EH-150 series PLC **HITACHI**
EH-RTD8
Resistance Temperature Detective input module
Instruction manual

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.

Caution
1. All rights reserved.
2. The content of this manual may be changed without notice.
3. While efforts have been made on this manual to be accurate, please contact us if any mistake or unclear part is found.

■ Warranty period and coverage

The warranty period is within 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) Manufacturing number (MFG NO.)
(3) Details of failure

Safety precautions

■ Definitions and Symbols

| ⟨!⟩ **DANGER** | Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death. |

| ⚠ **CAUTION** | Indicates a potentially hazardous situation which, if not avoided, can result in minor to moderate injury, or serious damage of product. |

🚫 : Indicates Prohibition

❗ : Indicates Compulsion

⟨!⟩ DANGER
- Do not touch terminals while power ON. There is a danger of electric shock and/or injury.
- Be sure to install external safety devices outside of the PLC like emergency stop circuit or interlock circuit.

⚠ CAUTION
- Be sure that the rated voltage matches the power supply voltage of the unit. Otherwise, there is a danger of breakdown and/or injury and/or fire.
- Only qualified personnel shall carry out wiring work. Otherwise, there is a danger of breakdown and/or injury and/or fire.

⏚ COMPULSION
- Be sure to ground the unit. Otherwise, there is a danger of electric shock and/or malfunction.

🚫 PROHIBITION
- Do not attempt to modify nor disassemble the unit. There is a danger of breakdown and/or injury and/or fire.

■ 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 user 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.
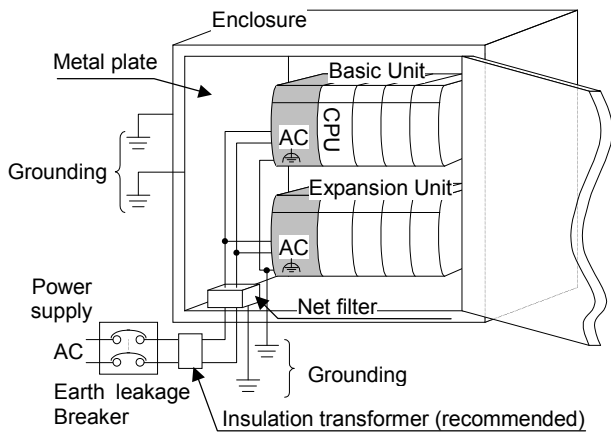
Figure 1　Power wiring example

Table 1　Specifications of the net filter

Item	Spec.
Rated voltage (V AC)	250
Rated current (A)	5
Withstand voltage (V) (between Terminal and case)	1,500
Insulation resistance (MΩ) (500V DC, 1min., between terminal and case)	100 (min.)
Attenuation characteristic (dB) — 0.5 to 30 MHz	Common mode more than 40dB
Attenuation characteristic (dB) — 0.15 to 30 MHz	Differential mode more than 40dB

■ Power Wiring

- Appropriate emergency circuitry, interlock circuitry and similar safety measures should be added to the system.
- Appropriate safety measures should be included in the system for unexpected breaking of wire or malsignal caused from instantaneous power failure.
- Applied voltage must be in the range specified in the manual. Otherwise, there is a danger of breakdown and/or injury and/or fire.
- Install an external earth leakage breakers to avoid short circuit accident.
- 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 CPU and I/O modules.
  ● Assembling cabinet or machine including PLC.
  ● Wiring.
- Install net filter specified in Table 1 or similar. The input and output cable of the net filter should be separated as much as possible. Be sure to ground the net filter.
- A shielded and insulated transformer is recommended.
- The basic and expansion unit should be connected to common power source and powered up together as shown in Figure 1.
- To install an arrester in each power wire is recommended in order to prevent lightning damage and/or injury.

■ I/O Wiring

- Be sure that the input/output matches the specified voltage. Otherwise, there is a danger of breakdown and/or fire.
- Use shielded cable for relay outputs modules, and connect shields to a functional ground for one side or both sides depending on applications.
- 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.
- Refer to the following table.

Electric wire for wiring			Terminal tightening torque
Size	Material	Type	
22-14 AWG	Copper	Single/twisted wire available	9in. –1bs (1.02 Nm)

■ 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 the field wiring before PLC power on. Otherwise, there is a risk of fire.
- Do not attempt to disassemble, repair or modify any part of the PLC.
- Do not pull on cables or bend cables beyond their natural limit. Otherwise, there is a risk of breaking of wire.
- Keep PLC modules in their boxes during storage and transport.
- Check carefully your PLC program before operation.

Installation environment

Avoid the following locations to install the PLC.

- Excessive dusts, salty air, or conductive materials (iron powder, etc.)
- Direct sunlight.
- 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.

Reference Manual

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

Manual name	Manual No.
EHV-CPU APPLICATION MANUAL	NJI-481∗ (X)
EHV-150 APPLICATION MANUAL	NJI-281∗ (X)

∗ The alphabet between 481 and (X) means version (A, B...) and the space means the first edition.

Specifications

■ General specifications

Item	Specifications
Operating ambient temperature	0 to 55°C
Storage ambient temperature	-10 to 75°C
Operating ambient humidity	5 to 95 % RH (no condensation)
Storage ambient humidity	5 to 95 % RH (no condensation)
Vibration resistance	Conforms to IEC 60068-2-6
Noise resistance	○ Noise voltage 1,500 Vpp 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: 3,000 V at metal exposed area
Insulation resistance	20 MΩ or more between the AC external terminal and case ground (FE) terminal (based on 500 V DC)
Dielectric withstand voltage	1,500 V AC for 1 minute between the AC external terminal and case ground (FE) terminal
Grounding	Class D grounding (ground with power supply module)
Usage environment	No corrosive gases, no excessive dust
Structure	Open, wall-mount type
Cooling	Natural air cooling

■ Performance specification

Item		Specification		
Type		EH-RTD8		
Supported RTD type		PT100 / PT1000 (3-wire or 2-wire)		
Number of channel Selectable by the DIP switch		6 (3-wire) or 8 (2-wire)		
Temperature range Selectable by the DIP switch		-200 to 850°C or -40 to 60°C		
Resolution Selectable by the DIP switch		°C conversion	°F conversion	PT4 compatible
		-200 to 850°C : 0.1°C	-328 to 1562°F : 0.1°F	-60 to 410°C : 15 bits
		-40 to 60°C : 0.02°C	—	-25 to 45°C : 15 bits
Conversion time Selectable by the DIP switch		1.6s (all channels) or 0.5s (all channels)		
Accuracy *1	Standard accuracy (25°C)	Max. ±0.5°C (measured temperature under 380°C) Max. ±0.8°C (measured temperature over 380°C)		
	Temperature coefficient	±0.01% / °C (FS)*2 (±0.1°C / °C)		
Measurement current		0.18mA		
Diagnostic error	LED	LED blinking at error channel		
(Wire breaking detection)	Conversion value	H7FFF		
Input filter Selectable by the DIP switch		None or moving average 16 times		
Warm-up time *3		1 minute		
Isolation	Channel to internal circuit	Photo coupler		
	Between channels	Not isolated		
Weight		Approximately 0.15 kg		
External wiring		Removable terminal (M3)		
Internal current consumption (5 V DC)		Max. 300mA		
External power		None		
Wiring		Twisted shield cable, wiring resistance Max. 5Ω (Max. 100m of 22AWG)		
I/O assignment Selectable by the DIP switch		X8W or X4W (PT4 compatible mode)		

*1 Example : Measuring under 380°C in ambient temperature 35°C.(under noise-free environment)

    0.5°C (standard accuracy) + 0.1°C/°C (temperature coefficient) × 10 (difference to 25°C) = ±1.5°C

*2 Full scale is -200 to 850°C.

*3 It is the time for data to be stable after power on.

■ Name and function of each part

Name and function of each part		Model name	EH-RTD8

1] Lock button
5] LED display
2] I/O cover
4] Mode setting DIP switch
3] Terminal

Model name	EH-RTD8
Weight	Approx. 0.15 kg
Consumption current	Approx. 300 mA
Dimensions (mm (in.))	

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

No.	Name	Function	Remarks
1]	Lock button	Press this button to dismount. Module can be fixed firmly by a screw of M4 × 10 mm (0.39 in.).	
2]	I/O cover	This is the cover attached to the terminal block area.	
3]	Terminal	This is the terminal block for connecting input signals. The terminal block is removable.	
4]	Mode setting DIP switch	These switches are to set wiring type, temperature range, input filter, conversion time, temperature unit, EH-PT4 compatible mode and sensor type.	Refer to Mode setting DIP switch.

5]	LED display	The status of module and input signal are indicated in this LED. OK : Green : Normal status
		2W : Green : 2-wire mode Off : 3-wire mode
		AMB : Green : -40 to 60°C mode Off : -200 to 850°C mode
		HS : Green : High speed conversion time (0.5s)
		        Off : Normal conversion time (1.6s)
		    0 to 7 : Blinking red : Open-wire or out-of-range is detected in corresponding channel number (0.5s cycle)
			Refer to Mode setting DIP switch.

Item	Detail explanation	Remarks
Explanation of operation	The module receives input signals from outside. The CPU module verifies the status of the installed module and if the I/O assignment information matches that contained in the user program, the input information is received according to the contents of the user program.	
Terminal block	The screws for the terminal block are M3 screws. Use a crimp terminal that fits the screw diameter. The maximum thickness of the cable should be only up to 0.75 mm². (Use 0.5 mm² cable when two crimp terminals are attached to the same terminal.) The recommended crimp terminal is indicated below. 6 (Recommended) 6 Handle very carefully since cable could be detached when screw is loose. Unit : mm	

■ Terminal layout and internal circuit

| Terminal layout | | Internal circuit |

No.	Signal name	
	2-wire	3-wire
①	A0	A0
②	A1	b0
③	B2・B3	B1
④	A4	A2
⑤	A5	b2
⑥	B6・B7	B3
⑦	NC	A4
⑧	NC	b4
⑨	NC	B5
⑩	B0・B1	B0
⑪	A2	A1
⑫	A3	b1
⑬	B4・B5	B2
⑭	A6	A3
⑮	A7	b3
⑯	NC	B4
⑰	NC	A5
⑱	NC	b5

OK 2W AMB HS
0 1 2 3
4 5 6 7

PT INPUT   EH-RTD8
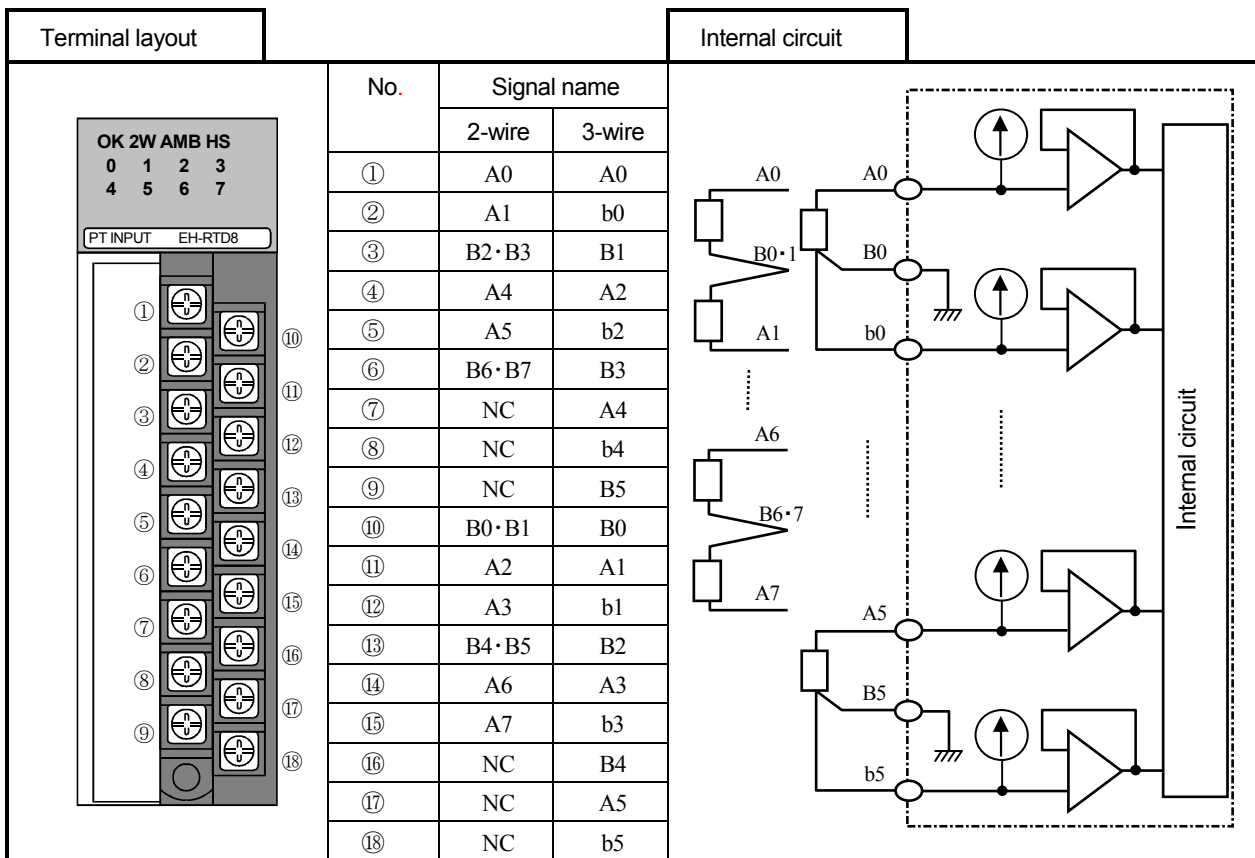
■ Mode setting DIP switch

Please set the DIP switch before use. If change the DIP switch while power on, the setting is same as before.

[Black part is factory setting]

No.	Setting	Function
SW1-1	1	Wiring type
	OFF	3-wire
	ON	2-wire
SW1-2	2	Temperature range
	OFF	-200 to 850°C, °F conversion: -328 to 1562°F, EH-PT4 compatible:-60 to 410°C
	ON	-40 to 60°C, °F conversion: -328 to 1562°F , EH-PT4 compatible: -25 to 45°C
SW1-3	3	Input filter
	OFF	None
	ON	16 times moving average
SW1-4	4	Conversion time
	OFF	1.6s
	ON	0.5s
SW1-5	5	Temperature unit
	OFF	°C
	ON	°F
SW1-6	6	EH-PT4 compatible mode
	OFF	Disable
	ON	Enable
SW1-7	7	For system use
	OFF	Set always OFF
SW1-8	8	For system use
	OFF	Set always OFF
SW2	9	Sensor type
	OFF	Pt1000
	ON	Pt100

■ Conversion table

Range	Input	°C conversion	°F conversion	PT4 compatible	Remarks
-200 to 850°C	Under -200°C	-32768 (H8000)	-32768 (H8000)	H7FFF	
	-200°C	-2000	-3280	H7FFF	Measurement minimum
	-60°C	-600	-760	HF666	PT4 range minimum
	0°C	0	320	H0000	
	410°C	4100	7700	H4199	PT4 range maximum
	850°C	8500	15620	H7FFF	Measurement maximum
	Over 850°C	32767 (H7FFF)	32767 (H7FFF)	H7FFF	

Range	Input	°C conversion	°F conversion	PT4 compatible	Remarks
-40 to 60°C	Under -40°C	-32768 (H8000)		H7FFF	
	-40°C	-4000		H7FFF	Measurement minimum
	-25°C	-2500		HD800	PT4 range minimum
	0°C	0	*1	H0000	
	45°C	4500		H4800	PT4 range maximum
	60°C	6000		H7FFF	Measurement maximum
	Over 60°C	32767 (H7FFF)		H7FFF	

*1: Same as -200 to 850°C.

■ I/O assignment and I/O addresses

The I/O assignment of EH-RTD8 is X8W. If EH-PT4 data compatible mode is enabled, it is X4W, which is same as EH-PT4. Data table is listed as below.

Outside IO number	CH	Remarks
WX**0	CH0 data	
WX**1	CH1 data	
WX**2	CH2 data	
WX**3	CH3 data	
WX**4	CH4 data	When EH-PT4 compatible mode is enabled, data is always 0.
WX**5	CH5 data	When EH-PT4 compatible mode is enabled, data is always 0.
WX**6	CH6 data	When EH-PT4 compatible or 3-wire mode is enabled, data is always 0.
WX**7	CH7 data	When EH-PT4 compatible or 3-wire mode is enabled, data is always 0.

■ Open-wire detection and out-of-range detection

If CPU module is EHV series, open-wire detection and out-of-range detection are monitored in the data WEX**0.

WEX**0

Out-of-range detection (ON when out of the range.)							
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0
Open-wire detection (ON when open-wire is detected.)							
bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8
CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0

■ Caution

(1) LED indication

LED	Off	Blinking	Lighting
OK	- No power supplied. - Module error. (Contact your local supplier.)	Module error. (Contact your local supplier.)	Normal operation.
2W	3-wire mode.	-	2-wire mode.
AMB	-200 to 850°C.	-	-40 to 60°C.
HS	1.6s conversion time.	-	0.5s conversion time.
0 to 7	Normal operation.	- Wire is disconnected. - Input signal is out of the range.	-

* If no sensor is connected, open-wire is detected, LED of corresponding input number is blinking. The blinking can be avoided by short between terminals in each channel.
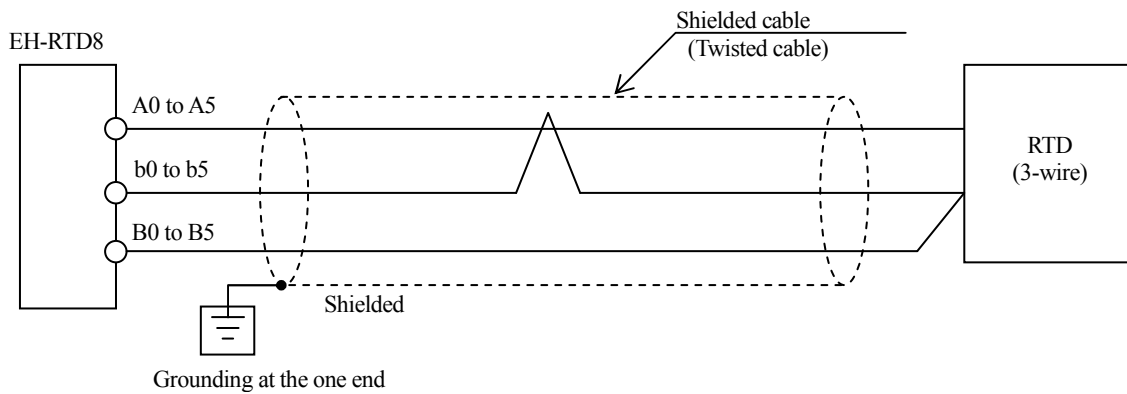
[Intended terminals in 3-wire input] A*, B* and b*

[Intended terminals in 2-wire input] A* and B*

(2) Wiring

Since analog signal is very sensitive, be sure to use shielded cable in order to protect from noise, and route the cable apart from other power/signal cables.

Be sure to ground the shield at one end basically. But grounding at both ends or no grounding can be more effective depending on system environment.

3-wire input

2-wire input