EH-SIO
Serial Communication Module Instruction manual

EH-150 EHV HX

HITACHI

Thank you for purchasing a Hitachi Programmable Logic Controller.
To operate it safely, please read this instruction manual and all the user manuals carefully. Please be sure to use the latest versions of user manuals and keep them at hand of end users for future reference.

■ Warranty period and coverage

The warranty period is either 18 months after manufacturing date (MFG. No.) or 12 months after installation.
Examination and repair within the warranty period is covered. However within the warranty period, the warranty will be void if the fault is due to ;

(1) Incorrect use from instructed 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 or repair cost, please contact your supplier or the local Hitachi Distributor. (Depending on failure part, repair might be impossible.)

■ Ordering spare parts and inquiries

Please contact your local suppliers for ordering products/spare parts or any inquiries with providing the following information.

(1) Product name
(2) MFG. No. (Manufacturing number)
(3) Details of failure

■ Definitions and Symbols

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.

■ Safety precautions

DANGER

- Do not touch terminals while power is ON. There is a risk of electric shock and/or injury.
- 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.

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.

COMPULSION

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

PROHIBITION

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

■ Information for UL-listed products

- UL508 (CSA C22.2 No. 142-M1987)
- Surrounding air temperature 0 to 55°C (*)

(*) If HX-CP1H16, HX-CP1H16R, HX-CP1H16M, HX-CP1S08, HX-CP1S08M, HXC-CP1H16 or EH-YR16 is used as UL-listed product, the max. surrounding air temperature rating is 45°C.

■ Common precautions

- Use proper cable ferrules for terminals. Using improper cable ferrules or connecting bare wires to terminals directly might result in fire.
- Do not turn on power, if the unit appears damaged.
- Be sure to check all field wiring before PLC power on. Otherwise, there is a risk of fire.
- Do not cover vent holes of the housing.
- Do not pull on cables or bend cables beyond their natural limit. Otherwise, there is a risk of breaking of wire.
- Check carefully your PLC program before operation.
- Keep PLC modules in their boxes during storage and transport.
- In case of the following operations, turn off power. Otherwise, there is a danger of breakdown and/or injury and/or fire.
  - Mounting or dismounting modules.
  - Assembling cabinet or machine including PLC.
  - Wiring.

■ Installation environment

Avoid the following locations to install the PLC.
- Excessive dusts, salty air, or conductive materials (iron powder, etc.)
- Direct sunlight.
- Surrounding air temperature less than 0 °C or more than 55 °C.
- Humidity less than 5 % or more than 95 %.
- Dew condensation.
- Direct vibration or impact to the unit.
- Corrosive, explosive or combustible gases.
- Water, chemicals or oil splashing on the PLC.
- Close to noise emission devices.

■ Mounting

- Mount the PLC on a metal plate and install in a cabinet as follows.
- Be sure to ground the cabinet and the metal plate, otherwise there is a risk of malfunction.
- Install the PLC as described in "■Reference manual".
- Take appropriate measures when the PLC system installed in locations :
  - Influenced easily due to noise or static electricity or other forms of noise.
  - Under strong electromagnetic field.
  - Close to power supplies.
- Be sure to tighten mounting screws, terminal screws and connector screws.
- Be sure to check that devices with lock mechanism, such as an expansion cable or terminal blocks, are locked properly.

■ Wiring

- Be sure that the power voltage matches the specified voltage. Otherwise, there is a danger of breakdown and/or fire.
- Be sure that the input voltage matches the specified voltage. Otherwise, there is a danger of breakdown and/or fire.
- Route the AC power line and I/O lines separated as much as possible. Do not route both cables in a same duct.
- Route the I/O lines and data lines as close as possible to the grounded surfaces such as cabinet elements, metal bars and cabinets panels.

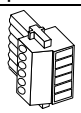
■ Reference manual

Read the following application manual carefully to use the PLC safely and properly. Be sure to keep the latest version.

Manual name	Manual No.
EH-150 Application manual	NJI-281*(X)
EHV-CPU Application manual	NJI-481*(X)
HX Series Application manual (Hardware)	NJI-637*(X)
EH-SIO Application manual	NJI-443*(X)

* Alphabet before (X) indicates version (space, A, B…).

■ Accessory

No.	Item name	Model	Appearance	Qty.	Remarks
1	Connector for RS-422 / 485 Port	BL3.5/6F		1	Weidmuller Production

■ Supported CPU module

The table below lists the functions by EH-SIO software version and the CPU modules in which these functions are available.

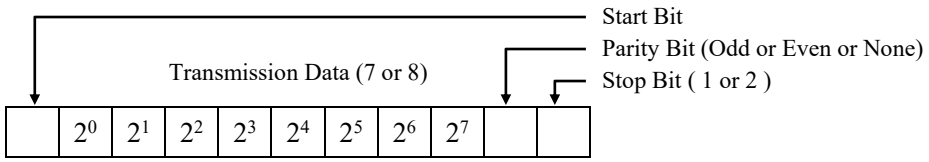
Function of EH-SIO	Software Version *1				Available CPU module	
	1.0	2.0	2.1	2.3 or later	EH-CPU516 (Ver. E2.02 to E2.06) EH-CPU548 (Ver. E4.02 to E4.05)	All EHV CPU modules EH-CPU516 (Ver. E2.07 or later) EH-CPU548 (Ver. E4.06 or later)
Free-protocol	✓	✓	✓	✓	✓	✓
Modbus Master (RTU)	✓	✓	✓	✓	✓	✓
Modbus Master (ASCII)	-	✓	✓	✓	✓	✓
Modbus Slave (RTU)	✓	✓	✓	✓	✓	✓
Modbus Slave (ASCII)	-	✓	✓	✓	✓	✓
Hi-Protocol (Standard)	-	✓	✓	✓	-	✓
Hi-Protocol (Simplified)	-	-	✓	✓	-	✓
Hi-Protocol (Enhance setting)	-	-	-	✓	-	✓
Simple data link	-	✓	✓	✓	-	✓

*1 The software version of EH-SIO can be checked in the name plate of the module side, or the status register before initial-setting completion.

« Note »

HX-CPU (Software ver. 3.5.8.26 or later) supports EH-SIO. However, how to make the program is totally different from EH / EHV-CPU series. As to the program for EH-SIO by using HX-CPU, please refer to HX Series APPLICATION MANUAL.

■ Functional Specifications

Item		Specifications		
Attachment position		Basic Base, Expansion Base (EH-SIO cannot operate on the remote base.)		
Number of mounted units		No restriction (8 units max. for the Modbus Slave mode, Hi-Protocol mode, Simple data link mode) * Total current consumption can be over the capacity of power supply module depending on module configuration. Be sure to check that the total current is less than the maximum output current of power supply module.		
Occupied I/O Number		128 points		
I/O Assignment		LADDER EDITOR		Word 4W/4W
		Control Editor		X4Y4W (SIO)
Error detection		Watchdog Timer, Abnormal Command, ROM Check, RAM Check		
Communication Specification	Communication I/F	Port 1 *3		Selection from RS-232C / RS-422 / RS-485
		Port 2		Selection from RS-232C / RS-422 / RS-485
	Transmission Speed	Selection from 600 / 1,200 / 2,400 / 4,800 / 9,600 / 19,200 / 38,400 / 57,600 bps		
	Transmission Method	Bit serial transmission (Sent out from the lowest bit in character units.)		
	Synchronization Method	Start-Stop Synchronization		
	Transmission code configuration			
	Input Buffer	1,024 byte/Port		
	Output Buffer	1,024 byte/Port		
	Error control	Over-run Error, Framing Error, Parity Error, Input Buffer Full, Message Error, Time-out Error, etc.		
	RS-232C Communication I/F	Connection mode		1:1
		Cable length		Max. 15 m
		Connector		RJ-45 connector
	RS-422 / 485 Communication I/F	Connection mode		1:N (N : Max. 32 units)
		Cable length		Max. 500 m
		Connector	Port 1 *3	RJ-45 connector
			Port 2	Attached with EH-SIO (BL3.5/6F, Weidmuller product)

*3 Communication interface of Port 1 is selectable in hardware Rev.10 or later. Hardware Rev.04 or before is RS-232C communication I/F fixed.

■ Modbus mode　Supported function code

The following table shows that the function code which are supported by EH-SIO in Modbus communication mode and meaning of function code in Modbus slave mode.

Function code	Function	
	Modbus　Original	EH-SIO slave mode operation
01 (0x01)	Read Coil Status	Read output (Y) values
02 (0x02)	Read Input Status	Read input (X) values
03 (0x03)	Read Holding Registers	Read internal output (WR) values
04 (0x04)	Read Input Registers	Read internal output (WM) values
05 (0x05)	Force Single Coil	Write output (Y) value
06 (0x06)	Preset Single Register	Write internal output (WM) value *4
		Write internal output (WR) value *4
15 (0x0F)	Force Multiple Coils	Write multiple output (Y) values
16 (0x10)	Preset Multiple Registers	Write multiple internal output (WR) values

*4 Software ver. 2.6 or before　"WM" can be accessed by function code 06.
Software ver. 3.0 or later　Target internal output of function code 06 can be selected from "WM" and "WR" by initial setting.

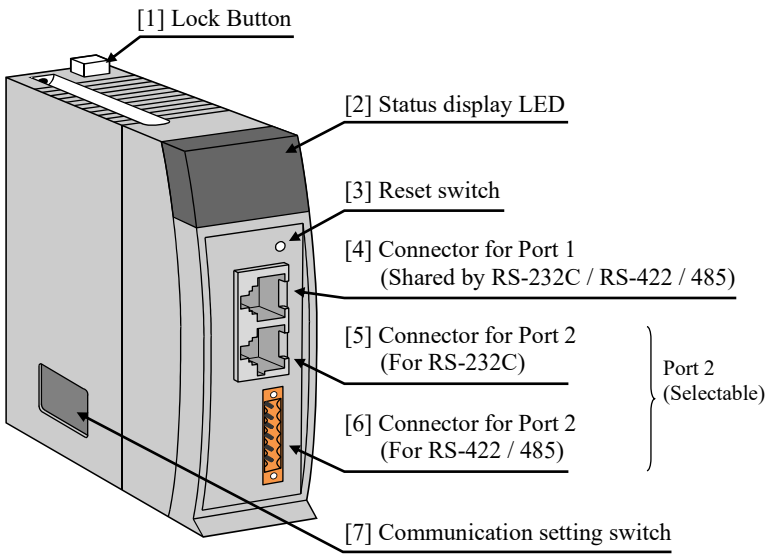
■ Hi-Protocol (Communication procedure for H series) mode supported task code

Command	Function	Remark
10H	CPU status read	
16H	CPU occupancy / cancel	
17H	Forced cancel of occupancy	
40H	Monitoring with I/O number designation (N continuous points)	
42H	Forced set / reset with I/O number designation (N continuous points)	
44H	Monitoring with I/O number designation (N random points)	
45H	Forced set / reset with I/O number designation (N random points)	
A0H	Monitoring with I/O number designation (N continuous points)	Occupancy is not necessary
A2H	Forced set / reset with I/O number designation (N continuous points)	Occupancy is not necessary
A4H	Monitoring with I/O number designation (N random points)	Occupancy is not necessary
A5H	Forced set / reset with I/O number designation (N random points)	Occupancy is not necessary

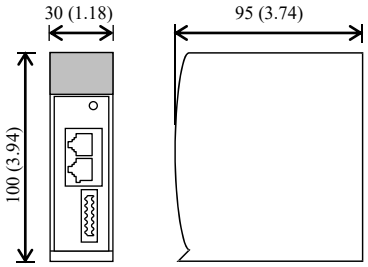
EH-SIO (Hi-protocol mode) has supported the enhanced setting since software ver. 2.3.
Purpose of this enhance setting is replacement from Large-H series to EHV series.
In case that EH-SIO is used instead of COMM-H / COMM-2H, the enhance setting is useful because the parameter of enhance setting in initial setting is same as setting of DIP switch on COMM-H / COMM-2H.

■ Name and Function of each part

Name and Function of each part



Type	EH-SIO
Weight	Approx. 0.13 kg (0.29 lb.)
Dimensions (mm (in.))	

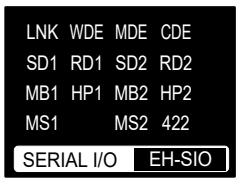


No.	Name		Function	Remarks
[1]	Lock Button		When dismounting the module from a base unit, press this button and lift up the module. The module can be fixed firmly by a screw (M4, 10 mm (0.39 in.)).	—
[2]	Status Display LED		This LED displays the status of module.	—
[3]	Reset Switch		Resets when the module is abnormal.	—
[4]	Connector for Port 1	RS-232C	Used to connect the RS-232C communication I/F.	Selection with Communication Setting Switch
		RS-422 / 485 *5	Used to connect the RS-422 I/F or RS-485 communication I/F.	
[5]	Connector for Port 2	RS-232C	Used to connect the RS-232C communication I/F.	Selection with Communication Setting Switch
[6]		RS-422 / 485	Used to connect the RS-422 I/F or RS-485 communication I/F.	
[7]	Communication Setting Switch		The communication specification is configured by this switch. Please set according to connected devices after the power off and dismounting from a base unit.	—

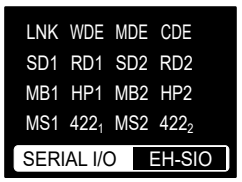
*5 Communication interface of Port 1 is selectable in hardware Rev.10 or later. Hardware Rev.04 or before is RS-232C communication I/F fixed.

■ LED Display

Hardware Rev.04 or before



Hardware Rev.10 or later



Appearance of LED	Name	Display contents	Details	Color
	LNK	Simple Data Link Mode*6	Lighting when the simple data link mode setting	Green
	WDE	Watch dog Timer	Lighting when MPU error. (Serious failure) Port 1, Port 2 combined use	Red
	MDE	Module Error*7	Lighting when module error (Serious failure) Port 1, Port 2 combined use	Red
	CDE	Command Error*7	Lighting when the command error and so on. (Minor failure) Port 1, Port 2 combined use	Red
	SD1	Send Data	Flickering when sending data (P1)	Green
	RD1	Receive Data	Flickering when receiving data (P1)	Green
	MB1	During Modbus Mode	Lighting on the Modbus mode setting (P1)	Green
	HP1	During Hi-Protocol Mode*6	Lighting on the Hi-Protocol mode setting (P1)	Green
	MS1	During the Modbus Master Mode	Lighting on the Modbus Master mode setting (P1)	Green
	422_1	Select the RS-422 / 485 I/F*8	Lighting when select the RS-422 / 485 I/F (P1)	Green
	SD2	Send Data	Flickering when sending data (P2)	Green
	RD2	Receive Data	Flickering when receiving data (P2)	Green
	MB2	During Modbus Mode	Lighting on the Modbus mode setting (P2)	Green
	HP2	During Hi-Protocol Mode*6	Lighting on the Hi-Protocol mode setting (P2)	Green
	MS2	During the Modbus Master Mode	Lighting on the Modbus Master mode setting (P2)	Green
	422_2	Select the RS-422 / 485 I/F	Lighting when select the RS-422 / 485 I/F (P2)	Green

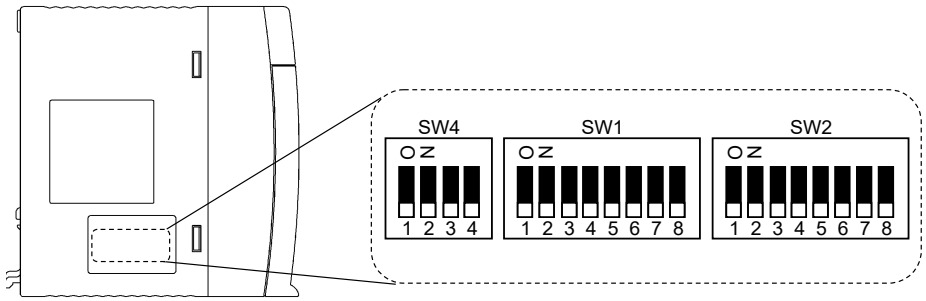
(P1) : for Port 1, (P2) : for Port 2

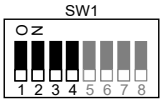
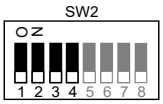
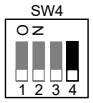
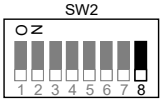
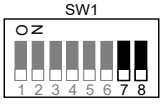
*6 Hi-Protocol and Simple Data Link Mode are supported in software ver. 2.0 or later.

*7 MDE and CDE are shared by Port 1 and Port 2.

*8 Communication interface of Port 1 is selectable in hardware Rev.10 or later. Hardware Rev.04 or before is RS-232C communication I/F fixed.

■ Communication setting switch



No.	Item	Detail
1	Transmission Speed  Port 1  Port 2	Select the transmission speed from the combinations in the table below.
2	Transmission code configuration  Port 1  Port 2	Select the transmission code configuration from the combinations in the table below.
3	Select the communication I/F for Port 1 *9 	Bit4 of SW4 is used for select of communication I/F of Port 1. (RS-232C or RS-422 / 485) RS-422 or 485 is switched by external wiring.
4	Select the communication I/F for Port 2 	Bit 8 of SW2 is used for select of communication I/F of Port 2. (RS-232C or RS-422 / 485) RS-422 or 485 is switched by external wiring.
5	Built-in terminator for Port 1 *9 	Bit3 of SW4 enables/disables the built-in terminator for port 1. It works when the communication I/F for port 1 is RS-422/485 (Bit4 of SW4 is ON). If the communication I/F for port 1 is RS-232C (Bit4 of SW4 is OFF), set it to OFF.
6	Operation mode 	If bit-7 and 8 of SW1 is ON, EH-SIO will start up with self-check mode. Please refer to the EH-SIO application manual for further information.

Bit1	Bit2	Bit3	Bit4	Speed
OFF	OFF	OFF	ON	300 bps
OFF	OFF	ON	OFF	600 bps
OFF	OFF	ON	ON	1,200 bps
OFF	ON	OFF	OFF	2,400 bps
OFF	ON	OFF	ON	4,800 bps
OFF	ON	ON	OFF	9,600 bps
OFF	ON	ON	ON	19,200 bps
ON	OFF	OFF	OFF	38,400 bps
ON	OFF	OFF	ON	57,600 bps

Bit5	Bit6	Bit7	Transmission code configuration		
			Data length	Stop bit	Parity
OFF	OFF	OFF	7	2	Even
OFF	OFF	ON	7	2	Odd
OFF	ON	OFF	7	1	Even
OFF	ON	ON	7	1	Odd
ON	OFF	OFF	8	2	None
ON	OFF	ON	8	1	None
ON	ON	OFF	8	1	Even
ON	ON	ON	8	1	Odd

Bit4	Communication I/F for Port 1
ON	RS-422 / 485
OFF	RS-232C

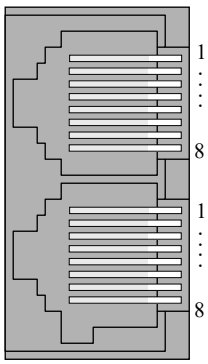
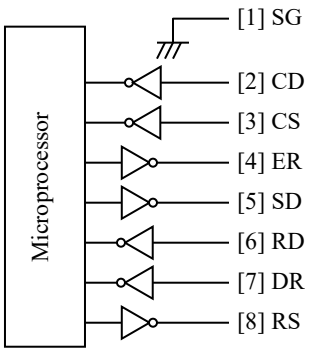
Bit8	Communication I/F for Port 2
ON	RS-422 / 485
OFF	RS-232C

Bit3	Built-in terminator for port 1
ON	Enables
OFF	Disables

Bit7	Bit8	Operation mode
ON	ON	Self-check mode
OFF	OFF	Normal operating mode

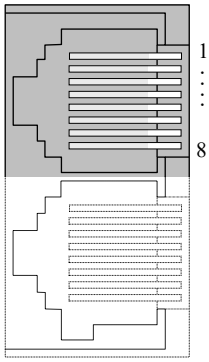
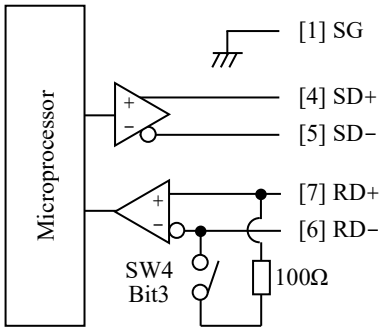
*9 Since hardware Rev.20, SW4 has been changed to 4-bit type. Bit1 and 2 should always be OFF.

■ Connector for RS-232C

Terminal Configuration	Pin No.	Signal abbreviation	Meaning	Internal Circuit
	1	SG	Signal Ground	
	2	CD *10	Carrier detect	
	3	CS *10	Clear to Send	
	4	ER *10	Equipment Ready	
	5	SD	Send Data	
	6	RD	Received Data	
	7	DR *10	Data Set Ready	
	8	RS *10	Request to Send	

*10 These signals are not used in Modbus mode.

■ Connector of Port 1 for RS-422 / 485

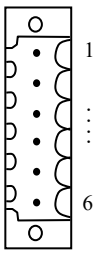
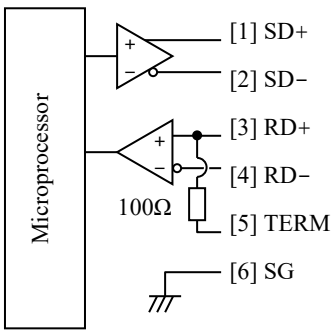
Terminal Configuration	Pin No.	Signal abbreviation	Meaning	Internal Circuit
	1	SG	Signal Ground	
	2	N.C.	(Not. Used)	
	3	N.C.	(Not. Used)	
	4	SD+	Send Data (+)	
	5	SD−	Send Data (−)	
	6	RD−	Received Data (−)	
	7	RD+	Received Data (+)	
	8	N.C.	(Not. Used)	

« Note »

Terminator is not built-in Port 1 in hardware Rev.10. Please add it to external wiring as necessary.

For hardware Rev.20 and later port 1, built-in terminator are available.

■ Connector of Port 2 for RS-422 / 485

Terminal Configuration	Pin No.	Signal abbreviation	Meaning	Internal Circuit
	1	SD+	Send Data (+)	
	2	SD−	Send Data (−)	
	3	RD+	Received Data (+)	
	4	RD−	Received Data (−)	
	5	TERM	Terminator	
	6	SG	Signal Ground	

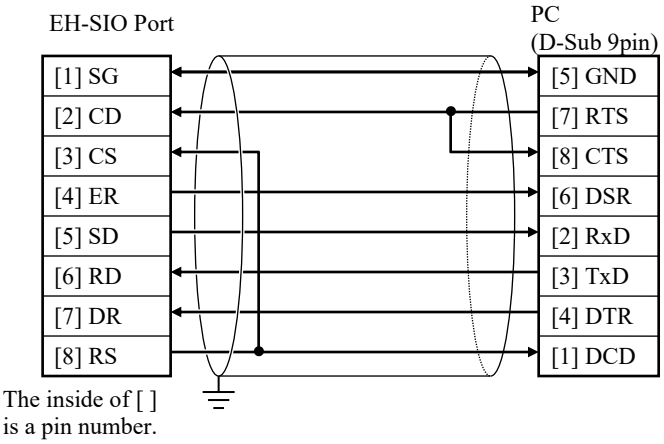
■ Communication with external device

Please use a twisted-pair cable with a shield for a communication cable.

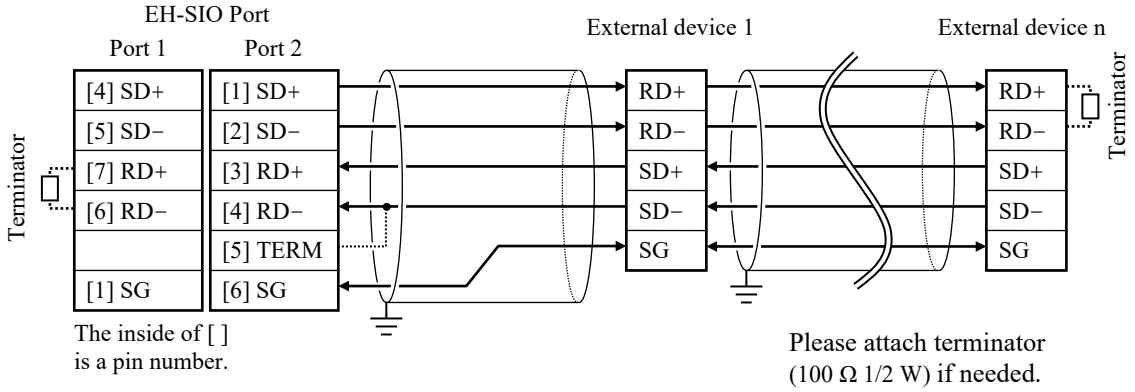
« Note »

When you use it for the equipment corresponding to CE Marking, please attach ferrite cores in the both ends of a communication cable.

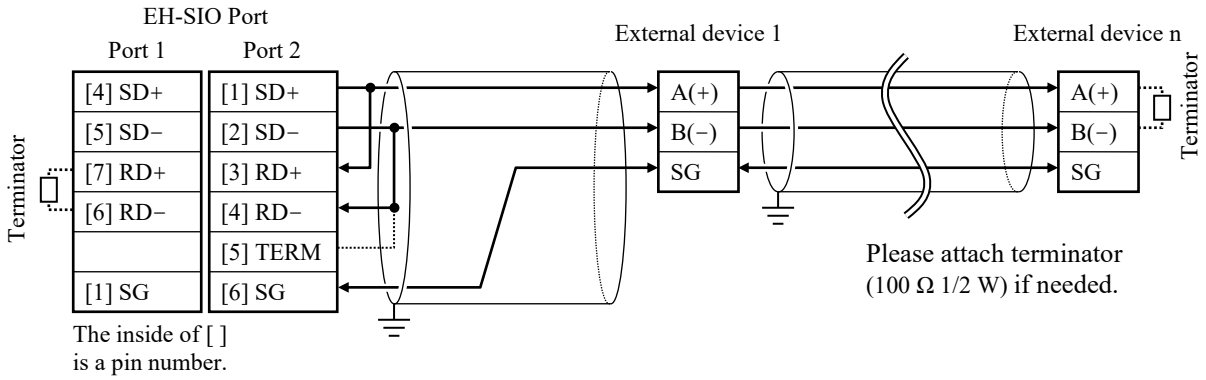
● When connecting with a personal computer in RS-232C communication I/F



● When connecting with external device in RS-422 communication I/F



● When connecting with external device in RS-485 communication I/F



When multi-drop connecting multiple external devices using Port 1 as RS-422 / 485, it becomes easier to wire by inserting a terminal block between the RJ-45 connector and the external device.

« Note »

Be Sure to ground shield of the cable at one end in principle.

But grounding at both ends or non-grounding could be more effective depending on noise environment.

Please choose the suitable grounding method.

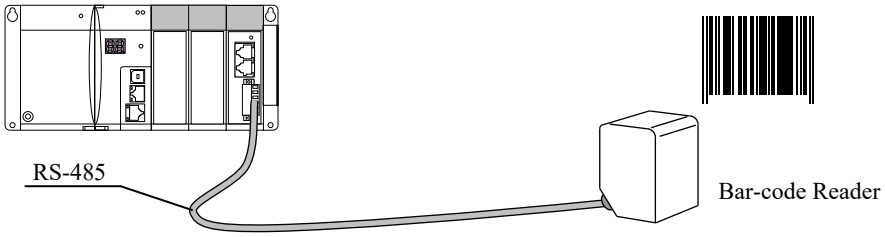
■ User Program

The initial setting is necessary to operate EH-SIO. Initial setting is carried out by TRNS 9 command.
Also user program with TRNS 9 command is necessary to operate EH-SIO.

■ The example of applications

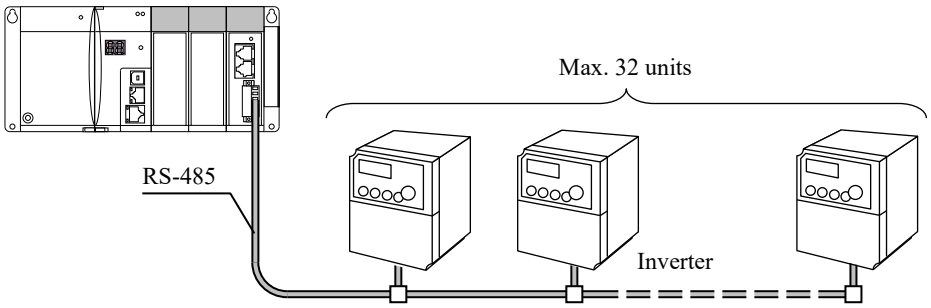
(1) Free protocol mode

EH-SIO can read bar code information from a bar code reader by user program.
Since EH-SIO can specify four kinds of data-communications methods (send only, receive only, send after receiving, receive after sending), a bar-code data can be read upon a command from CPU module, or cyclic data can be read automatically.



(2) Modbus master mode

The Hitachi inverter is controllable by user program.
EH-SIO is supporting the Modbus protocol. Since EH-SIO is able to convert communication data and calculate check code (CRC), user program can be created easily.



(3) Hi-Protocol mode

EH-SIO can communicate with HMI (Human Machine Interface) which is supports H series communication procedure.

For example, it is convenient when using two or more touch panels to be connected. Moreover, since EH-SIO can be mounted also in an expansion base, system expansion is very flexible.

« Note »

Programming tools, such as Control Editor and LADDER EDITOR, are not connectable with EH-SIO.