



## MICRO-EH (Thermocouple expansion unit) Safety Precautions

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

**Caution**

1. It is not allowed to reprint any part of this manual without permission.
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 mistakes or unclear part is found.

### 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 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 or repair cost, please contact your supplier or the local Hitachi Distributor. (Depending on failure part, repair might be impossible.)

### 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 number
MICRO-EH APPLICATION MANUAL	NJI-350(X)
MICRO-EH BASIC UNIT(20/40/64 points type) APPLICATION MANUAL	NJI-465(X)

The postfix of the publication number is subject to change for revision.

### General cautions

#### Definitions and Symbols



Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death.



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 during power ON. Failure to observe this caution may cause personal injury.
- Be sure to install external safety devices outside of the PLC like emergency stop circuit or interlock circuit.

**CAUTION**

- Always use the rated power voltage according to the module specifications. Using other voltages may damage the equipment or cause personal injury or fire.
- Only qualified personnel shall carry out wiring work. Failure to observe this caution may damage the equipment or cause personal injury or fire.

**COMPULSION**

- Be sure to ground the unit. Failure to do so may cause malfunction.

**PROHIBITION**

- Do not attempt to disassemble, repair or modify any part of the PLC. Failure to observe this caution may cause fire or damage of the equipment or malfunction.

## Mounting

- This equipment must be placed within a suitable enclosure such as a cabinet (key or tool entry) .
- 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 installing systems in locations :
  - Subject to static electricity or other forms of noise.
  - Subject to strong electromagnetic field.
  - Close to power supplies.
- Be sure to tighten mounting screws, terminal screws and connector screws.
- Check if devices with lock mechanism, such as an expansion cable and terminal blocks, are locked properly.

### ■ Power Wiring Procedures

- Appropriate emergency circuitry, interlock circuitry and similar safety measures should be added to the system.
- Appropriate safety measures should be included in the system to ensure safety in the event of abnormal signals caused by broken wires or momentary power interruptions.
- Always use the rated power voltage according to the manual. Using other voltages may damage the equipment or cause personal injury or fire.
- Install an external earth leakage breakers to avoid short circuit accident.
- Always turn off the power supply to the PLC before attempting any of the following. Performing any of these acts may result in damage to the PLC or personal injury or malfunction.
  - Mounting or dismounting the basic or expansion unit.
  - Assembling the equipment.
  - Wiring.
- Install net filter specified in table-1. 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 wired to a common power source and powered up together as shown in fig. 1.
- Install a lightning arrester  
To prevent damage to the equipment as a result of being struck by lightning, it is recommended that a lightning arrester be installed for each PLC's power supply circuit.

Table1 Net filter

Item	Spec.	
Rated voltage	250 V	
Rated current	5 A	
Withstand voltage (V) (between Terminal and case)	1500 V	
Insulation resistance (MΩ) (500VDC, 1 min., between terminal and case)	min. 100 MΩ	
Attenuation frequency range (MHz)	Differential mode, 40dB	0.5 to 30
	Common mode, 40dB	0.15 to 30

Reference : EMC filter ZAC2205-00U (TDK)

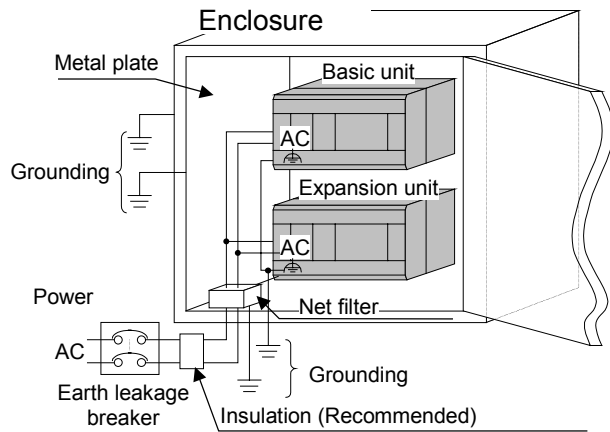


Figure 1 Power wiring example

### ■ I/O Wiring Procedures

- Always use the rated input/output voltage according to the module specifications. Using other voltages may damage the equipment or cause personal injury or fire.
- Use shielded cable and connect the both ends of shields to ground. Depending on actual noise environment, it could be more effective to connect only one end of shield or not to connect both ends. Take a appropriate grounding method accordingly.
- Install AC power cables in separate cable trays or bunches from I/O signal or data lines.
- 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.

### ■ General Wiring Procedures

- Use copper conductors for all wiring. You can use one copper conductor – AWG#14 (2.1 mm<sup>2</sup>) through AWG#22 (0.36 mm<sup>2</sup>) or two copper conductors – AWG#16 (1.3 mm<sup>2</sup>) through AWG#22 (0.36 mm<sup>2</sup>) – per terminal.
- The suggested torque for terminal connections is 0.5 to 0.6 Nm.
- 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 the power supply to a broken PLC.
- Be sure to check all wiring before applying the power. Incorrect wiring may damage the equipment or cause 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. The lines may break.
- Check carefully your PLC program before using.
- Keep PLC modules in their boxes during storage and transport.

## Environmental Conditions

- Avoid the following locations to install the PLC.
- Excessive dust, 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.

■ Specifications  
General Specifications

Item	Specification
Type	EH-D6ETC , EH-D4ETC
Power voltage	24V DC ( 19.2 to 30V DC )
Allowable momentary power failure	10ms
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	Complies with JIS C 0911
Noise resistance	<ul style="list-style-type: none"> <li>- Noise voltage 1500 Vp-p Noise pulse width 100 ns, 1 micro sec (Noise created by the noise simulator is applied across the power supply module's input terminals. This is determined by this company's measuring methods.)</li> <li>- Based on NEMA ICS 3-304 (with the exception of input module)</li> <li>- Static noise: 3000 V at metal exposed area</li> </ul>
Dielectric withstand voltage	500V DC
Grounding	Class D (100Ω) independent grounding
Usage environment	No corrosive gases, no excessive dirt
Structure, Cooling	Attaches to an open wall , Natural air cooling
Protection against electrical shock hazard	Class 1 equipment Open equipment
I/O assignment	FUN0 ( X5W / Y3W )

Input Specifications

No. of channels		4 channels			
Supported thermocouple(Selected by DIP switch)		Type K, J, E, S, T, B, N			
Each type of Specification (Ambient temp. 0 to 55 °C)	Type	Accuracy guaranteed range	accuracy (*1)	Resolution	Input range
	K	-200 to 1200 °C	± 0.4% (FS)	0.1 °C / 0.2 °F	-270 to 1370 °C
	J	-40 to 750 °C	± 0.3% (FS)	0.1 °C / 0.2 °F	-270 to 1200 °C
	E	-200 to 900 °C	± 0.3% (FS)	0.1 °C / 0.2 °F	-270 to 1000 °C
	S	0 to 1600 °C	± 1.0% (FS)	1.0 °C / 1.0 °F	-50 to 1760 °C
	T	-200 to 350 °C	± 0.8% (FS)	0.1 °C / 0.2 °F	-270 to 400 °C
	B	600 to 1700 °C	± 1.0% (FS)	1.0 °C / 1.0 °F	0 to 1820 °C
	N	-200 to 1200 °C	± 0.4% (FS)	0.1 °C / 0.2 °F	-270 to 1300 °C
	50mV	-50 to 50mV	± 0.5% (FS)	0.01 mV	-50 to 50mV
	100mV	-100 to 100mV	± 0.5% (FS)	0.02 mV	-100 to 100mV
Conversion data		15bits + sign ( 0.1 °C / 0.1 °F / 0.01mV )			
Isolation	Between channels	Not isolated			
	Between channel and internal circuit	Isolated by photo coupler			
Cold junction input range		-20 to 80 °C			
Cold junction compensation accuracy		± 2 °C or less (ambient temp. 0 to 55 °C)			
Diagnostic error (Over flow or breaking wire)		Input data : H7FFF (LED blinking at error channel)			
Update cycle ( 4 channels all )		563msec ( thermocouple ) / 141msec ( mV )			
External wiring (*2)		Max. 100 m			

\*1) Overall error is sum of accuracy for each sensor and accuracy of cold junction compensation. Error of thermocouple is not included in the above accuracy. Above accuracy is guaranteed under the condition of 10 minutes after power ON.

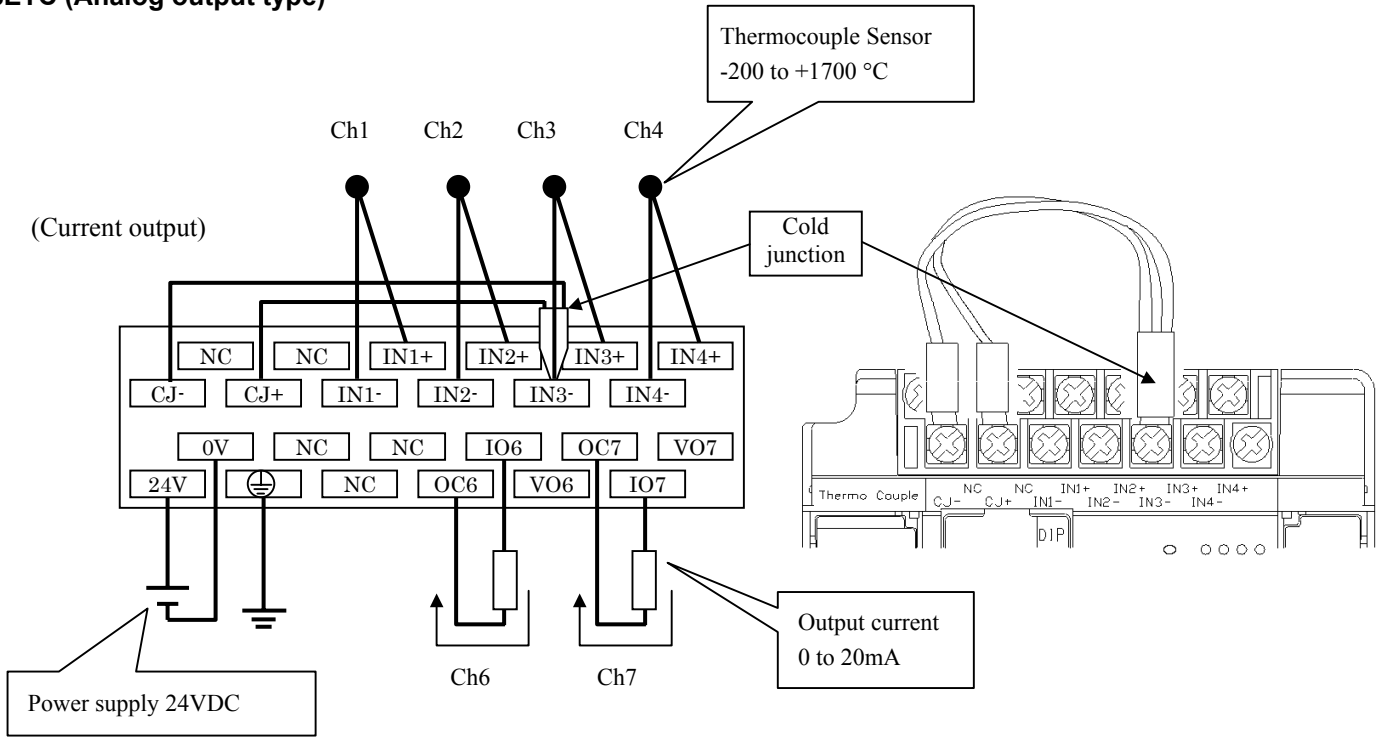
\*2) Note : The max. cable length is 100m, however it depends on noisy environment or other conditions.

Analog output Specifications ( EH-D6ETC only )

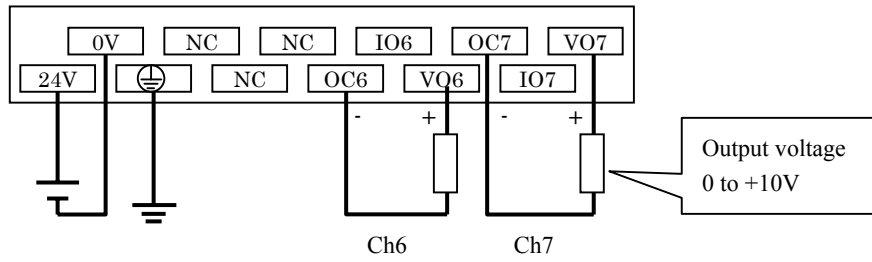
No. of analog output		2 channels	
Output Ranges		0-10 V (10.24 V Max.) / 0-20 mA (20.48 mA Max.)	
Resolution		12 Bits	
Accuracy		± 1% of full scale over temp. range	
Response time		8.8 ms	
Current Outputs	User Load Range and Max. Voltage Output Load Capacitance and Inductance	10 to 500 Ω , 10 V 2000 pF Max. , 1 Henry Max.	
Voltage Outputs	Output Loading Output Load Inductance	10 kΩ Minimum at 10 V 1 micro F Max.	

■ Terminal configuration

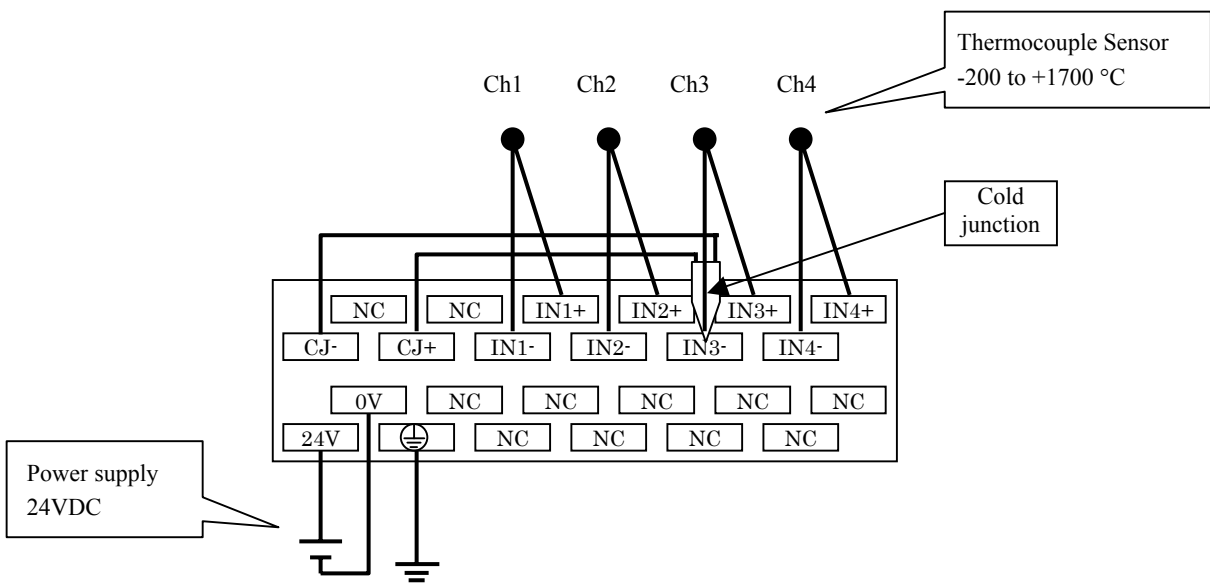
**EH-D6ETC (Analog output type)**



(Voltage output)



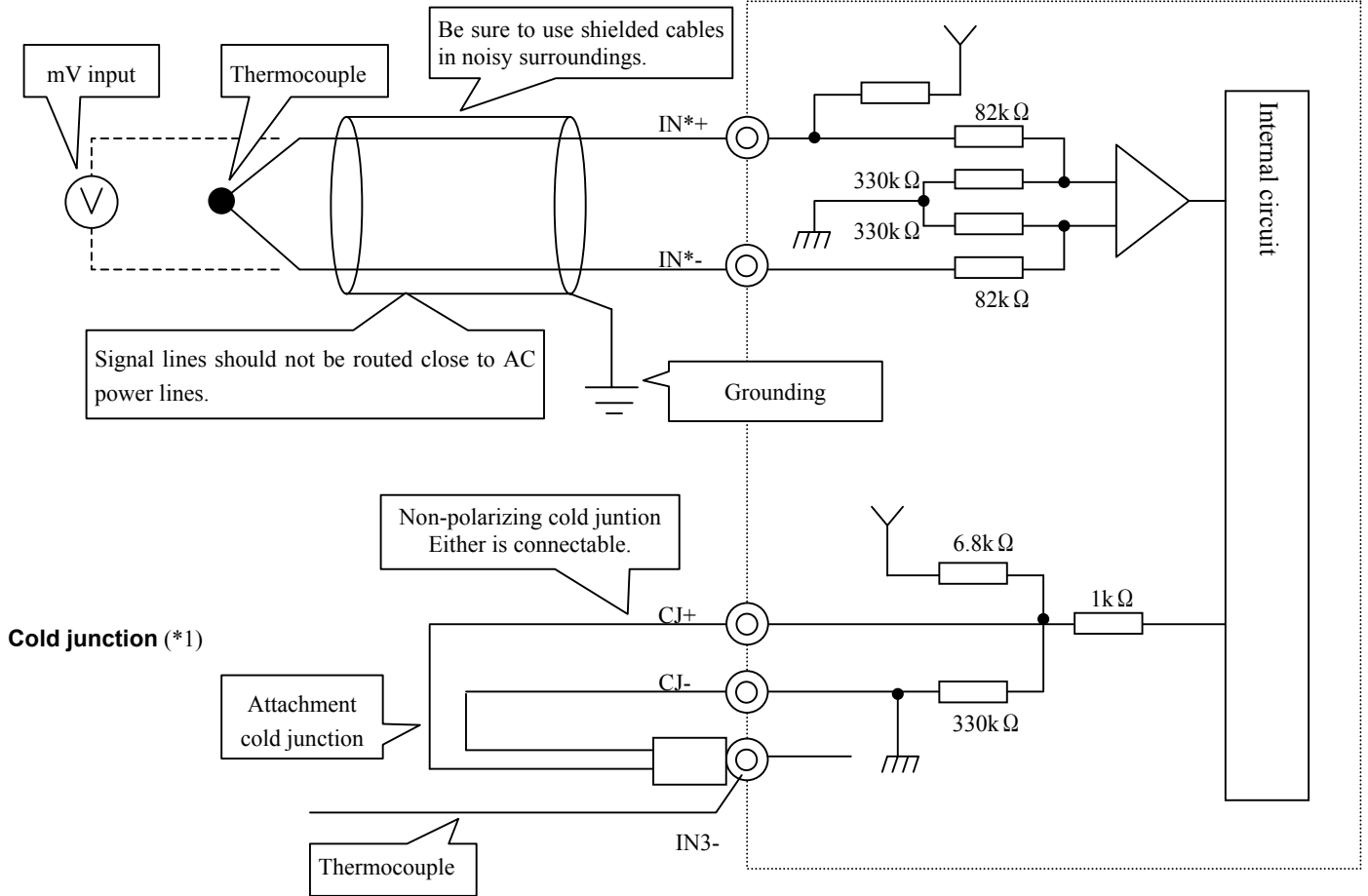
**EH-D4ETC (No analog output version)**



■ Wiring and circuit diagram

**Input signal**

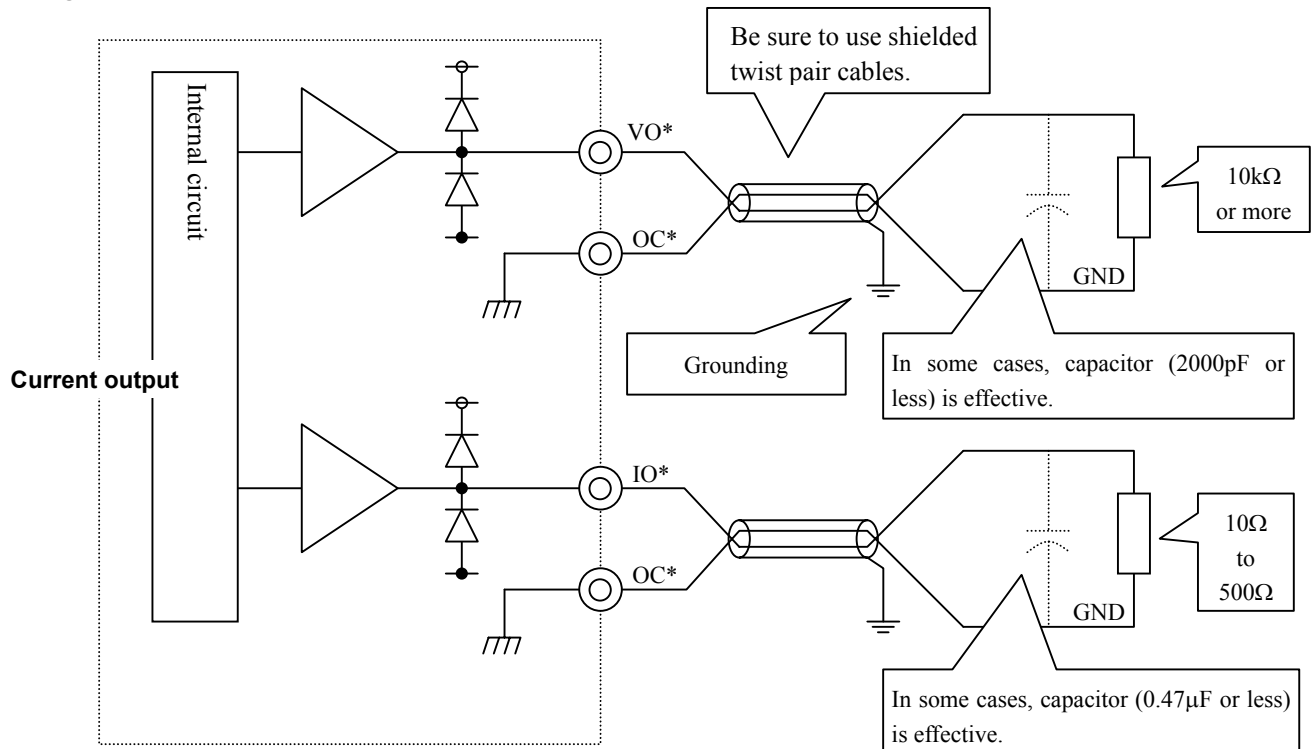
Thermocouple or mV



\*1 Used only at the thermocouple input, and unnecessary at the mV input.

**Analog output signal**

Voltage output



■ Data conversion table

Input

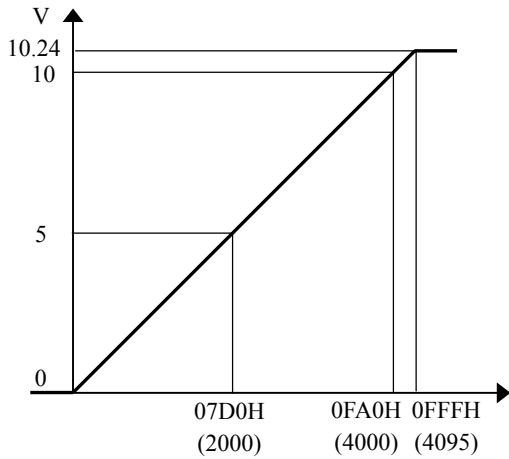
Mode	Input signal	Decimal	Hexadecimal	LED (ch.1~4) *
°C	Over range or cable disconnection	32767	H7FFF	Blink
	1820 °C	18200	H4718	Off
	0 °C	0	H0000	Off
	-270 °C	-2700	HF574	Off
	Under range	-32768	H8000	Blink
°F	Over range or cable disconnection	32767	H7FFF	Blink
	3276.6 °F	32766	H7FFE	Off
	0 °F	0	H0000	Off
	-518 °F	-5180	HEBC4	Off
	Under range	-32768	H8000	Blink
-50 to 50mV	Over range or cable disconnection	32767	H7FFF	Blink
	50 mV	5000	H1388	Off
	0 mV	0	H0000	Off
	-50 mV	-5000	HEC78	Off
	Under range	-32768	H8000	Blink
-100 to 100mV	Over range or cable disconnection	32767	H7FFF	Blink
	100 mV	10000	H2710	Off
	0 mV	0	H0000	Off
	-100 mV	-10000	HD8F0	Off
	Under range	-32768	H8000	Blink

\* LED blinks depending on input value. Please check wiring by the LED indication.

\* LED at an open channel blinks as it is regarded as wire breaking. This LED blinking can be avoided by short circuit between IN\*- and IN\*+. Input data in this case will be undefined value.

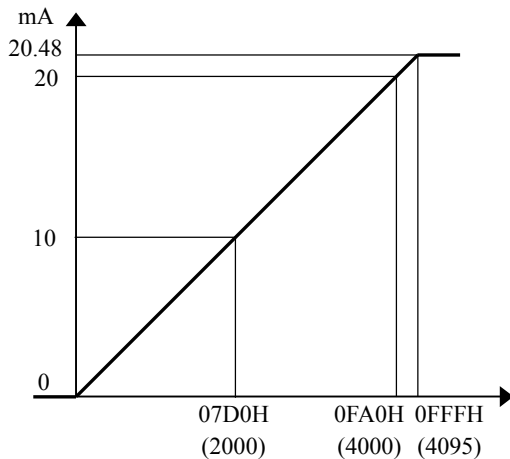
Output

0 to 10V Range



Voltage	10.24V	0FFFH (4095)
	10 V	0FA0H (4000)
	5 V	07D0H (2000)
	0 V	0000H (0)
Resolution		0.0025 V

0 to 20 mA Range



Current	20.48mA	0FFFH (4095)
	20mA	0FA0H (4000)
	10mA	07D0H (2000)
	0mA	0000H (0)
Resolution		0.005mA

■ Range configuration

Input type ( Common to all channels )

Sw1	Sw2	Sw3	Type	Remarks
OFF	OFF	OFF	K	Factory default
ON	OFF	OFF	J	
OFF	ON	OFF	E	
ON	ON	OFF	S	
OFF	OFF	ON	T	
ON	OFF	ON	B	
OFF	ON	ON	N	
ON	ON	ON	mV	Voltage input

Conversion type ( Common to all channels )

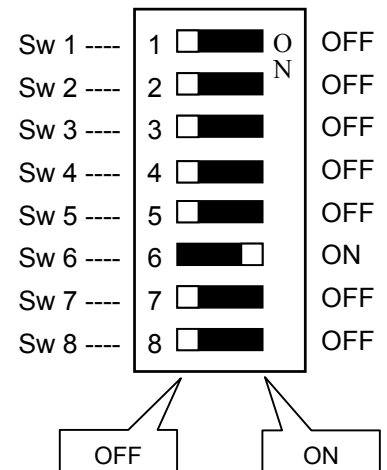
Sw4	Conversion type	Remarks
OFF	°C or 50mV	Factory default
ON	°F or 100mV	

Analog output (Common to all channels)

Sw5	Range	Remarks
OFF	0 - 10V	Factory default
ON	0 - 20mA	

Sw6 : Be sure to set on.  
Sw7 : Be sure to set off.  
Sw8 : Be sure to set off.

Dip switch  
( Factory default )



Note : Power on again after adjusting.

■ I/O assignment, Data allocation

I/O assignment : FUN0

Data allocation: The following table

WXu00	System area	
WXu01	RTD input data Ch.1	Signed 16 bits data
WXu02	RTD input data Ch.2	
WXu03	RTD input data Ch.3	
WXu04	RTD input data Ch.4	
WYu05	System area	Do not write any value.
WYu06	Analog output data Ch.6	Be sure to write 12 bits data (0 to H0FFF).
WYu07	Analog output data Ch.7	

u : Unit number (1 to 4)

Example : Unit 1, Ch.2 → WX102, Unit 4, Ch.7 → WY407

■ NOTE

▪ **Basic unit corresponding to a thermocouple expansion unit**

Be sure to use a thermocouple expansion unit with the basic unit of software version 1.20 or newer. This is not supported the basic unit of software version 1.12 or older.

Software version of the basic unit can be monitored with WRF051 of special internal output area.

▪ **Signal level in case written output data is out of range**

Even if output data is over the range, the signal stays at the Max. value, and even if under the range, it stays at the minimum value. Output value is signed 16 bits data. 8000H to 7FFFH (-32768 to 32767)

Example : Range 0-10V, 2000H written → 10.24V output

Example : Range 0-20mA, FF00H written → 0mA output

▪ **LED indication**

LED	Lighting	Off	Blinking
POW	- Power is supplied to exp. Unit. - Power is supplied to the next connected unit.	- No power is supplied.	-
OK	- Unit OK	- No power is supplied to the basic unit. - Expansion cable is disconnected.	- Unit cannot start operating properly. (Power on again, or replace it.)
ch.1-4	-	- Thermocouple is connected properly.	- Wire breaking or short circuit * - Data out of the range *

\* (1).Sensor error detection

If the input signal is out of the range (incl. wire breaking), the LED of each input blinks in 1 sec. cycle.

(1) sensor error detection has priority over (2) cold junction error detection.

(2).Cold junction error detection

If the signal of cold junction input is out of the range (incl. wire breaking), the LED of thermocouple configured input flashes once a second.

▪ **UL requirements**

This unit is industrial control equipment for use in hazardous locations “class 1, Division 2. Groups A, B, C, and D”.

- WARNING: EXPLOSION HAZARD – SUBSTITUTION OF ANY COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION2.
- WARNING: EXPLOSION HAZARD – DO NOT REPLACE MODULES UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
- WARNING: EXPLOSION HAZARD – DO NOT CONNECT OR DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KOWN TO BE NON-HAZARDOUS.
- WARNING: EXPLOSION HAZARD – DO NOT CONNECT OR DISCONNECT CABLE UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
- WARNING: Fire, Explosion, and Severe Burn Hazard. Do Not Recharge, Disassemble, Heat Above 212°F (100°C), Incinerate, Or Expose Contents To Water.