of the compact link module.
5) I/O numbers of link area are as follows. CPU module accesses to the compact link module as the I/O module, because the I/O assignment of module is set except "LINK". So, I/O number for link area becomes I/O number that mounted compact link module on slot of base unit.

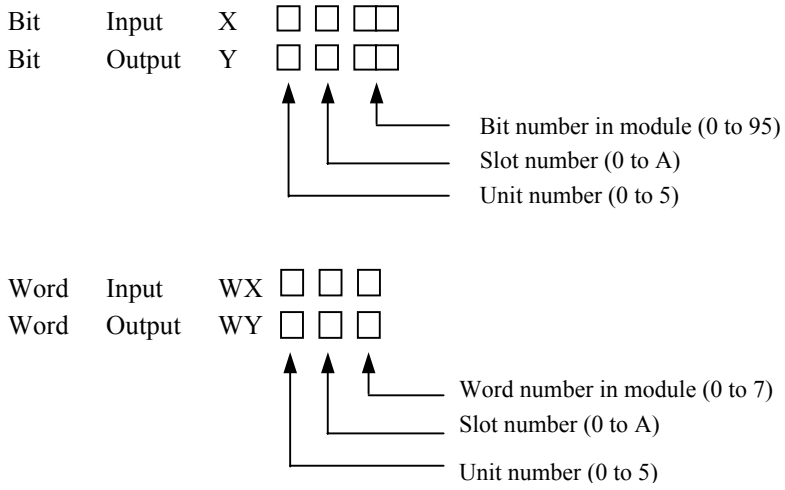


Figure 4.3.3 I/O number of link area in the “Y8W” or "X4Y4W" or “X8W” method

6) Bit number in module is from 0 to 95. Therefore, use the word number as WY6 and WY7 in Figure 4.3.2 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 as shown in Figure 4.3.4.

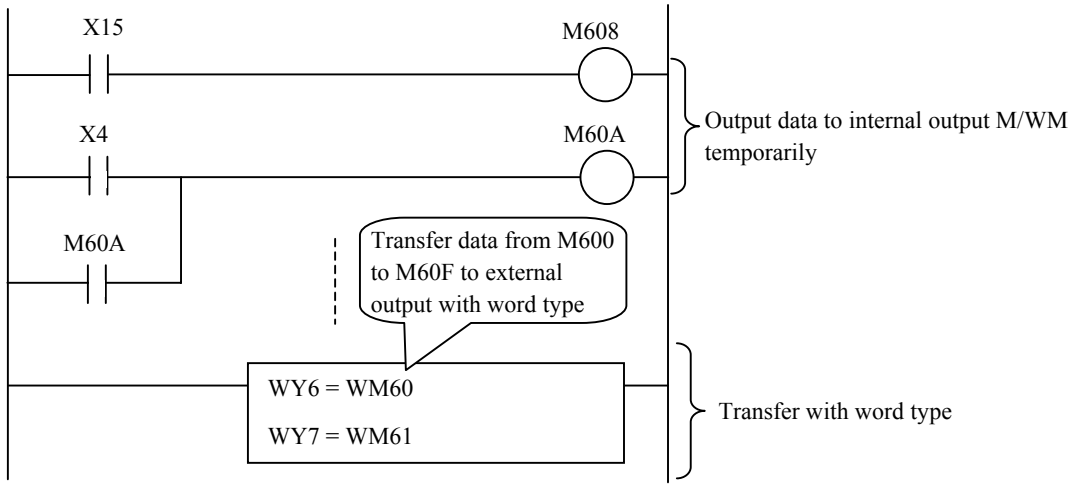


Figure 4.3.4 Sample program with bit I/O numbers that exceed 95

7) In the case of I/O assignment "X4Y4W", output area is compacted in the module, and the link area is assigned the channel number from 0 to 3 shown in Figure 4.3.5. Therefore the module occupies 4 channels from head channel.

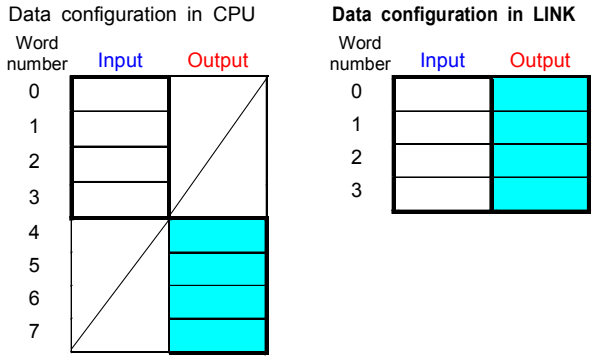


Figure 4.3.5 Data configuration with the operation mode “Mode2”

8) When the slave station is set the operation mode in Mode1 or Mode2 or Mode3, the CPU module corresponding to each slave station can refer to only the area data that the slave station occupies.

4.3.3 System configuration example (Slave: Mode0c/ Mode2c)

Figure 4.3.6 is the system configuration example that master station is set to Mode0 and slave stations are set to Mode0c or Mode2c as operation mode. Refer to section 3.1 for the setting method of the compatible mode.

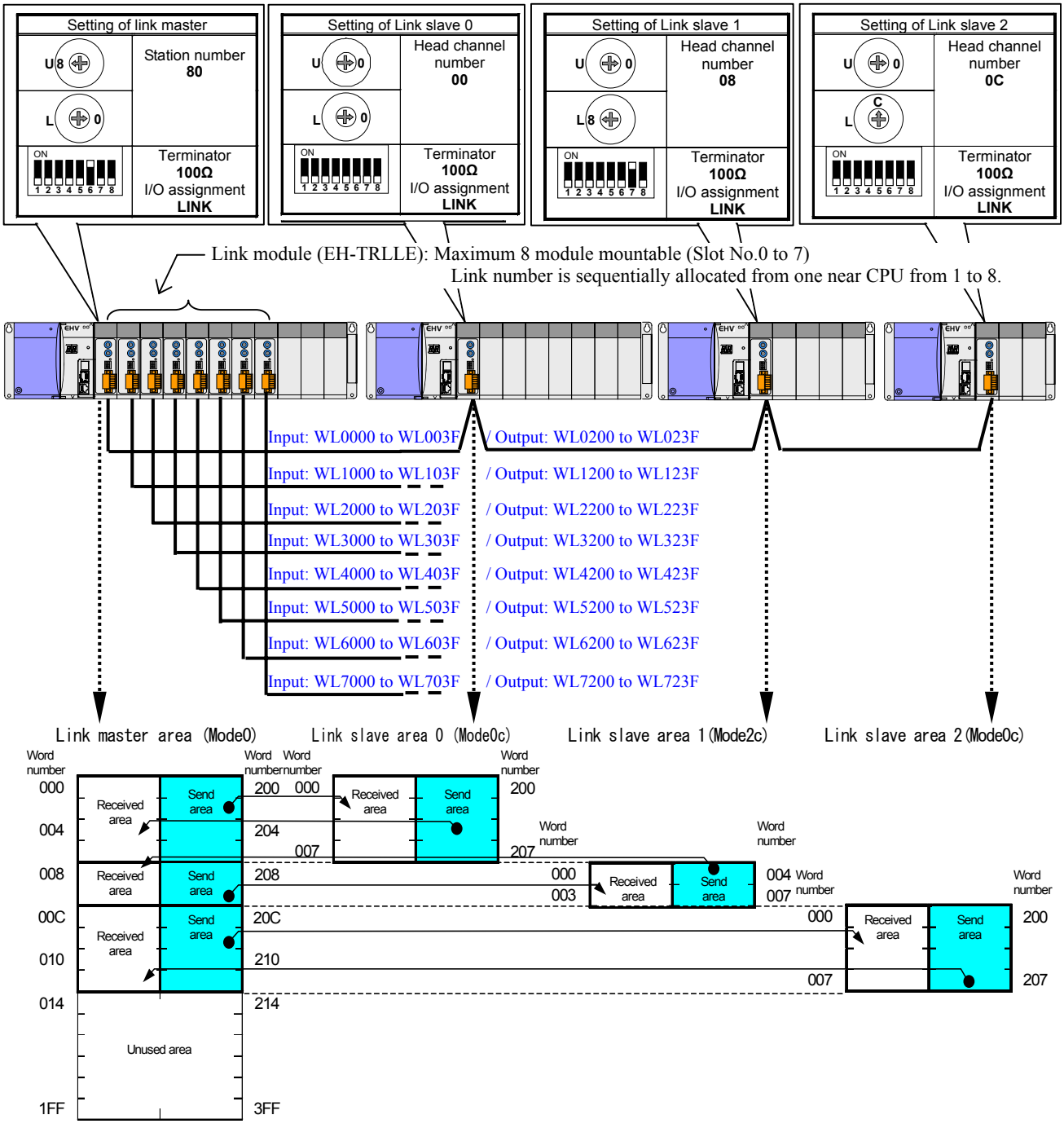


Figure 4.3.6 System configuration example (Slave: Mode0c/ Mode2c)

[Explanations]

1) In the case of operation mode "Mode0" of the master station, the slave stations can set the operation modes of Mode0c or Mode2c. The operation mode "Mode0c" and "Mode2c" are compatible mode of link module REM-LH2 for H-200/250/252B/252C series.
2) When the slave station is set the rotary switches to the operation mode "Mode0c", the head channel number is the head number of the link area (in the case of figure 4.3.6: WL0), and the module occupies 8 channels from head channel. In this mode, the output area of the slave station sets the link area from WL200 to WL207 by link parameter. So, the input area owns link area from WL0 to WL7. There are the inputs of 128 points and the outputs of 128 points.
3) When the slave station is set the rotary switches to the operation mode "Mode2", the head channel number is the head number of the link area (in the case of figure 4.3.6: WL0 and WL4), and the module occupies 4 channels from head channel. In this mode, the output area of the slave station sets the link area from WL4 to WL7 by link parameter. So, the input area owns link area from WL0 to WL3. In this mode, output area is compacted in the module, and the link area is assigned the channel number from 0 to 3 shown to Figure 4.3.7. So there are the inputs of 64 points and the outputs of 64 points.

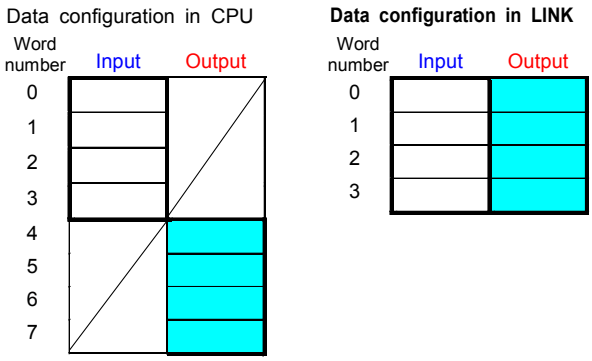


Figure 4.3.7 Data configuration with the operation mode “Mode2c”

4.3.4 System configuration example (Master: Mode1)

Figure 4.3.8 is the system configuration example that master station is set to Mode1. Refer to section 3.1 for the setting method of the compatible mode.

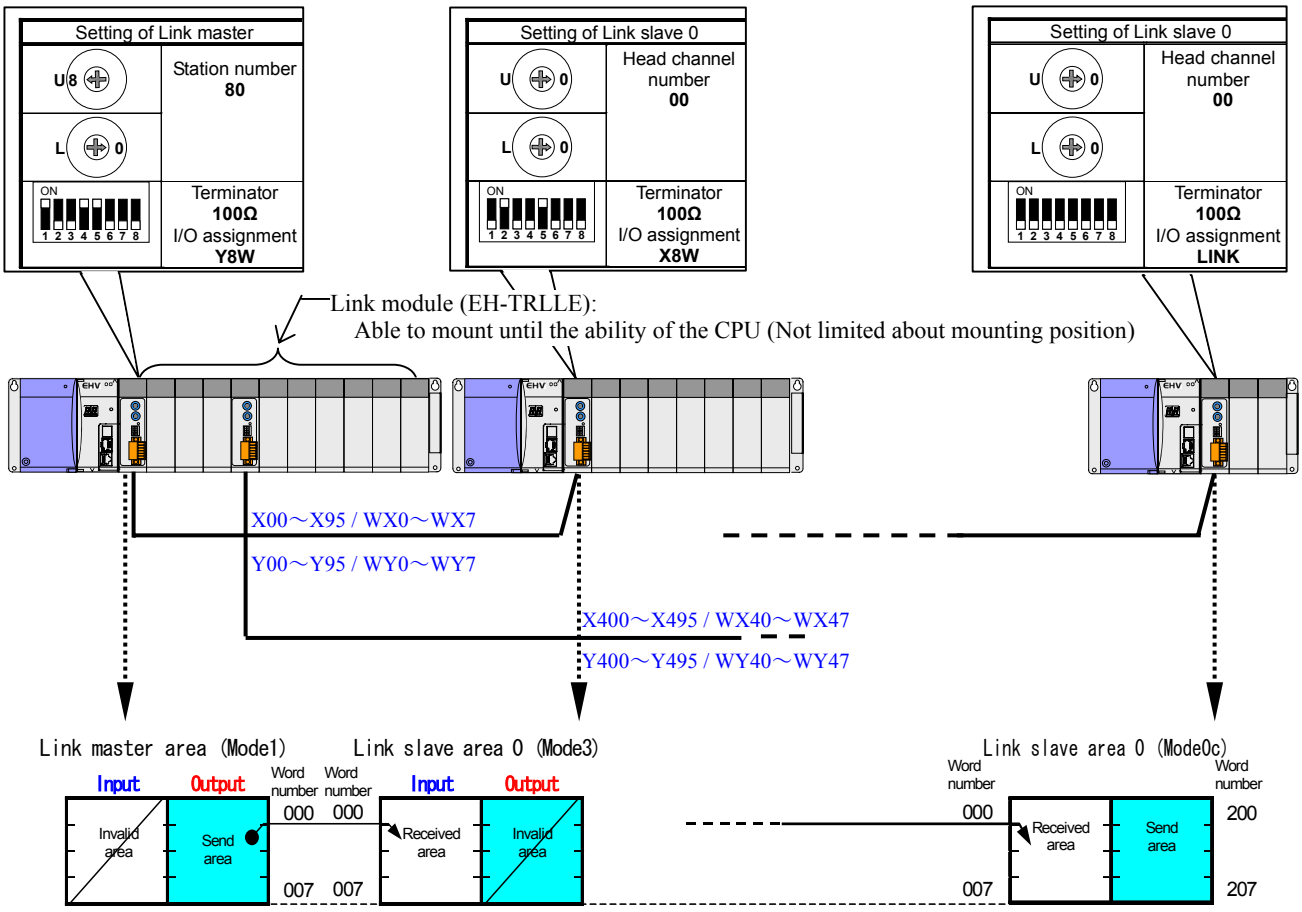


Figure 4.3.8 System configuration example (Master: Mode1)

[Explanations]

1) In the case of operation mode "Mode1" of the master station, the slave stations can set the operation modes of Mode3 or Mode0c.
2) When the slave station is set the rotary switches to the operation mode "Mode3", the head channel number is the head I/O number (in the case of figure 4.3.8: WX0), and the module occupies 8 channels from head channel.
3) When the slave station is set the rotary switches to the operation mode "Mode0c", the head channel number is the head number of the link area (in the case of figure 4.3.8: WL0), and the module occupies 8 channels from head channel. In this mode, the output area of the slave station sets the link area from WL200 to WL207 by link parameter. So, the input area owns link area from WL0 to WL7. There are the inputs of 128 points and the outputs of 128 points.
4) When the master station is set operation mode "Mode1", the external input area is invalid. So, CPU module can't refer to the data that is sent from the slave station set to the operation mode "Mode0c".

4.3.5 System configuration example (Master: Mode3)

Figure 4.3.9 is the system configuration example that master station is set to Mode3. Refer to section 3.1 for the setting method of the compatible mode.

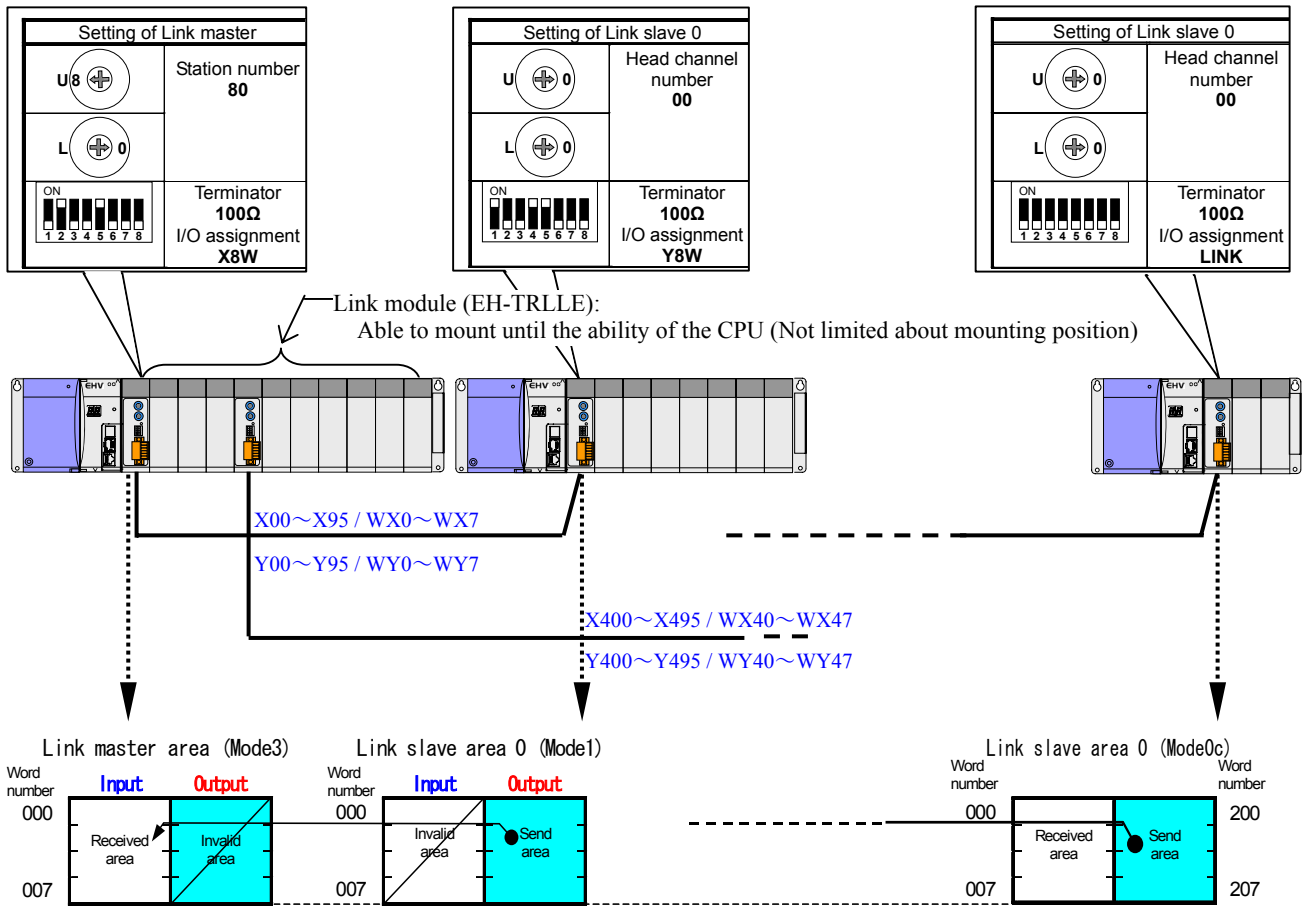


Figure 4.3.9 System configuration example (Master: Mode3)

[Explanations]

1) In the case of operation mode "Mode3" of the master station, the slave stations can set the operation modes of Mode1 or Mode0c.
2) When the slave station is set the rotary switches to the operation mode "Mode1", the head channel number is the head I/O number (in the case of figure 4.3.9: WY0), and the module occupies 8 channels from head channel.
3) When the slave station is set the rotary switches to the operation mode "Mode0c", the head channel number is the head number of the link area (in the case of figure 4.3.9: WL0), and the module occupies 8 channels from head channel. In this mode, the output area of the slave station sets the link area from WL200 to WL207 by link parameter. So, the input area owns link area from WL0 to WL7. There are the inputs of 128 points and the outputs of 128 points.
4) When the slave station is set operation mode "Mode3", the external output area is invalid. So, CPU module doesn't refer to the data that is sent from the master station.

4.3.6 System configuration example (Master: Mode2)

Figure 4.3.10 is the system configuration example that master station is set to Mode2. Refer to section 3.1 for the setting method of the compatible mode.

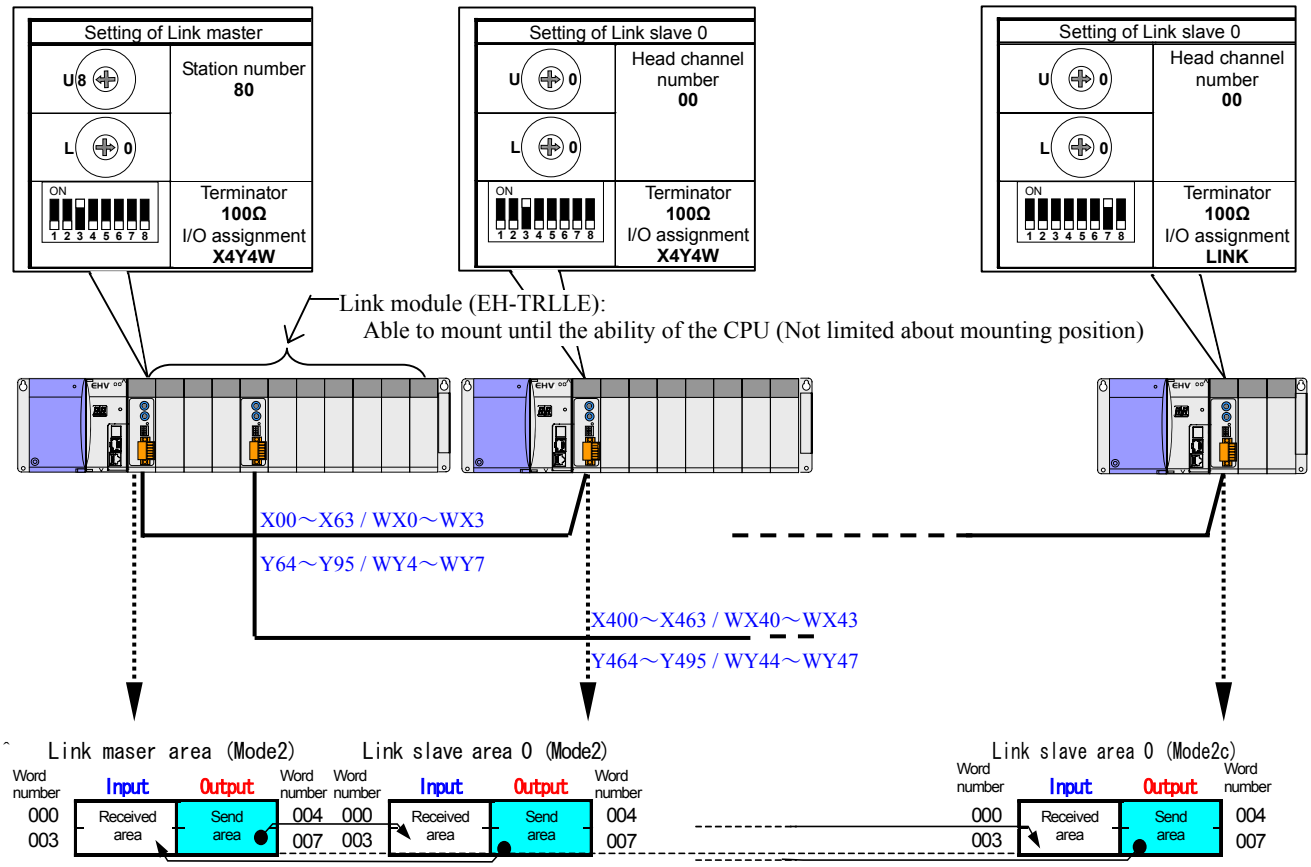


Figure 4.3.10 System configuration example (Master: Mode2)

[Explanations]

1) In the case of operation mode "Mode2" of the master station, the slave stations can set the operation modes of Mode2 or Mode2c.
2) When the slave station is set the rotary switches to the operation mode "Mode2", the head channel number is the head I/O number (in the case of figure 4.3.10: WX0 and WY4). And the output area is compacted in the module, and the link area is assigned the channel number from 0 to 3. Therefore the module occupies 4 channels from head channel. So there are the inputs of 64 points and the outputs of 64 points.

3 When the slave station is set the rotary switches to the operation mode "Mode2c", the head channel number is the head number of link area (in the case of figure 4.3.10: WL0 and WL4). And the output area is compacted in the module, and the link area is assigned the channel number from 0 to 3. Therefore the module occupies 4 channels from head channel. So there are the inputs of 64 points and the outputs of 64 points.

4.3.7 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 4.3.11. Refer to EH-150 application manual about the details of FUN 201 command.

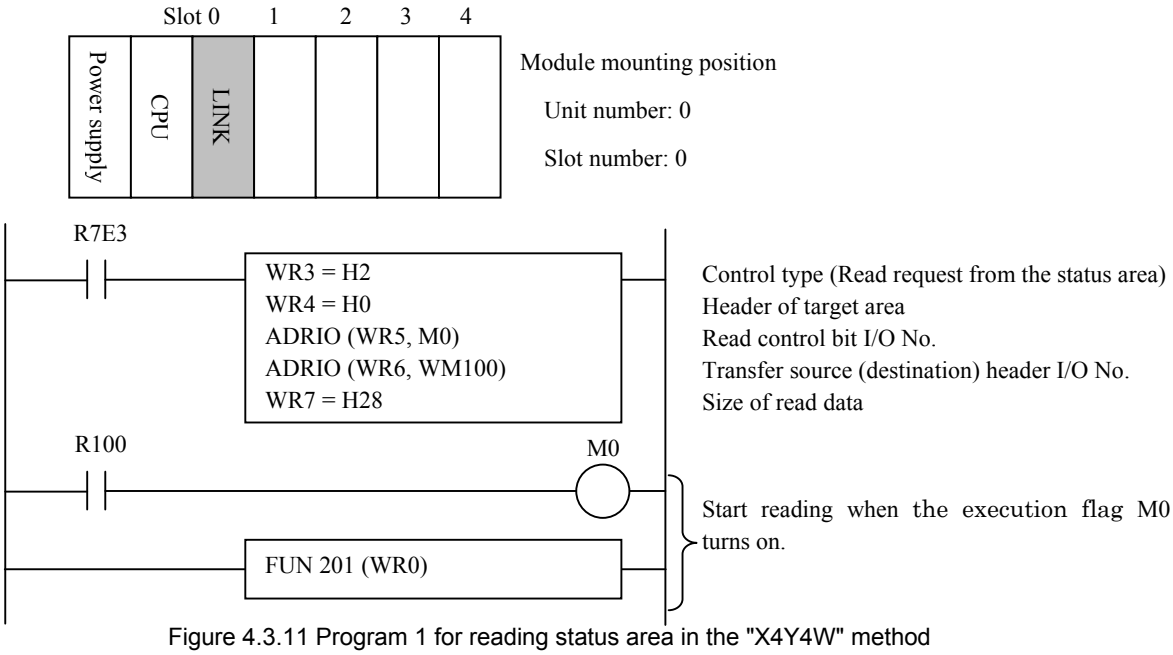


Figure 4.3.11 Program 1 for reading status area in the "X4Y4W" method

(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 4.3.12. Refer to EHV-CPU programming manual about the details of SCRW command.

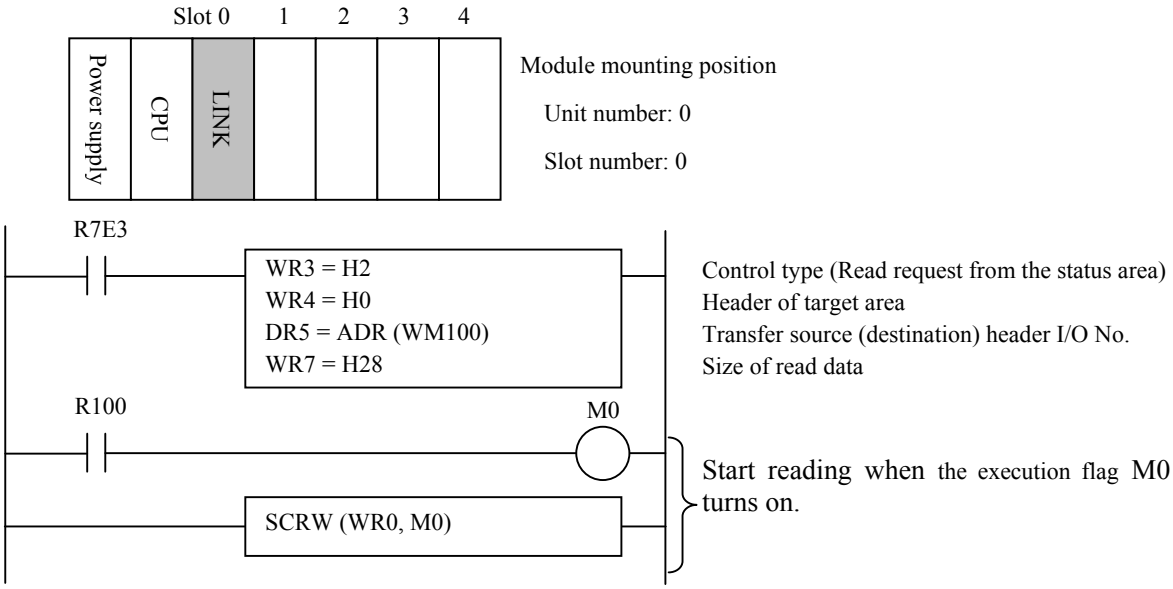


Figure 4.3.12 Program 2 for reading status area in the "X4Y4W" method

4.4 Replacement from H-302/702/2002/4010 series

This compact link module (EH-TRLLE) has communication-compatibility with the remote I/O MINI module for H-302/702/2002/4010 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.

4.4.1 Replacement configuration example of H series (Master/ Slave: Mode0)

Figure 4.4.1 shows the system configuration example of the H 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 series in order to postpone the wiring work of stations. In this case, please turn off high-speed refresh mode (HS) of the front Dipswitch of the compact link modules.

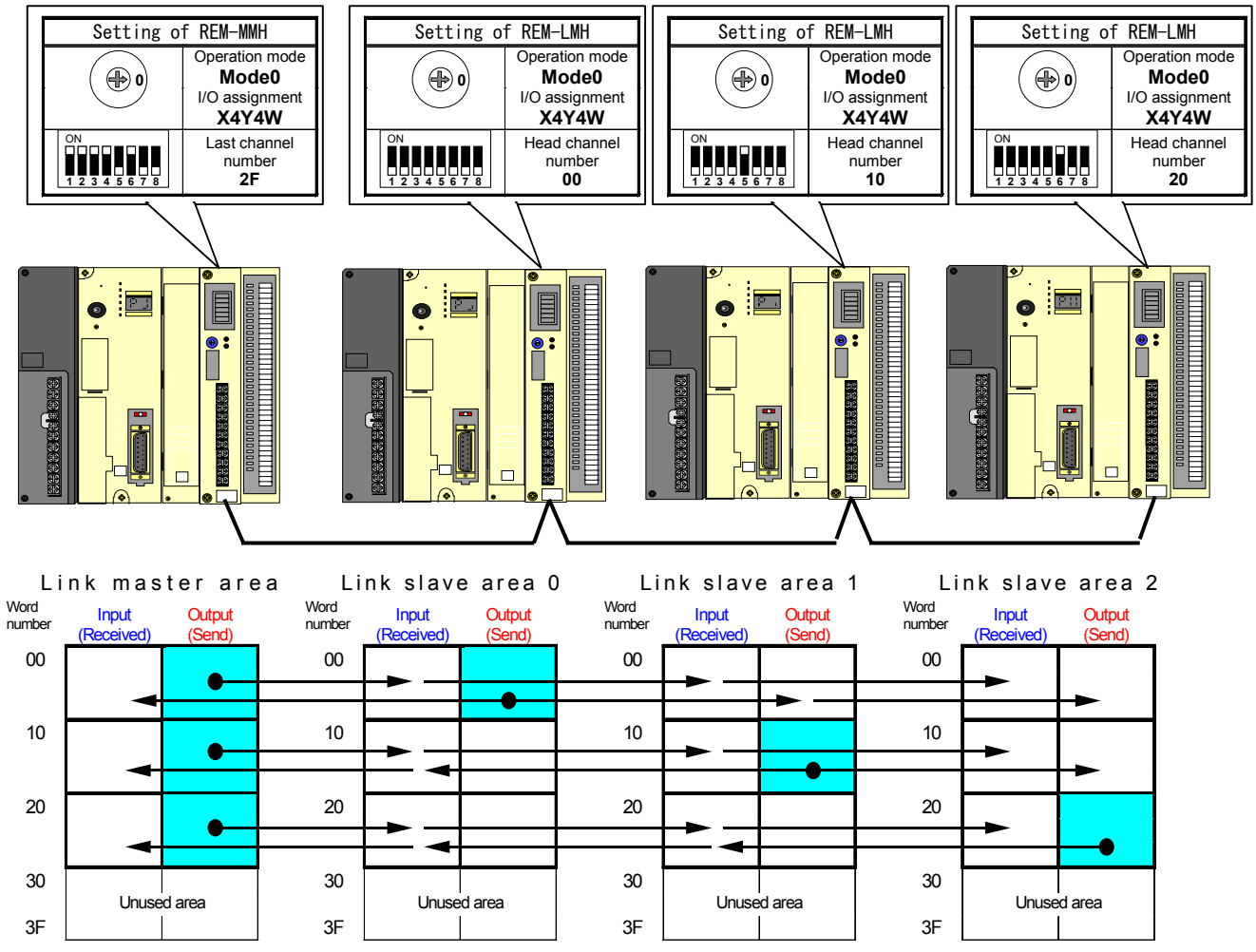


Figure 4.4.1 System configuration example (Master/ Slave: Mode0)

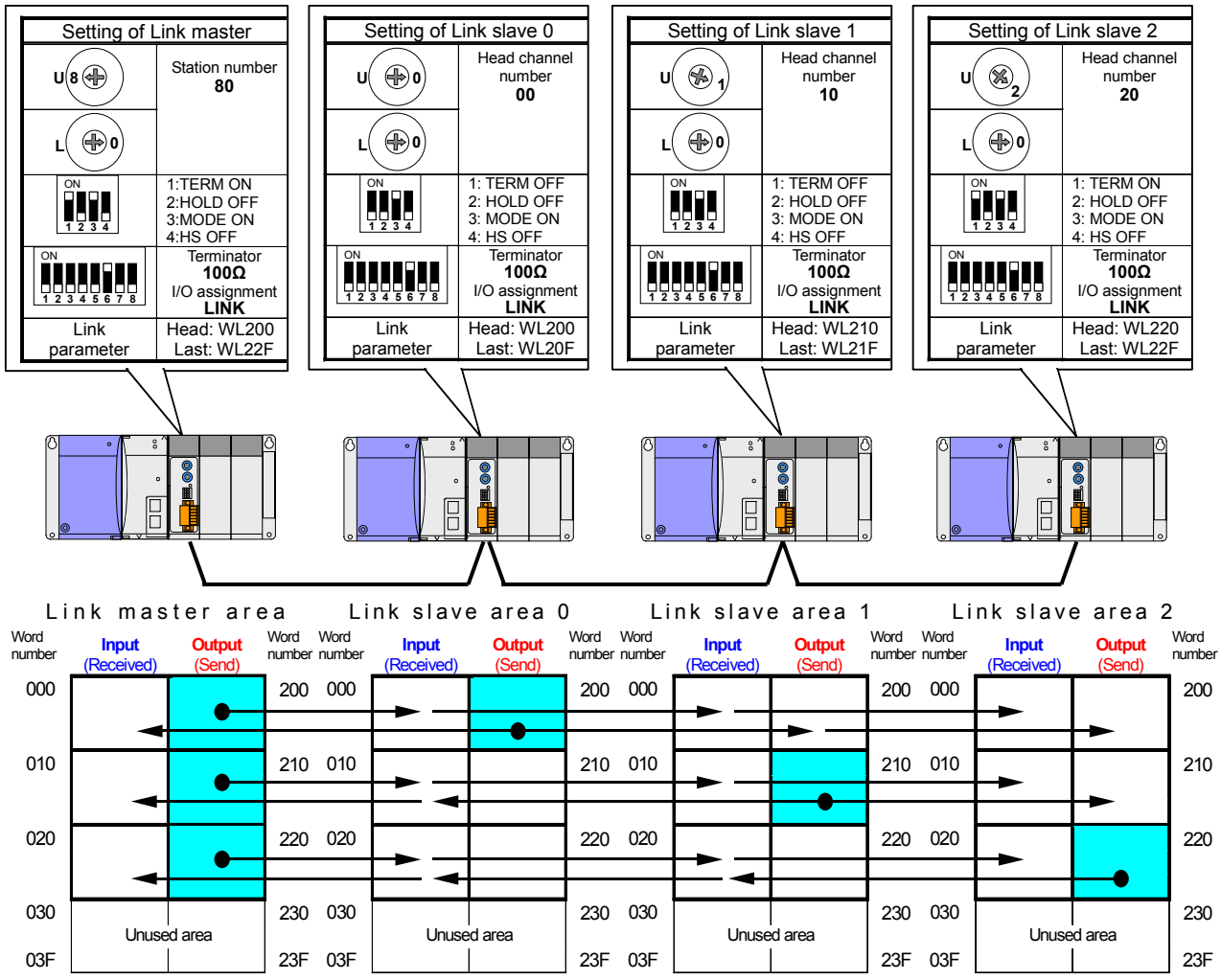


Figure 4.4.2 Replacement system configuration example (Master/ Slave: Mode0)

[Explanations]

1) Set the head channel number and the operation mode etc. to rotary switches and Dipswitch. Refer to section 3.1 for the setting method of some switches. In addition, change the value of the terminator according to a use cable.
2) The output area of the master station sets the link area from WL200 to WL22F by link parameter, and the input area owns link area from WL0 to WL2F. So the data received from slave stations is stored in the input area.
3) The send area of the slave station sets the area by link parameter in the range from WL200 to WL22F. The output area except the send data area is the received data area from other slave station and the input area is the received data area from master station.
4) The data of the area that other stations occupy are updated as described below at the slave station.
   When the slave station received the data of a master station and the other slave station, it stores data. And the slave station abandons the data when it received only data of either master station and slave station. Because it is detected an error as a transmission error then, it becomes the reception time-out error when this state continues more than 500ms. Therefore, the data of the input area are handled according to OUTPUT HOLD setting when the slave station leaves a system.
   Example: If the slave station 2 leaves a system, the link data are updated below.
   The data of the input area (WL20 to WL2F) are handled according to OUTPUT HOLD setting at master station.
   The data of the input area (WL20 to WL2F) are handled according to OUTPUT HOLD setting at slave station 0 or 1. And the data of the output area (WL220 to WL22F) hold the data that they received

just before that if it does not become the reception time-out error.

The data of the input area (WL0 to WL2F) are handled according to OUTPUT HOLD setting at slave station 2. And the data of the output area (WL200 to WL21F) hold the data that they received just before that if it does not become the reception time-out error.

4.4.2 Replacement configuration example of H series (Slave: Mode1, Mode2, Mode3)

Figure 4.4.3 shows the system configuration example of the H series. Figure 4.4.4 shows the replaced system configuration example of the EH-150 series.

Figure 4.4.3 is the system configuration example that master station is set to Mode0 and slave stations are set to Mode1 or Mode2 or Mode3 as operation mode.

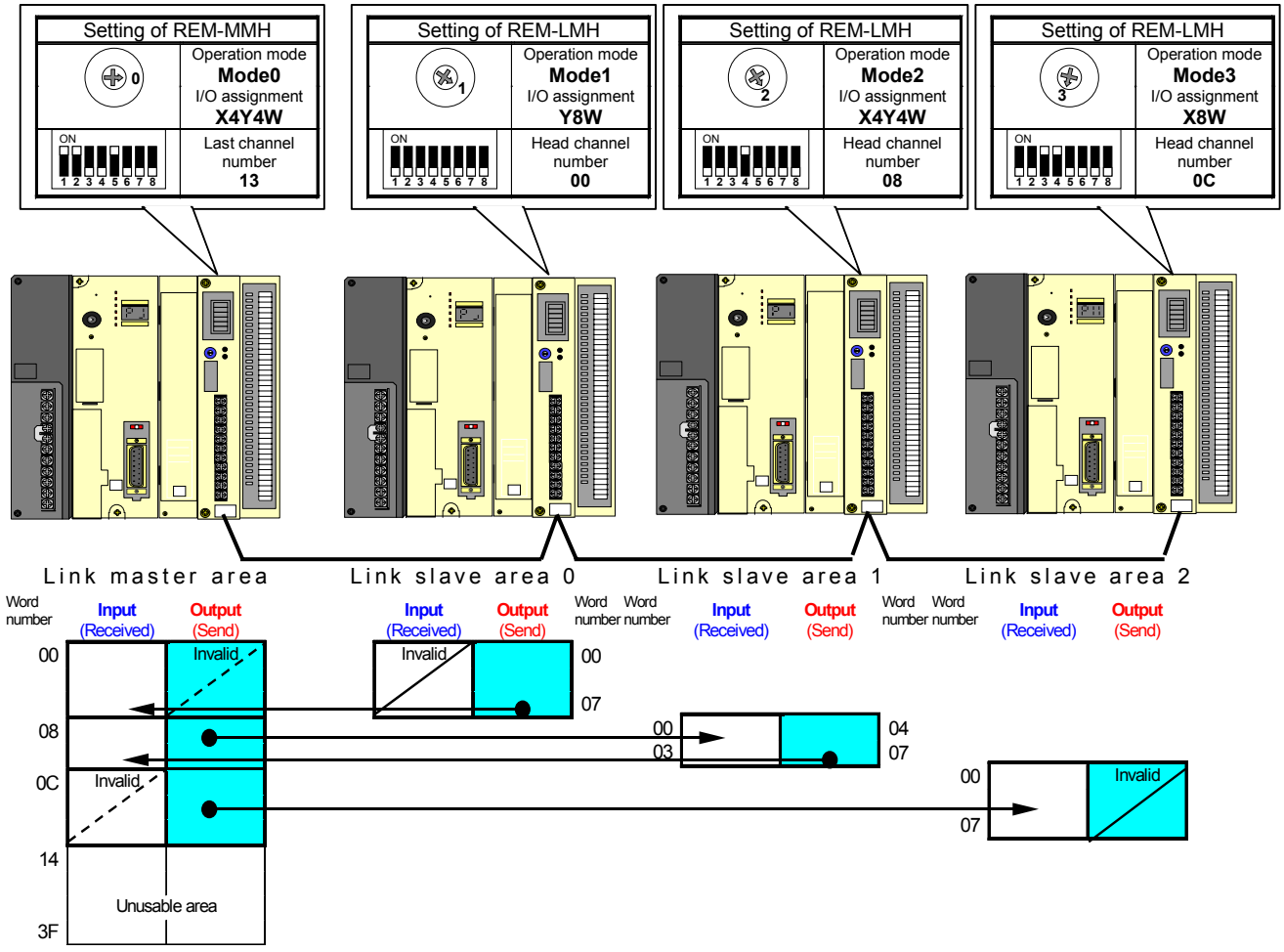


Figure 4.4.3 System configuration example (Slave: Mode1, Mode2, Mode3)

Mode1 is the operation mode that there are the outputs of 8 words. This mode occupies 8 channels, but CPU module can't read the input area of the module.

Mode2 occupies 4 channels as the pair of each input and output, and there are the inputs of 64 points and the outputs of 64 points.

Mode3 is the operation mode that there are the inputs of 8 words. This mode occupies 8 channels, but CPU module can't write the output area of the module.

When the slave station is set the operation mode in Mode1 or Mode2 or Mode3, the CPU module corresponding to each slave station can refer to only the area data that the slave station occupies.

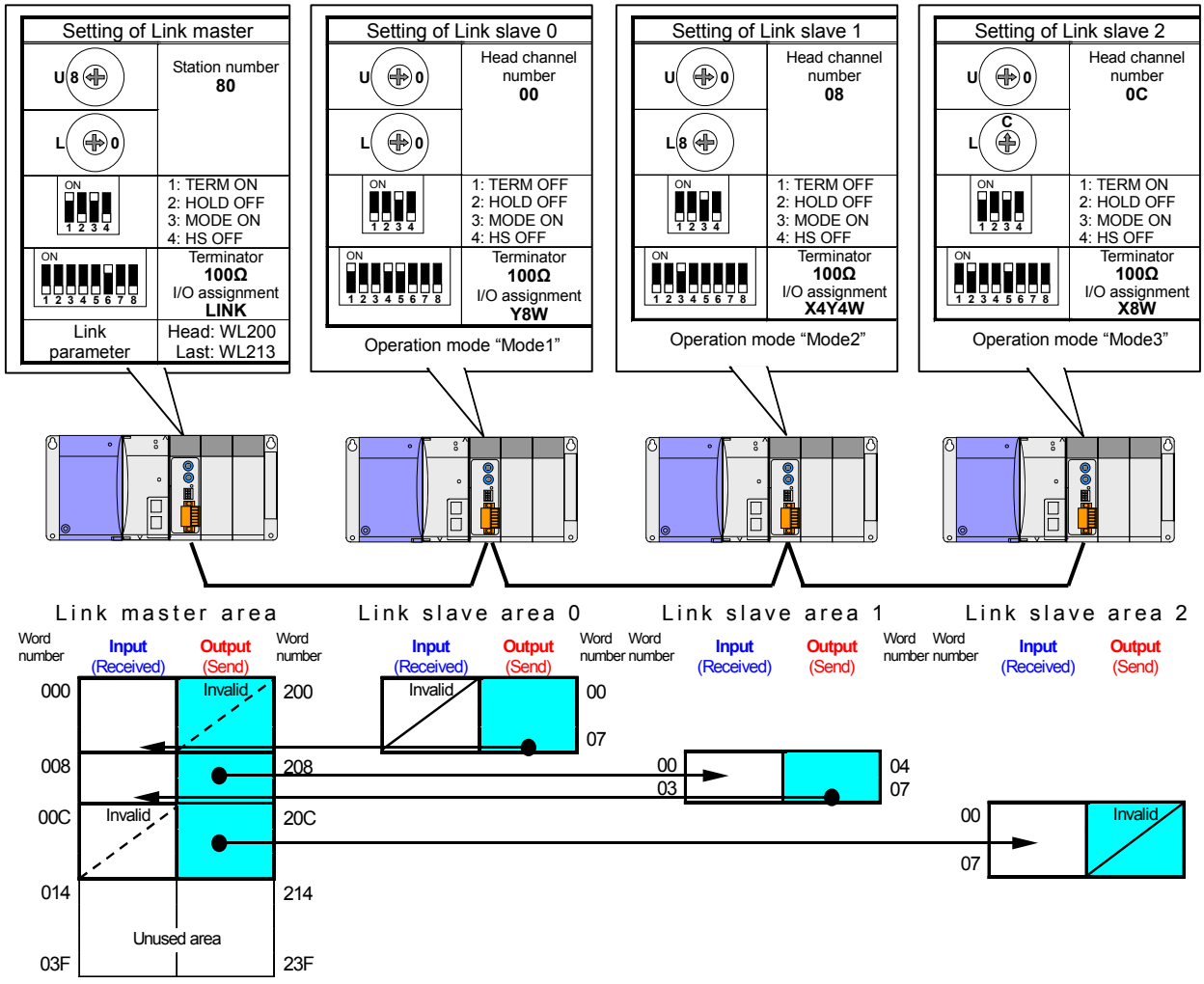


Figure 4.4.4 Replacement system configuration (Slave: Mode1, Mode2, Mode3)

[Explanations]

1) Set the head channel number and the operation mode etc. to rotary switches and Dipswitch. Refer to section 3.1 for the setting method of some switches.
   In addition, change the value of the terminator according to a use cable.
2) Set The I/O assignment "LINK" to master station. The change in the user's program is necessary for EH-TRLLE as to the I/O number that used to REM-MMH.
3) The output area of the master station sets the link area from WL200 to WL213 by link parameter, and the input area owns link area from WL0 to WL13. So the data received from slave stations is stored in the input area.
4) The operation mode "Mode1", "Mode2" and "Mode3" of the compact link module use an area of the external input and output. Therefore, the send area uses the external outputs area, and the received area uses the external inputs area in the slave station. The change in the user's program is not necessary for the slave station.

4.5 Replacement from 200/250/252B/252C series

This compact link module has communication-compatibility with the current products for H-200/250/252B/252C 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.

4.5.1 Replacement configuration example of REM-LH2 (Slave: Mode0c, Mode2c)

Figure 4.5.1 shows the system configuration example of the H-200/250/252B/252C series. Figure 4.5.2 shows the replaced system configuration example of the EH-150 series.

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 H-200/250/252B/252C 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 the front Dipswitch of the compact link modules.

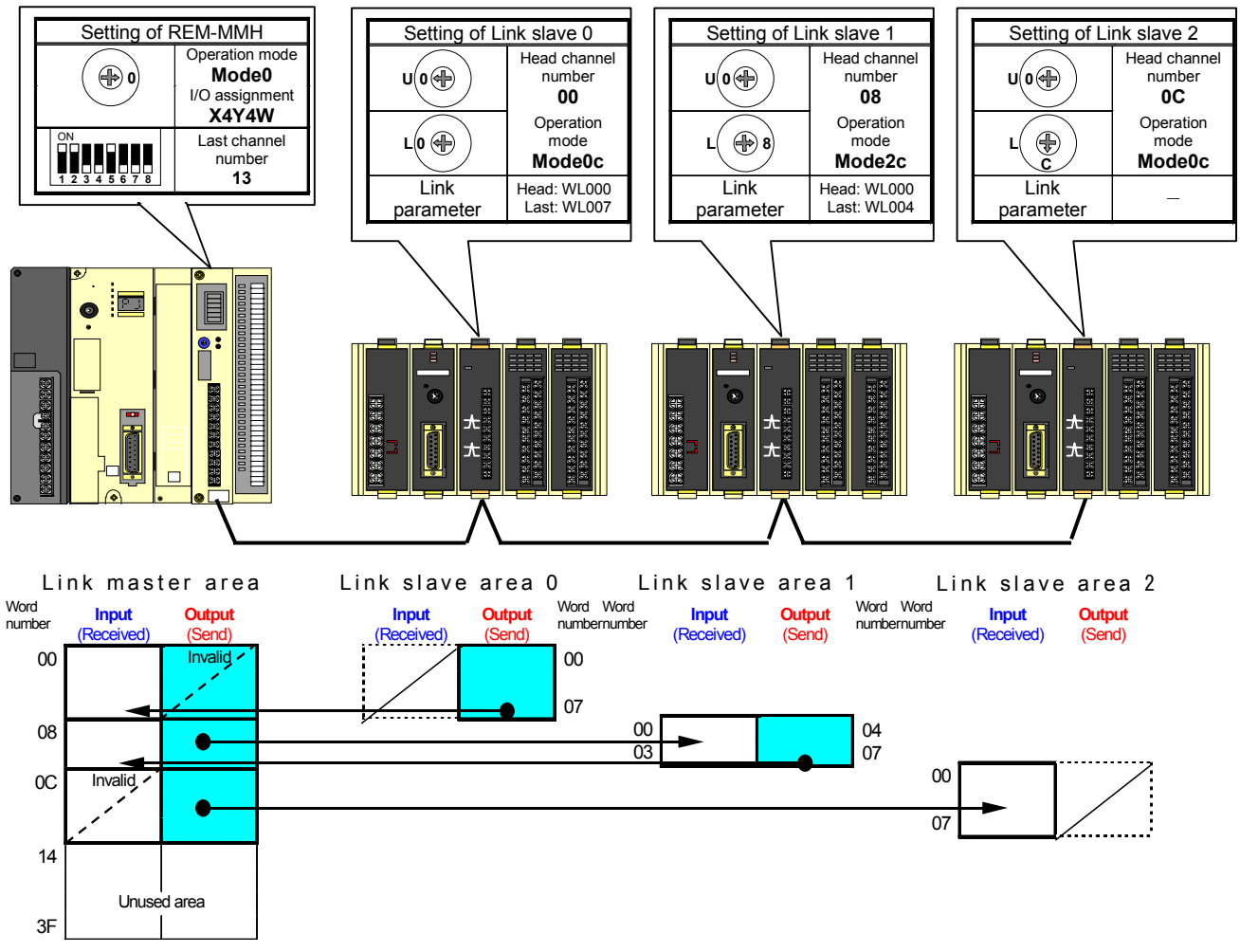


Figure 4.5.1 System configuration example including the REM-LH2

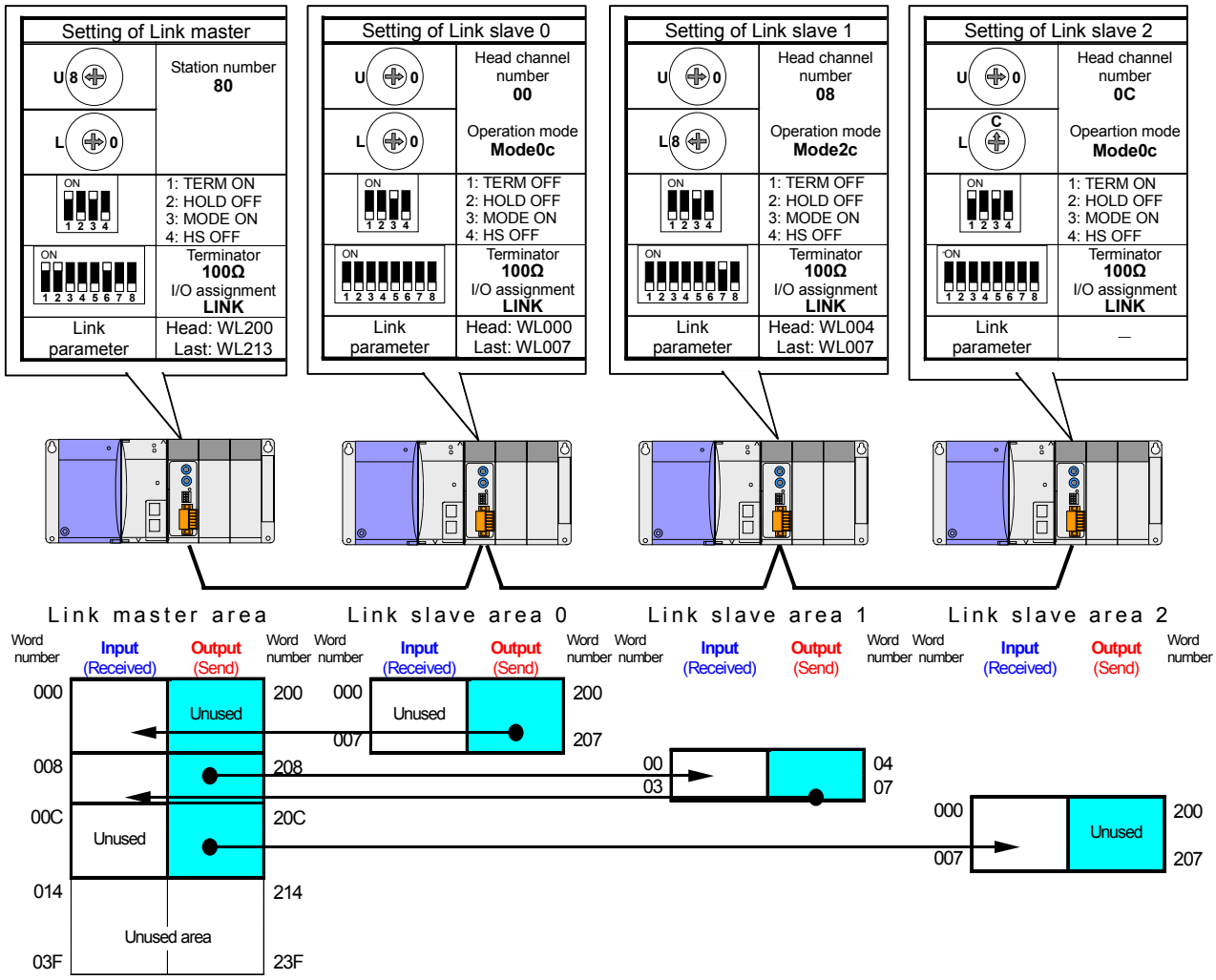


Figure 4.5.2 Replacement system configuration (Slave: Mode0c, Mode2c)

[Explanations]

1) Set the head channel number and the operation mode etc. to rotary switches and Dipswitch. Refer to section 3.1 for the setting method of some switches.
   In addition, change the value of the terminator according to a use cable.
2) Set The I/O assignment "LINK" to master station. The change in the user's program is necessary for EH-TRLLE as to the I/O number that used to REM-MMH.
3) The output area of the master station sets the link area from WL200 to WL213 by link parameter, and the input area owns link area from WL0 to WL13. So the data received from slave stations is stored in the input area.
4) The specifications of REM-LH2 are different from EH-TRLLE about the operation mode "Mode0c". Change in the user's program for the link parameter and the I/O number of the send data.
5) In the operation mode “Mode0c”, the output area of the slave station sets the link area from WL200 to WL207 by link parameter, and the input area owns link area from WL0 to WL7. So the data received from slave stations is stored in the input area.
6) In Mode2c, output area is compacted in the module, and the link area is assigned the channel number from 0 to 3. So there are the inputs of 64 points and the outputs of 64 points. The output area of the slave station sets the link area from WL4 to WL7 by link parameter. So, the input area owns link area from WL0 to WL3.

4.5.2 Replacement configuration example of the remote I/O slave station

Figure 4.5.3 shows the system configuration example including the remote I/O slave station of the H-200/250/252B/252C series. Figure 4.5.4 shows the replaced system configuration example of the EH-150 series.

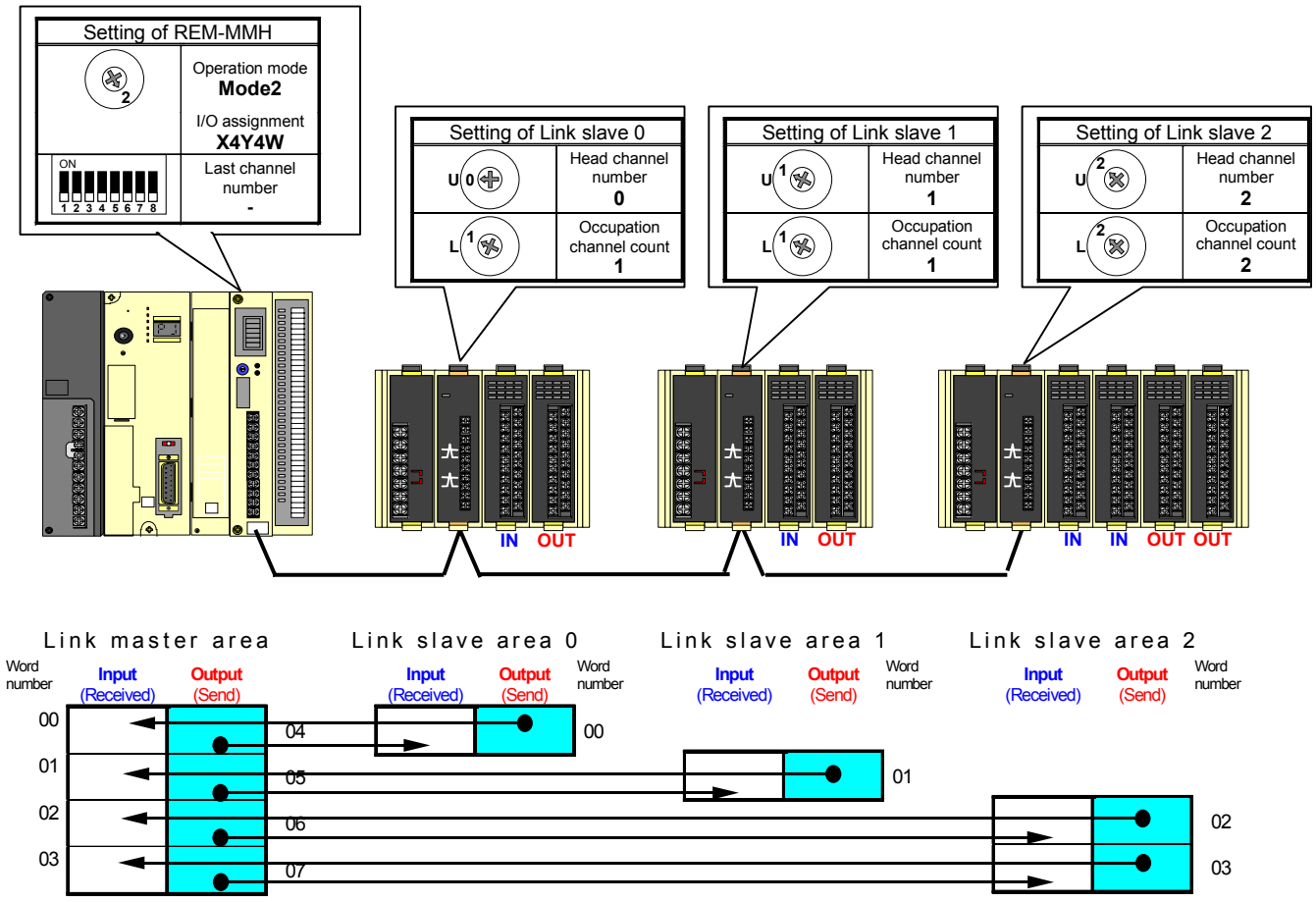


Figure 4.5.3 Replacement configuration example including the remote I/O slave station

The master station is set the operation mode "Mode2c" to the switches, and there are the inputs of 64 points and the outputs of 64 points. And the remote slave station is set the mode for the I/O compression. The input module and the output module are mounted the modules of same number to the base unit for slave station. And the input module is mounted near to remote slave station module on the base.

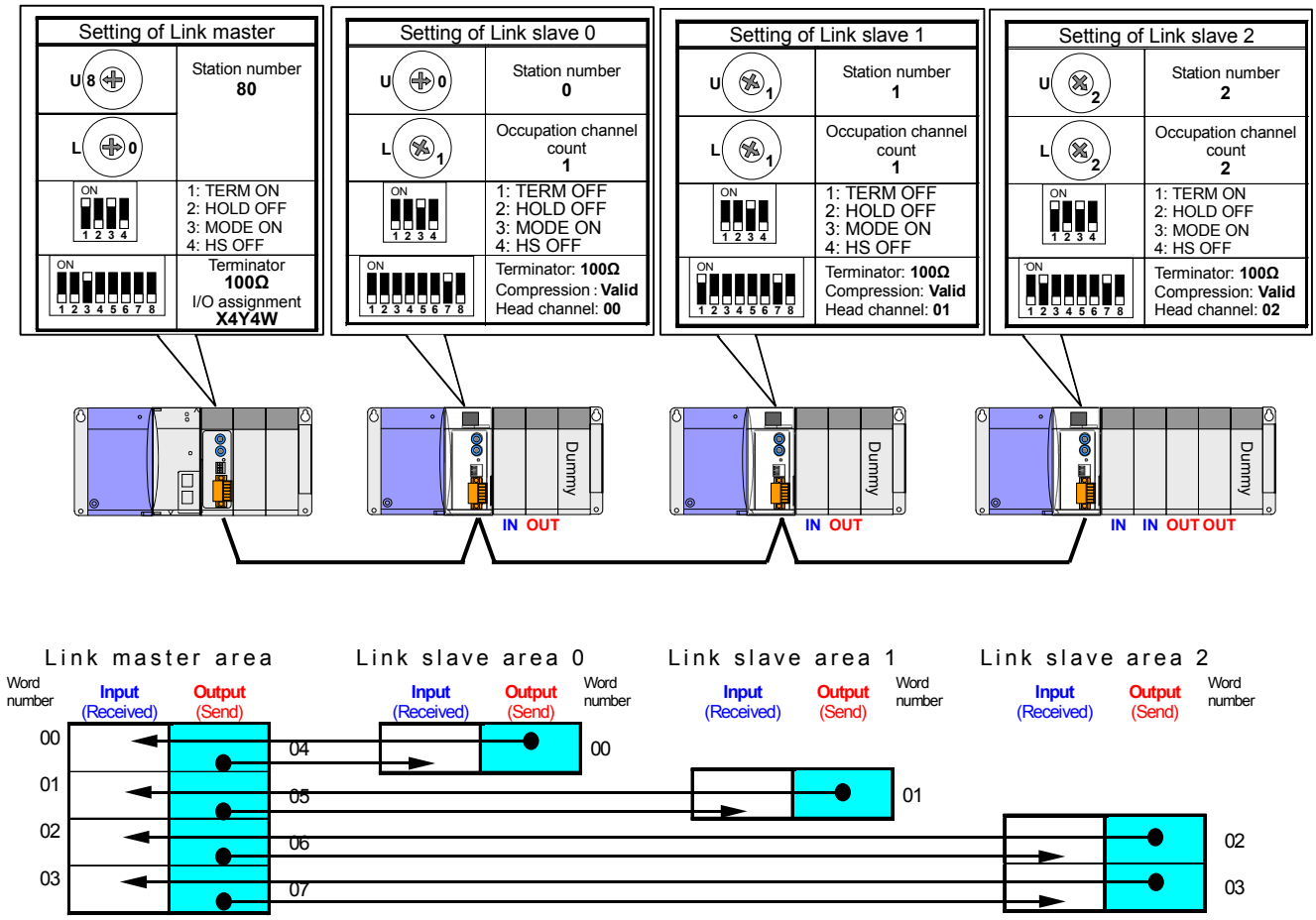


Figure 4.5.4 Replacement system configuration (Remote I/O slave station)

[Explanations]

1) Set the head channel number and the operation mode etc. to rotary switches and Dipswitch. Refer to section 3.1 for the setting method of some switches.
   In addition, change the value of the terminator according to a use cable.
2) Set The I/O assignment "X4Y4W" to master station. The change in the user's program isn't necessary for EH-TRLLE as to the I/O number that used to REM-MMH.
3) In this mode, output area is compacted in the module, and the link area is assigned the channel number from 0 to 3. So there are the inputs of 64 points and the outputs of 64 points. The output area of the master station owns the link area from WY4 to WY7, and the input area stores the data received from slave stations into the link area from WX0 to WX3.
4) Refer to the manual of the compact remote module for the remote slave station.

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.

When REM-MMH/LMH of the conventional products set the switch to operation mode "Mode0", input and output processing for REM-MMH/LMH may not be carried out every 1 scan of the CPU. In addition, data may be updated in the time shorter than CPU scan time, when the input and output processing method of the CPU module takes the direct processing.

[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, HS switch off.

The link refresh time is calculated as follows.

Link refresh time= (A + B) * ([Master station's assigned channel count] * 2)·····(4.2)

The value A and value B in the above equation are as follows.

Table 4.6.1 Transmission interval and processing time for one word

Sign	Meaning	Setting		Time (μs)
		HS	Operation mode	
A	Transmission interval	OFF	Low speed	600
		ON	High speed	6
B	Processing time / word	–	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 for response from the link slave. Time-out time is 0.5ms in high-speed mode, and is 7ms in low speed mode. Therefore, "the missing channel's count * 7ms" is added in link refresh-time in low-speed mode.

Because the link master station sends the link data in the range of the send area that set to the master station, the link slave station that was set the channels except for the area occupied by the master station cannot participate in an I/O 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 7ms for response from the leaving station, and starts operation for link slave of next station number.

For example, when the channel count occupied by the station that left the I/O link system is twenty, the refresh-time changes to 141ms from 27ms in the station only. So, the link refresh-time of the I/O link system becomes long 114ms. (In the case of low-speed mode)

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.

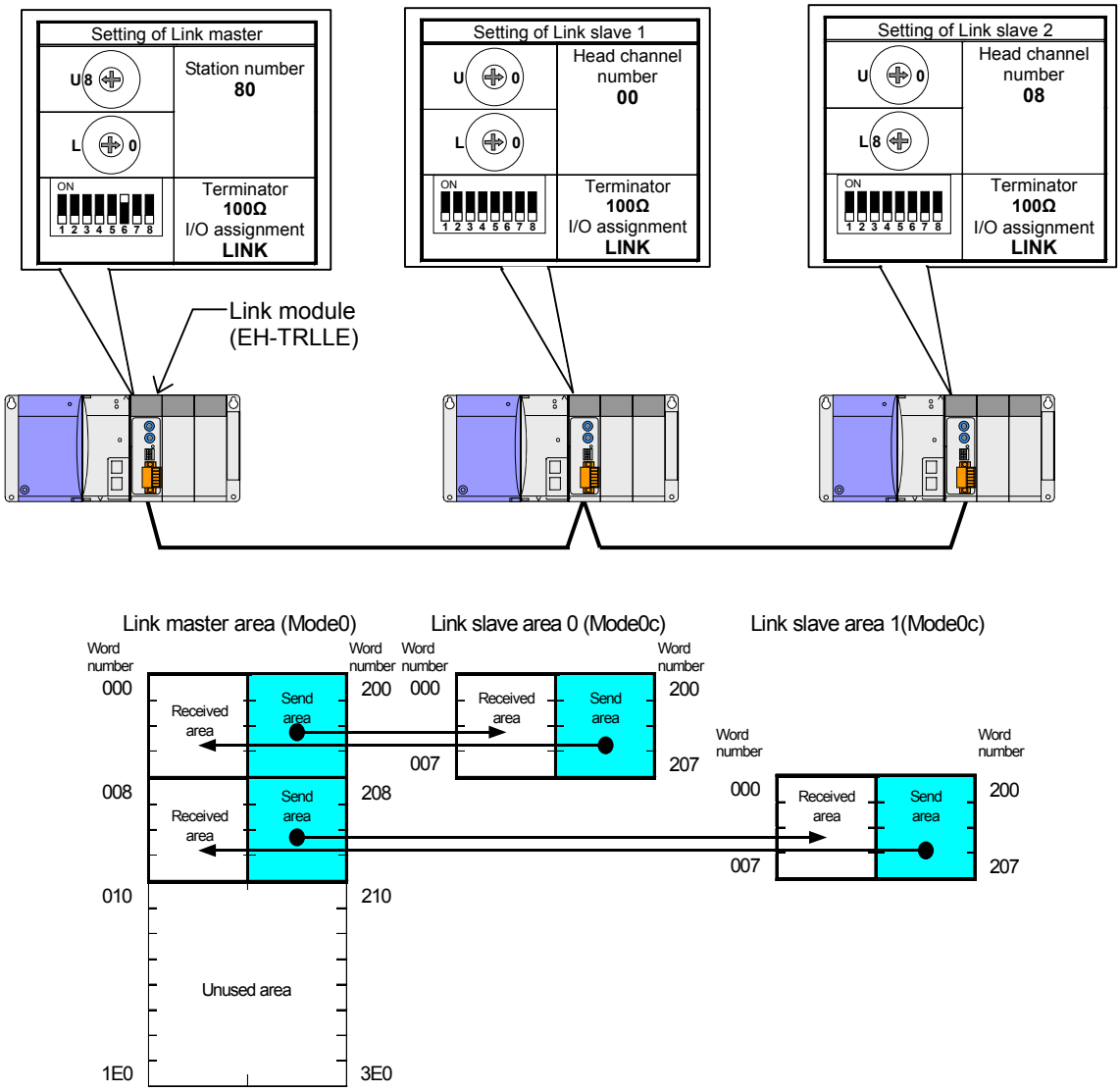
(Note 2) The link refresh times are stored in link status area when "X4Y4W" is set with the I/O assignment of link module (EH-TRLLE). But cannot refer to link status area in EH-CPU104A/208A. Refer to Section 6.2.2 for the details.

■ 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)*(16*2) = about 2.2 [ms]

Master station's assigned channel count

Processing time / word

Transmission interval

According to equation (4.1),

Response time = (20 + 20 + 2.2) = about 42.2 [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

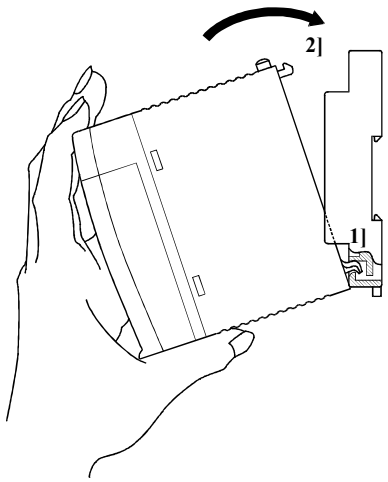


Figure 5.1.1 Installing the module

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

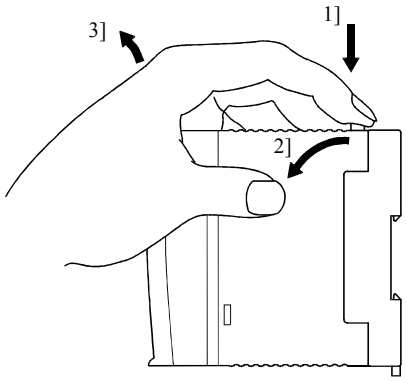


Figure 5.1.2 Removing the module

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-TRLLE) 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 "Y8W" or "X4Y4W" or "X8W", 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).

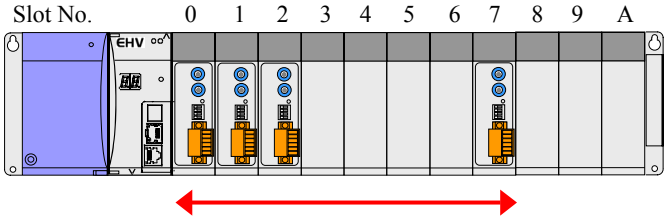


Figure 5.2.1 Mountable slots for link module with I/O assignment “LINK”

(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 "Y8W" or "X4Y4W" or "X8W", there is not limiting it to the number of mounting of link modules per CPU. Refer to section 1.1.2 for the details.

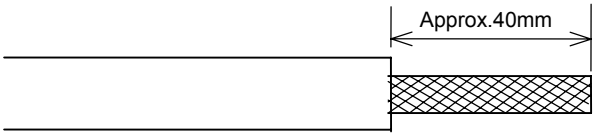
(3) In the case of EH-CPU104A/208A

In the case of EH-CPU104A/208A, set the I/O assignment "Y8W" or "X4Y4W" or "X8W" for compact link module. There is not limiting it to the number of mounting of link modules per CPU.

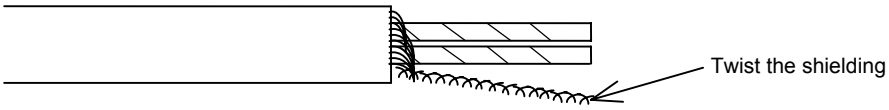
5.3 How to prepare of twisted pair cables

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

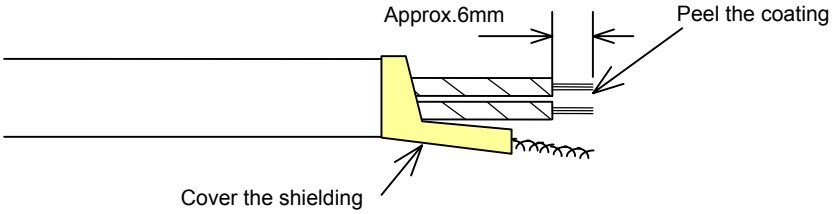
[Procedure 1] Peel approximately 40 mm of the coating off the end of the cable.



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



[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.



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.

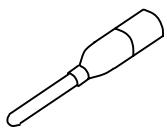
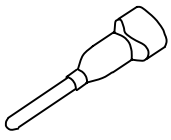
Table 5.3.1 Example of applicable clamp terminals

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

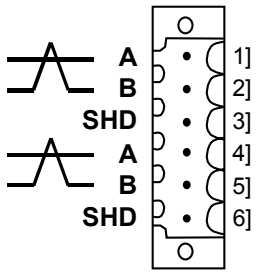
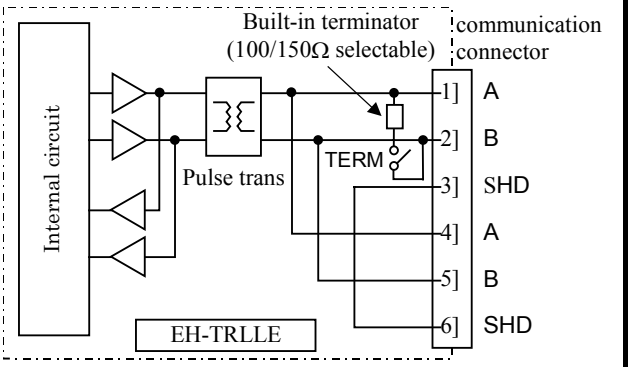
Table 5.3.3 The outline shape of clamp terminal

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, 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. (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.

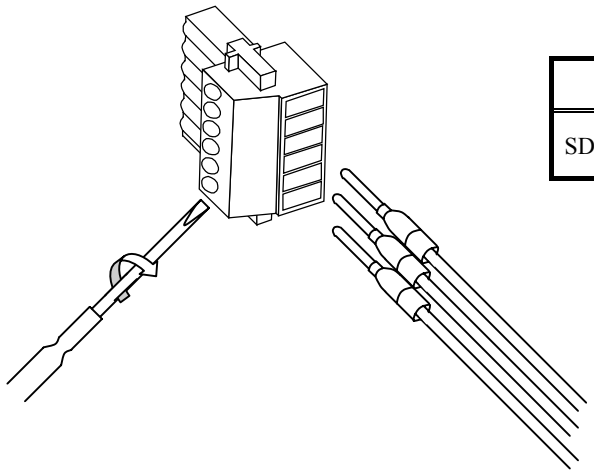


Figure 5.4.1 Installation example of communications cable with the clamp terminal

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.

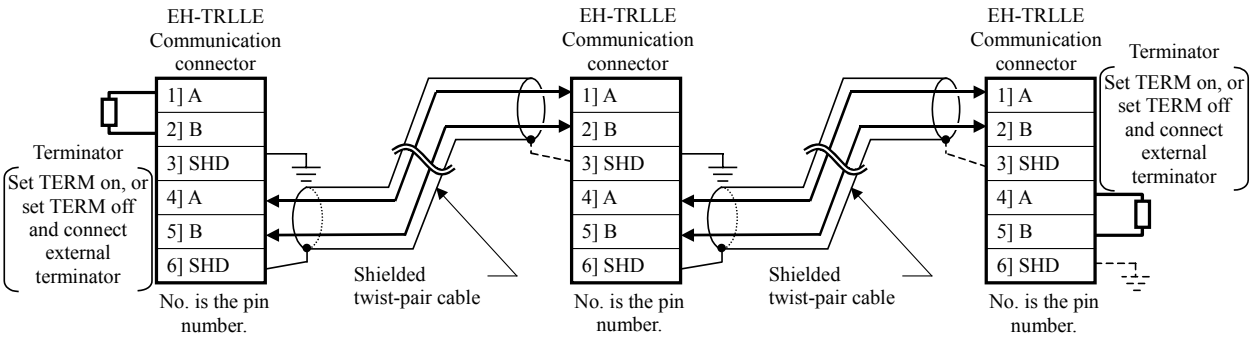


Figure 5.4.2 Normal connection method

[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.

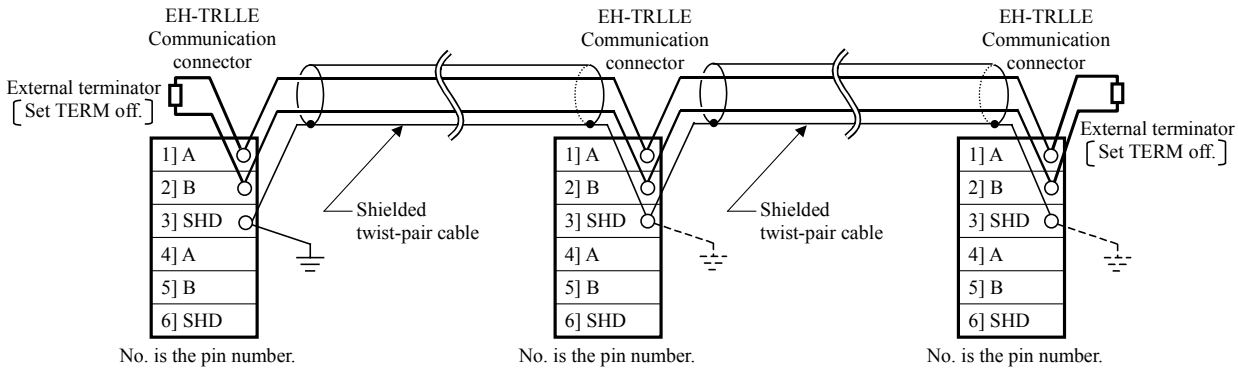


Figure 5.4.3 Connection method when enabling the replacement of link slave while operating

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.

Refer to Chapter 9 for setting details.

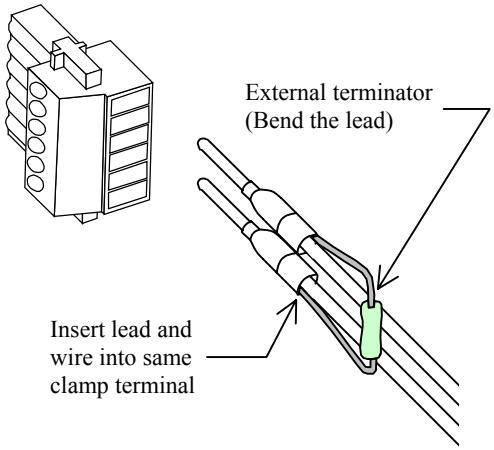


Figure 5.4.4 Example of connecting external terminator

⚠ 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.

When EH-TRLLE is connected to the remote I/O MINI module, it may count the error with the head channel of the remote I/O MINI module at the time when turns on power supply.

(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

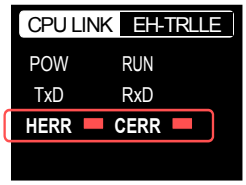
Chapter 6 Error indication and Countermeasure

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-TRLLE)

Error display LED	LED	Name of error	Contents of error	Check timing (clear timing)	Counter measure
	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 Dipswitches correctly.
And when a watchdog 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 Dipswitch.

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 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	Undefined				Number of times transmission error (Note 3)											
≀		≀															
+5C		Undefined				Number of times transmission error (Note 3)											
+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.

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

When the duplicate area 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-TRLLE, there is the case that the duplicate area 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: Head channel 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 channel 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 channel number (1-operating, 0-stopped)

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

(Note 1) The internal output numbers in Table 6.2.1 are the relative numbers. The link error flag area in each system is 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) I/O assignment: The bit does ON according to the setting of the I/O assignment.
Bit15-Invalid, Bit14-“LINK (Mode0)”, Bit13-“LINK (Mode0c)”, Bit12-“LINK (Mode2c)”

(Note 3) The transmission error is the detected timeout error when there is no response about the received data from other stations during fixed period of time. The monitoring time is 0.5ms at the high-speed mode, and is 7ms at the low-speed mode. 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 link data hold the data that they received just before that if it does not become the reception time-out error even if a transmission error occurs. Don't use the Link operation status flag and the times transmission error for the effective check of link data. Use the error flag from c to f for the effective check of link data.

When EH-TRLLE is connected to the remote I/O MINI module, it may count the error with the head channel of the remote I/O MINI module at the time when turns on power supply.

（Note 4）These error information are cleared by turning on again the power supply. Please note that this error information is 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 4.3.7 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	Undefined				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 (Note 2)											
≀		≀															
+24		Undefined				Number of times transmission error (Note 2)											
+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: Head channel number error (1-error, 0-no error) f: Transmission path disconnected (1-error, 0-no error)
g: Number indicates the channel 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 channel number (1-operating, 0-stopped)

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 fixed period of time. The monitoring time is 0.5ms at the high-speed mode, and is 7ms at the low-speed mode. 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 link data hold the data that they received just before that if it does not become the reception time-out error even if a transmission error occurs. Don't use the Link operation status flag and the times transmission error for the effective check of link data. Use the error flag from c to f for the effective check of link data.
When EH-TRLLE is connected to the remote I/O MINI module, it may count the error with the head channel of the remote I/O MINI module at the time when turns on power supply.

(Note 3) These error information are cleared by turning on again the power supply. Please note that this error information is 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.

(Note 4) When the area that the slave station occupies is beyond channel 31, the status information after channel 32 is stored in the area after channel 0.

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.

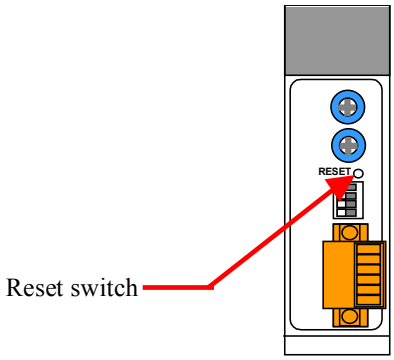
6.4 Function of reset switch

When hard error (HERR) occurs in link module (EH-TRLLE), 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.



Compact link module
(EH-TRLLE)

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.

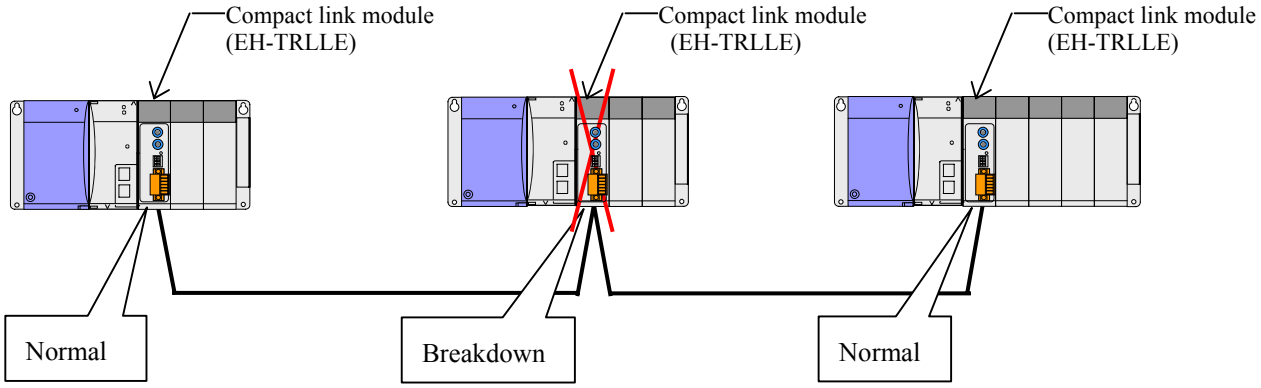


Figure 6.5.1 Fallback operation when breakdown in module occurs

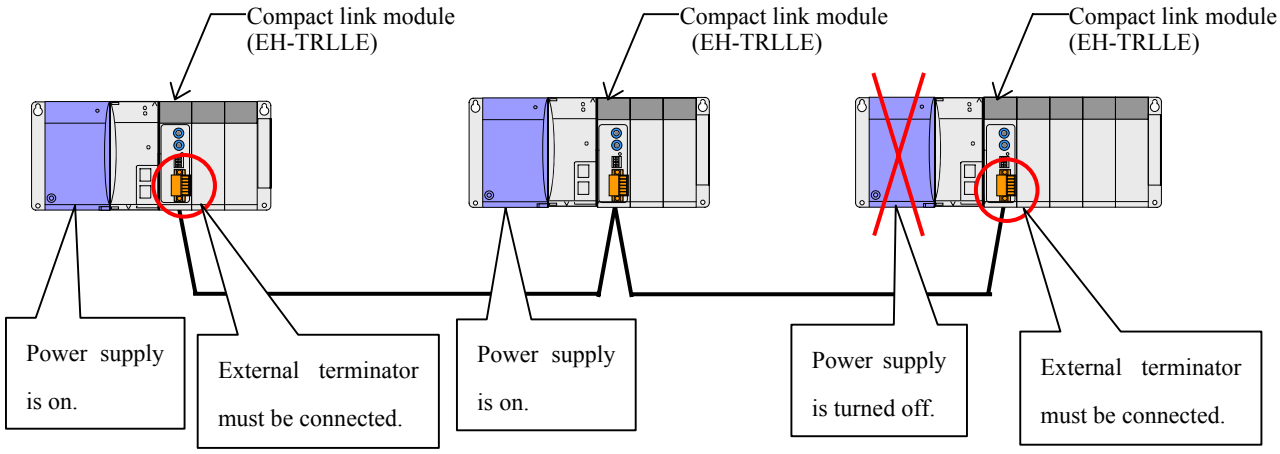


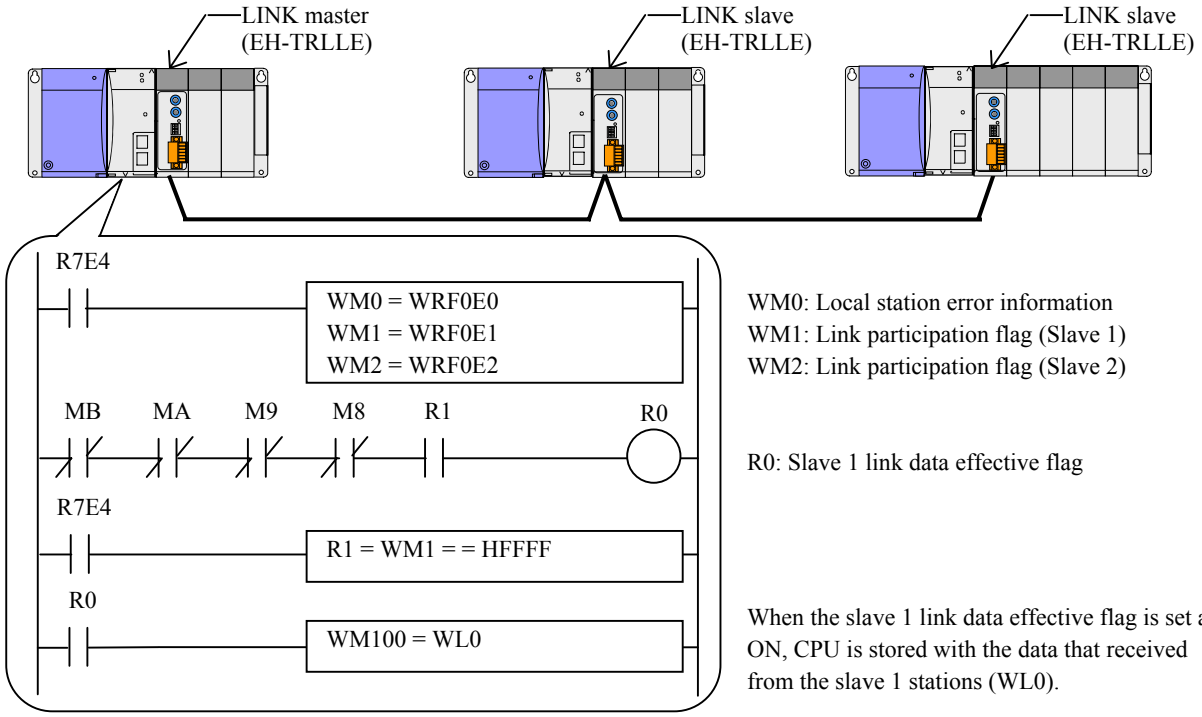
Figure 6.5.2 Fallback operation when power supply of end station is turned off

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.

Here, show the example that assumed an I/O link area 32 channels from 0 to 1F.



LINK slave 1: The link area is the channel from H0 to HF.
LINK slave 2: The link area is the channel from H10 to H1F.

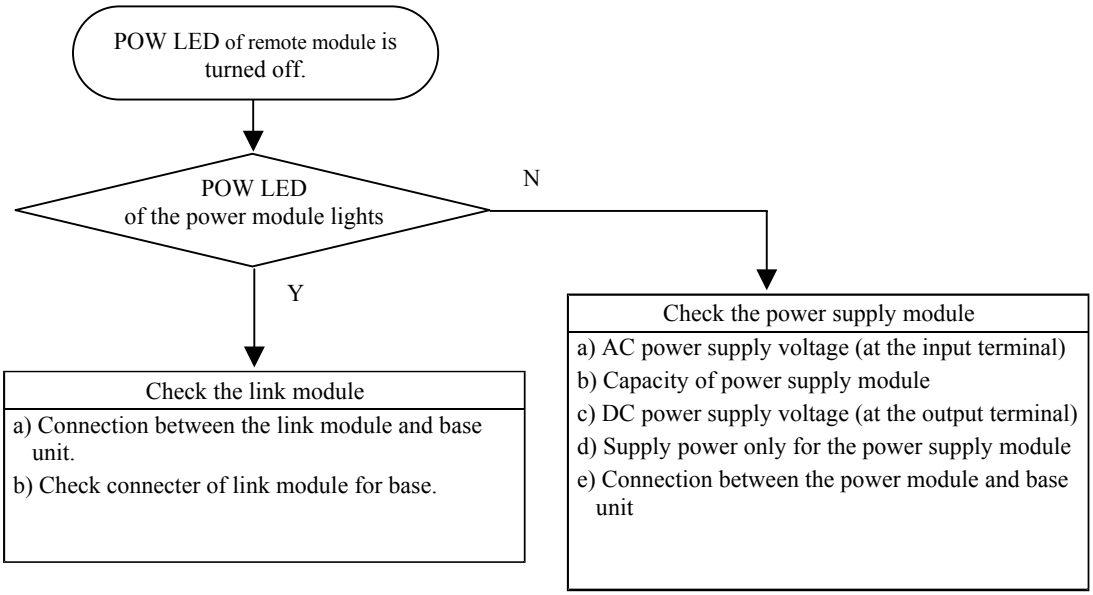
Figure 6.5.3 Program example of Link data effective check

The link operating flag does OFF, when the transmission error count is updated. And when module cannot receive data before reception time-out time (High-speed: 0.5ms, Low-speed: 7ms), the transmission error occurs. When the transmission error count is updated, confirm it about the cable connection, laying method and terminator or not.

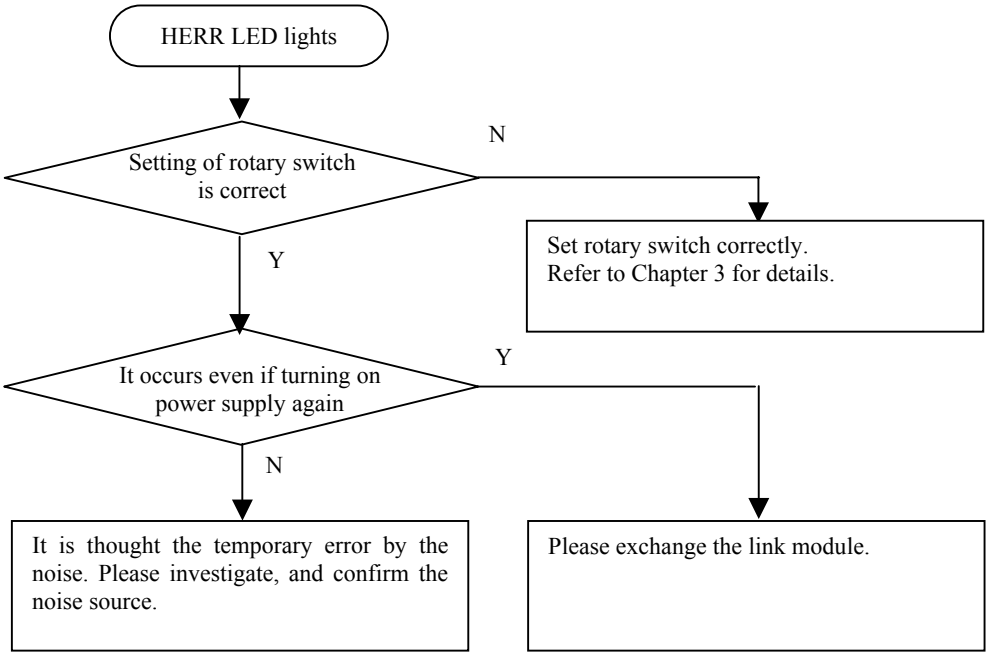
6.6 Troubleshooting

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

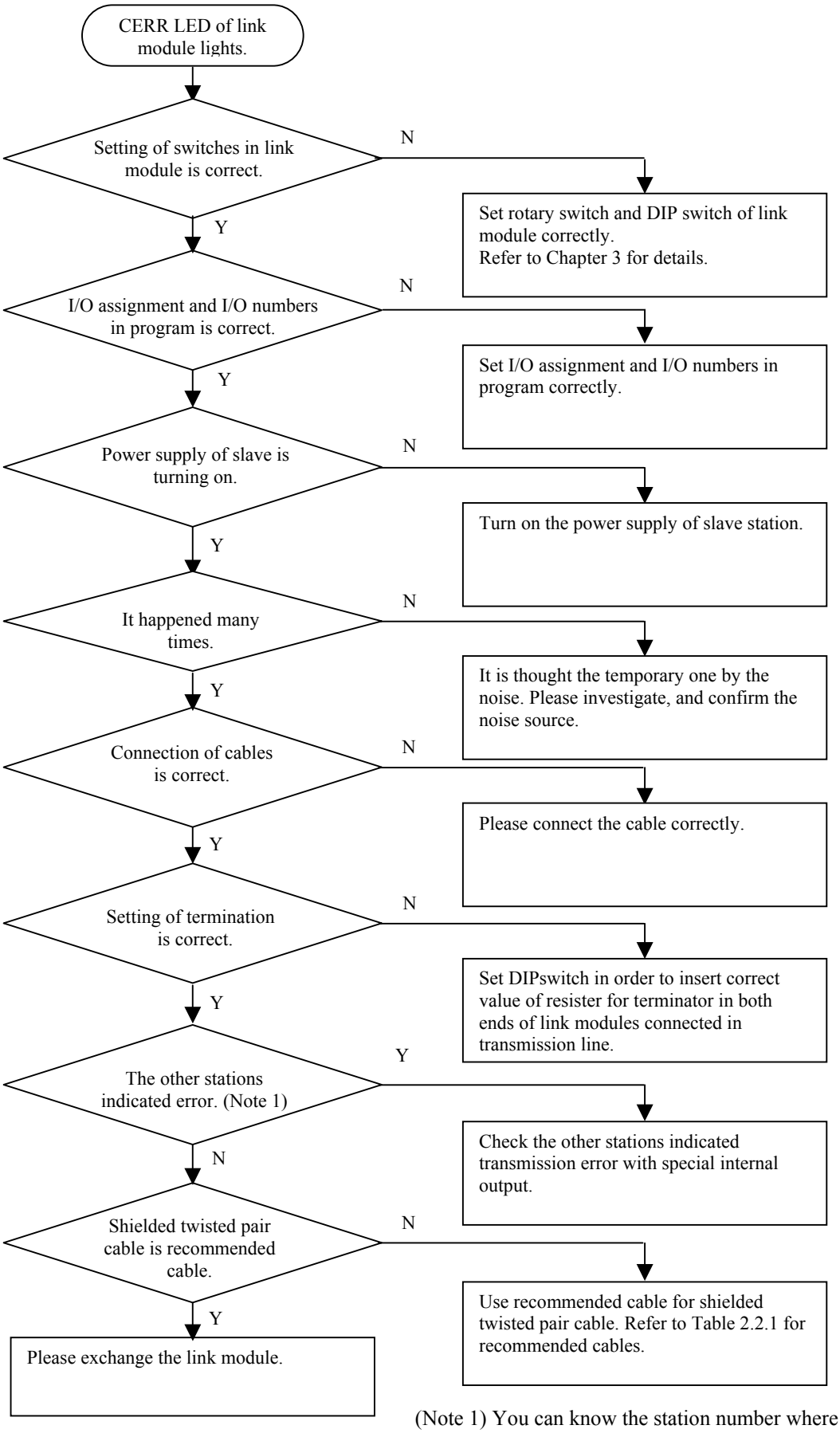
(1) POW LED: as turning off (5V DC power abnormality).



(2) HERR LED lights (hardware abnormality).

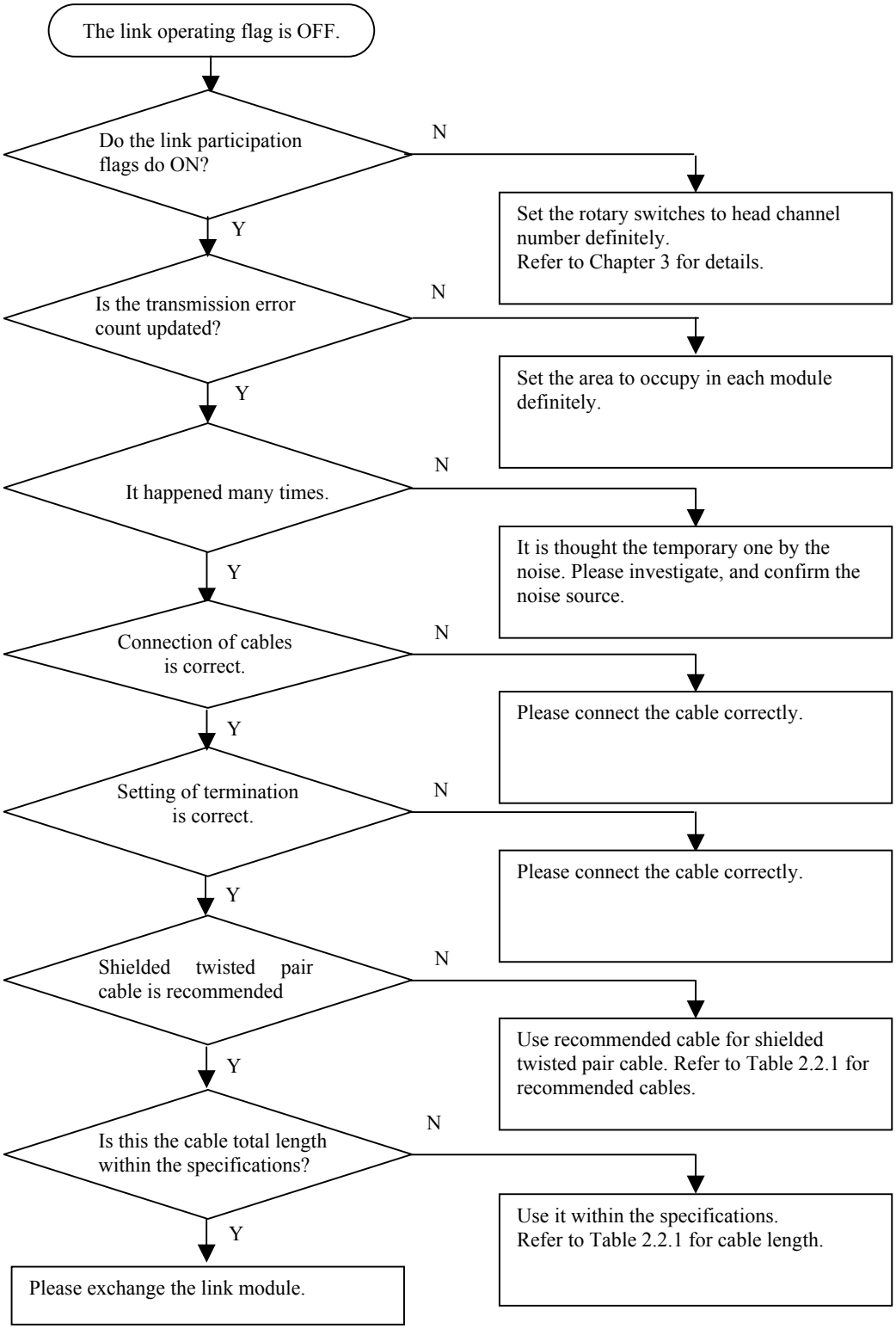


(3) CERR LED of link module lights. (Transmission time-out error)



(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.

(4) The link operating flag is OFF



(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.

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 7.2.1 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 module by an I/O assignment of excepting "LINK. 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 "X1Y1W" to show in Table 8.1.1.

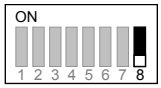
Table 8.1.1 I/O information notation by programming software

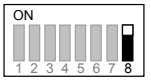
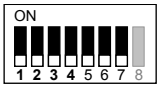
Programming software	I/O classification to choose at I/O assignment setting
Control Editor	“X1Y1W”
Ladder Editor	“B1/1”
Notation of the following manual	“X1Y1W”

■Description of side Dipswitch

Refer to Table 8.1.2 for the setting method of Dipswitch arranged on the module side. The setting method is same about other switches.

Table 8.1.2 Description of side Dipswitch

<table>
<tr><th>No.</th><th>Setting description</th><th>Details</th></tr>
<tr><td>1</td><td>Select the built-in terminator value
 

[Default setting: OFF]</td><td>Built-in 100Ω and 150Ω terminator on module, it is chosen which terminator is inserted between A and B terminals of communication connector.
<table>
<tr><th>Bit8</th><th>Position</th><th>Selection of built-in terminator</th></tr>
<tr><td>OFF</td><td> 
</td><td>100 Ω (for recommended 0.3mm^2 and 0.5mm^2 twisted pair cable)</td></tr>
<tr><td>ON</td><td> 
</td><td>150 Ω (for recommended 0.75mm^2 twisted pair cable)</td></tr>
</table></td></tr>
<tr><td>2</td><td>Set an I/O assignment
 

[Default setting: OFF]</td><td>Set an I/O assignment of the module. (Note 1)
<table>
<tr><th>Bit1</th><th>Bit2</th><th>Bit3</th><th>Bit4</th><th>Bit5</th><th>Bit6</th><th>Bit7</th><th>Position</th><th>I/O assignment</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td> 
</td><td>X1Y1W</td></tr>
</table></td></tr>
</table>

(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)
X1Y1W	Not available	Available	Available	Input: 512 points / Output: 512 points

(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.

This mode is the operation mode that there are each 512 points of input and output in the link area. When EH-TRLLE is set the operation mode "Mode0" to the master station and is set "Mode0s" to slave station, use the occupied area in the range of channel number from 0 to 31 in the slave station. When compact link module is set the operation mode "Mode0s", it must use the link area within 32 channels per system. When the system has the link area that is more than 32 channels, the input area becomes the unsettled data.

8.1.1 Access method of compact link in I/O assignment "X1Y1W”

When use compact link by I/O assignment "X1Y1W", 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 4.3.7 about access method of status area.
(Note 2) Cannot use high function modules commands in EH-CPU104A/208A.

About the area to occupy in module, set the head channel number by rotary switches with the operation mode "X1Y1W". Then set the number of the channels to occupy to a control register. The control register is "WY*1" of the external output area. Set it in the range from 01h to 20h. Write in the number of the occupation channels at WY*1 to 1st scan by a user's program.

(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 8.1.1. Refer to EH-150 application manual about the details of FUN200 command.

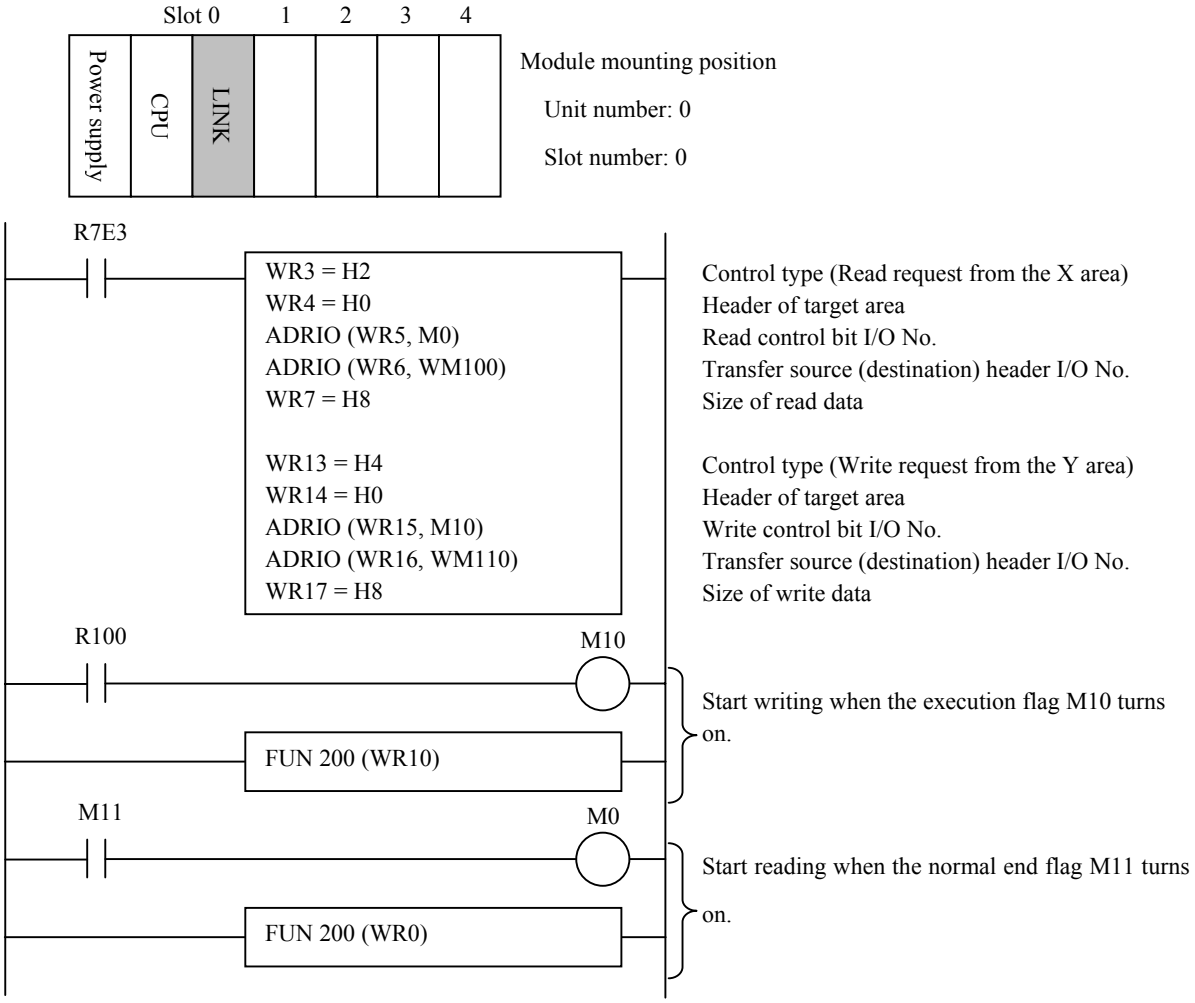


Figure 8.1.1 Access program 1 to the second XY area

(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 8.1.2. Refer to EHV-CPU programming manual about the details of XYRW command.

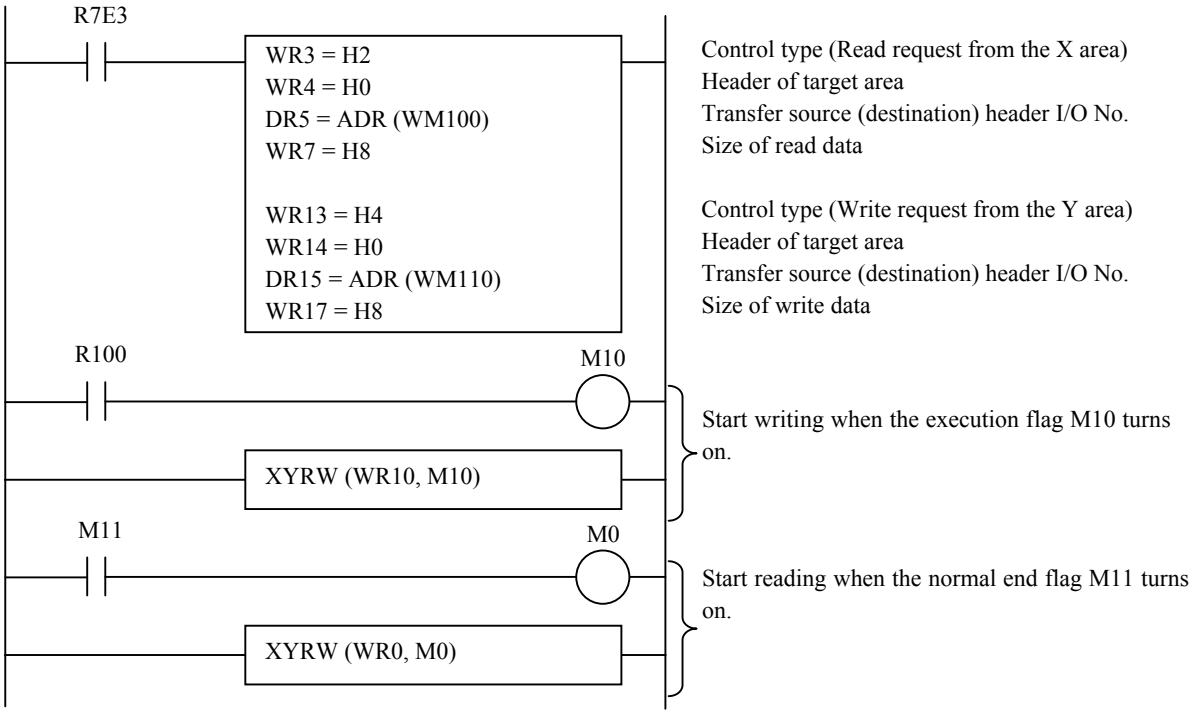


Figure 8.1.2 Access program 2 to the second XY area

EHV-CPU can't access the second XY area directly when compact link was set in I/O assignment of "X1Y1W".

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.

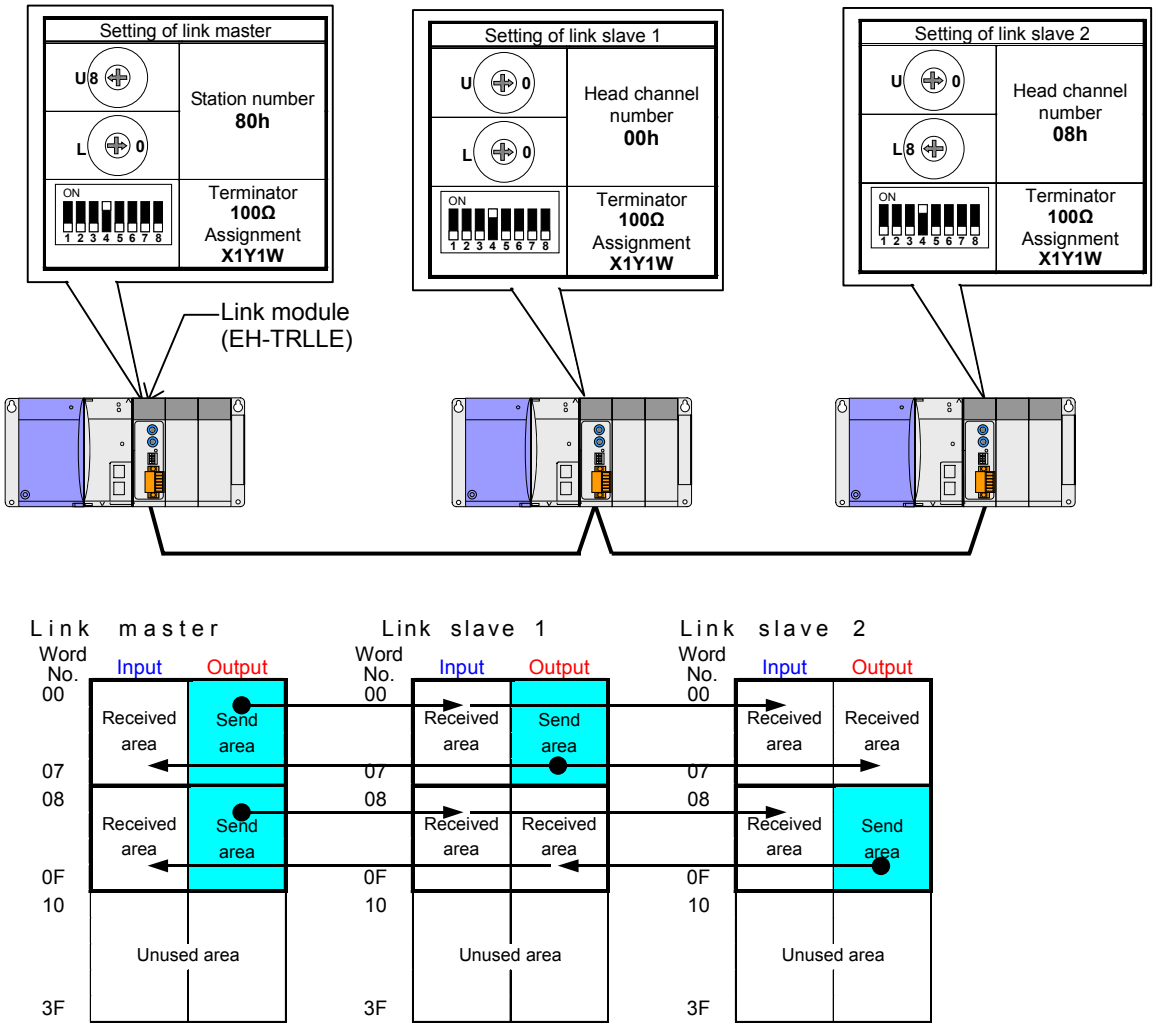


Figure 8.1.3 System configuration diagram of the "X1Y1W" mode

The data of the area that other stations occupy are updated as described below at the slave station.

When the slave station received the data of a master station and the other slave station, it stores data. And the slave station abandons the data when it received only data of either master station and slave station. Because it is detected an error as a transmission error then, it becomes the reception time-out error when this state continues more than 500ms. Therefore, the data of the input area are handled according to OUTPUT HOLD setting when the slave station leaves a system.

Example: If the slave station 2 leaves a system, the link data are updated below.

The data of the input area (channel from H08 to H0F) are handled according to OUTPUT HOLD setting at master station.

The data of the input area (channel from H08 to H0F) are handled according to OUTPUT HOLD setting at slave station 1. And the data of the output area (channel from H08 to H0F) hold the data that they received just before that if it does not become the reception time-out error.

The data of the input area (channel from H00 to H0F) are handled according to OUTPUT HOLD setting at slave station 2. And the data of the output area (channel from H00 to H07) hold the data that they received just before that if it does not become the reception time-out error.

Match the terminator value with a use cable.

Chapter 9 Appendix

9.1 Choice guideline of the twisted pair cable

A choice guidance of the cable is shown below. The cable should be decided by the environment and terms of use of the real system. It can expect an extensive application by observing the next guidance.

9.1.1 Electrical characteristic

Refer to main cable specifications of the twisted pair cable in Table 9.1.1.

Table 9.1.1 Cable specifications

Item		Condition	Specifications	
Cable type		-	Polyethylene insulated PVC sheathed cable	
Number of a conductor		-	2 conductors (1 pair)	
Conductor	Official cross-section (mm^2)	-	0.3	0.5
	Resistance (Ω/km)	20 degrees Celsius	53.3 or less	35.3 or less
Insulator	Quality of material	-	Polyethylene	
	Standard thickness (mm)	-	0.3	
	Dielectric withstand voltage (V)	-	1 minute or more at 1,500V AC	
	Insulation resistance (MΩ/km)	20 degrees Celsius	1,500 or more	
Characteristic impedance		Sine wave at 1MHz	80	70
Electrostatic capacity (pF/m)		Sine wave at 1kHz	70 or less	75 or less

9.1.2 Cable structure

The twists count of the twisted pair cable with shield is 1 time per 120mm or less.

The 2-lines type twisted pair cable is suitable for low noise environment and a use of the short-range transmission. Because the cable using PVC (Polyvinyl chloride) as the insulator is unstable electrically, it is not suitable for high-speed data communications. In the case of long transmission distance or fast transmission speed, when these cables are used in the system, transmission wave pattern becomes dull remarkably. Therefore, do not choose these cables because products may produce a transmission error or a communication stop.

PE (polyethylene) is used to most of communication cables as an insulator. In the case to choose a cable, be careful about the materials of the insulator.

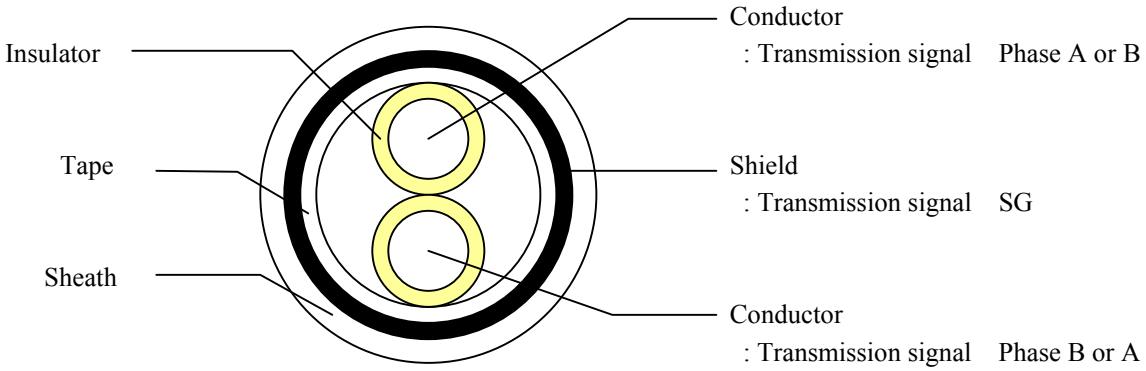


Figure 9.1.1 Twisted pair cable of 2-line type

9.1.3 Cable length

You should choose transmission speed or transmission distance by a system scale and the need ability. The relations between transmission speed and transmission distance is shown in Table 9.1.2. But the value is a reference level, and the transmission distance varies by the use cable or the number of connected apparatus. Refer to the catalogue of the cable maker or the manual of each product for the details.

Table 9.1.2 Transmission speed and Transmission distance

Transmission speed (kbps)	Maximum transmission distance (Reference value) (m)	Maximum transmission distance of representative product (Guarantee value at recommended cable)
125	1,000	Product type: Compact link module Product model: EH-TRLLE Transmission speed: 768kbps Maximum transmission distance: 150m(0.3SQ), 300m(0.5SQ)
250	800	
500	480	
1,000	240	

9.1.4 Terminator

Connect terminator of the characteristic impedance equivalency between the transmission signal A and B at the both ends of the transmission cable. The resistance value of the terminator recommends 100 Ω metal film resistors of 1/4W or more. However, confirm the resistance value of the terminator that a cable maker recommends because it varies by the use cable. In addition, confirm the manual of each product about the recommended resistance value of the terminator because it varies by the connected apparatus.

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