High-performance Multi-point Control System

SR Mini HG SYSTEM

Hardware Instruction Manual

RKC® RKC INSTRUMENT INC.

IMSRM15-E6

- Modbus is a registered trademark of Schneider Electric.
- The name of each programmable controller (PLC) means the products of each manufacturer.
- Company names and product names used in this manual are the trademarks or registered trademarks of the respective companies.

Thank you for purchasing this RKC product. In order to achieve maximum performance and ensure proper operation of your new instrument, carefully read all the instructions in this manual. Please place the manual in a convenient location for easy reference.

SYMBOLS

WARNING : This mark indicates precautions that must be taken if there is danger of electric shock, fire, etc., which could result in loss of life or injury.

CAUTION : This mark indicates that if these precautions and operating procedures are not taken, damage to the instrument may result.

 : This mark indicates that all precautions should be taken for safe usage.

 : This mark indicates important information on installation, handling and operating procedures.

 : This mark indicates supplemental information on installation, handling and operating procedures.

 : This mark indicates where additional information may be located.

⚠ WARNING

- To prevent injury to persons, damage to instrument and equipment, a suitable external protection device shall be required.
- All wiring must be completed before power is turned on to prevent electric shock, fire or damage to instrument and equipment.
- This instrument must be used in accordance with the specifications to prevent fire or damage to instrument and equipment.
- This instrument is not intended for use in locations subject to flammable or explosive gases.
- Do not touch high-voltage connections such as power supply terminals, etc. to avoid electric shock.
- RKC is not responsible if this instrument is repaired, modified or disassembled by other than factory-approved personnel. Malfunction can occur and warranty is void under these conditions.

CAUTION

- This product is intended for use with industrial machines, test and measuring equipment. (It is not designed for use with medical equipment and nuclear energy.)
- This is a Class A instrument. In a domestic environment, this instrument may cause radio interference, in which case the user may be required to take additional measures.
- This instrument is protected from electric shock by reinforced insulation. Provide reinforced insulation between the wire for the input signal and the wires for instrument power supply, source of power and loads.
- Be sure to provide an appropriate surge control circuit respectively for the following:
  - If input/output or signal lines within the building are longer than 30 meters.
  - If input/output or signal lines leave the building, regardless the length.
- This instrument is designed for installation in an enclosed instrumentation panel. All high-voltage connections such as power supply terminals must be enclosed in the instrumentation panel to avoid electric shock by operating personnel.
- All precautions described in this manual should be taken to avoid damage to the instrument or equipment.
- All wiring must be in accordance with local codes and regulations.
- All wiring must be completed before power is turned on to prevent electric shock, instrument failure, or incorrect action.
  The power must be turned off before repairing work for input break and output failure including replacement of sensor, contactor or SSR, and all wiring must be completed before power is turned on again.
- To prevent instrument damage as a result of failure, protect the power line and the input/output lines from high currents with a suitable overcurrent protection device with adequate breaking capacity such as fuse, circuit breaker, etc.
- Prevent metal fragments or lead wire scraps from falling inside instrument case to avoid electric shock, fire or malfunction.
- Tighten each terminal screw to the specified torque found in the manual to avoid electric shock, fire or malfunction.
- For proper operation of this instrument, provide adequate ventilation for heat dispensation.
- Do not connect wires to unused terminals as this will interfere with proper operation of the instrument.
- Turn off the power supply before cleaning the instrument.
- Do not use a volatile solvent such as paint thinner to clean the instrument. Deformation or discoloration will occur. Use a soft, dry cloth to remove stains from the instrument.
- To avoid damage to instrument display, do not rub with an abrasive material or push front panel with a hard object.
- Do not connect modular connectors to telephone line.
- When high alarm with hold action/re-hold action is used for Alarm function, alarm does not turn on while hold action is in operation. Take measures to prevent overheating which may occur if the control device fails.

NOTICE

- This manual assumes that the reader has a fundamental knowledge of the principles of electricity, process control, computer technology and communications.
- The figures, diagrams and numeric values used in this manual are only for purpose of illustration.
- RKC is not responsible for any damage or injury that is caused as a result of using this instrument, instrument failure or indirect damage.
- RKC is not responsible for any damage and/or injury resulting from the use of instruments made by imitating this instrument.
- Periodic maintenance is required for safe and proper operation of this instrument. Some components have a limited service life, or characteristics that change over time.
- Every effort has been made to ensure accuracy of all information contained herein. RKC makes no warranty expressed or implied, with respect to the accuracy of the information. The information in this manual is subject to change without prior notice.
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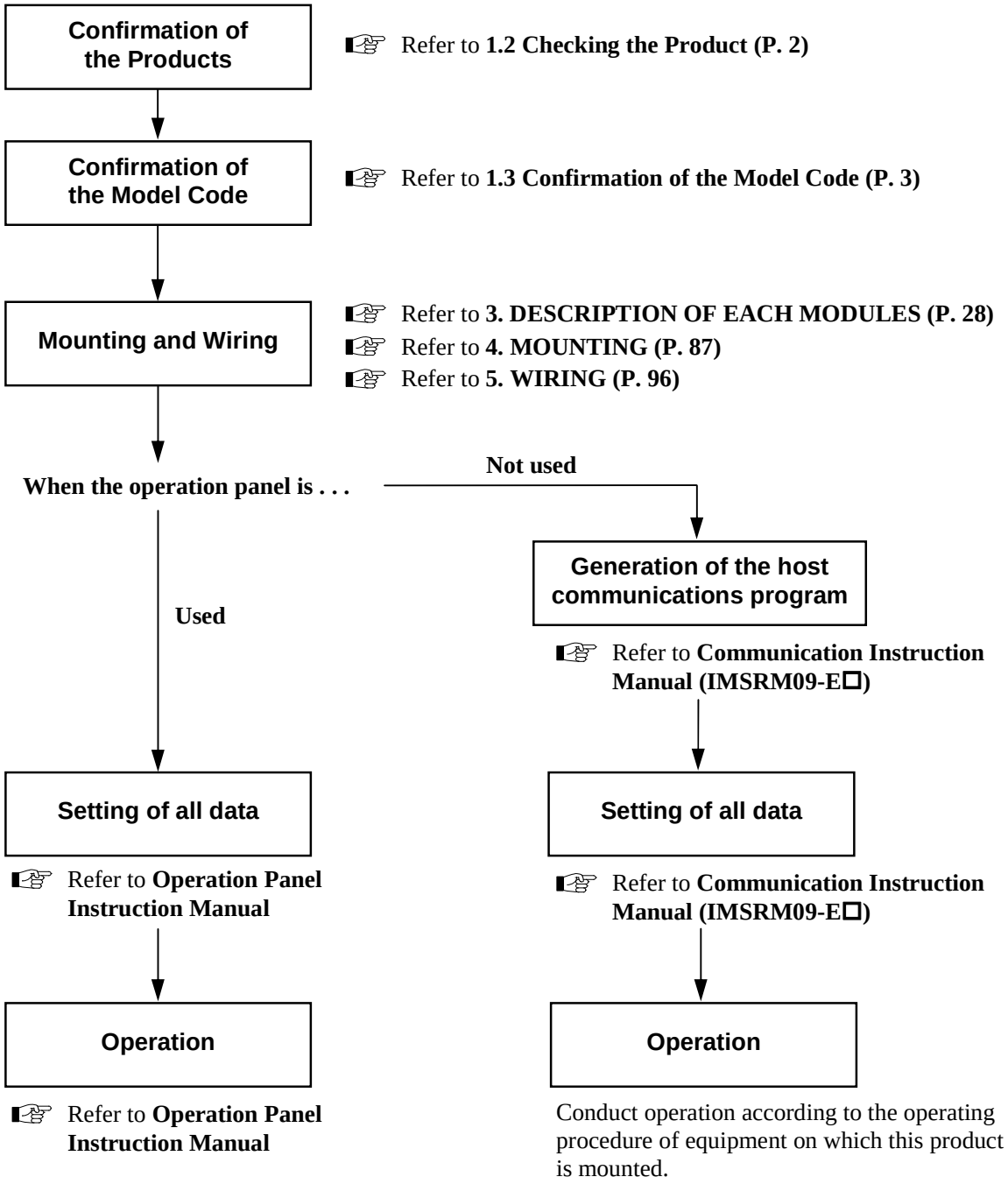
1. OUTLINE

This manual describes the specifications, hardware of the SR Mini HG SYSTEM control unit (H-PCP-A/B module *, Function modules).

* When it used the H-PCP-G/H/J (Power supply/CPU module), refer to each instruction manual. Refer to this manual only about description of the function module.

1.1 Handling Procedures

For proper operation of your new instrument, follow the procedures and precautions listed below.



1.2 Checking the Product

When unpacking your new instrument, please confirm that the following products are included. If any of the products are missing, damaged, or if your manual is incomplete, contact your nearest RKC sales office or agent for replacement.

☐ H-PCP-A/B module (Power supply/CPU module) .... 1 module

H-PCP-A/B module is included in control unit.
One H-PCP-A/B module (power supply/CPU module) is required for each control unit.

☐ Function modules .... Required number of modules

Function module is included in control unit.

☐ DIN rail holding clips .... Two clips per unit

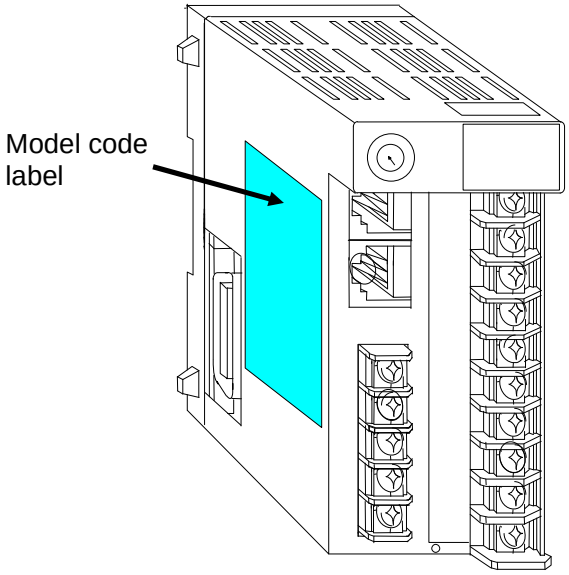
☐ Hardware Quick Manual (IMS01V01-E☐) .... 1 copy

☐ Communication Quick Manual (IMS01V02-E☐) .... 1 copy

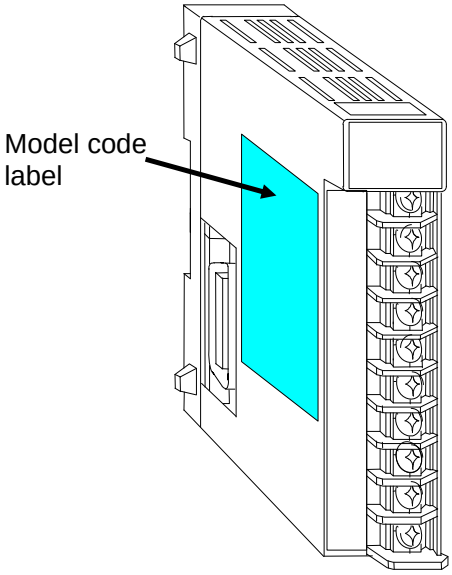
Modules for the SR Mini HG SYSTEM cannot be mixed with those for the SR Mini SYSTEM.

1.3 Confirmation of the Model Code

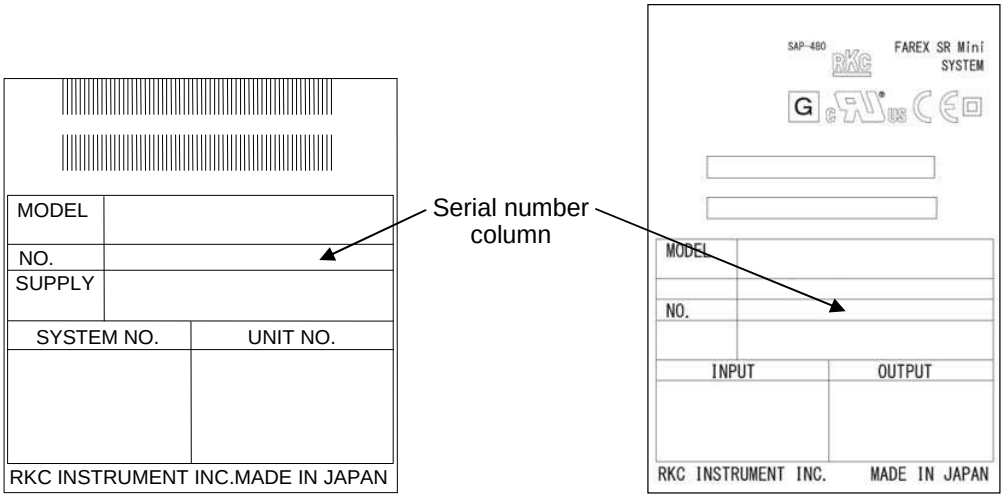
The model code for the instrument you received is listed below. Please confirm that you have received the correct instrument by checking the model code label, located on the left side of the module, with this list. If the product you received is not the one ordered, please contact RKC sales office or the agent.



H-PCP module



Single type function module



Model code label

If the product conforming to CE/UL/cUL (or CSA) is selected, "/CE" is entered in the serial number column.

■ H-PCP module (Power/CPU module) model code

H-PCP- □ - □ □ N - □ * □ □
(1) (2) (3) (4) (5) (6) (7)

(1) Type

A: DO 4 points type
B: DO 2 points type with DI function

(2) Power supply voltage

1: 100 to 120 V AC
2: 200 to 240 V AC
3: 24 V DC

(3) Communication interface

1: RS-232C
4: RS-422A

(4) External connector

N: No function

(5) DO signal

M: Relay contact output
D: Open collector output

(6) First alarm function *

N: No alarm function
□: Refer to **Alarm code table**

(7) Second alarm function *

N: No alarm function
□: Refer to **Alarm code table**

* It is alarm function of H-TIO-□ module, H-CIO-A module.

Alarm code table

A: Deviation High	B: Deviation Low
C: Deviation High and Low	D: Deviation Band
E: Deviation High (with alarm hold)	F: Deviation Low (with alarm hold)
G: Deviation High and Low (with alarm hold)	H: Process High
J: Process Low	K: Process High (with alarm hold)
L: Process Low (with alarm hold)	

A special alarm function

Q: Deviation High (with alarm re-hold)	R: Deviation Low (with alarm re-hold)
T: Deviation High and Low (with alarm re-hold)	

The selected function will be common for all the modules with alarm functions in the control unit.

For the H-PCP module with the ladder communication, special specification code “Z-190” must be specified at the end of the model code. The H-TIO-K, H-CIO-A, H-DI-B and H-DO-C module cannot be used to the H-PCP-A/B module with the specification of ladder communication.

When the communication interface of H-PCP module is RS-232C, only one control unit can be connected.

For the H-PCP-A module with the Modbus communication, special specification code “Z-1021” must be specified at the end of the model code. The H-TIO-K, H-TI-A/B/C, H-CIO-A, H-DI-A/B, H-DO-A/B/C/D, H-AI-A/B and H-AO-A/B module cannot be used to the H-PCP-A module with the specification of Modbus communication.

For the H-PCP-A module with the MEMOBUS communication, special specification code "Z-1001" must be specified at the end of the model code. The H-TIO-K, H-CIO-A, H-DI-A/B, H-DO-A/B/C/D, H-AI-A/B and H-AO-A/B module cannot be used to the H-PCP-A module with the specification of MEMOBUS communication.

For the contents of the DO, four functions can be selected out of the six functions; first alarm, second alarm, heater break alarm, burnout alarm, temperature rise completion and loop break alarm. For details on the DO Allocation, refer to the following **Initial Code**.

Initial Code

- □ □ □ □ - □ □ - □ □

(1) (2) (3) (4) (5) (6) (7) (8)

(1) Digital output 1 (DO1)

N: Unused

□: Refer to **DO allocation code table**

(2) Digital output 2 (DO2)

N: Unused

□: Refer to **DO allocation code table**

(3) Digital output 3 (DO3)

N: Unused

□: Refer to **DO allocation code table**

(4) Digital output 4 (DO4)

N: Unused

□: Refer to **DO allocation code table**

(5) TI alarm 1

N: No alarm function

□: Refer to **TI, AI alarm code table**

(6) TI alarm 2

N: No alarm function

□: Refer to **TI, AI alarm code table**

(7) AI alarm 1

N: No alarm function

□: Refer to **TI, AI alarm code table**

(8) AI alarm 2

N: No alarm function

□: Refer to **TI, AI alarm code table**

DO allocation code table

1: Temperature alarm 1
2: Temperature alarm 2
3: Heater break alarm
4: Burnout alarm
5: Temperature rise completion
6: AI alarm 1
7: AI alarm 2
8: Loop break alarm
(TI alarm output is common with temperature alarm output)

TI, AI alarm code table

H: Process high alarm
J: Process low alarm
K: Process high alarm (with alarm hold)
L: Process high alarm (with alarm hold)

For DO1 to DO4, specify different code numbers other than "N."

For type B, only DO1 or DO2 can be selected. For DO3 or DO4, set "N."

■ H-TIO module (Temperature control module) model code

● 1 channel control type

H-TIO- □ - □ □ □ - □ □ ∗ □ □
(1) (2) (3) (4) (5) (6) (7) (8)

(1) Type

A: 1 channel type (Temperature input)
C: 1 channel heat/cool type (Temperature input)
E: 1 channel type
(High accuracy temperature input)
G: 1 channel heat/cool type
(High accuracy temperature input)
H: 1 channel type
(Voltage/Current input)
R: 1 channel fuzzy control type
(High accuracy temperature input)

(2) Control action

A: ON/OFF control (Reverse action) [1]
C: ON/OFF control (Direct action) [1]
F: PID control with autotuning function
(Reverse action)
D: PID control with autotuning function
(Direct action)
B: Heat/Cool PID control with autotuning function (Air cooling) [2]
W: Heat/Cool PID control with autotuning function (Water cooling) [2]

(3) Input type

□: Refer to **Input range table (P. 14)**

(4) Range

□: Refer to **Input range table (P. 14)**

(5) Control output (Heat-side)

M: Relay contact output
V: Voltage pulse output
D: Open collector output
T: Triac output
□: Current output
(Refer to **Output code table**)
□: Voltage output
(Refer to **Output code table**)

(6) Control output (Cool-side) [3]

None: No function
M: Relay contact output
V: Voltage pulse output
D: Open collector output
T: Triac output
□: Current output
(Refer to **Output code table**)
□: Voltage output
(Refer to **Output code table**)

(7) Alarm output [4]

N: No function
1: First alarm output [5]
2: Second alarm output [5]
3: Heater break alarm output [6]
4: Loop break alarm output [7]

(8) Current transformer input [8]

N: No function
P: CT input: CTL-6-P-N
S: CT input: CTL-12-S56-10L-N

Output code table

3: 0 to 1 V DC	4: 0 to 5 V DC	5: 0 to 10 V DC	6: 1 to 5 V DC
7: 0 to 20 mA DC	8: 4 to 20 mA DC	9: Others	

[1] Only possible to select for type A, E and H.
[2] Only possible to select for type C and G.
[3] Both heat-side and cool-side outputs can be selected by using the Heat/Cool control type (C, G). For other types, “No function” is selected for cool-side control output, and only heat-side control output can be selected.
[4] Output type is relay contact output.
[5] Only possible to select for type A, E, H and R. First/second alarm types are those selected by the H-PCP module.
[6] Only possible to select for type A.
[7] Only possible to select for type A, E and R.
[8] Current transformer input can be designated when the input belongs to type A and C, as well as the type of control output (heat-side) is relay contact output, voltage pulse output, open collector output, or triac output.

- **2 channel control type**

H-TIO- □ - □ □ □ - □ □ ∗ □ □
(1) (2) (3) (4) (5) (6) (7) (8)

(1) Type [1]

B: 2 channels type (Temperature input)
D: 2 channels heat/cool type (Temperature input)
F: 2 channels type (High accuracy temperature input)
J: 2 channels type (Continuous voltage/current input)
P: 2 channels fuzzy control type (Temperature input)

(2) Control action

A: ON/OFF control (Reverse action) [2]
C: ON/OFF control (Direct action) [2]
F: PID control with autotuning function (Reverse action)
D: PID control with autotuning function (Direct action)
B: Heat/Cool PID control with autotuning function (Air cooling) [3]
W: Heat/Cool PID control with autotuning function (Water cooling) [3]

(3) Input type

□: Refer to **Input range table (P. 14)**

(4) Range

□: Refer to **Input range table (P. 14)**

(5) Control output (Heat-side)

M: Relay contact output
V: Voltage pulse output
D: Open collector output
T: Triac output
□: Current output (Refer to **Output code table**)
□: Voltage output (Refer to **Output code table**)

(6) Control output (Cool-side) [4]

None: No function
M: Relay contact output
V: Voltage pulse output
D: Open collector output
T: Triac output
□: Current output (Refer to **Output code table**)
□: Voltage output (Refer to **Output code table**)

(7) Alarm output

N: No function

(8) Current transformer input [5]

N: No function
P: CT input: CTL-6-P-N
S: CT input: CTL-12-S56-10L-N

Output code table

3: 0 to 1 V DC	4: 0 to 5 V DC	5: 0 to 10 V DC	6: 1 to 5 V DC
7: 0 to 20 mA DC	8: 4 to 20 mA DC	9: Others	

[1] In two channels type, the inputs, ranges and outputs should be identical.
Both inputs of H-TIO-F module are only RTD inputs.

[2] Only possible to select for type B and F.

[3] Only possible to select for type D.

[4] Both heat-side and cool-side outputs can be selected by using the Heat/Cool control type (D).
For other types, “No function” is selected for cool-side control output, and only heat-side control output can be selected.

[5] Current transformer input can be designated when the input belongs to type D, as well as the type of control output (heat-side) is relay contact output, voltage pulse output, open collector output, or triac output.

■ H-TIO module (Position proportioning control module) model code

H-TIO- K - Z □ □ - M M
(1) (2) (3) (4) (5) (6)

(1) Type

K: 1 channel control type for control motor drive

(2) Control action

Z: PID control (position proportioning)

(3) Input type

□: Refer to **Input range table (P. 14)**

(4) Range

□: Refer to **Input range table (P. 14)**

(5) Control output (Open-side)

M: Relay contact output

(6) Control output (Close-side)

M: Relay contact output

The H-TIO-K module cannot be used to the H-PCP-A/B module with the specification of ladder communication.

■ H-TI module (Temperature input module) model code

H-TI- □ - □ □
(1) (2) (3)

(1) Type

A: 4 channels RTD input
B: 2 channels thermocouple, RTD input (High accuracy type)
C: 4 channels thermocouple input

(2) Input type

□: Refer to **Input range table (P. 14)**

(3) Range

□: Refer to **Input range table (P. 14)**

■ H-CIO module (Cascade control module) model code

● Heat control type

H-CIO- □ - □ □ □ - □ ∗ □
(1) (2) (3) (4) (5) (6)

(1) Type

A: 1 channel cascade control type

(2) Control action

F: PID control with autotuning function (Reverse action)
D: PID control with autotuning function (Direct action)

(3) Input type

□: Refer to **Input range table (P. 14)**

(4) Range

□: Refer to **Input range table (P. 14)**

(5) Slave control output

M: Relay contact output
V: Voltage pulse output
D: Open collector output
T: Triac output
□: Current output
(Refer to **Output code table**)
□: Voltage output
(Refer to **Output code table**)

(6) Master manipulated output (Distribution output)

None: No function
M: Relay contact output
V: Voltage pulse output
D: Open collector output
T: Triac output
□: Current output
(Refer to **Output code table**)
□: Voltage output
(Refer to **Output code table**)

Output code table

3: 0 to 1 V DC	4: 0 to 5 V DC	5: 0 to 10 V DC	6: 1 to 5 V DC
7: 0 to 20 mA DC	8: 4 to 20 mA DC	9: Others	

For the master and slave, the input and the range become same.

The H-CIO-A module cannot be used to the H-PCP-A/B module with the specification of ladder communication.

- **Heat/Cool control type**

H-CIO- □ - □ □ □ - □ ∗ □
(1) (2) (3) (4) (5) (6)

(1) Type

A: 1 channel cascade control type

(2) Control action

B: Heat/Cool PID control with autotuning function (Air cooling)
W: Heat/Cool PID control with autotuning function (Water cooling)

(3) Input type

□: Refer to **Input range table (P. 14)** *

(4) Range

□: Refer to **Input range table (P. 14)** *

(5) Control output (Heat-side)

M: Relay contact output
V: Voltage pulse output
D: Open collector output
T: Triac output
□: Current output
(Refer to **Output code table**)
□: Voltage output
(Refer to **Output code table**)

(6) Control output (Heat-side)

M: Relay contact output
V: Voltage pulse output
D: Open collector output
T: Triac output
□: Current output
(Refer to **Output code table**)
□: Voltage output
(Refer to **Output code table**)

* For the Heat/Cool control types (B and W), no voltage or current input can be specified.

Output code table

3: 0 to 1 V DC	4: 0 to 5 V DC	5: 0 to 10 V DC	6: 1 to 5 V DC
7: 0 to 20 mA DC	8: 4 to 20 mA DC	9: Others	

For the master and slave, the input and the range become same.

The H-CIO-A module cannot be used to the H-PCP-A/B module with the specification of ladder communication.

■ Input range table

Thermocouple input (H-TIO-A/B/C/D/E/G/K/P/R, H-TI-B/C, H-CIO-A)

Input type		Code	
		Input	Range
K	0 to 400 °C	K	02
	0 to 800 °C	K	04
	0 to 1300 °C	K	11
	0.0 to 400.0 °C	K	09
	0.0 to 800.0 °C	K	10
	0.0 to 1300.0 °C [1]	K	23
	0 to 800 °F	K	A1
	0.0 to 800.0 °F	K	A4
	0 to 2400 °F	K	A5
	0.0 to 2400.0 °F [1]	K	B4
	-200.0 to +300.0 °C [1]	K	32
	-100.0 to +400.0 °C [2]	K	36
J	0 to 400 °C	J	02
	0 to 800 °C	J	04
	0 to 1200 °C	J	06
	0.0 to 400.0 °C	J	08
	0.0 to 800.0 °C	J	09
	0.0 to 1200.0 °C [1]	J	16
	0 to 1600 °F	J	A2
	0.0 to 700.0 °F	J	A4
	0 to 2100 °F	J	A5
	0.0 to 1600.0 °F [1]	J	B2
	-200.0 to +300.0 °C [1]	J	26
R	0 to 1700 °C	R	03
	0.0 to 1700.0 °C [1]	R	05
	0 to 3000 °F	R	A3
S	0 to 1700 °C	S	03
	0.0 to 1700.0 °C [1]	S	04
	0 to 3000 °F	S	A3
B [3]	0 to 1800 °C	B	03
	0.0 to 1800.0 °C [1]	B	04
	0 to 3000 °F	B	A5
E	0 to 1000 °C	E	02
	0.0 to 700.0 °C	E	03
	0 to 400 °C	E	04
	0.0 to 400.0 °C [1]	E	07
	0.0 to 1000.0 °C [1]	E	08
	0 to 1800 °F	E	A3
	0.0 to 1800.0 °F [1]	E	A6

Input type		Code	
		Input	Range
T	0.0 to 400.0 °C	T	06
	0 to 400 °C	T	08
	0 to 200 °C	T	09
	-200 to +200 °C	T	10
	0.0 to 200.0 °C [1]	T	12
	-200.0 to +200.0 °C [1]	T	13
	0.0 to 700.0 °F	T	A7
	0 to 700 °F	T	A9
	-300 to +400 °F	T	B1
	-300.0 to +400.0 °F [1]	T	B3
N	0 to 1300 °C	N	02
	0.0 to 1300.0 °C [1]	N	05
	0 to 2300 °F	N	A1
	0.0 to 2300.0 °F [1]	N	A4
PL II	0 to 1200 °C	A	03
	0.0 to 1200.0 °C [1]	A	04
	0 to 2300 °F	A	A3
	0.0 to 2300.0 °F [1]	A	A5
W5Re/ W26Re	0 to 2300 °C	W	03
	0.0 to 2300.0 °C [1]	W	04
	0 to 3000 °F	W	A3
U	0.0 to 600.0 °C	U	04
	0 to 400 °C	U	05
	-200 to +200 °C	U	06
	0.0 to 400.0 °C [1]	U	03
	-200.0 to +200.0 °C [1]	U	09
	0 to 700 °F	U	A5
	-300 to +400 °F	U	A6
	0.0 to 700.0 °F [1]	U	A8
	-300.0 to +400.0 °F [1]	U	A9
L	0 to 400 °C	L	01
	0.0 to 400.0 °C	L	03
	0.0 to 900.0 °C	L	04
	0 to 900 °C	L	05
	0 to 800 °F	L	A1
	0 to 1600 °F	L	A2
	0.0 to 800.0 °F [1]	L	A5
	0.0 to 1600.0 °F [1]	L	A6

[1] The range can be specified only by H-TIO-E/G/R, H-TI-B or H-CIO-A module (high accuracy type).

[2] The range can be specified only by H-TIO-A/B/C/D [Z-1013 specification] or H-TI-C module [Z-1013 specification].

[3] Accuracy is not guaranteed between 0 to 399 °C (0 to 799 °F) for type B thermocouple input.

RTD input (H-TIO-A/B/C/D/E/F/G/K/P/R, H-TI-A/B, H-CIO-A)

Input type		Code	
		Input	Range
JPt100	0.0 to 400.0 °C	P	16
	0 to 400 °C	P	17
	-200 to +200 °C	P	18
	-200.0 to +200.0 °C	P	21
	-50.00 to +150.00 °C [1]	P	22
	-300 to +900 °F	P	B4
	0 to 800 °F	P	B3
	0.0 to 800.0 °F	P	B7
	-300.0 to +900.0 °F [2]	P	B8
Pt100	0.0 to 400.0 °C	D	16
	0 to 400 °C	D	17
	-200 to +200 °C	D	18
	-200.0 to +200.0 °C	D	21
	-50.00 to +150.00 °C [1]	D	22
	-300 to +1200 °F	D	B5
	0 to 800 °F	D	B4
	0.0 to 800.0 °F	D	B7
	-300.0 to +1200.0 °F [2]	D	B8

[1] The range with the resolution of 1/100 can be specified only by H-TIO-E module.
[2] The range can be specified only by H-TIO-F module (high accuracy type).

Voltage input and Current input (H-TIO-H/J, H-CIO-A)

Input type			Code	
			Input	Range
Voltage input *	0 to 10 mV DC	0.0 to 100.0 %	1	01
	-10 to +10 mV DC	0.0 to 100.0 %	G	01
	0 to 100 mV DC	0.0 to 100.0 %	2	01
	-100 to +100 mV DC	0.0 to 100.0 %	U	01
	0 to 1 V DC	0.0 to 100.0 %	3	01
	-1 to +1 V DC	0.0 to 100.0 %	W	01
	0 to 5 V DC	0.0 to 100.0 %	4	01
	1 to 5 V DC	0.0 to 100.0 %	6	01
	-5 to +5 V DC	0.0 to 100.0 %	D	01
	0 to 10 V DC	0.0 to 100.0 %	5	01
	-10 to +10 V DC	0.0 to 100.0 %	V	01
Current input *	0 to 20 mA DC	0.0 to 100.0 %	7	01
	4 to 20 mA DC	0.0 to 100.0 %	8	01

* Display scale of the voltage and current input can be changed.

■ H-CT module (Current transformer input module) model code

H-CT- □ - □
(1) (2)

(1) Type

A: CT input 6 points type (Each 2 points together are common)

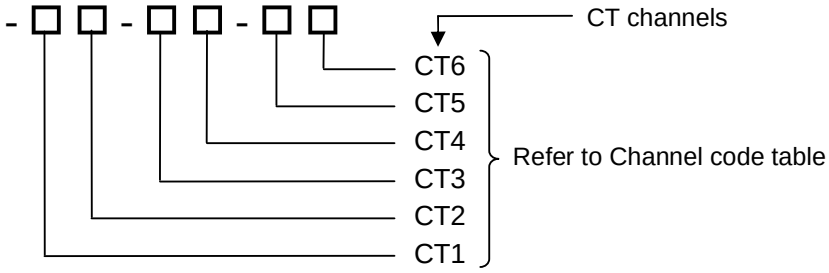
(2) CT type

P: CTL-6-P-N is used for 0 to 30 A
S: CTL-12-S56-10L-N is used for 0 to 100 A

📖 CT (current transformer) is sold separately.

Initial code

Specify the temperature control channels of H-TIO-□ module corresponding to each CT channel of H-CT-A module.



Channel code table

- Specify the temperature control channels corresponding to each CT channel.

H-TIO-□ Channel No.	Unused	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Code No.	N	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	G	H	J

📖 Each temperature control channel of H-TIO-□ module corresponding to each H-CT-A module can be allocated by the operation panel or host communication.

📖 The overlapping of temperature control channels is possible.
The unused channel is to be specified as “N.”

■ H-DI module (Digital input module) model code

H-DI- □
(1)

(1) Type

A: 24 V DC 8 points input type (4 points/common)
B: 24 V DC 8 points event input type (4 points/common)

📖 The H-DI-B module cannot be used to the H-PCP-A/B module with the specification of ladder communication.

■ H-DO module (Digital output module) model code

H-DO- □ - □
(1) (2)

(1) Type

A: 8 points output type
B: 4 points output type (Output signal is only relay contact output.)
C: 8 points event output type (Output signal is only open collector output.)
D: 16 points output type (Output signal is only open collector output.)

(2) Output signal

M: Relay contact output (Type A: 4 points/common, Type B: Independent common)
D: Open collector output (8 points/common)

📖 The H-DO-C module cannot be used to the H-PCP-A/B module with the specification of ladder communication.

Initial code

• H-DO-A, H-DO-D

- □ □
  - Block 2 (H-DO-A: Lower 4 points of terminal) (H-DO-D: Lower 8 points of terminal) Refer to **DO allocation code table**
  - Block 1 (H-DO-A: Upper 4 points of terminal) (H-DO-D: Upper 8 points of terminal) Refer to **DO allocation code table**

DO allocation code table

N:	Unused
1:	Temperature alarm 1
2:	Temperature alarm 2
3:	Heater break alarm
4:	Burnout alarm
5:	AI alarm 1
6:	AI alarm 2
7:	Loop break alarm

• H-DO-B

- □ N
  - Block 1 (All points of terminal) Refer to **DO allocation code table**

📖 Above initial code is for H-DO-A, H-DO-B and H-DO-C type module. As for the allocation of H-DO-C type module is done by the operation panel or host computer communication.

📖 H-TI alarm 1 and alarm 2 is output from H-DO-C module.

■ H-AI module (Analog input module) model code

H-AI- □ - □ □ □ □
(1) (2) (3) (4) (5)

(1) Type

A: 4 points analog input (Not insulated between input channels)
B: 2 points analog input (Insulated between input channels)

(2) AI 1 input type

□: Refer to **Analog input code table**

(3) AI 2 input type

□: Refer to **Analog input code table**

(4) AI 3 input type *

□: Refer to **Analog input code table**

(5) AI 4 input type *

□: Refer to **Analog input code table**

* The B type module is to be designated as “N” (no signal).

Analog input code table

1: 0 to 10 mV DC	2: 0 to 100 mV DC	3: 0 to 1 V DC	4: 0 to 5 V DC
5: 0 to 10 V DC	6: 1 to 5 V DC	7: 0 to 20 mA DC	8: 4 to 20 mA DC
D: -5 to +5 V DC	V: -10 to +10 V DC	W: -1 to +1 V DC	9: Others

■ H-AO module (Analog output module) model code

H-AO- □ - □ □ □ □
(1) (2) (3) (4) (5)

(1) Type

A: 4 points analog output type (Not insulated between output channels)
B: 2 points analog output type (Insulated between output channels)

(2) AO 1 output type

□: Refer to **Analog output code table**

(3) AO 2 output type

□: Refer to **Analog output code table**

(4) AO 3 output type *

□: Refer to **Analog output code table**

(5) AO 4 output type *

□: Refer to **Analog output code table**

* The B type module is to be designated as “N” (no signal).

Analog output code table

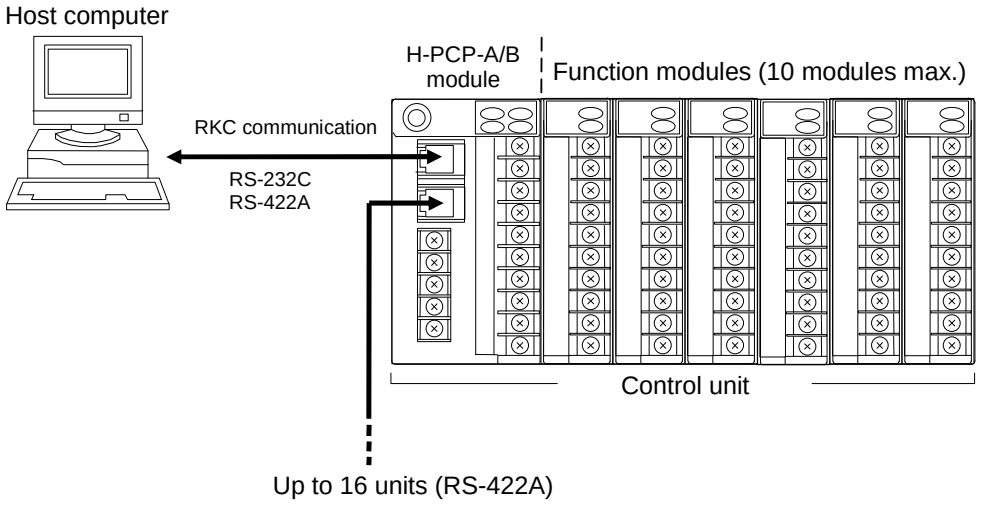
3: 0 to 1 V DC	4: 0 to 5 V DC	5: 0 to 10 V DC	6: 1 to 5 V DC
7: 0 to 20 mA DC	8: 4 to 20 mA DC	9: Others	

2. SYSTEM CONFIGURATION

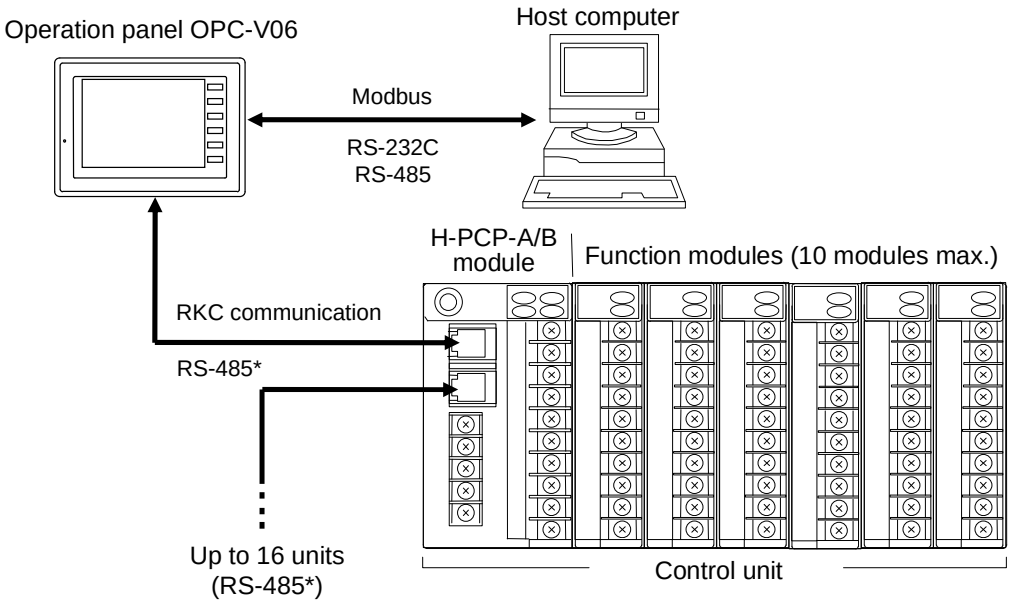
2.1 Basic Configuration

The basic system consists of control units containing the H-PCP-A/B module connected with the function modules of the desired type, and the dedicated operation panel for display and setting or the host computer.

- **Example 1: Connection with host computer**

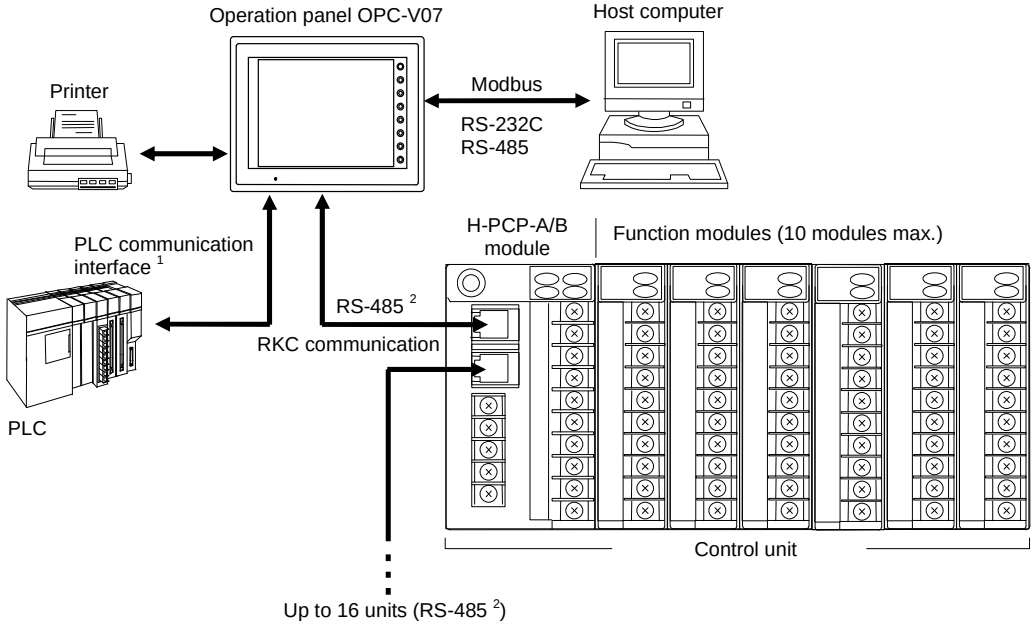


- **Example 2: Connection with RKC operation panel OPC-V06**



*The communication interface for control unit (H-PCP-A/B) is RS-422A.
The communication interface is converted RS-422A to RS-485 by connecting modular connector for terminal.

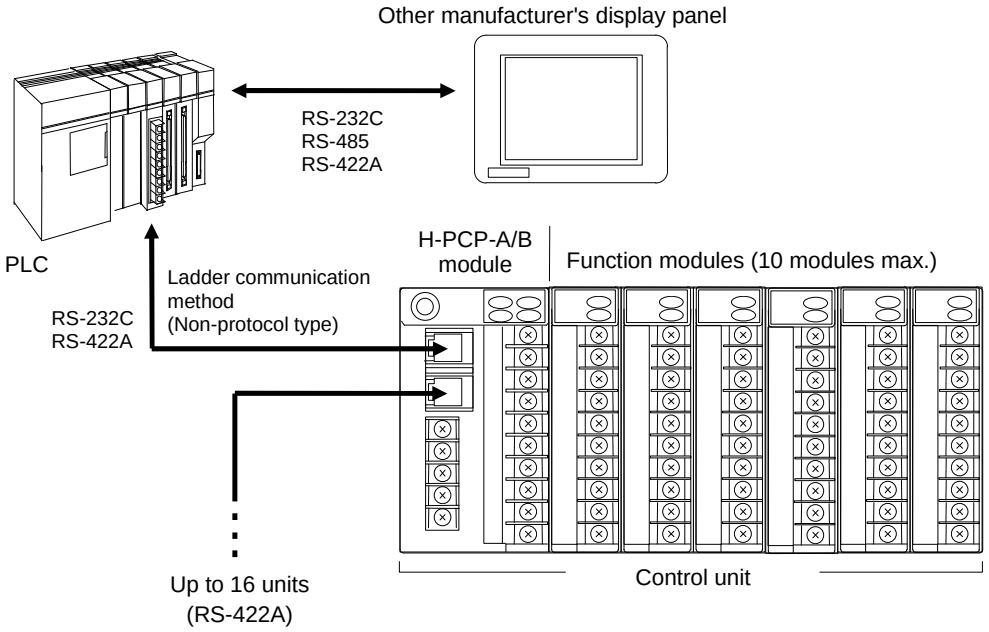
- **Example 3: Connection with RKC operation panel OPC-V07**



[1] When connecting a programmable controller (PLC), it is necessary to make the programmable controller settings, monitor screens, etc. with the panel editor V-SFT.
☞ For the panel editor V-SFT, please contact RKC sales office or the agent.

[2] The communication interface for control unit (H-PCP-A/B) is RS-422A.
The communication interface is converted RS-422A to RS-485 by connecting modular connector for terminal.

- **Example 4: Connection with PLC via ladder communication and with other manufacturer's display panel**



2.2 Precautions for System Configuration

CAUTIONS

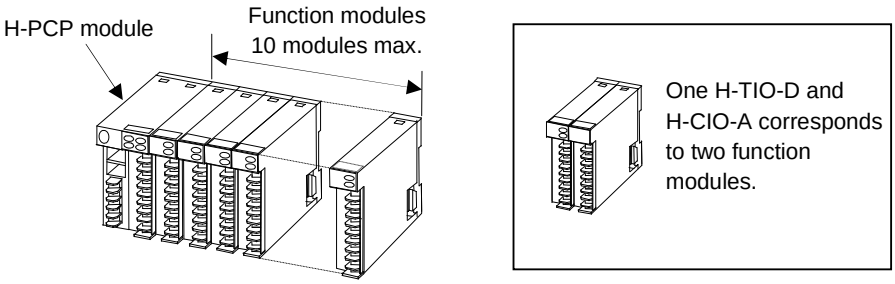
If you add or delete a function module, or change the arrangement of the modules, or replace a module with a different model, be sure to perform "Module initialization (identifier CL)" before setting the data.
"Module initialization" stores the new module configuration in the H-PCP module.
If data is set before "Module initialization" is performed, the H-PCP module will set the previously stored initial data of the old modules in the new modules, which may cause malfunction.

☞ For details on how to initialize the module, Refer to **SR Mini/SR Mini HG SYSTEM Supplementary Information Initialize Settings [Extended Communications] (IMSRM07-E□)**.

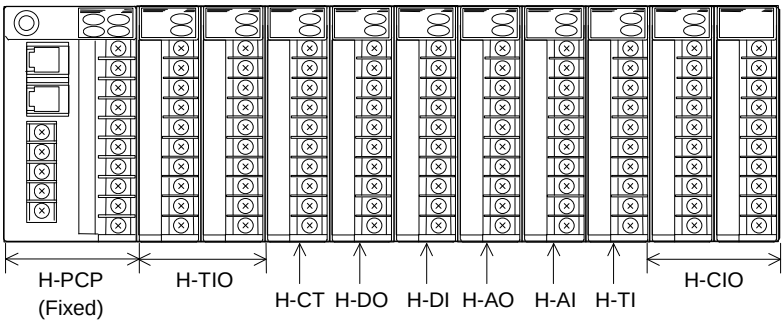
The above manual can be downloaded from the official RKC website:
http://www.rkcinst.com/english/manual_load.htm

When configuring or extending the system, observe the following precautions.

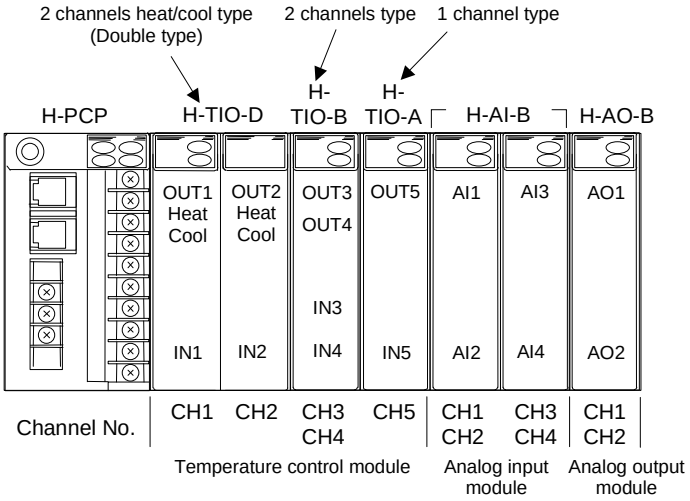
- The maximum number of function modules that can be connected to one control unit is 10, excluding the H-PCP module. However, if any specific module is mounted together with these function modules in the control unit, the maximum number of function modules mounted becomes less than 10.



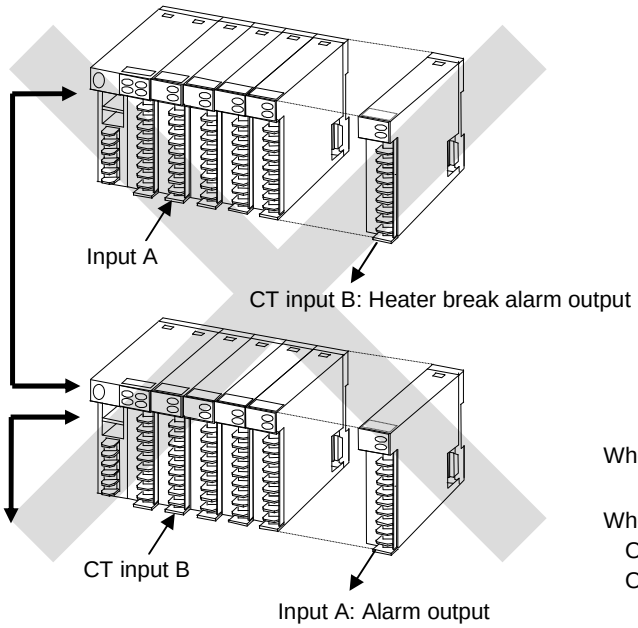
- As the mounting position of the H-PCP module is fixed to be on the left hand end of the function modules. There is no priority order of function module connection to the H-PCP module. For example, if the operation panel is used, the measured and set values can be easily checked from screen configuration with each module connected as follows. The assigned channel position can also be easily checked.



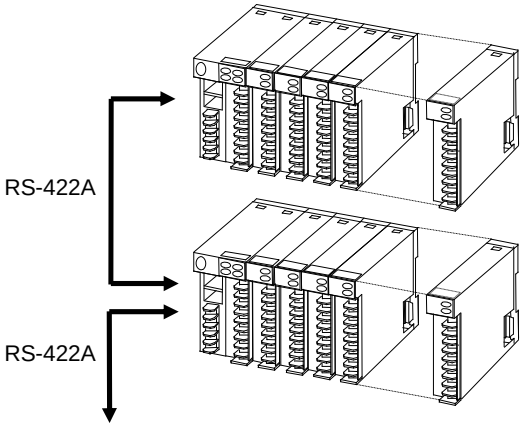
- Module channel numbers are automatically assigned from the left in order for each type of module.



- Assign CT inputs and H-DO module alarm outputs within the same control unit. (Because all control inputs and outputs must be closed within the same control unit.)



- If two or more control units are multi-drop connected, the communication specification of all H-PCP modules must be RS-422A.



When the host computer connected:
Up to 16 control unit

When the operation panel is connected:
OPM, OPM-H, OPC, OPC-H: Up to 8 control unit
OPC-V06, OPC-V07: Up to 16 control unit

- Total power consumption of control units shall not exceed the maximum power consumption of H-PCP module on the power supply side.

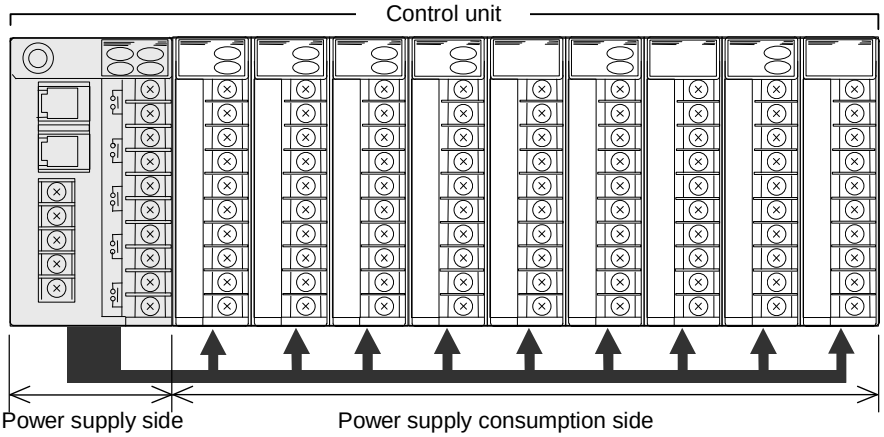
Maximum power consumption of H-PCP module

H-PCP module	CE/UL/cUL (or CSA) approved instrument:			Standard type		
	100 to 120 V AC	200 to 240 V AC	24 V DC	100 to 120 V AC	200 to 240 V AC	24 V DC
H-PCP-A	40 VA	50 VA	21 W	20 VA		30 W
H-PCP-B	40 VA	50 VA	21 W	25 VA		30 W

- The H-PCP module contains a switching power supply and the maximum current that the H-PCP module can supply to the connected function modules is 1700 mA for 5 V power supply and 1000 mA for 12 V [CE/UL/cUL (or CSA) approved instrument] power supply. When adding function module(s), consider the power consumption of the total system referring to the following table so that either of the total current in the 5 V and 12 V power supplies will not exceed the maximum current that the H-PCP module can supply. However, when the system consists of AI-B modules only, up to seven (7) AI-B modules (total current 1820 mA for 5 V power supply) can be connected.

Maximum current available for function modules

H-PCP module	CE/UL/cUL (or CSA) approved instrument:		Standard type	
	5 V power supply	12 V power supply	5 V power supply	12 V power supply
H-PCP-A	1700 mA	1000 mA	1600 mA	400 mA
H-PCP-B	1700 mA	1000 mA	1600 mA	1000 mA



Users do not have to care about switching the 5 V and 12 V power supplies. The H-PCP module supplies both 5 V and 12 V power to the function modules.

Consuming current of each function module

Function module	Power supply voltage of 5 V	Power supply voltage of 12 V
H-DO-A/B module (Relay contact output)	45 mA	140 mA
H-DO-A/C/D module (Open collector output)	45 mA	0 mA
H-DO-D module	70 mA	0 mA
H-AO-A module	40 mA	80 mA
H-AO-B module	40 mA	130 mA
H-TIO-D module	150 mA	80 mA
H-TIO-A/B/C/E/F/G/H/J/K/P/R module	150 mA	40 mA
H-CIO-A module	290 mA	40 mA
H-DI-A/B module	30 mA	0 mA
H-CT-A module	110 mA	0 mA
H-TI-A module	150 mA	0 mA
H-TI-B module	260 mA	0 mA
H-TI-C module	270 mA	0 mA
H-AI-A module	140 mA	0 mA
H-AI-B module	260 mA	0 mA
H-LNK-B module (Connectable to the H-PCP-A/J)	270 mA	120 mA

Continued on the next page.

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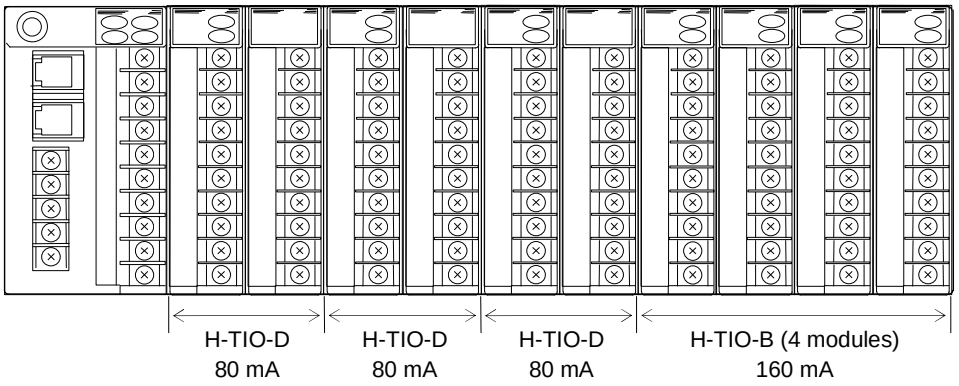
[Example] When power supply voltage of 12V

- **When using H-TIO-B modules together with H-TIO-D modules**



As the H-TIO-D module consumes an output current of 80 mA/slot and the H-TIO-B module, an output current of 40 mA, the following current is obtained.

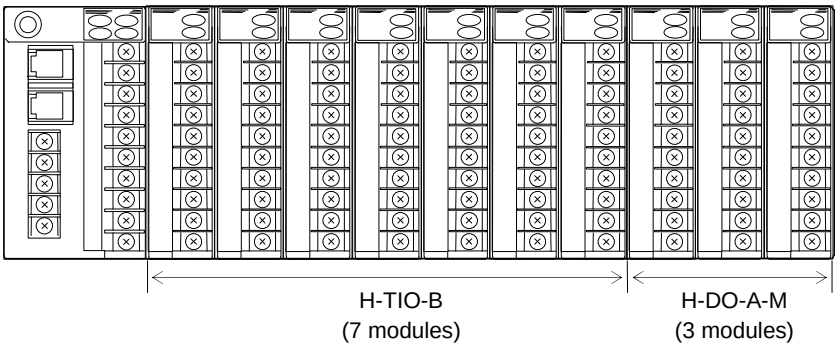
For H-TIO-D (3 modules): 80 mA × 3 = **240 mA**,

For H-TIO-B (4 modules): 40 mA × 4 = **160 mA**

240 mA + 160 mA = 400 mA ≤ 1000 mA: Maximum power supply capacity

The above current does not exceed the maximum power supply capacity (1000 mA). However, as one H-TIO-D module is assumed to correspond to two function modules, **up to 7 function modules** can be mounted.

- **When using H-DO-A-M modules together with H-TIO-B modules**



As an example in which the H-DO modules need to be added for outputting the alarm independently for each channel, when (H-DO-A-M modules: 3 modules) are added to (H-TIO-B modules: 7 modules):

Each consuming output current becomes as follows.

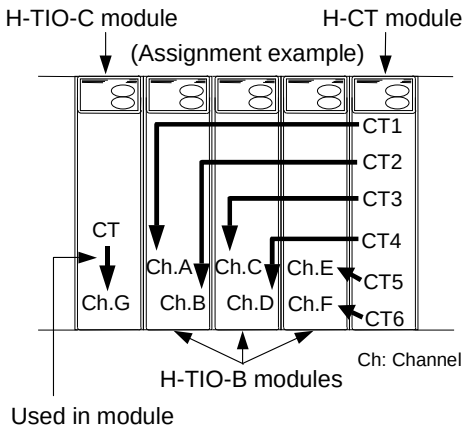
For H-TIO-B modules (7 modules): 40 mA × 7 = **280 mA**,

For H-DO-A-M modules (3 modules): 140 mA × 3 = **420 mA**

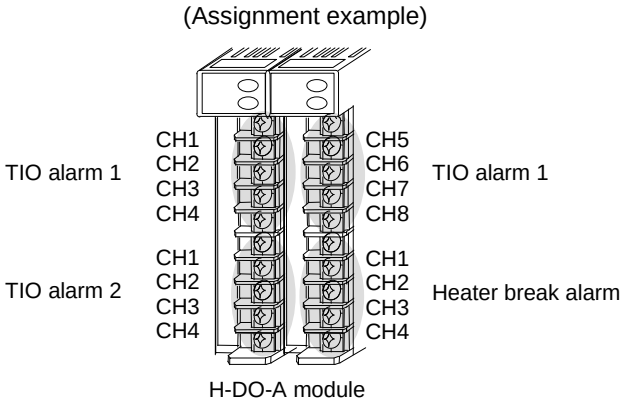
280 mA + 420 mA = 700 mA ≤ 1000 mA: Maximum power supply capacity

As the total current described above does not exceed the maximum power supply capacity (1000 mA), **up to 10 function modules** can be mounted.

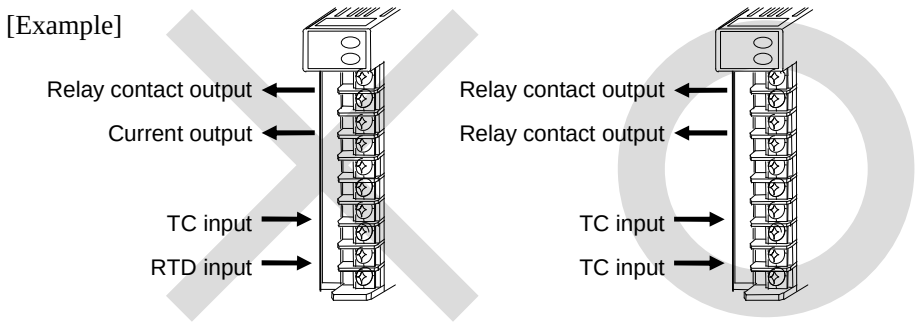
- For the H-TIO module with CT input (optional), the CT input is processed within the H-TIO module. Therefore, it cannot be assigned to other channels.



- For the H-DO-A and H-DO-B modules, duplicated alarms cannot be output. For the H-DO-A and H-DO-B modules, the functions assigned to each block consisting of four H-DO module output points. Channel numbers of the corresponding H-TIO module are automatically set in order from the top for each block of the functions assigned. For this reason, duplicate alarms in the same channel and of the same type cannot be output. However, the above does not apply to the H-DO-C module.



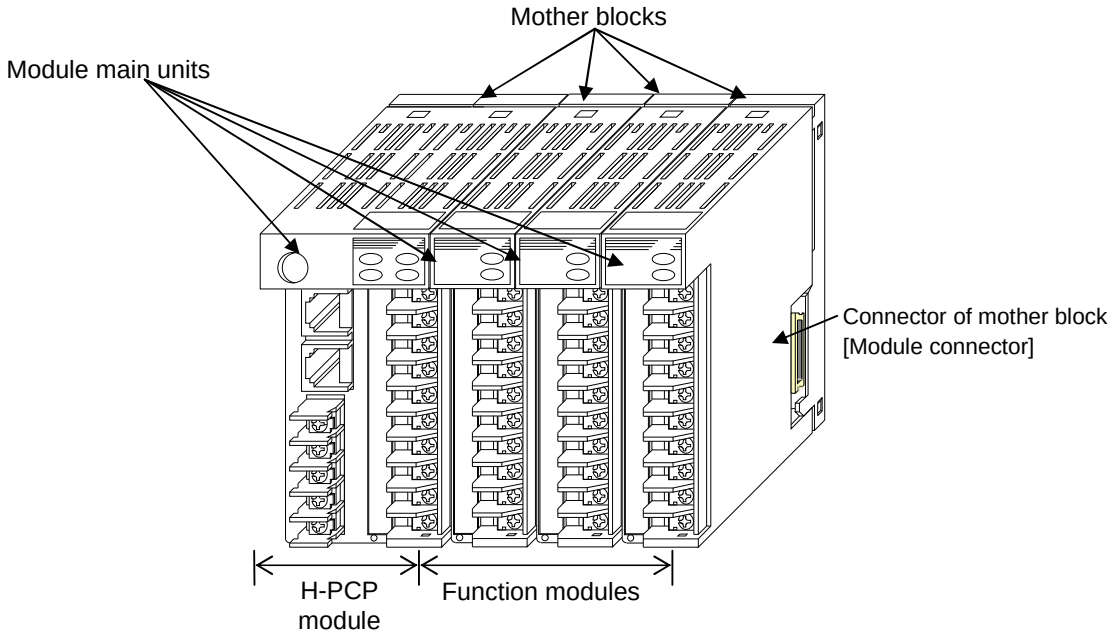
- The input and output specification of the two channels H-TIO module are the same for both channels.



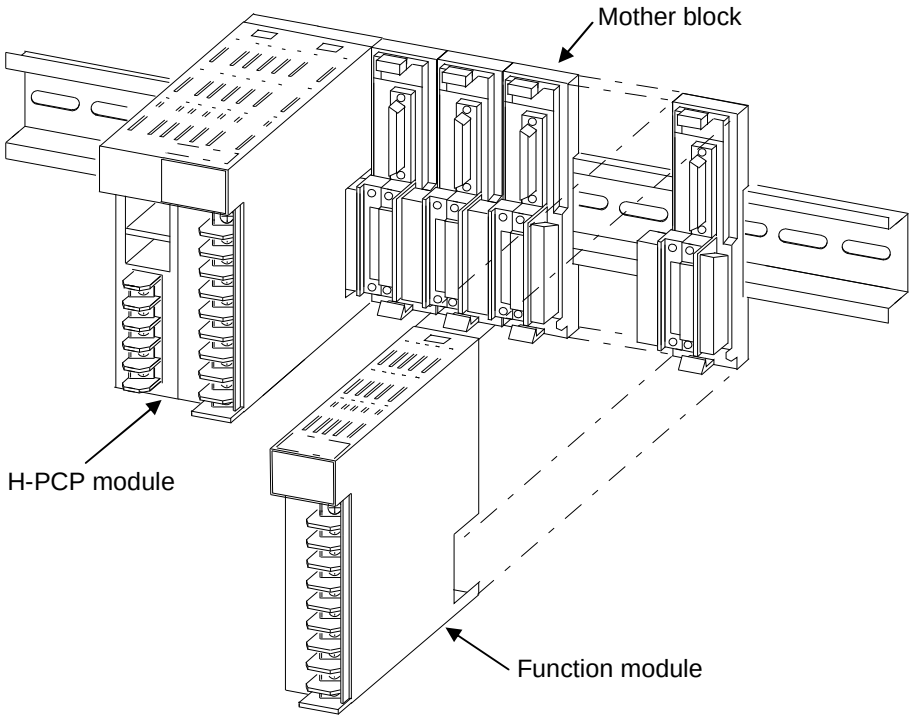
3. DESCRIPTION OF EACH MODULES

3.1 Basic Configuration

The control unit consists of various kinds of modules and a mother block and each modules are connected with each other by the connectors of mother block.



Control unit using the H-PCP module as the basic module and connecting the necessary types of modules as necessary. It is possible to build up a multi function.



3.2 Common Item of Module

3.2.1 Mother block

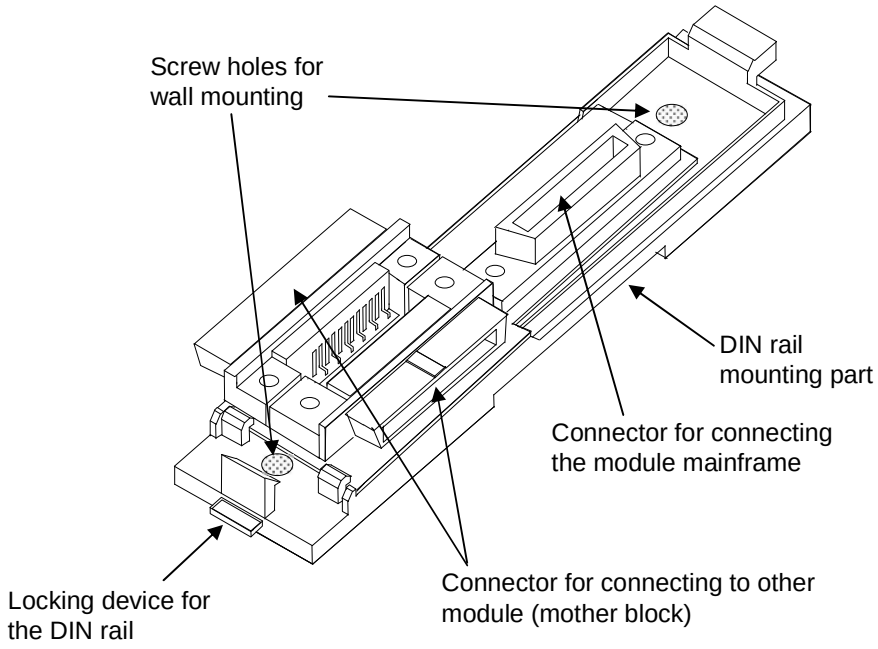
■ Outline

The mother block, attached to each module as a set, has the structure that allows the connection with neighboring modules and makes it possible to attach the control units to a DIN rail or wall surface, etc.

There are three types of mother blocks which depend on the type of modules. These three types are the blocks for single type function modules, for double type function modules and for power supply/CPU modules (H-PCP modules).

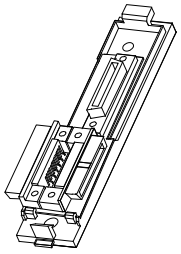
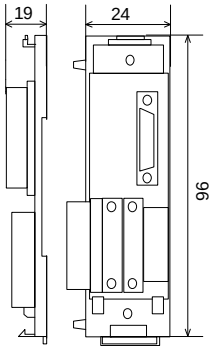
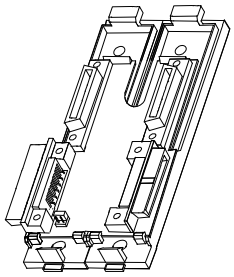
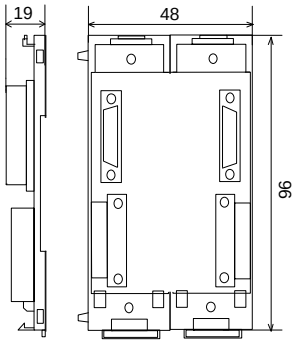
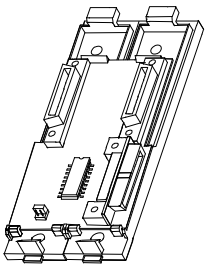
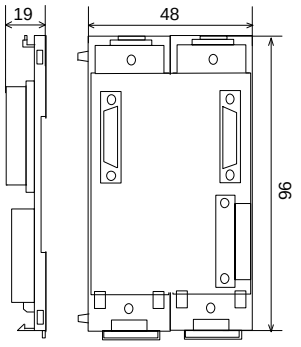
As the control unit can be detached from the mother block in a one-touch operation, modules can be easily changed in increasing the number of modules or in replacing equipment at maintenance etc.

■ Parts description



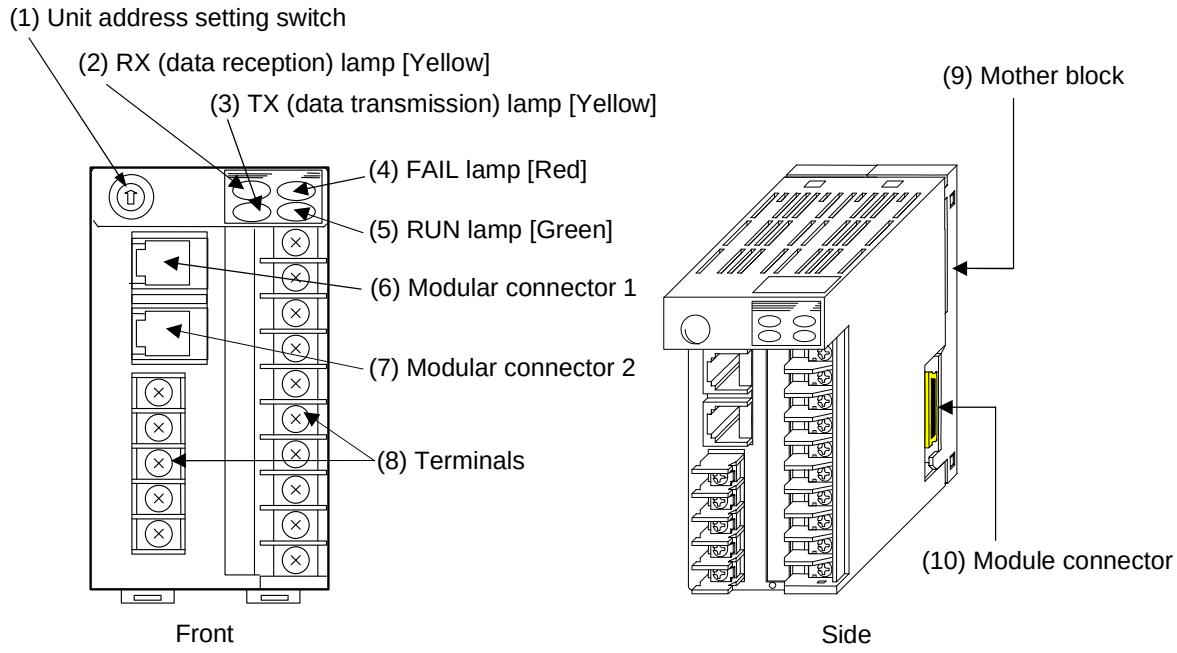
Mother block of single type module

■ Dimensions

	Appearance	Dimensions (mm)	Remarks
Single type			Mother block dedicated to single type module connection
Double type			Mother block dedicated to double type module connection
H-PCP module exclusive type			Mother block dedicated to H-PCP module connection

3.2.2 Parts description

■ H-PCP-A/B module

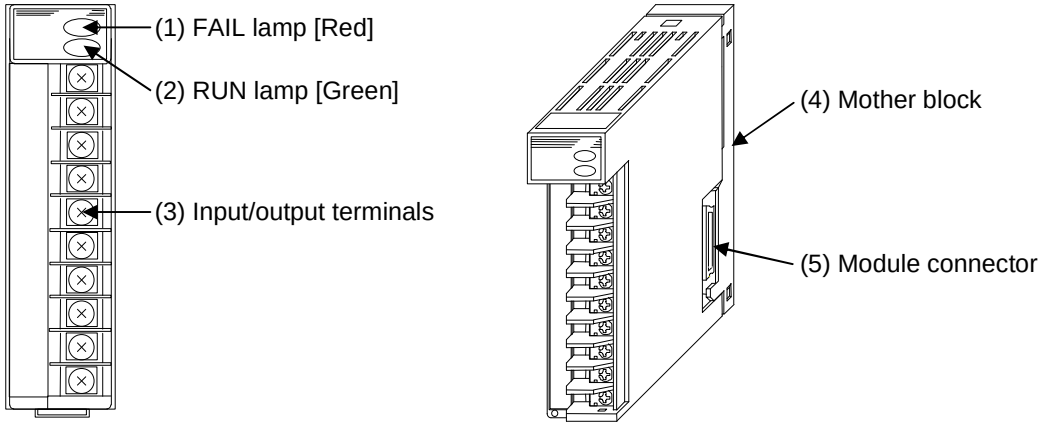


No.	Name	Description
(1)	Unit address setting switch	Set control unit slave address number Setting range: 0 to 15 (0 to F, hexadecimal)
(2)	RX (data reception) lamp [Yellow]	ON when data is correctly received
(3)	TX (data transmission) lamp [Yellow]	ON when data is correctly sent
(4)	FAIL lamp [Red]	ON during abnormal operation OFF during normal operation
(5)	RUN lamp [Green]	Flashing during normal operation
(6)	Modular connector 1	RS-232C or RS-422A connection with the host computer or operation panel
(7)	Modular connector 2	RS-422A connection with other control unit
(8)	Terminals	Ground, power supply, FAIL output, digital input and digital output terminals
(9)	Mother block	Module DIN rail mounting connector
(10)	Module connector	Connector for power supply and bus connection

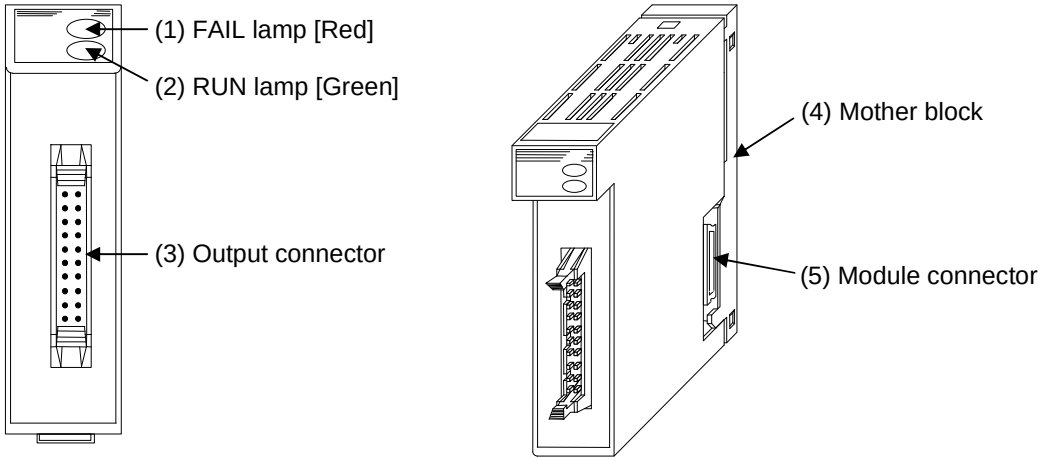
■ Single type module

● Terminal type

Module types: H-TIO-A/B/C/E/F/G/H/J/K/P/R, H-TI-A/B/C, H-CT-A, H-DI-A/B, H-DO-A/B/C, H-AI-A/B and H-AO-A/B

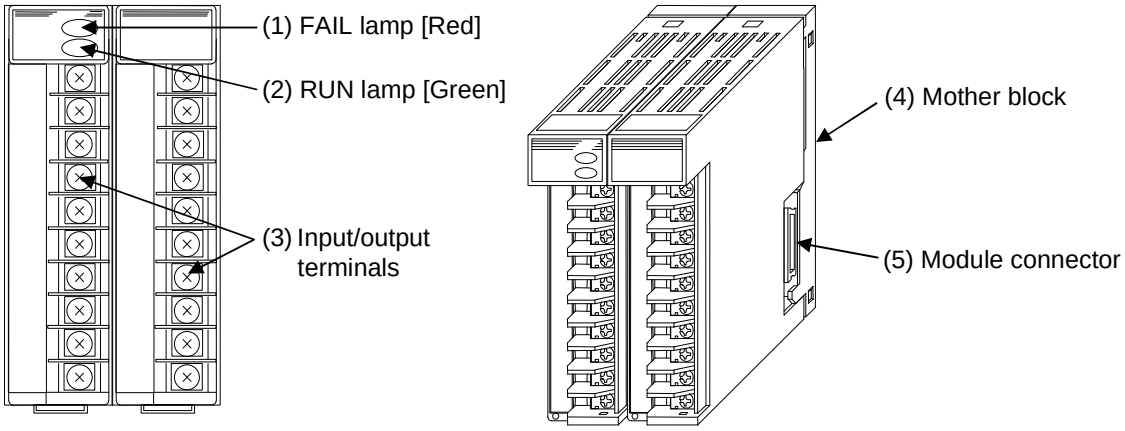


● Connector type (Only for H-DO-D type)



No.	Name	Description
(1)	FAIL lamp [Red]	ON during abnormal operation OFF during normal operation
(2)	RUN lamp [Green]	Flashing during normal operation
(3)	Input/output terminals or Output connector	Input/output terminals or Digital output connector
(4)	Mother block	Module DIN rail mounting connector
(5)	Module connector	Connector for power supply and bus connection

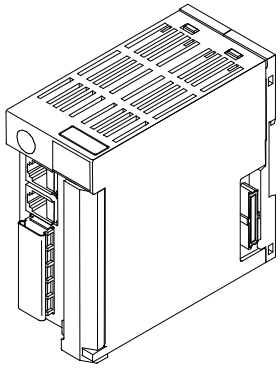
■ Double type module



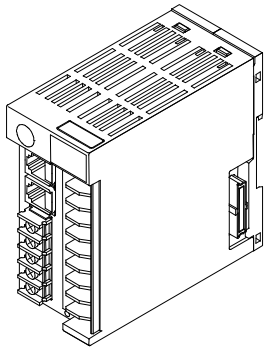
No.	Name	Description
(1)	FAIL lamp [Red]	ON during abnormal operation OFF during normal operation
(2)	RUN lamp [Green]	Flashing during normal operation
(3)	Input/output terminals	Input/output terminals
(4)	Mother block	Module DIN rail mounting connector
(5)	Module connector	Connector for power supply and bus connection

3.2.3 External view

■ H-PCP module



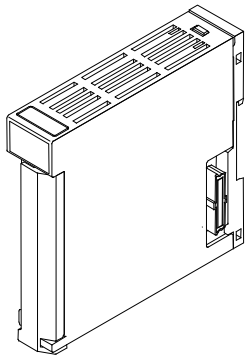
With the terminal cover fixed to the module



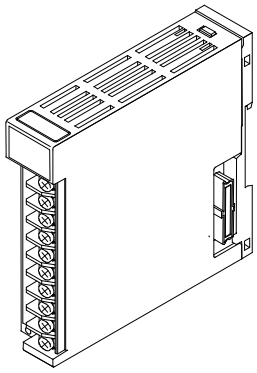
With the terminal cover removed from the module

■ Single type module

- **Terminal type**

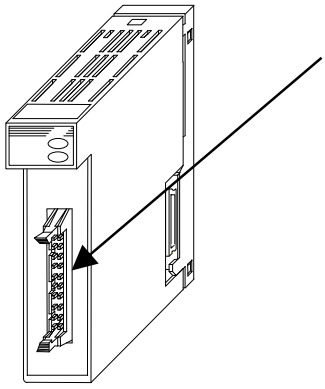


With the terminal cover fixed to the module



With the terminal cover removed from the module

- **Connector type (Only for H-DO-D type)**

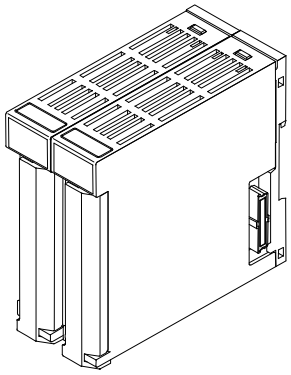


Connector type: HIF3BA-20PA-2.54DS(71)
(MIL-standard compliant)
Manufactured by HIROSE ELECTRIC CO., LTD.

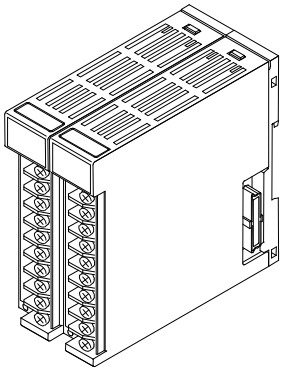
Mating socket: HIF3BA-20D-2.54R
Manufactured by HIROSE ELECTRIC CO., LTD.

The following socket may also be fitted.
AXM120415 (With strain relief)
Manufactured by Panasonic Corporation.
(Old company name: Matsushita Electric Works, Ltd.)

■ Double type module



With the terminal cover fixed to the module



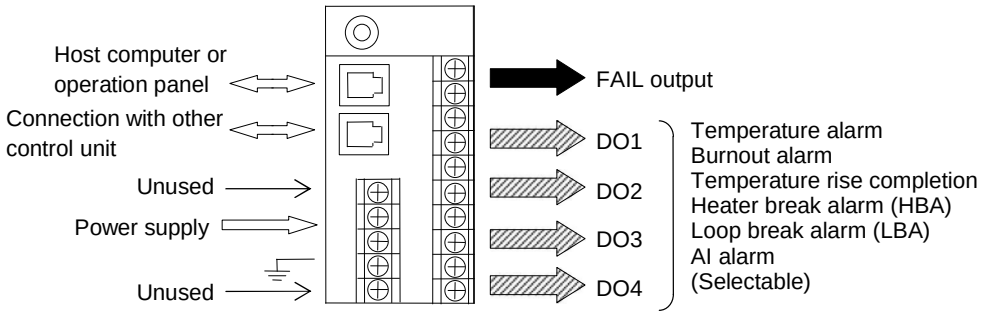
With the terminal cover removed from the module

3.3 H-PCP Module

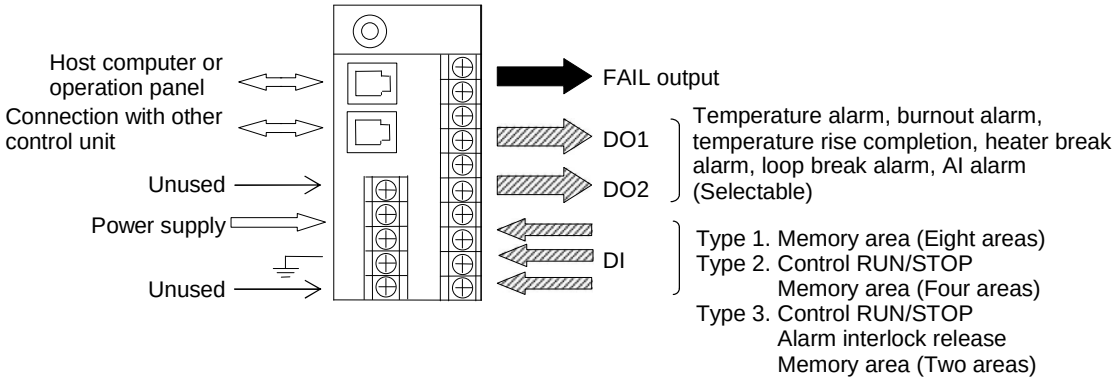
3.3.1 Outline

The H-PCP module is made up of the CPU section and the power supply section for the SR Mini HG SYSTEM control unit. This module is indispensable to construct the control unit with other modules. The H-PCP module carries out the supply of power to each module, the data management and the interfacing with the operation panel or a host computer. There are the following two types of H-PCP modules according to the functions.

- **H-PCP-A type (Module with four DO points)**

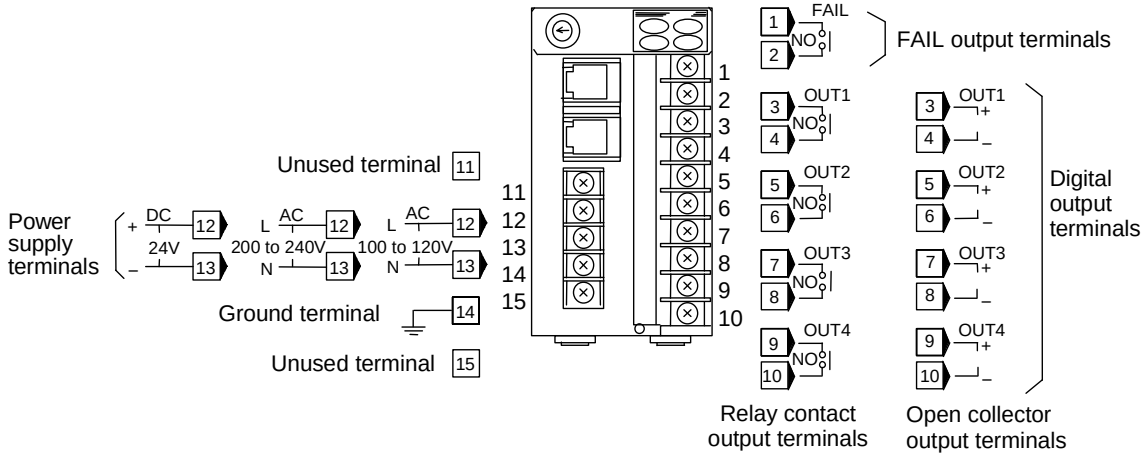


- **H-PCP-B type (Module with two DO points and three DI points)**

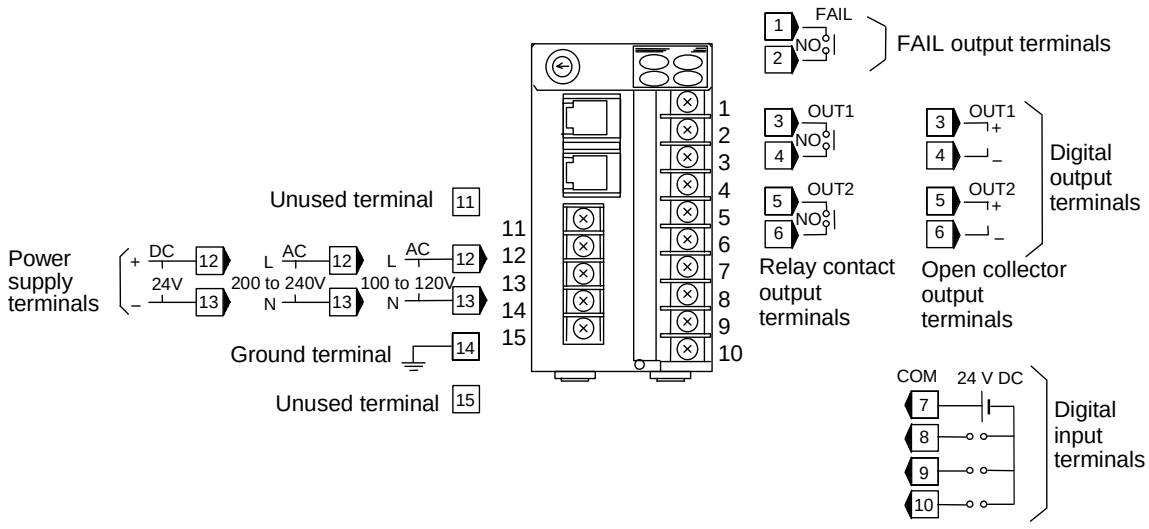


3.3.2 Terminal configuration

- **H-PCP-A type (Module with four DO points)**



- **H-PCP-B type (Module with two DO points and three DI points)**



3.3.3 Functional description

■ Output function

● FAIL output

The FAIL output is output when a problem occurs in the CPU operation and the FAIL lamp will light at the same time. Use this output for FAIL monitoring or for signal output to an external PLC, etc.

- Number of outputs: 1 point
- Output type: Relay contact output, 1a contact (Open at error occurrence)
  [Rating: 250 V AC, 0.1 A (Resistive load)]
  (CE/UL/cUL (or CSA) approved instrument: 30 V DC, 0.1 A)

When the FAIL condition occurs in any of the function modules in the control unit, the FAIL output will also be output. However in this situation, the FAIL lamp will not light.

If the composition of the control unit is changed (add or delete a function module, or change the arrangement of the modules, or replace a module with a different model) without the module initialization, the FAIL output will be output. However in this situation the FAIL lamp will not light either.

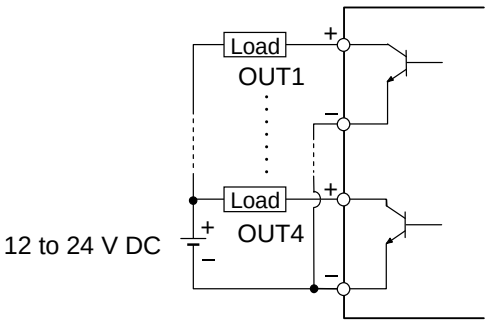
For details on how to initialize the module, refer to **SR Mini/SR Mini HG SYSTEM Supplementary Information Initialize Settings [Extended Communications] (IMSRM07-E□)**.

● Digital output (DO) [H-PCP-A and H-PCP-B]

The digital outputs (DO) can be selected from the alarm 1, alarm 2, heater break alarm (HBA), burnout alarm, temperature rise completion, loop break alarm (LBA), AI alarm 1 or AI alarm 2.
In addition, function of digital output (DO) selects in operation panel or host communication.

- Number of outputs: 4 points (H-PCP-A type), 2 points (H-PCP-B type)
- Output type: Relay contact output, 1a contact (Closed at alarm occurrence)
  [Rating: 250 V AC, 0.1 A (Resistive load)]
  (CE/UL/ cUL (or CSA) approved instrument: 30 V DC, 0.1 A)
  Open collector output
  [Load voltage: 12 to 24 V DC, 0.1 A (Maximum load current)]

Open collector output wiring example



- 🕮 If there is no heater break alarm function in the control unit (H-TIO-A/C/D modules provided with CT input as optional, or control unit without H-CT module), a heater break alarm cannot be selected.
- 🕮 If there is no H-AI module in the control unit, an AI alarm cannot be selected.
- 🕮 For the control unit consisting of only the H-TIO-H/J modules, a loop break alarm cannot be selected.
- ☞ For details on function selection with the digital output, refer to **SR Mini/SR Mini HG SYSTEM Supplementary Information Initialize Settings [Extended Communications] (IMSRM07-E□)**.

■ Input function

● Digital input (DI) [H-PCP-B]

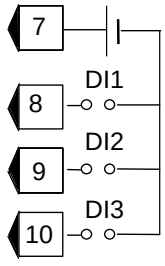
For digital input, memory area selection, control RUN/STOP selection or alarm interlock release specifying can be performed. In addition, any of the following combinations of functions is available for digital input.

- Type 1: Memory area selection (8 areas selection)
- Type 2: Combination of control RUN/STOP selection and memory area selection (4 areas selection)
- Type 3: Combination of control RUN/STOP selection, alarm interlock release and memory area selection (2 areas selection)

- 🕮 **After the contact is closed, it takes a short time until the action of this device is actually selected. Therefore, pay attention to this delay time if the device is used together with a PLC, etc.**
- 🕮 External power (24 V DC) supply is required for digital input.

Memory area selection (Type 1)

The memory area (control area) can be selected depending on the open or closed state of terminal numbers 7 to 10. Select the memory area by configuring an external contact circuit or using a contact output signal from the PLC, if necessary.

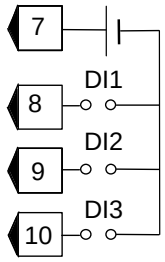


Control area / Terminal No.	1	2	3	4	5	6	7	8
7 - 8	–	×	–	×	–	×	–	×
7 - 9	–	–	×	×	–	–	×	×
7 - 10	–	–	–	–	×	×	×	×

–: Open ×: Closed

Control RUN/STOP selection, memory area selection (Type 2)

Selection can be performed depending on the open or closed state of terminal numbers 7 to 10.



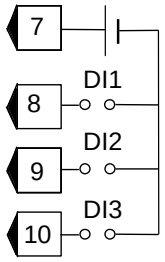
Control area / Terminal No.	1	2	3	4
7 - 8	–	×	–	×
7 - 9	–	–	×	×

–: Open ×: Closed

Contact open: Control STOP Contact closed: Control RUN

Control RUN/STOP selection, alarm interlock release specifying and memory area selection (Type 3)

Selection or release specifying can be performed depending on the open or closed state of terminal numbers 7 to 10.



Contact open: Memory area No.1 Contact closed: Memory area No.2

Contact closed: Alarm interlock released

Contact open: Control Stop Contact closed: Control Run

■ Communication function

The H-PCP module has communication port COM.PORT1/COM.PORT2 and can be connected with operation panel, host computer and extension control unit.

Interface: RS-422A or RS-232C
Protocol: RKC communication protocol
Ladder communication (Non-protocol type) [Z-190 specification]
Communication speed: 2400 bps, 4800 bps, 9600 bps and 19200 bps
(Select the communication speed by the dip switch in the H-PCP module)
Connection instrument: Operation panel, host computer, extension control unit, PLC
[Z-190 specification]

For the H-PCP-A/B module with the ladder communication, special specification code "Z-190" must be specified at the end of the model code.
The H-TIO-K, H-CIO-A, H-DI-B and H-DO-C module cannot be used to the H-PCP-A/B module with the specification of ladder.

For details on the dip switch settings, refer to **3.3.4 Settings before operation (P. 42)**.

3.3.4 Settings before operation

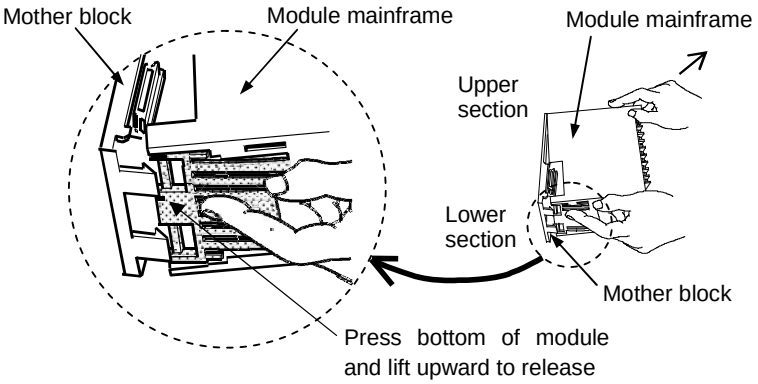
■ Communication setting

⚠ WARNING

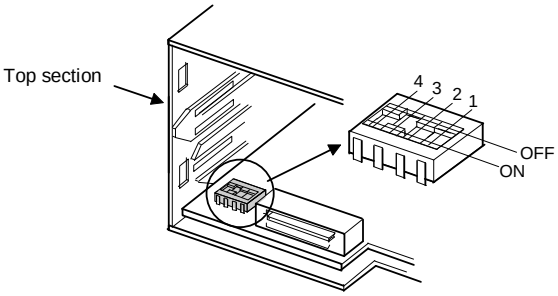
- To prevent electric shock or instrument failure, always turn off the power before setting the switch.
- To prevent electric shock or instrument failure, never touch any section other than those instructed in this manual.

Using the dip switches inside the H-PCP-A/B module, sets the communication speed and data configuration.

1. To separate the module mainframe from the mother block, press the bottom on the module, lifting upward, to release connection.



2. Data configuration and communication speed can be set with the dip switches located in the H-PCP-A/B module.



Rear view of module mainframe with mother block removed

For the Modbus (Z-1021)／MEMOBUS (Z-1001)

1	2	Data configuration
OFF	OFF	Do not set this one
OFF	ON	8-bit even parity
ON	OFF	8-bit odd parity
ON	ON	8-bit without parity

Factory set value: 8-bit without parity

For the RKC communication/Ladder communication (Z-190)

1	2	Data configuration
OFF	OFF	8-bit without parity
OFF	ON	7-bit even parity
ON	OFF	7-bit odd parity
ON	ON	Do not set this one

Factory set value: 8-bit without parity

3	4	Communication speed
OFF	OFF	2400 bps
OFF	ON	4800 bps
ON	OFF	9600 bps
ON	ON	19200 bps

Factory set value: 9600 bps

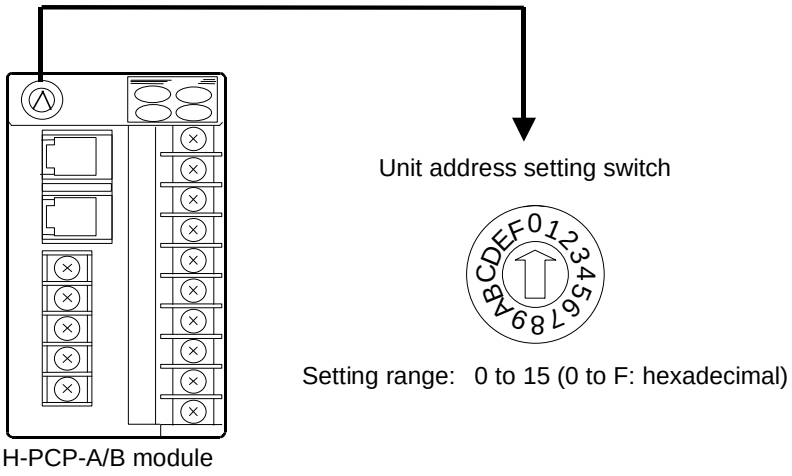
When using the ladder communication, always set the data configuration to “8-bit without parity.”

Continued on the next page.

3. After communication setting is complete, place the module mainframe opening on top of the mother block tab and snap the lower part of module mainframe on to the mother block. A snapping sound will be heard when module mainframe is securely connected to mother block.

■ Unit address settings

When each control unit is multi-drop connected to host computer or operation panel, set the address of each control unit using the unit address setting switch in the H-PCP-A/B module.
Use a very small blade screwdriver to set the unit address on the unit address setting switch located on the front of each H-PCP-A/B module.



Set the unit address such that it is different to the other addresses on the some line. Otherwise, problems or malfunction may result.

For Modbus (Z-1021 specification) or MEMOBUS (Z-1001 specification), the value obtained by adding "1" to the set address corresponds to the address used for the actual program.

Number of connectable control units

- When connected host computer or PLC: Up to 16 units
- When connected RKC operation panel:
  OPM, OPM-H, OPC, OPC-H: Up to 8 units
  OPC-V06, OPC-V07: Up to 16 units

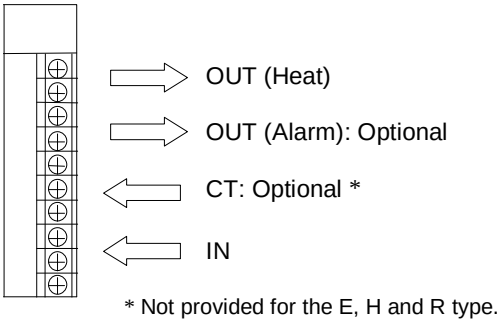
3.4 H-TIO Module

3.4.1 Outline

The H-TIO module is used to perform temperature or process control.
The H-TIO modules corresponding to the necessary number of control points are connected to the H-PCP module.

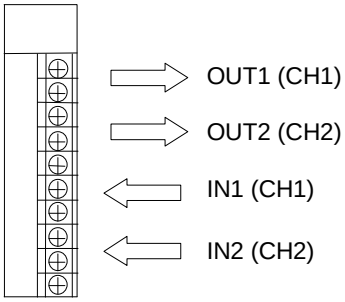
☞ For details on the limited number of H-TIO modules connected to the H-PCP module, refer to page 24.

A, E, H and R type [1 channel type]

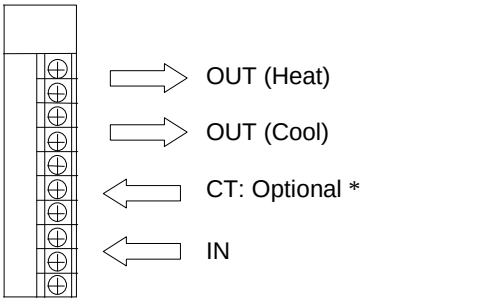


* Not provided for the E, H and R type.

B, F, J and P type [2 channels type]

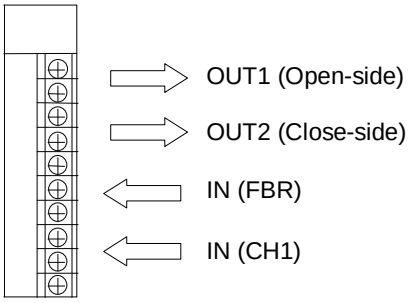


C and G type [1 channel heat/cool type]

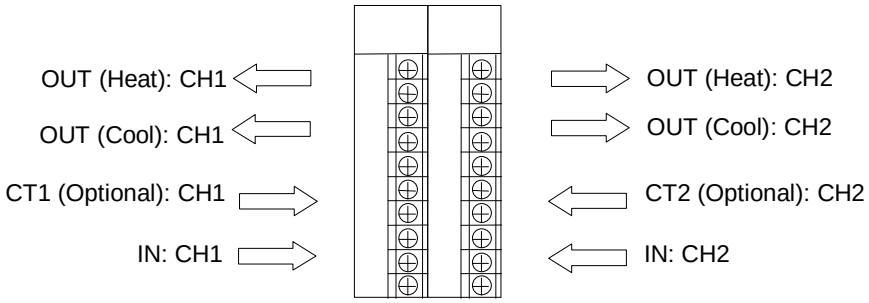


* Not provided for the G

K type [1 channel position proportioning type]

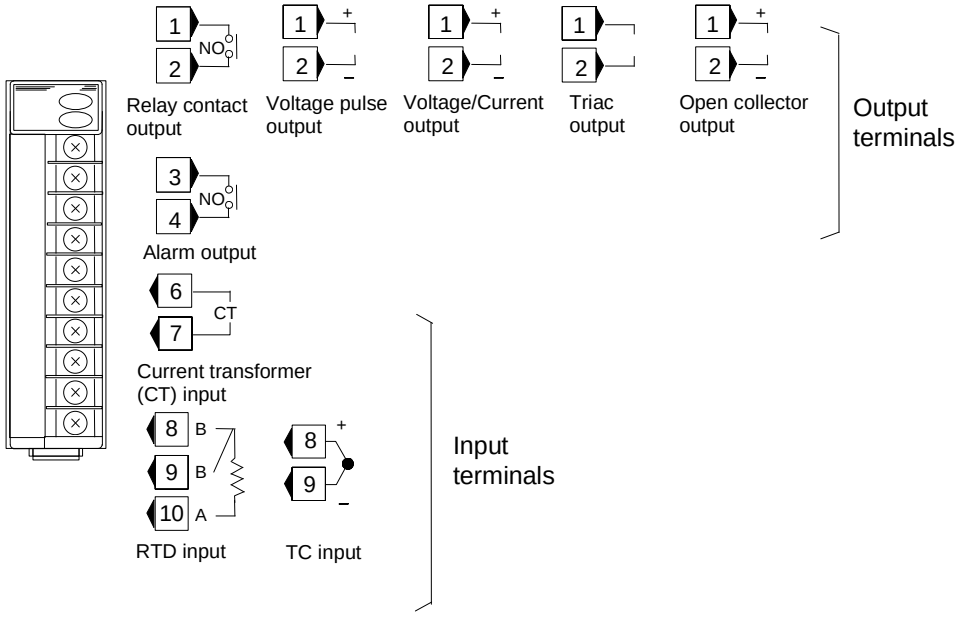


D type [2 channels heat/cool type]

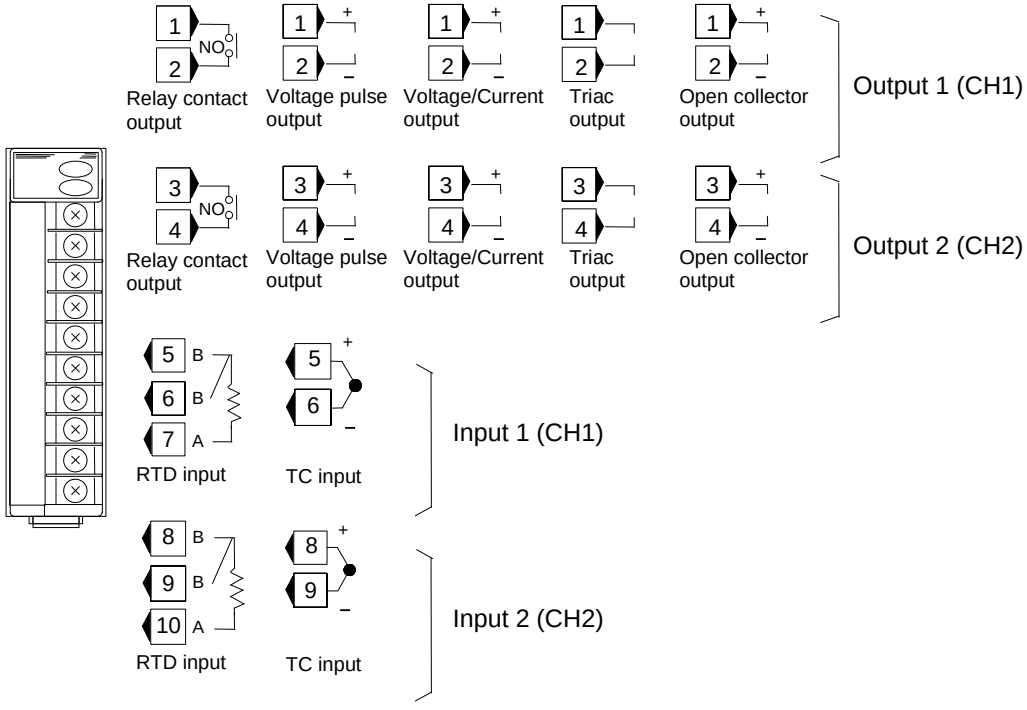


3.4.2 Terminal configuration

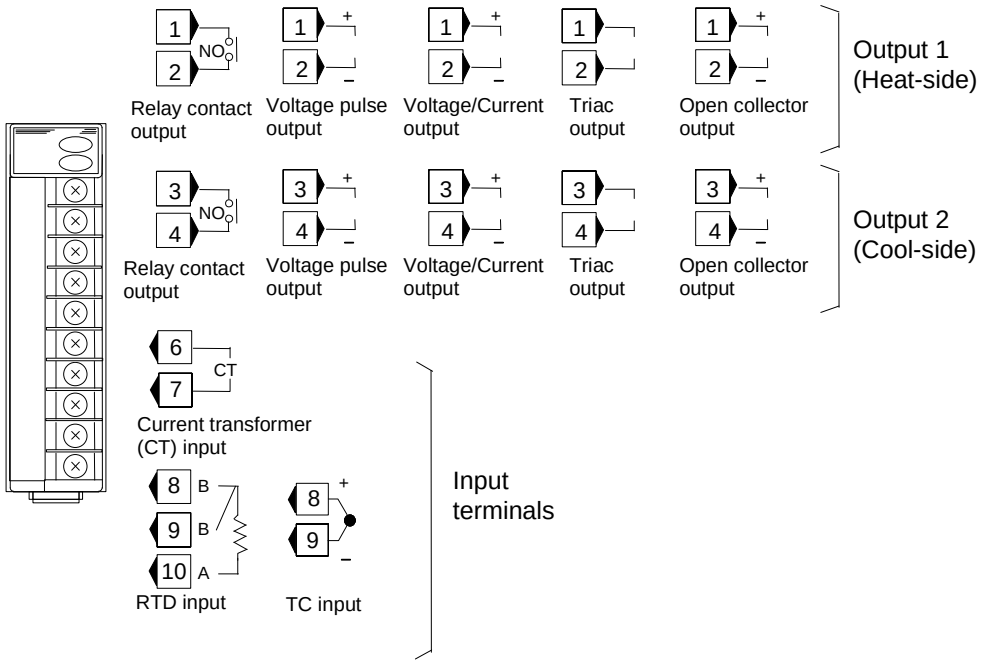
■ H-TIO-A type



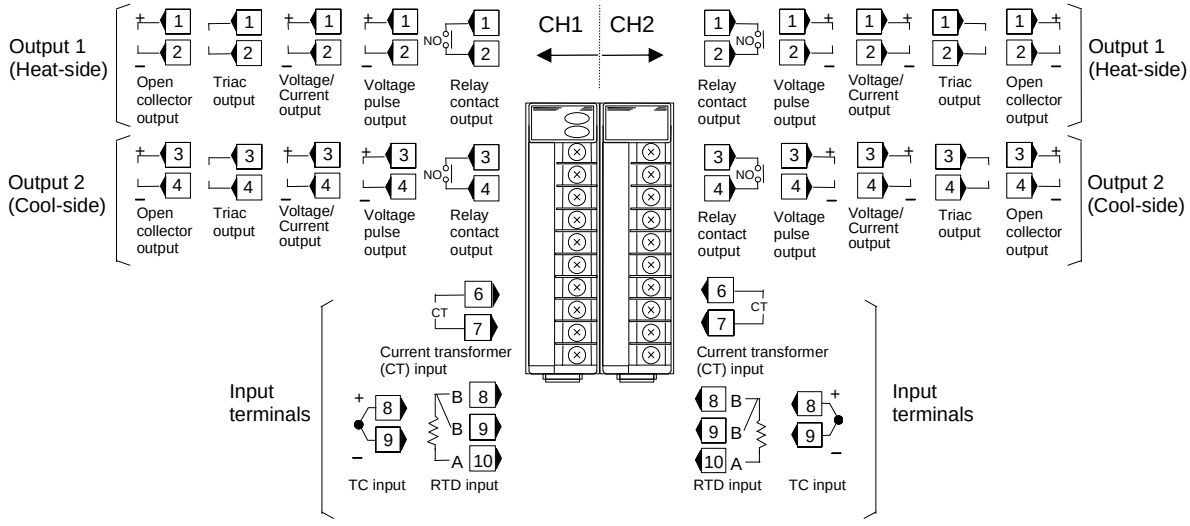
■ H-TIO-B type



■ H-TIO-C type

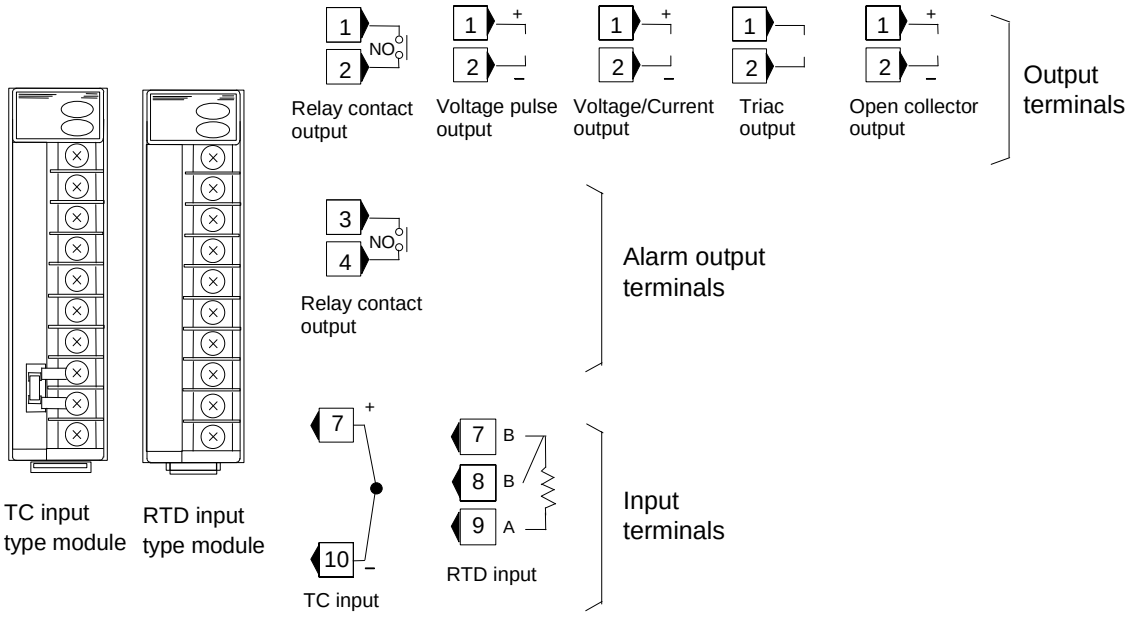


■ H-TIO-D type

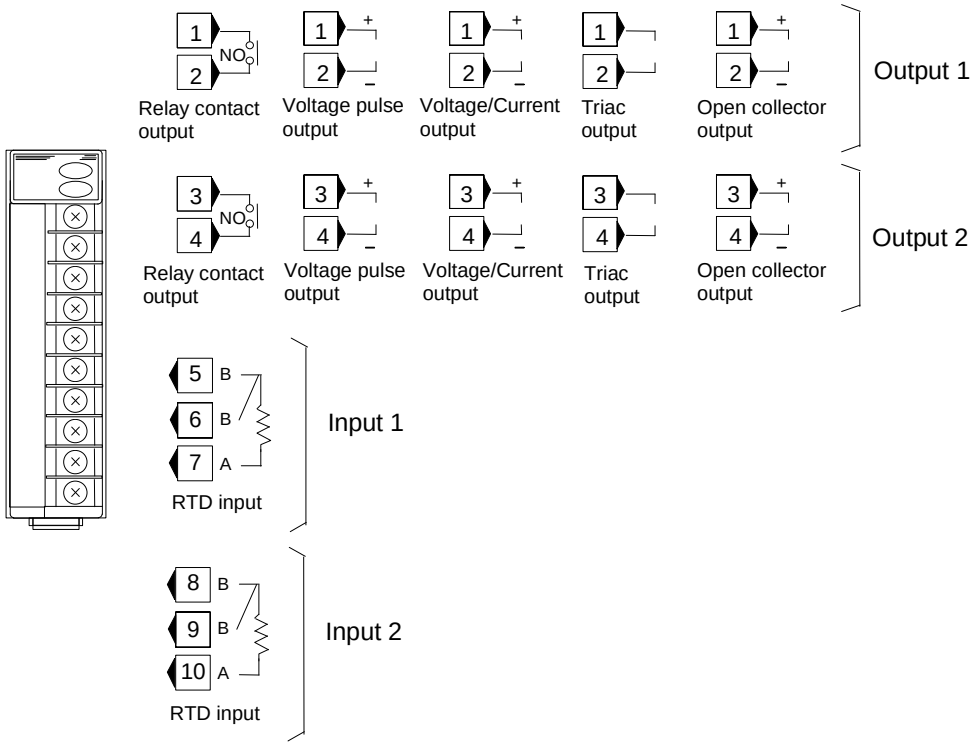


Although the terminal numbers are the same numbers for both channel 1 and channel 2, the left side as seen from the front panel of the module is channel 1 and the right side is channel 2.

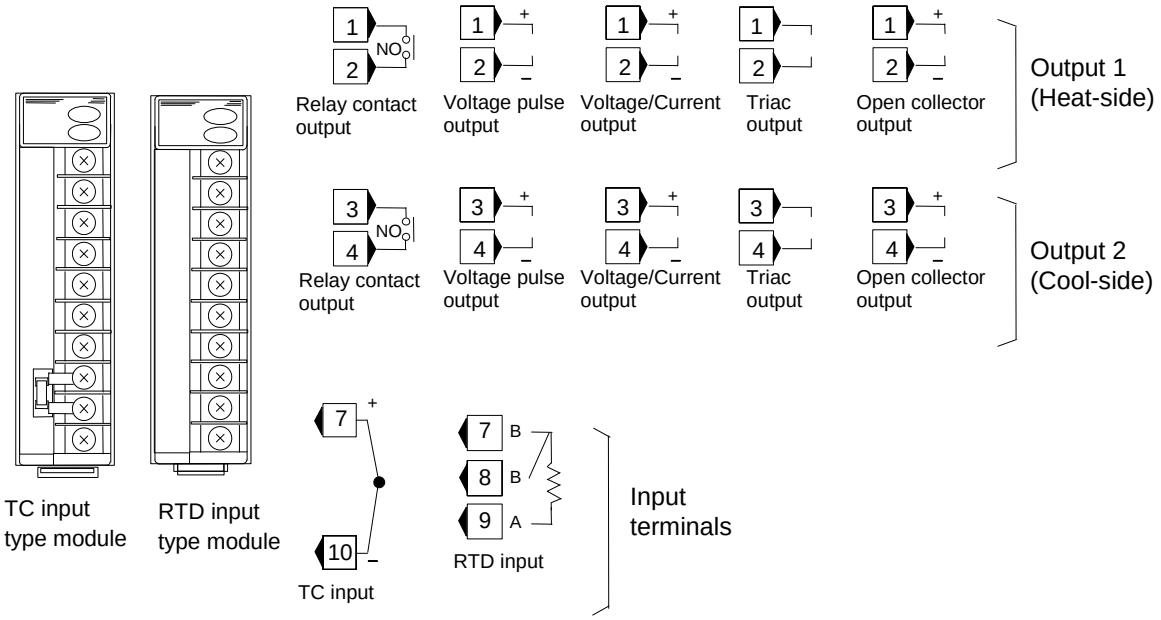
■ H-TIO-E type



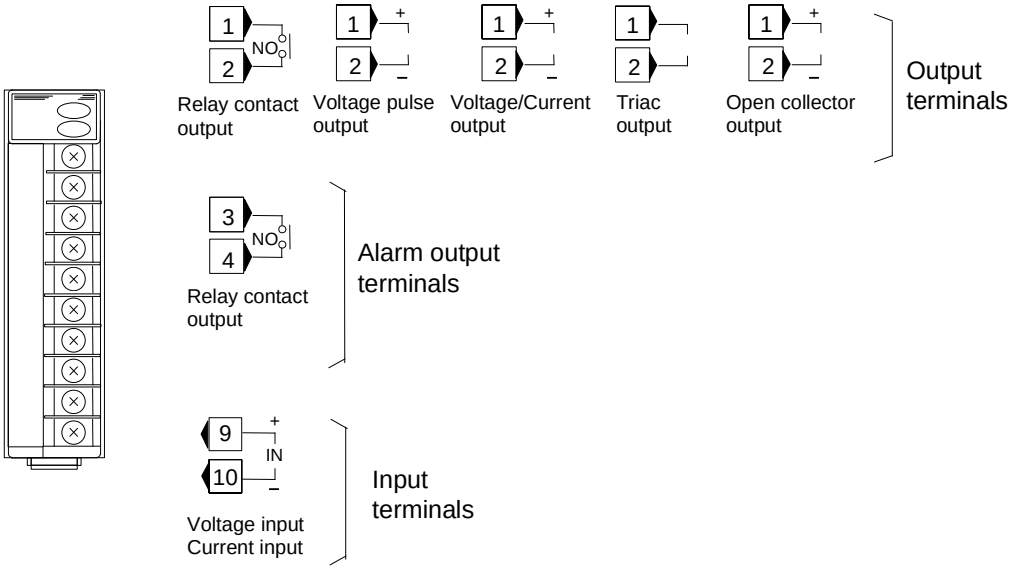
■ H-TIO-F type



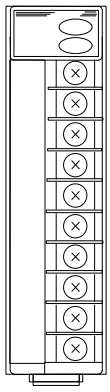
■ H-TIO-G type

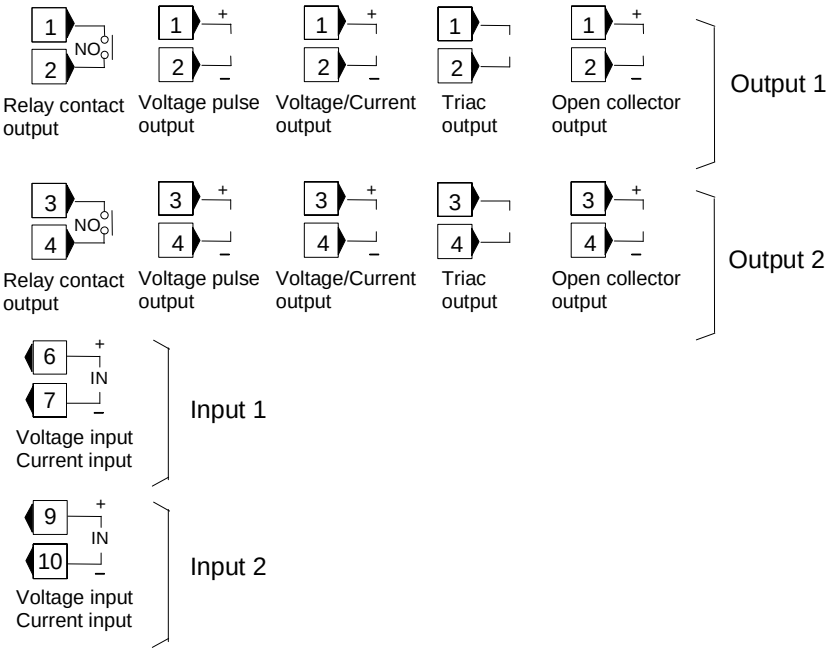


■ H-TIO-H type

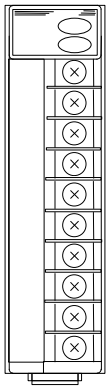


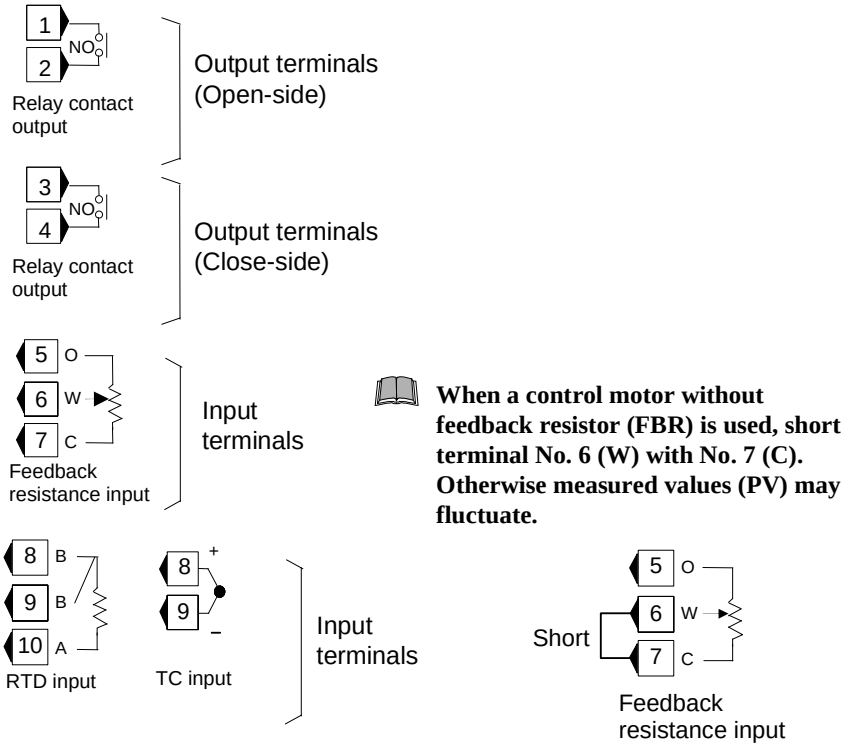
■ H-TIO-J type



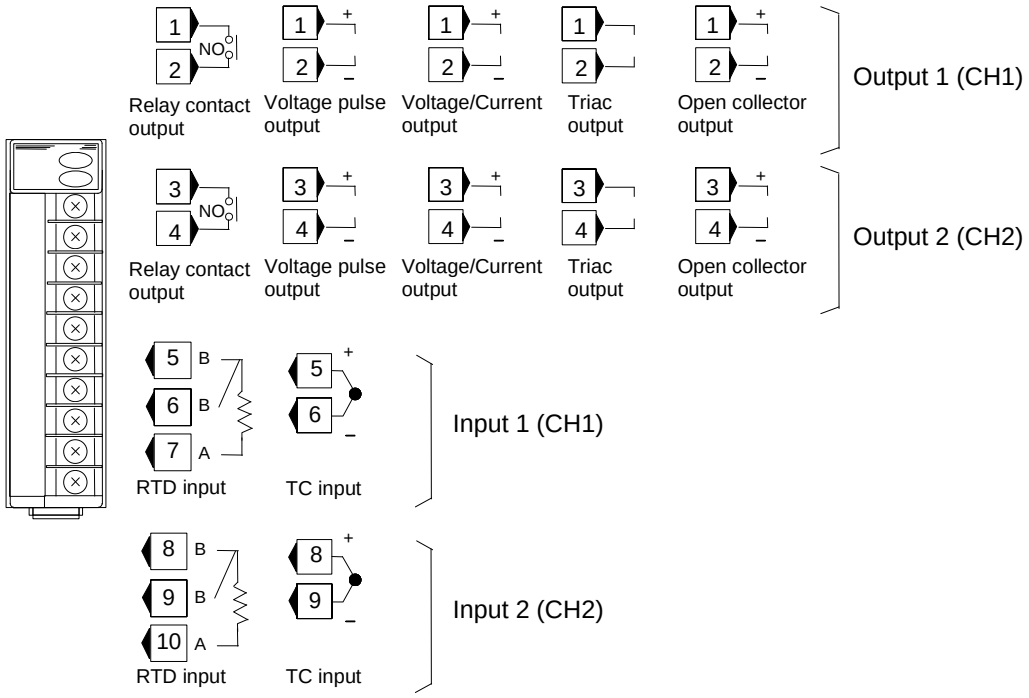


■ H-TIO-K type

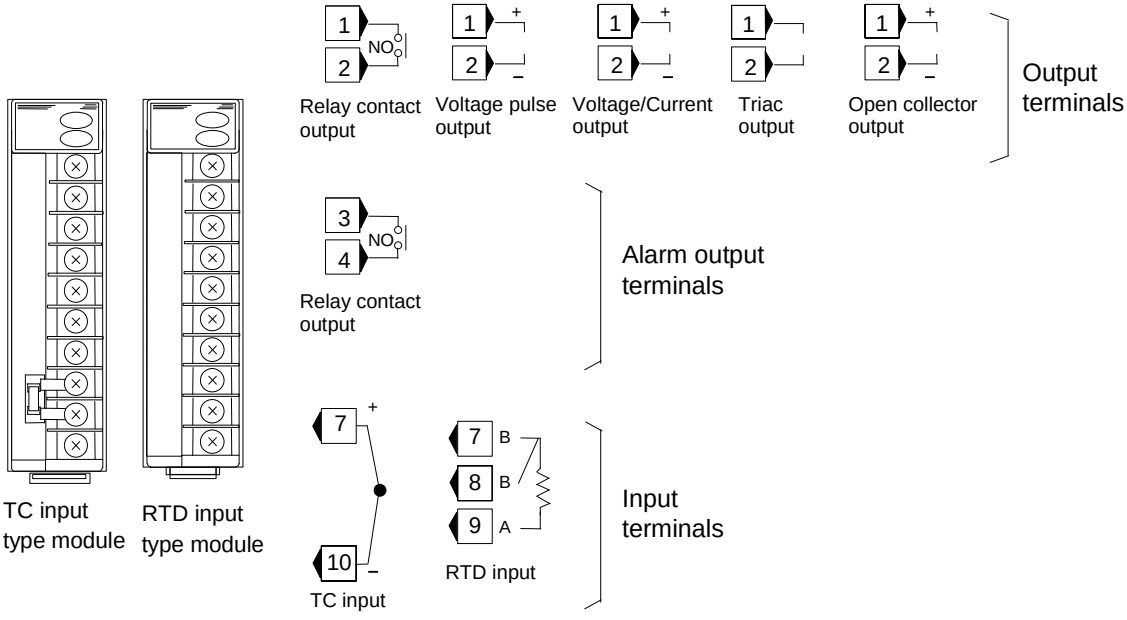




■ H-TIO-P type



■ H-TIO-R type

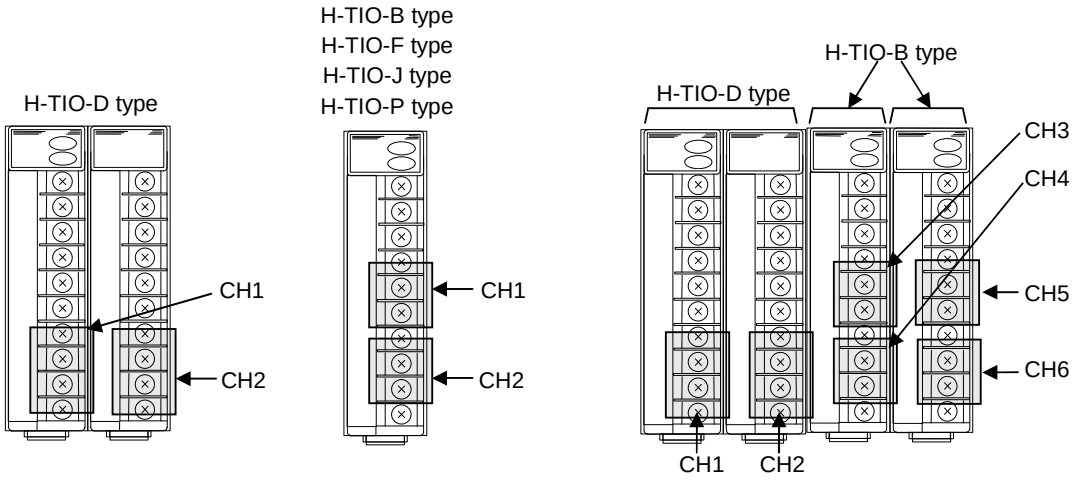


3.4.3 Functional description

(1) Input function

■ Channel number

CH1 and CH2 are assigned to the input terminals of the B, F, J or P type (2 channels type) module in order from the top of these terminals. In addition, CH1 and CH2 are assigned to the D type (2 channels heat/cool type) modules in order from the left of these modules for each module.
If the D type modules are mounted together with other type modules, channel numbers are assigned automatically to these modules in order from the left.



Channel number assignment

■ Input type

Select any input type of thermocouple, RTD or continuous voltage/current input.
(Specify when ordering)

List of H-TIO module input types

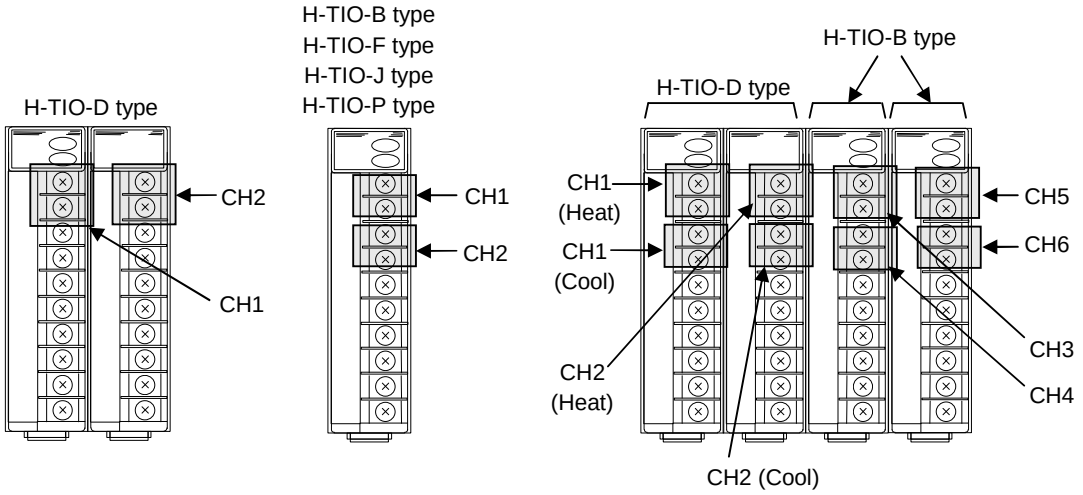
Input type	H-TIO module type
Thermocouple	H-TIO-A, H-TIO-B, H-TIO-C, H-TIO-D, H-TIO-E, H-TIO-G, H-TIO-K, H-TIO-P, H-TIO-R
RTD	H-TIO-A, H-TIO-B, H-TIO-C, H-TIO-D, H-TIO-E, H-TIO-F, H-TIO-G, H-TIO-K, H-TIO-P, H-TIO-R
Voltage/Current	H-TIO-H, H-TIO-J

Different input types cannot be mixed in one module. The desired input type is determined for each module.

(2) Output function

■ Channel number

In the same way as the input terminals, CH1 and CH2 are assigned to the output terminals of the B, F, J or P (2 channels) type module in order from the top of these terminals.
In addition, CH1 and CH2 are assigned to the D type (2 channels heat/cool type) modules in order from the left for each module. The heat and then cool outputs are assigned to these channels in order from the top.
If the D type modules are mounted together with other type modules, channel numbers are assigned automatically to these modules in order from the left.



Channel number assignment

■ Output type

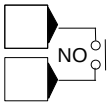
Any output type of relay contact output, voltage pulse output, voltage output, current output, triac output or open collector output can be selected for each heat output and heat/cool output.
(Specify when ordering)

For 1 module/2 channel modules, output types cannot be mixed in one module. Each output type is selected for each module.

For details on each output, refer to **8. SPECIFICATIONS (P. 128)**

● Relay contact output

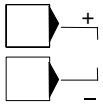
Output status: Independent 1a contact output (closed during outputting).



Rating: 250 V AC, 3 A (Resistive load)

● Voltage pulse output

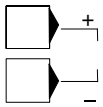
This output is for driving the SSRs and 12 V DC is output during the outputting.



Allowable load resistance: 600 Ω or more

● Current and voltage output

The current output can be selected from 4 to 20 mA DC or 0 to 20 mA DC, and the voltage output can be selected from 0 to 1 V DC, 0 to 5 V DC, 0 to 10 V DC or 1 to 5 V DC. (Specify when ordering)

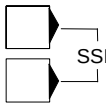


Allowable load resistance: 500 Ω or less (Current output)
1 kΩ or more (Voltage output)

It is possible only in the 1 to 5 V DC voltage output to make a common connection of the minus terminals of the outputs, including the voltage pulse output.
(Refer to P. 99.)

● Triac output

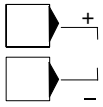
This output can directly drive AC power by the small SSR built in the module. The zero-cross control method is employed.



Capacity: 0.5 A (At an ambient temperature of 40 °C)
Maximum load voltage: 250 V AC

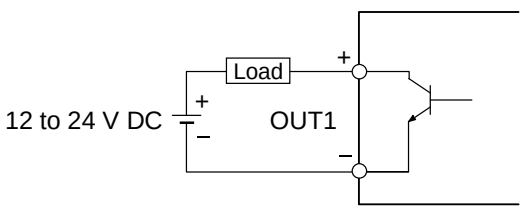
● Open collector output

This transistor sink output uses switching between the transistor emitter and collector. An external power supply of 12 to 24 V DC is connected to the load in series.

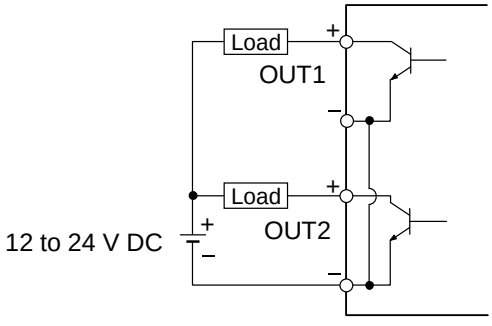


Maximum load current: 100 mA or less

Open collector output wiring example



H-TIO-A, E, H and R type



H-TIO-B, C, D, F, G, J and P type

The minus (–) terminals of open collector outputs, OUT1 and OUT2 are connected within the module.

(3) Alarm function

One H-TIO module is provided with two alarm points (Alarm 1 and Alarm 2) as standard.
Alarm 1/2 types are those selected by the H-PCP module.

Alarm type:

Deviation high alarm	Process high alarm
Deviation low alarm	Process low alarm
Deviation high and low alarm	Process high alarm with hold action
Band alarm	Process low alarm with hold action
Deviation high alarm with hold action	Deviation high alarm with re-hold action
Deviation low alarm with hold action	Deviation low alarm with re-hold action
Deviation high and low alarm with hold action	Deviation high and low alarm with re-hold action

(4) Alarm output function (Optional)

An alarm can be output from the H-TIO module itself (only for the H-TIO-A/E/H/R types).

- Number of output points: 1 point (relay contact output)
- Output type : Select any of temperature alarm output (ALM1), temperature alarm output (ALM2), heater break alarm output (HBA) [1] or loop break alarm output (LBA) [2].
  (The output type needs to be specified in the model code at the time of ordering.)
  [1] Only H-TIO-A can be selected.
  [2] Only H-TIO-A, H-TIO-E or H-TIO-R can be selected.


Each alarm can be output as summary output (*OR* output) from the digital output block in the H-PCP-A/B module. For details, refer to **3.3 H-PCP Module (P. 36)**.


The respective alarm (Alarm 1/2) can be output independently for each channel by connecting the H-DO-A/B/D module. For details, refer to **3.9 H-DO Module (P. 70)**.


For H-TIO-A/E/H/R type modules, an alarm can be output from each module (optional).

(5) Loop break alarm function (Excluding H-TIO-H/J type modules)

The loop break alarm function is used to detect a load (heater) break, a failure occurring in any external operating device (magnet relay, etc.) or a failure occurring in the control system (control loop) caused by an input (sensor) break. (Refer to P. 124.)


The loop break alarm can be output as summary output (*OR* output) from the digital output block in the H-PCP-A/B module. For details, refer to **3.3 H-PCP Module (P. 36)**.


The loop break alarm can be output independently for each channel by connecting the H-DO-A/B/D module. For details, refer to **3.9 H-DO Module (P. 70)**.

(6) Heater break alarm function (Optional)

The heater break alarm function is used to detect the current flowing into the load (heater) by using the current transformer (CT), thereby producing a heater break alarm when a heater break occurs.
(Refer to P. 123.)
This function can be added only to the H-TIO-A, C or D type module.(1 point/control loop)

- For H-TIO-A/C/D module with voltage/current output, no heater break alarm function can be used.
- The heater break alarm can be output as summary output (*OR* output) from the digital output block in the H-PCP-A/B module. For details, refer to **3.3 H-PCP Module (P. 36)**.
- The heater break alarm can be output independently for each channel by connecting the H-DO-A/B/D module. For details, refer to **3.9 H-DO Module (P. 70)**.

(7) Control function

As standard, the H-TIO module employs the brilliant PID control method which can prevent overshoot or disturbance (excluding the H-TIO-K module). (Refer to P. 113.)
The selectable control action type differs depending on the H-TIO module type. (Refer to the table below.)

Type	ON/OFF action	PID action with autotuning	Heat/Cool PID action with autotuning	PID action with autotuning (With fuzzy control)	Position proportioning control action
H-TIO-A	×	×	–	–	–
H-TIO-B	×	×	–	–	–
H-TIO-C	–	–	×	–	–
H-TIO-D	–	–	×	–	–
H-TIO-E	×	×	–	–	–
H-TIO-F	×	×	–	–	–
H-TIO-G	–	–	×	–	–
H-TIO-H	×	×	–	–	–
H-TIO-J	×	×	–	–	–
H-TIO-K	–	–	–	–	×
H-TIO-P	–	–	–	×	–
H-TIO-R	–	–	–	×	–

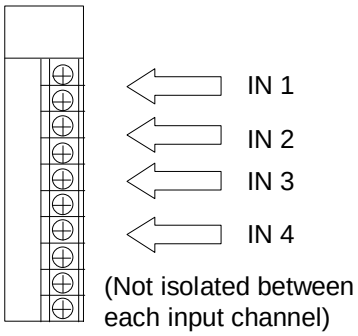
×: Selectable –: Not selectable

3.5 H-TI Module

3.5.1 Outline

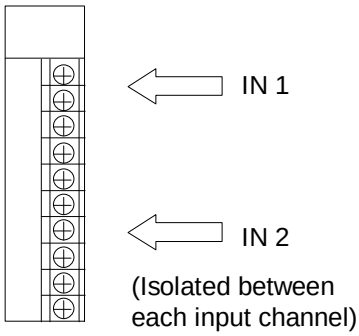
The H-TI module is used to monitor temperature inputs by thermocouple or RTD sensors.

- H-TI-A type
  (RTD input)



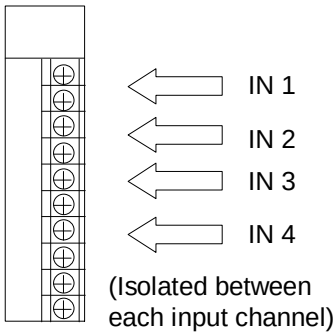
(Not isolated between each input channel)

- H-TI-B type
  (Thermocouple/ RTD input)



(Isolated between each input channel)

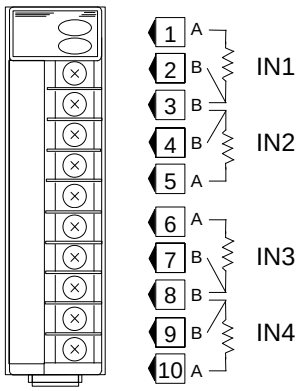
- H-TI-C type
  (Thermocouple input)



(Isolated between each input channel)

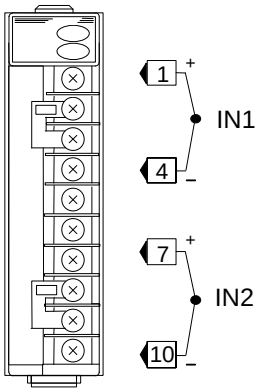
3.5.2 Terminal configuration

■ **H-TI-A type**

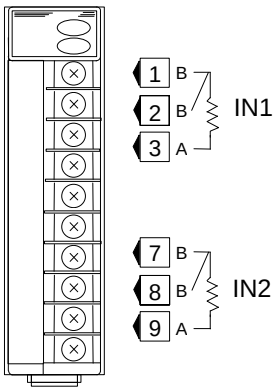


RTD input

■ **H-TI-B type**

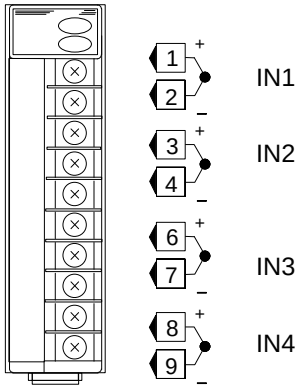


TC input



RTD input

■ H-TI-C type



TC input

3.5.3 Functional description

■ H-TI alarm function

As standard, the H-TI module is provided with tow alarm points/channel (TI alarm 1 and TI alarm 2). TI alarm 1/2 types are those selected by the H-PCP module.

Alarm type: Process high alarm, Process low alarm, Process high alarm (with hold action), and Process low alarm (with hold action)

Each TI alarm is different from a temperature alarm built in the H-TIO module.

Each TI alarm can be output as summary output (*OR* output) from the digital output block in the H-PCP-A/B module. For details, refer to **5.3 H-PCP Module (P. 36)**.

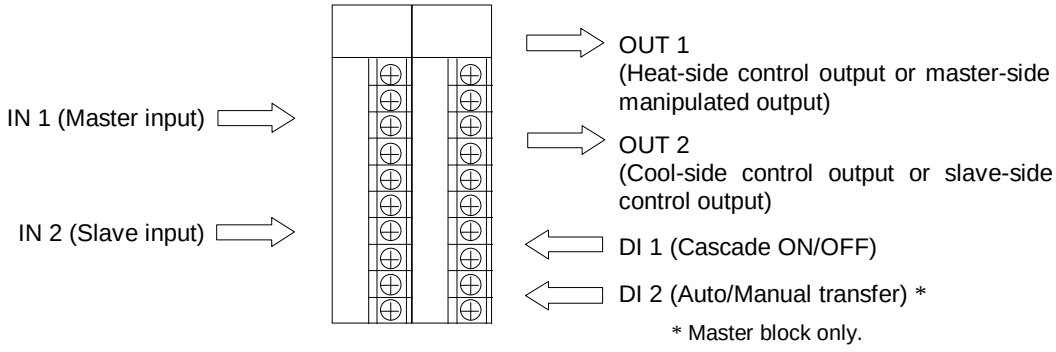
The respective alarm (TI alarm 1/2) can be output independently for each channel by connecting the H-DO-A/B/D module. For details, refer to **5.9 H-DO Module (P. 70)**.

3.6 H-CIO Module

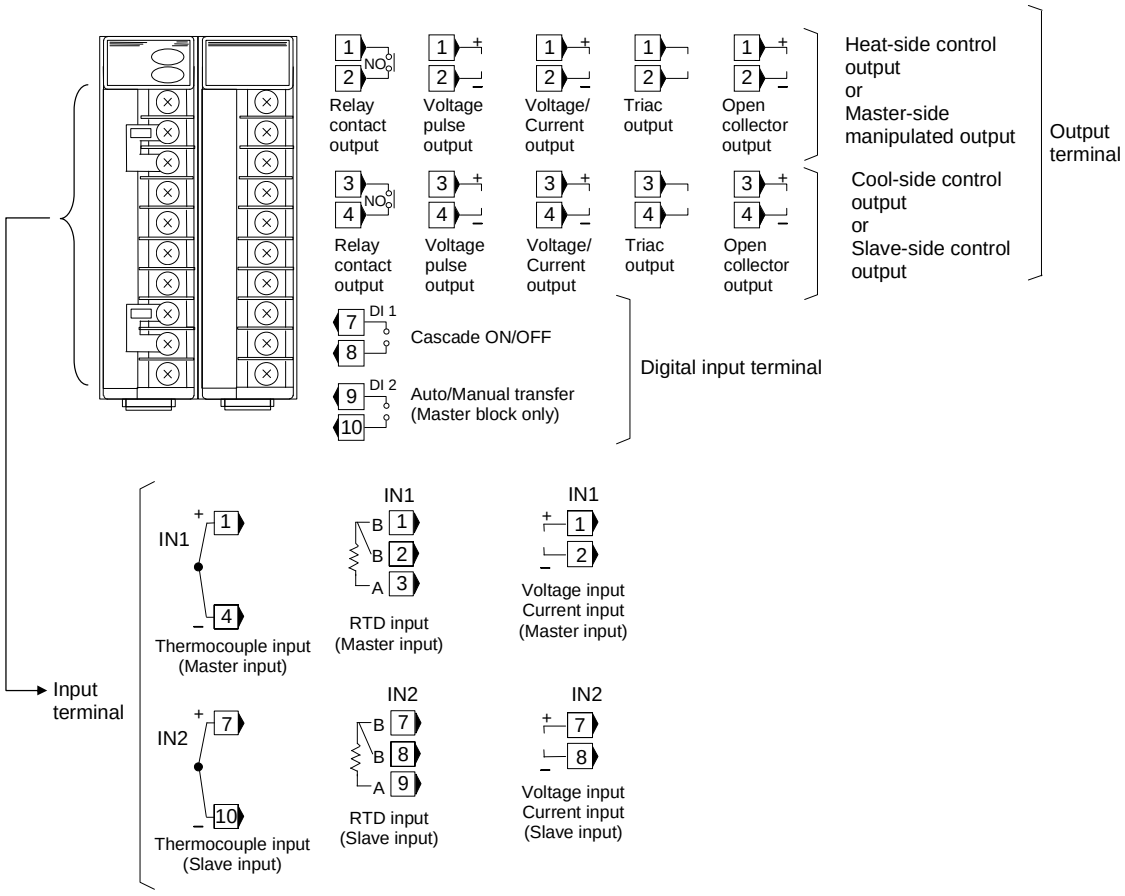
3.6.1 Outline

The H-CIO module is used to perform effective cascade control when there is a time lag between the controlled object and heat source.
The number of cascade control loops is 1 loop/module. The H-CIO modules corresponding to the required number of control points are connected to the H-PCP module. (Up to 5 loops/control unit)

- H-CIO-A type



3.6.2 Terminal configuration

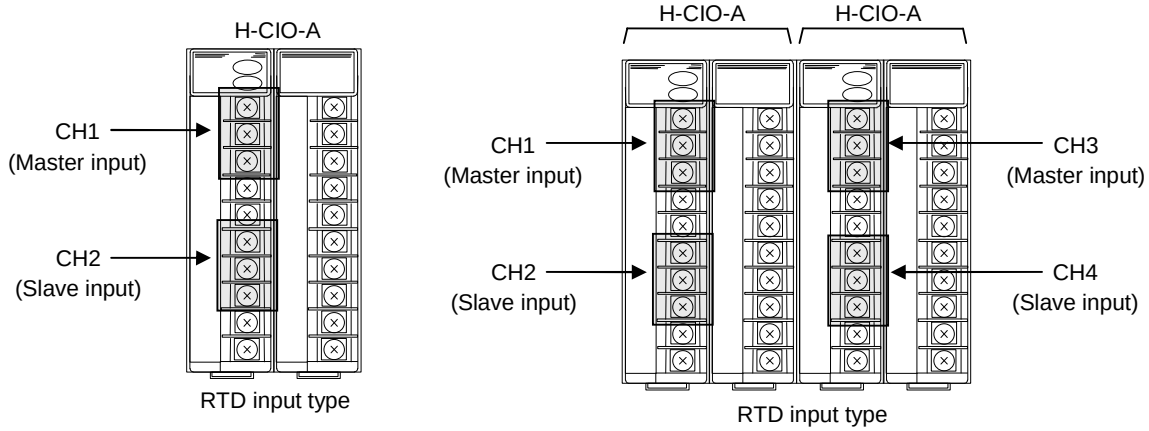


3.6.3 Functional description

(1) Input function

■ Channel number

For the H-CIO module, CH1 and CH2 are assigned to the input terminals of the H-CIO module order from the top.CH1 is for master input and CH2 is for slave input, respectively.
If several H-CIO modules are mounted together, channel numbers are assigned automatically to these modules in order from the left. (Number of connection: Up to 5 modules/control unit)



Channel number assignment

The same channel number assignment applies to the other input types.

■ Input type

Select the desired input type from thermocouple, RTD, voltage and current inputs.
(Specify when ordering.)

List of H-CIO module input types

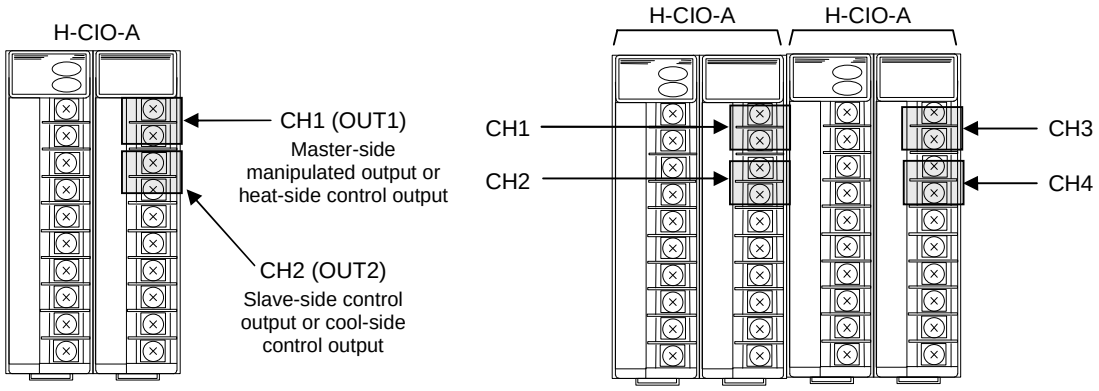
Input type	H-CIO module type
Thermocouple	H-CIO-A-F ☐ ☐ - ☐ ∗ ☐, H-CIO-A-D ☐ ☐ - ☐ ∗ ☐, H-CIO-A-B ☐ ☐ - ☐ ∗ ☐, H-CIO-A-W ☐ ☐ - ☐ ∗ ☐
RTD	H-CIO-A-F ☐ ☐ - ☐ ∗ ☐, H-CIO-A-D ☐ ☐ - ☐ ∗ ☐, H-CIO-A-B ☐ ☐ - ☐ ∗ ☐, H-CIO-A-W ☐ ☐ - ☐ ∗ ☐
Voltage/Current	H-CIO-A-F ☐ ☐ - ☐ ∗ ☐, H-CIO-A-D ☐ ☐ - ☐ ∗ ☐

Different input types cannot be mixed in one module. The desired input type is determined for each module.

(2) Output function

■ Channel number

In the same way as the input terminals, for the H-CIO module, CH1 and CH2 are assigned to the output terminals of the H-CIO module in order from the top.
If several H-CIO modules are mounted together, channel numbers are assigned automatically to these modules in order from the left. (Number of connection: Up to 5 modules/control unit)



Channel number assignment

The control output from the output terminals differs depending on the slave channel control action type.

	Slave channel control action type	
	H-CIO-A-F or H-CIO-A-D type	**H-CIO-A-B or H-CIO-A-W type**
OUT1	Master channel manipulated output	Slave channel heat-side control output
OUT2	Slave channel control output	Slave channel cool-side control output

■ Output type

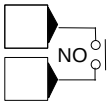
The desired output type can be selected from relay contact, voltage pulse, voltage, current, triac and open-collector outputs for each of OUT1 and OUT2. (Specify when ordering.)

For the module of 1 module/2 channels, various output types cannot be mixed in the module. One output type can be selected for each module.

For details on each output, refer to **8. SPECIFICATION (P. 128)**.

● Relay contact output

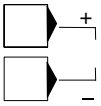
Output status: Independent 1a contact output (closed during outputting)



Rating: 250 V AC, 3 A (Resistive load)

● Voltage pulse output

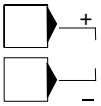
This output is for driving the SSRs and 12 V DC is output during the outputting.



Allowable load resistance: 600 Ω or more

● Current and voltage output

The current output can be selected from 4 to 20 mA DC or 0 to 20 mA DC, and the voltage output can be selected from 0 to 1 V DC, 0 to 5 V DC, 0 to 10 V DC or 1 to 5 V DC. (Specify when ordering)

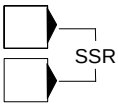


Allowable load resistance: 500 Ω or less (Current output)
1 kΩ or more (Voltage output)

It is possible only in the 1 to 5 V DC voltage output to make a common connection of the minus terminals of the outputs, including the voltage pulse output. (Refer to P. 99.)

● Triac output

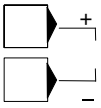
This output can directly drive AC power by the small SSR built in the module. The zero-cross control method is employed.



Capacity: 0.5 A (At an ambient temperature of 40 °C)
Maximum load voltage: 250 V AC

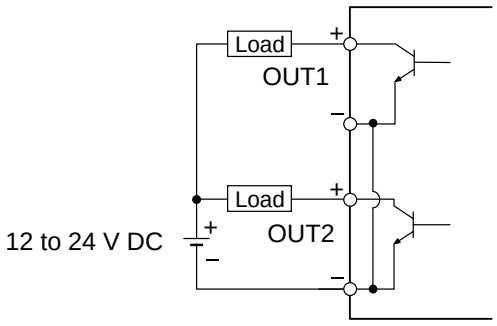
● Open collector output

This transistor sink output uses switching between the transistor emitter and collector. An external power supply of 12 to 24 V DC is connected to the load in series.



Maximum load current: 100 mA or less

Open collector output wiring example



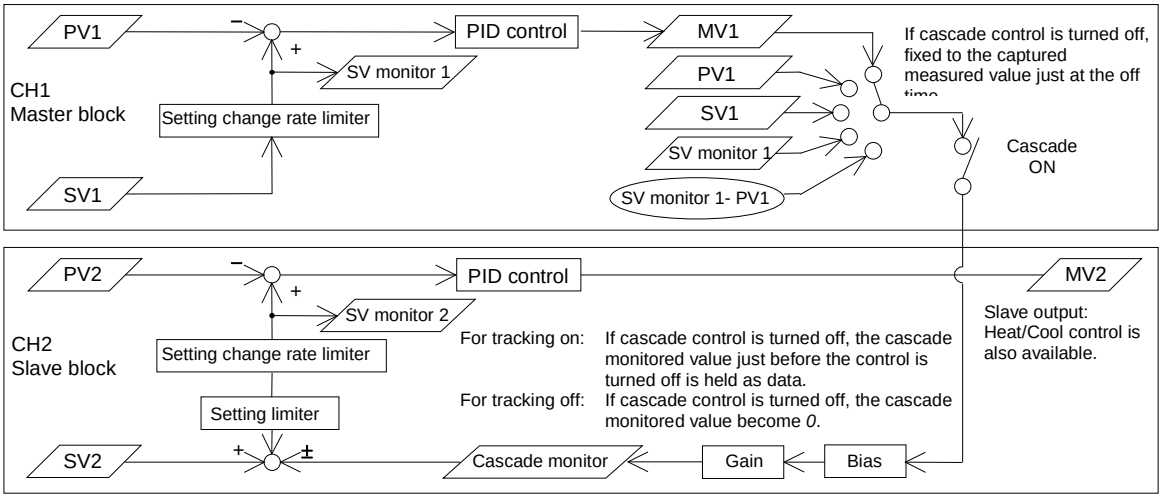
H-CIO-A type

The minus (–) terminals of open collector outputs, OUT1 and OUT2 are connected within the module.

(3) Cascade control function

There are master control and slave control blocks for cascade control. The master control block performs PID computation based on the temperature (measured value) at the measured point necessary to be finally controlled and then corrects the set value of the slave control block using the cascade signal. The slave control unit performs cascade temperature control by the set value corrected by the cascade signal.

Cascade module function configuration diagram



(4) Alarm function

One H-CIO module is provided with two alarm (Alarm 1 and Alarm 2) points as standard.
Alarm 1/2 types are those selected by the H-PCP module.

Alarm type:

Deviation high alarm	Process high alarm
Deviation low alarm	Process low alarm
Deviation high and low alarm	Process high alarm with hold action
Band alarm	Process low alarm with hold action
Deviation high alarm with hold action	Deviation high alarm with re-hold action
Deviation low alarm with hold action	Deviation low alarm with re-hold action
Deviation high and low alarm with hold action	Deviation high and low alarm with re-hold action

Each alarm can be output as summary output (*OR* output) from the digital output block in the H-PCP-A/B module. For details, refer to **3.3 H-PCP Module (P. 36)**.

The respective alarm (Alarm 1/2) can be output independently for each channel by connecting the H-DO-A/B/D module. For details, refer to **3.9 H-DO Module (P. 70)**.

(5) Loop break alarm function

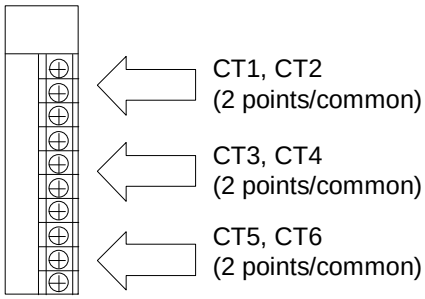
The loop break alarm function is used to detect a load (heater) break, a failure occurring in any external operating device (magnet relay, etc.) or a failure occurring in the control system (control loop) caused by an input (sensor) break. (Refer to P. 124.)

- The loop break alarm can be output as summary output (*OR* output) from the digital output block in the H-PCP-A/B module. For details, refer to **3.3 H-PCP Module (P. 36)**.
- The loop break alarm can be output independently for each channel by connecting the H-DO-A/B/D module. For details, refer to **3.9 H-DO Module (P. 70)**.

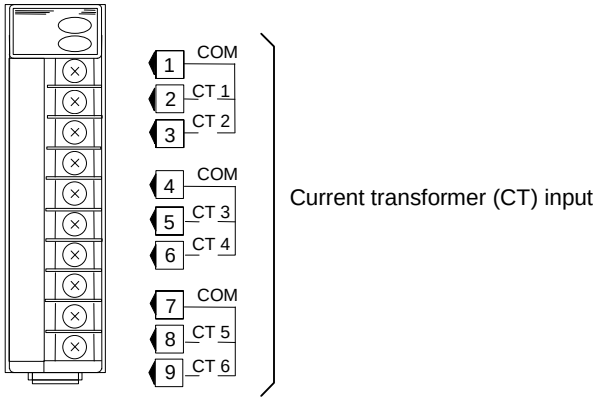
3.7 H-CT Module

3.7.1 Outline

The H-CT module is used specially for CT (current transformer) input for detecting heater current.
This is dedicated to CT input for heater break detection or current measurement.
Up to six CT input points can be input per module. In addition, the following two types of H-CT module are available depending on the heater capacity used: 0 to 30 A and 0 to 100 A. (Specify when ordering)



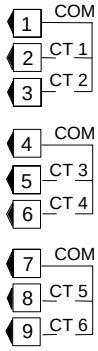
3.7.2 Terminal configuration



3.7.3 Functional description

■ Heater break alarm output function

The H-CT module, combined with the CT sensor or H-TIO module, can output a heater break alarm. (Refer to P. 123).



Up to six CT sensors can be connected to one H-CT module. The input terminals of the H-CT module consist of three blocks with one common terminal and two CT terminals per block.
In addition, respective H-TIO module channels can be freely assigned to these current transformers. In addition, as the specifying channel number is assigned in duplicate, 3-phase heater break can be detected by combining two or more current detectors (CT).

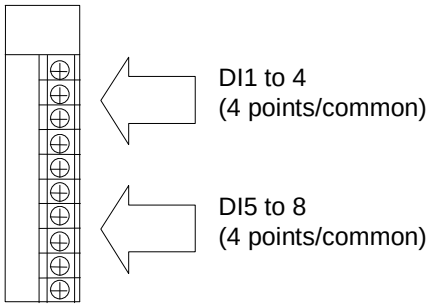
- For the heater capacity of 30 A or less, the H-CT-A-P module for 0 to 30 A (CT sensor: CTL-6-P-N using type) should be used in view of the current detection sensitivity.
- CT input cannot be assigned to the H-TIO module with voltage/current control output.
- Each CT input can be assigned from the dedicated Operation Panel, or host computer via communication.
- The heater break alarm can be output as summary output (*OR* output) from the digital output block in the H-PCP-A/B module. For details, refer to **3.3 H-PCP Module (P. 36)**.
- The respective heater break alarm can be output independently for each channel by connecting the H-DO-A/B/D module. For details, refer to **3.9 H-DO Module (P. 70)**.
- ☞ For details on CT input selection, refer to **SR Mini/SR Mini HG SYSTEM Supplementary Information Initialize Settings [Extended Communications] (IMSRM07-E□)**.

3.8 H-DI Module

3.8.1 Outline

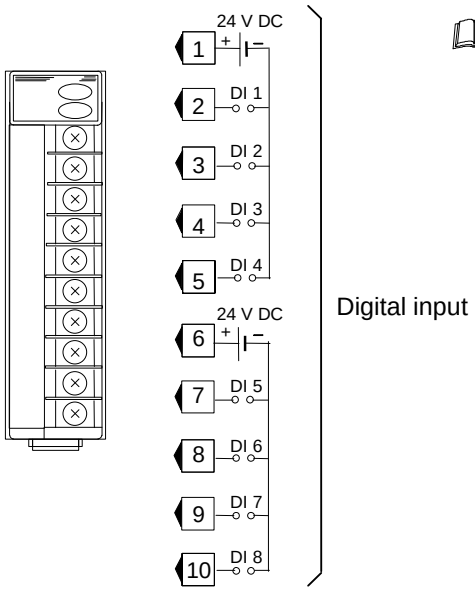
The H-DI module is used only for digital input.
The H-DI-A type module is used to select the operation status (memory area selection, control RUN/STOP selection, or alarm interlock release) of the control unit by using external contacts, etc.
The H-DI-B type module is used to display various event inputs on the operation panel. Each event input is logically operated (*AND*, *NAND*, *OR* or *NOR*) and the logical operation result can be also output from the H-DO-C module.
Up to eight input points can be configured for each H-DI module.

- H-DI-A and H-DI-B type



3.8.2 Terminal configuration

■ H-DI-A and H-DI-B type



Connect external power (24 V DC) to the number 1 and number 6 COM (common) terminals on the H-DI module so that these terminal sides become positive (+).

3.8.3 Functional description

(1) Digital input function (H-DI-A)

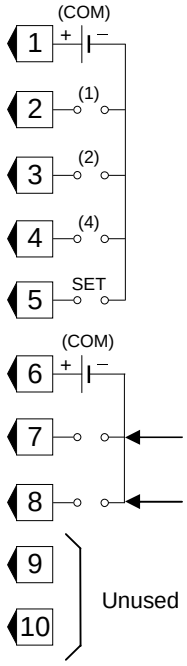
This is a function to switch the operation status of the control unit (refer to below) using the external signal fed into the H-DI-A module which is connected to the control unit. The operation status can be switched over by the open/close state of the digital input terminals 1 to 8 of the H-DI-A module.

Operation state types: Memory area selection, Control RUN/STOP selection and Alarm interlock release

For memory area selection, configure an external contact circuit or use a contact output signal from the PLC, if necessary.

After the contact is closed, it takes a short time until the action of this device is actually selected. Therefore, pay attention to this delay time if the device is used together with a PLC, etc.

Connect external power (24 V DC) to the number 1 and number 6 COM (common) terminals on the H-DI module so that these terminal sides become positive (+).



Terminal No. \ Control area	1	2	3	4	5	6	7	8
1 - 2	–	×	–	×	–	×	–	×
1 - 3	–	–	×	×	–	–	×	×
1 - 4	–	–	–	–	×	×	×	×

–: Open ×: Closed

The memory area (control area) is established by closing terminal number 5 (ENABLE terminal). [Function mode 1*]

Control RUN/STOP selection (contact closed: RUN, contact open: STOP)

Alarm interlock release (contact closed: alarm interlock release)
(No alarm interlock function is activated if the contact is in the normally closed state.)

* The function mode types below can be selected for the digital input function of the H-DI-A module. The digital inputs (DI) function can be set following function mode 1 to 2 in operation panel or host communication (initialize settings [extended communications]).

Function mode 1 (factory set value)

- Memory area selection (ENABLE terminal is used)
  After area selection setting, the actual area is changed by detecting the ENABLE edge.
- Control RUN/STOP selection
- Alarm interlock release

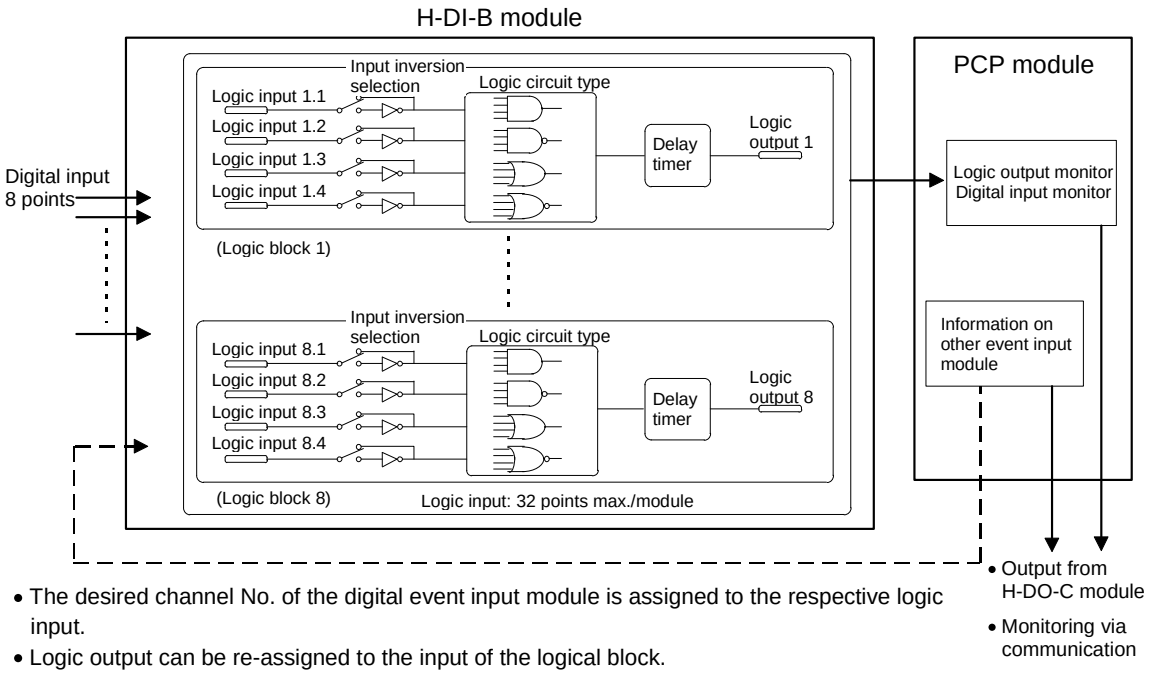
Function mode 2

- Memory area selection
  The actual area is changed approximately 2 seconds after area selection setting.
- Control RUN/STOP selection
- Alarm interlock release

(2) Digital event input function (H-DI-B)

■ Logic input function

Each logic is built by four event inputs. Up to eight logic results (logic outputs) per H-DI-B module can be monitored through communication or can be output from event output module (H-DO-C).
In addition, this function can assign the input of the H-DI-B module to any channel number of the H-DO-C module to output the result.
The logic section of event H-DI-B module consists of 4 logic input points, input reversal selection, logic circuit type selection, input delay timer and logic output.



H-DI-B module (event input function) and the H-PCP module with the specification of ladder communication cannot be selected at the same time.

Each event input can be assigned from the dedicated host computer via communication.

For details on event input selection, refer to **SR Mini/SR Mini HG SYSTEM Supplementary Information Initialize Settings [Extended Communications] (IMSRM07-E□)**.

3.9 H-DO Module

3.9.1 Outline

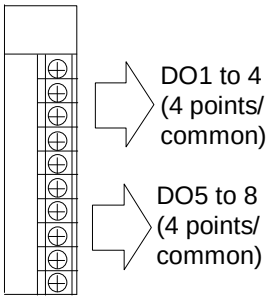
The H-DO module is used specially for digital output.

H-DO-A, H-DO-B and H-DO-D type modules can output alarm statuses* such as temperature and heater break alarms independently for each channel.

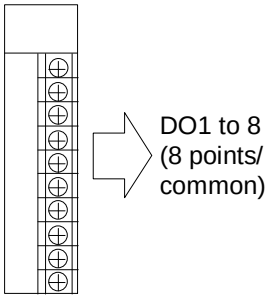
* Alarm statuses of Temperature alarm 1, Temperature alarm 2, Burnout alarm, Heater break alarm, Loop break alarm, AI alarm 1, and AI alarm 2.

For H-DO-C type modules, dedicated alarms or control unit operations can be independently output as event outputs.

• H-DO-A (8 points output type)

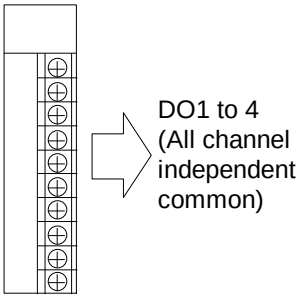


Relay contact output type



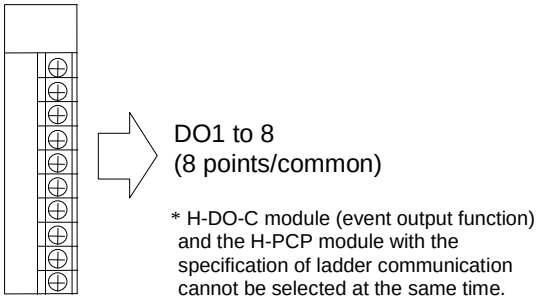
Open collector output type

• H-DO-B (4 points output type)



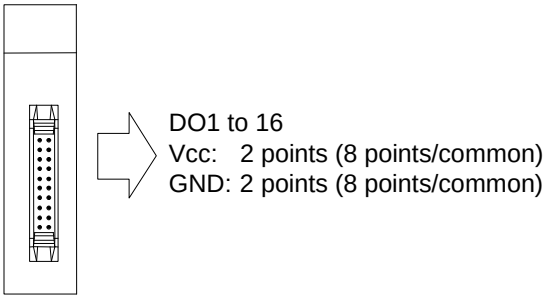
Relay contact output type

• H-DO-C (8 points output type) *



Open collector output type

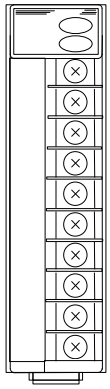
• H-DO-D (16 points output type)

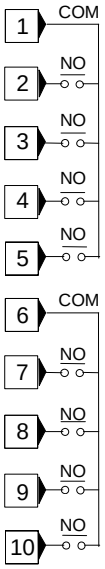


Open collector output type

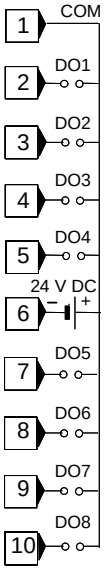
3.9.2 Terminal configuration

■ H-DO-A type



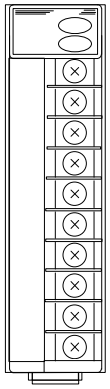


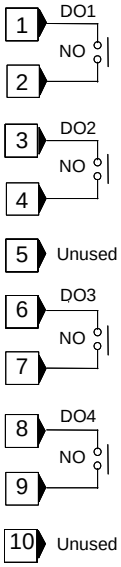
Relay contact output



Open collector output

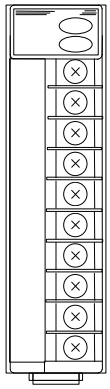
■ H-DO-B type

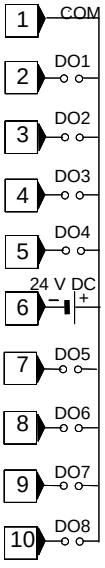




Relay contact output

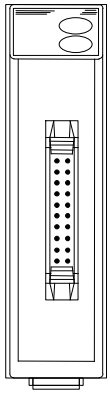
■ H-DO-C type

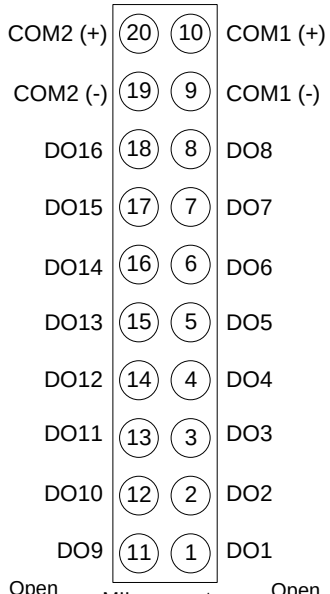




Open collector output

■ H-DO-D type





Open collector output — MIL connector pin arrangement — Open collector output

In using the open collector output, an external power supply of 24 V DC is required.

Connector to be used:	
	HIF3BA-20PA-2.54DS(71) (MIL-standard compliant) Manufactured by HIROSE ELECTRIC CO., LTD.
Mating socket:	HIF3BA-20D-2.54R Manufactured by HIROSE ELECTRIC CO., LTD.

3.9.3 Functional description

(1) Alarm output function (only for H-DO-A, H-DO-B and H-DO-D types)

■ Alarm output function types

Any alarm selected from the following alarm output functions can be output for each channel.

- **Temperature alarm output (alarm 1 and alarm 2)**

This alarm is output when the measured value (PV) of the H-TIO module is within the alarm setting range.
The alarm 1 and alarm 2 are output for each channel.

- **Heater break alarm output**

This alarm is output for each channel when the heater current detected by the current transformer is within the heater break alarm setting range.

- **Burnout alarm output**

This alarm is output for each channel when the input (sensor) breaks or the input value exceeds the scaling range.

- **Loop break alarm output**

This alarm is output for each channel when an error occurs in the control loop.

- **AI alarm output (AI alarm 1 and AI alarm 2)**

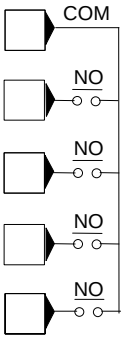
This alarm is output when the measured value (PV) of the H-AI module is within the AI alarm setting range. The AI alarm 1 and AI alarm 2 are output for each channel.

■ Output type

- **Relay contact output (H-DO-A and H-DO-B type)**

H-DO-A type

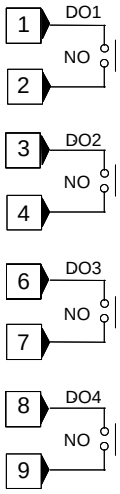
Output status: 1 a contact output
4 points/common



Rating: 250 V AC, 24 V DC
Maximum load current:
1 A/point (Resistive load)
4 A/common (Resistive load)

H-DO-B type

All point independent common output

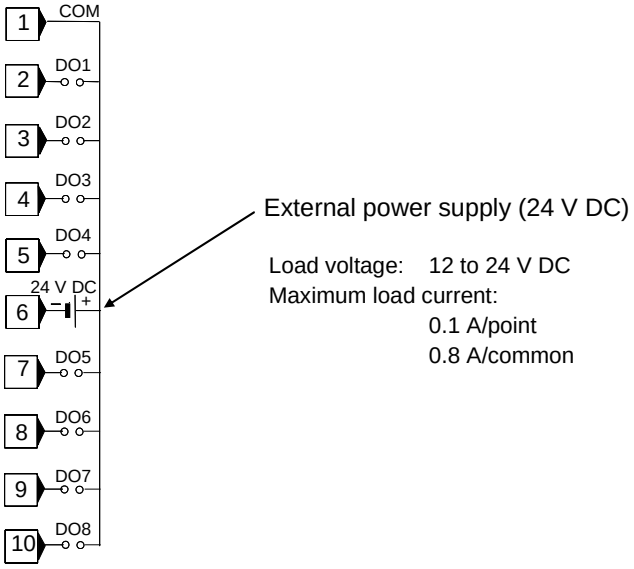


Rating: 250 V AC, 24 V DC
Maximum load current:
1 A/point (Resistive load)

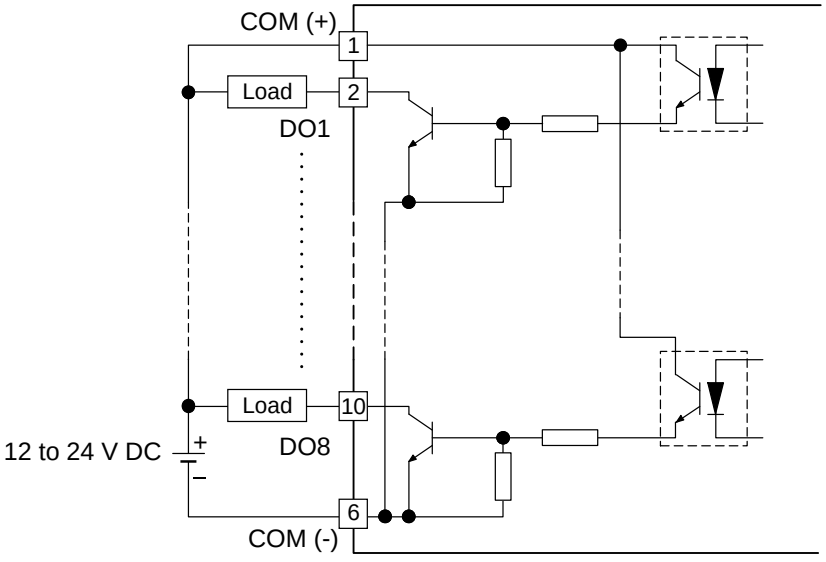
- **Open collector output (H-DO-A and H-DO-C type)**

The output status is an 8 points/common open collector output.
For the internal circuit driver of the H-DO module, connect the minus (–) terminal of an external power supply (24 V DC) to the number 6 terminal and connect the positive (+) terminal of the power supply to the common line of each output.

In using the open collector output, an external power supply of 24 V DC is required. Note that if this power supply is not connected, there will be no output from the module.



Open collector output wiring example



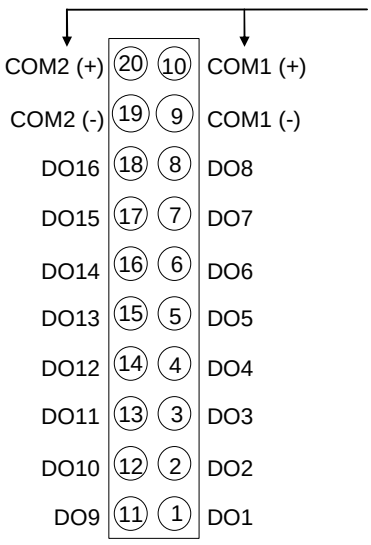
● Open collector output (H-DO-D type)

The output type becomes the transistor sink load output of 16 channels/2 commons (output type: 2 × 8 points/common).

In order to drive the output circuit within the H-DO module, connect a minus line (–) of the external power supply (24 V DC) to the number 9 pin on the DO1 to DO8 side, and a plus line (+) of the same power supply to the number 10 pin and the common line of each point from DO1 to DO8.

In addition, connect a minus line (–) of the external power supply (24 V DC) to the number 19 pin on the DO9 to DO16 side, and a plus line (+) of the same power supply to the number 19 pin and the common line of each point from DO9 to DO16.

In using the open collector output, an external power supply of 24 V DC is required. Note that if this power supply is not connected, there will be no output from the module.

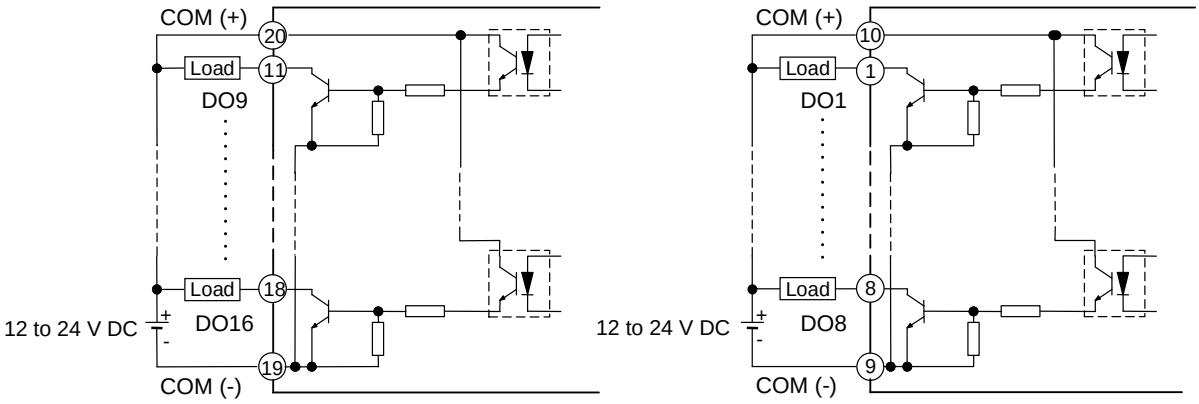


MIL connector pin arrangement
(Front view)

Load voltage: 12 to 24 V DC
Maximum load current:
0.05 A/point
0.4 A/common
Connector type: HIF3BA-20PA-2.54DS(71)
(MIL-standard compliant)
Manufactured by
HIROSE ELECTRIC CO., LTD.
Mating socket: HIF3BA-20D-2.54R
Manufactured by
HIROSE ELECTRIC CO., LTD.

The following socket may also be fitted.
AXM120415 (With strain relief)
Manufactured by Panasonic Corporation.
(Old company name: Matsushita Electric Works, Ltd.)

Open collector output wiring example



■ Alarm assignment

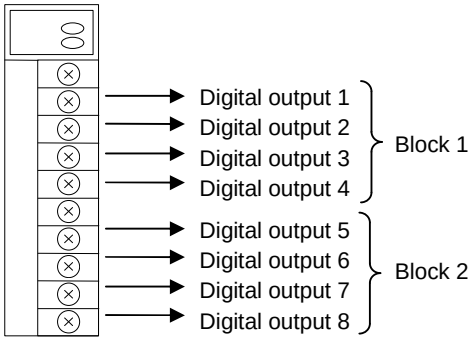
One H-DO-A or H-DO-B module is divided into each block (4 points/block) for the respective alarm type. Thus, four points per block are output.
One H-DO-D module is divided into each block (8 points/block) to output the respective alarm type. The alarm type to be output can be freely selected for each block.

● Alarm types

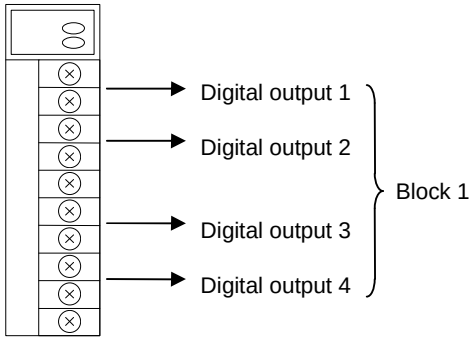
- Temperature alarm 1
- Temperature alarm 2
- Heater break alarm (HBA)
- Burnout alarm
- Loop break alarm (LBA)
- AI alarm 1
- AI alarm 2
- Unused (No alarm)

● Digital output(DO) grouping

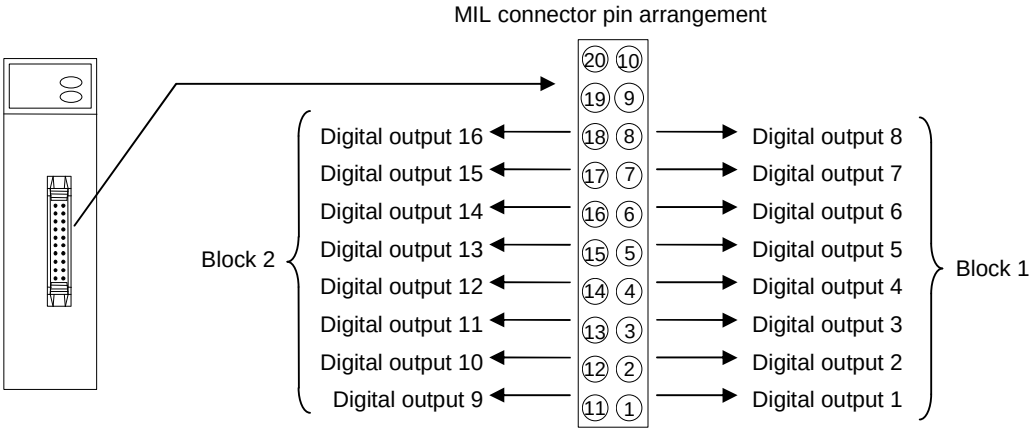
H-DO-A module



H-DO-B module



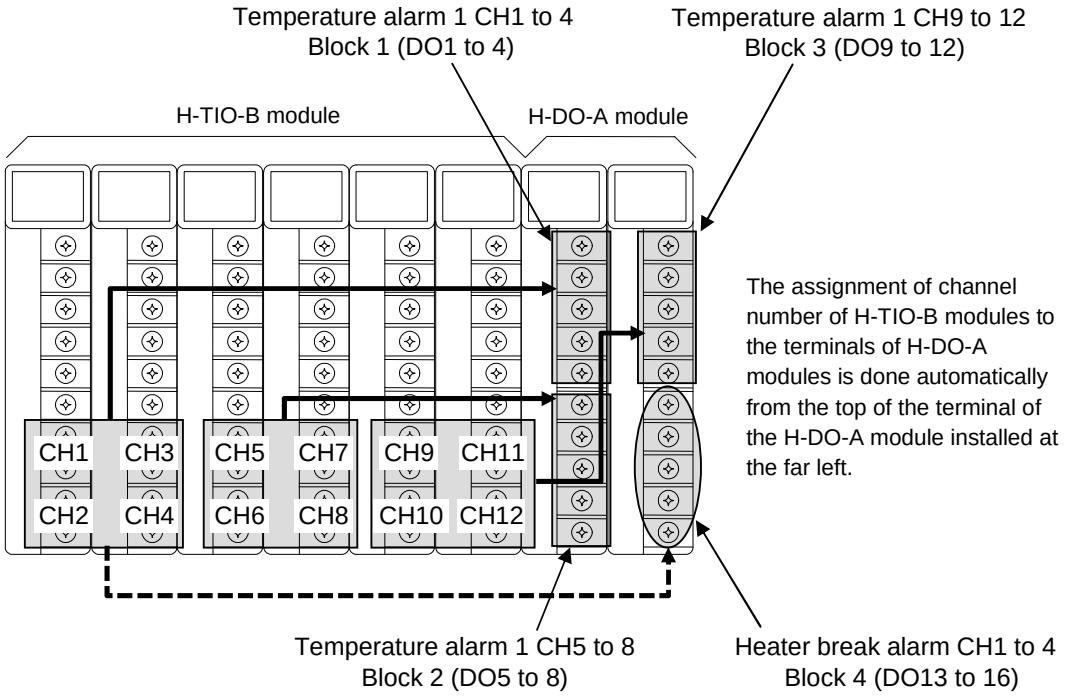
H-DO-D module



[Example]

When the temperature alarm 1 and heater break alarms of the H-TIO-B module are output independently for each channel by the H-DO-A module.

Block 1 (DO1 to 4): Temperature alarm 1 Block 3 (DO9 to 12): Temperature alarm 1
Block 2 (DO5 to 8): Temperature alarm 1 Block 4 (DO13 to 16): Heater break alarm



No assigned channel can be skipped. Terminals corresponding to the channel which does not use various alarms become vacant (unused).

Each alarm can be assigned from the dedicated host computer via communication.

For details on alarm selection, refer to **SR Mini/SR Mini HG SYSTEM Supplementary Information Initialize Settings [Extended Communications] (IMSRM07-E□)**.

(2) Event output function (Only for H-DO-C type)

The event output function enables up to eight points to be output per module of unique alarms different from ordinary temperature and AI alarms, control unit operations and comparison results which are output only under certain conditions.
The function can be set for each channel of the H-DO-C module.

■ Extension alarm output function

An extension alarm is output independently of H-TIO module alarms.
As it is independently set, it can be provided as a dedicated alarm output.
The event output function enables up to eight points to be output per module of unique alarms different from ordinary temperature and AI alarms, control unit operations and comparison results which are output only under certain conditions.
The function can be set for each channel of the H-DO-C module.

● Extension alarm output function

An extension alarm is output independently of H-TIO module alarms.
As it is independently set, it can be provided as a dedicated alarm output.

Event DO function selection	Event DO corresponding channel setting	Event DO mode select setting
Temperature deviation alarm	1 to 20 CH (H-TIO/H-CIO module)	High alarm, Low alarm, High/low alarm, Band alarm High alarm [1], Low alarm [1], High/low alarm [1], Band alarm [1] High alarm [2], Low alarm [2], High/low alarm [2]
Temperature process alarm	1 to 20 CH (H-TIO/H-CIO module)	High alarm, Low alarm High alarm [1], Low alarm [1]
Temperature set value alarm	1 to 20 CH (H-TIO/H-CIO module)	High alarm, Low alarm
AI process alarm	1 to 40 CH (H-AI module)	High alarm, Low alarm High alarm [1], Low alarm [1]
TI process alarm	1 to 40 CH (H-TI module)	High alarm, Low alarm High alarm [1], Low alarm [1]

[1] With hold action [2] With re-hold action

📖 Extension alarm output is different from the ordinary alarm output from the H-DO-A/B type module. Similarly, the ordinary alarm cannot be output from the H-DO-C type module (for event output).

📖 The alarm differential gap and alarm delay timer are commonly set.

📖 H-DO-C module (event output function) and the H-PCP module with the specification of ladder communication cannot be selected at the same time.

📖 Each alarm can be assigned from the dedicated host computer via communication.

☞ For details on alarm selection, refer to **SR Mini/SR Mini HG SYSTEM Supplementary Information Initialize Settings [Extended Communications] (IMSRM07-E□)**.

■ Status output function

This function is used to output the control unit action status other than the extension alarm output in addition to the ordinary alarm output states (Alarm 1 status, etc.).

Event DO function selection	Event DO corresponding channel setting	Event DO mode select setting
Unused (Manual mode)	—	—
Alarm 1	1 to 20 CH (H-TIO/H-CIO module)	—
Alarm 2	1 to 20 CH (H-TIO/H-CIO module)	—
Burnout	1 to 20 CH (H-TIO/H-CIO module)	—
Heater break alarm (HBA)	1 to 20 CH (H-TIO module)	—
AI alarm 1	1 to 40 CH (H-AI module)	—
AI alarm 2	1 to 40 CH (H-AI module)	—
Loop break alarm (LBA)	1 to 20 CH (H-TIO/H-CIO module)	—
PID/AT	1 CH	—
TI alarm 1	1 to 40 CH (H-TI module)	—
TI alarm 2	1 to 40 CH (H-TI module)	—
TI burnout	1 to 40 CH (H-TI module)	—
Event DI logic output status	1 to 40 CH (H-DI-B module)	—


Each event output can be assigned from the dedicated host computer via communication.


For details on event output selection, refer to **SR Mini/SR Mini HG SYSTEM Supplementary Information Initialize Settings [Extended Communications] (IMSRM07-E□)**.

■ Data comparison output function

This function is used to output the result of comparison between the measured value and measured value (or set value and set value) within the same group.

Event DO function selection	Event DO corresponding channel setting	Event DO mode select setting
	Data 1	Data 2
Temperature input measured value (PV) comparison Comparison between PV and PV	1 to 20 CH (H-TIO/H-CIO module)	1 to 20 CH (H-TIO/H-CIO module)
Temperature set value (SV) comparison Comparison between SV and SV	1 to 20 CH (H-TIO/H-CIO module)	1 to 20 CH (H-TIO/H-CIO module)
AI input measured value (PV) comparison Comparison between PV and PV	1 to 40 CH (H-AI module)	1 to 40 CH (H-AI module)
TI input measured value (PV) comparison Comparison between PV and PV	1 to 40 CH (H-TI module)	1 to 40 CH (H-TI module)

[Relationship between output and comparison]

Computing equation: The output turns ON at (Data 2) − (Data 1) ≤ 0

This means:
The output turns ON if (Data 2) is smaller than or equal to (Data 1). {Data 2 ≤ Data 1}
The output turns OFF if (Data 2) is larger than (Data 1). {Data 2 > Data 1}

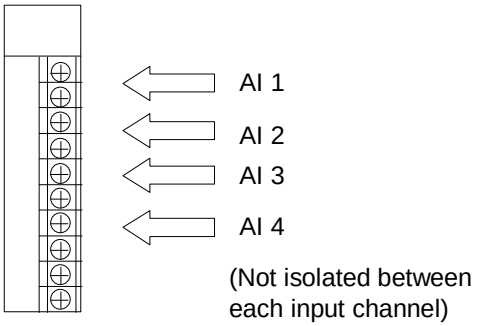
- The differential gap during comparison can be set. (All channel common setting)
  Setting range: 0.00 to 10.00 % of input range
- Each event output can be assigned from the dedicated host computer via communication.
- For details on event output selection, refer to **SR Mini/SR Mini HG SYSTEM Supplementary Information Initialize Settings [Extended Communications] (IMSRM07-E□)**.

3.10 H-AI Module

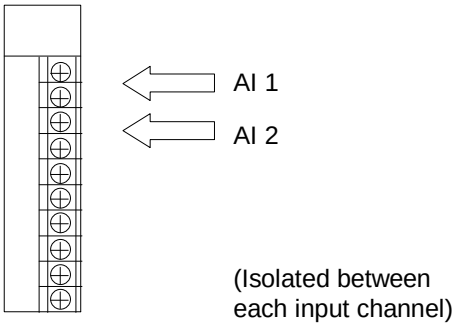
3.10.1 Outline

The H-AI module is specially for analog input (Voltage/Current input).
This module is used to monitor measured value, current value, etc. in the production line using external analog signals (Voltage/Current signals).

• H-AI-A type

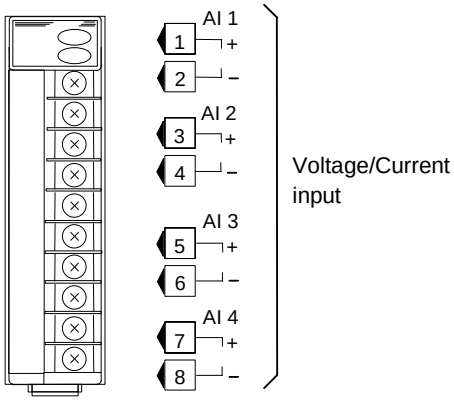


• H-AI-B type

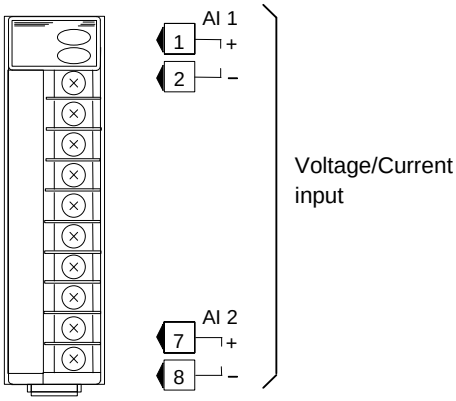


3.10.2 Terminal configuration

■ **H-AI-A type**



■ **H-AI-B type**



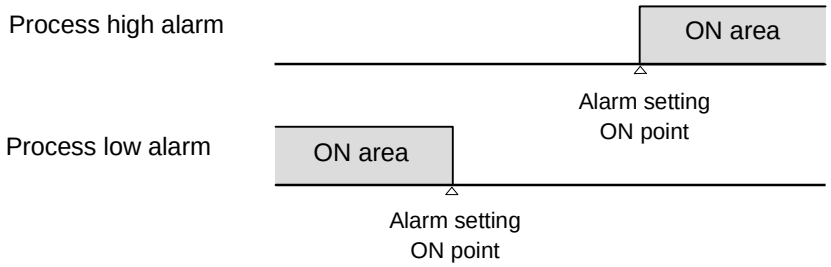
3.10.3 Functional description

■ AI alarm function

For the H-AI module, two types of alarm are available per channel as standard (AI alarm 1 and AI alarm 2). Alarm types are those selected by the H-PCP module.

Alarm type: Process high alarm, Process low alarm, Process high alarm with hold action, Process low alarm with hold action

● AI alarm types



An AI alarm is different from a temperature alarm built in the H-TIO module.

Each AI alarm can be output as summary output (*OR* output) from the digital output block in the H-PCP-A/B module. For details, refer to **3.3 H-PCP Module (P. 36)**.

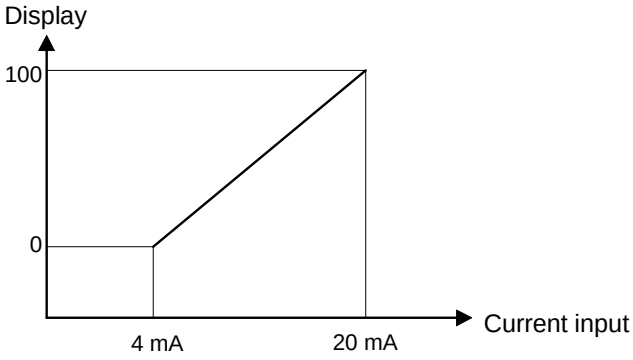
The respective alarm (AI alarm 1/2) can be output independently for each channel by connecting the H-DO-A/B/D module. For details, refer to **3.9 H-DO Module (P. 70)**.

■ Scaling function

This function is used to specify the display range (scaling) of the input value to the H-AI module.

[Example]

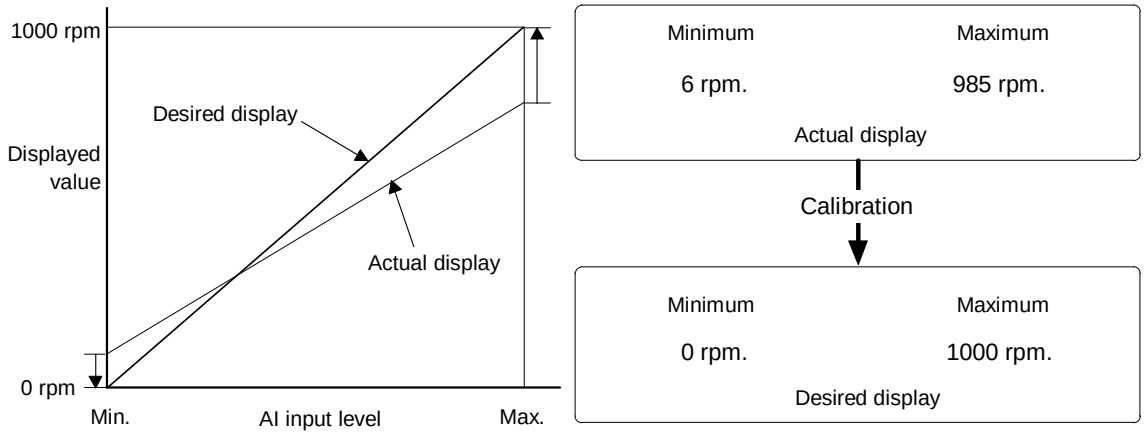
When the display range is scaled to 0 to 100 for a current input of 4 to 20 mA.



■ Input calibration function

This function is used to forcibly match the displayed value with the zero or full scale point for the purpose of correcting the AI zero or full scale point.
If the displayed value deviates from the H-AI module input value, the displayed value is calibrated (corrected) at its zero and full scale points so as to match the H-AI module input value.

[Example]
Display of motor r.p.m.*



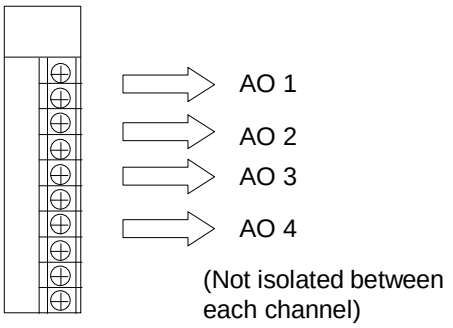
The maximum or minimum displayed value may deviate from the desired value due to an error occurring in the external motor r.p.m.* output signal, shunt resistor or current transformer.
At this time, the displayed value is forcibly matched with the input corresponding to the maximum or minimum value, thereby matching the displayed value with the actual r.p.m.*
More accurate monitoring becomes possible if calibration is performed by referring to the output from a tachometer (clamp meter for current measurement).
* r.p.m: revolutions per minute

3.11 H-AO Module

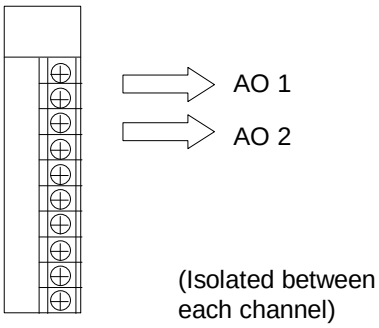
3.11.1 Outline

This module is used to output analog signals corresponding to measured value (PV), set value (SV), etc. of the control unit to record product line states and to set external devices remotely.
It can also be used for motor r.p.m.* open loop control in combination with the H-AI module.
* r.p.m: revolutions per minute

• H-AO-A type

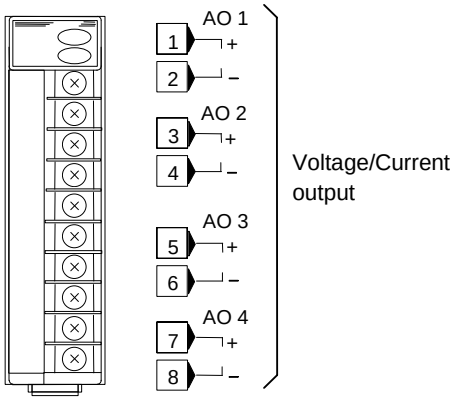


• H-AO-B type

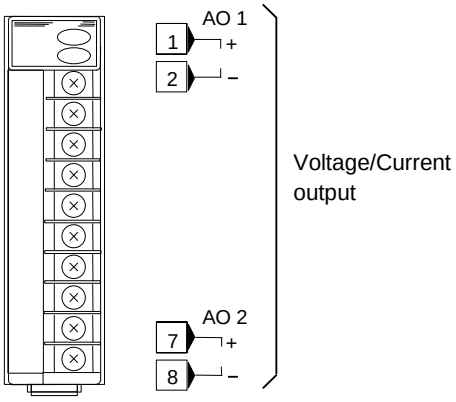


3.11.2 Terminal configuration

■ **H-AO-A type**



■ **H-AO-B type**



3.11.3 Functional description

■ Analog output function

The H-AO module can output control unit related data to a recorder, etc. as analog signal.

Data item to be output	Corresponding channel range
Temperature measured value (PV)	1 to 20 CH (H-TIO/H-CIO module)
Temperature set value (SV)	1 to 20 CH (H-TIO/H-CIO module)
Temperature deviation value	1 to 20 CH (H-TIO/H-CIO module)
Heat-side control output value	1 to 20 CH (H-TIO/H-CIO module)
Cool-side control output value	1 to 20 CH (H-TIO/H-CIO module)
H-AI module input value	1 to 40 CH (H-AI module)
H-TI module input value	1 to 40 CH (H-TI module)
H-TIO-K module feedback resistance input value	1 to 10 CH (H-TIO-K module)

Data can be output for each control unit.
When the control unit is multi-drop connected, no data on other control units can be output.

■ Output change rate limit function

This function is used to restrict rapid analog output changes.

The settings of the function becomes valid in manual mode.

■ Zooming function

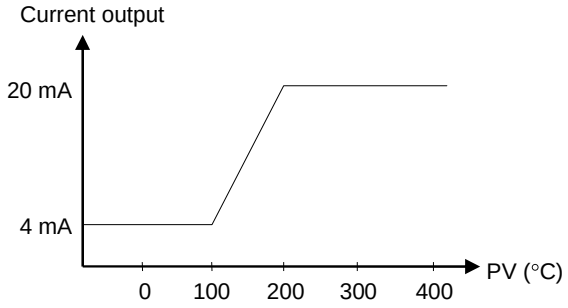
Can be set from 0 to 100 % for each of the high and low sides of the relevant output data.
(High > Low)

[Example]

When a temperature of 100 to 200 °C at measured value (PV) 1 is necessary to recorded for the temperature range from 0 to 400 °C.
Set the relevant values as follows.

AO function selection = Temperature measured value
Setting of channel corresponding to AO = 1 CH
AO zoom high = 50 %
AO zoom low = 25 %

In this case, a percentage of 0 to 100 % is output between 100 and 200 °C.



The setting of the zoom function becomes valid in recorder output mode.

■ AO display scaling function

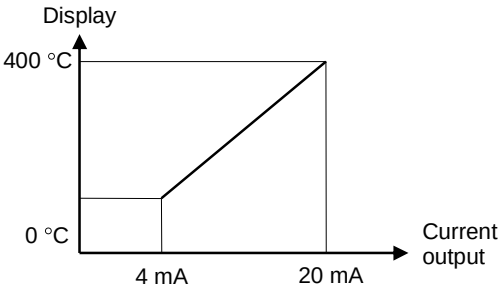
Any analog output from the H-AO module can match 1 to 5 V or 4 to 20 mA on the display.

[Example]

A screen display of 0 to 400 °C is required by using the H-AO module with an output of 4 to 20 mA. Set the relevant values as follows.

AO display scale high: 400
AO display scale low: 0

Thus, a temperature of 0 °C is displayed at an output of 4 mA, and a temperature of 400 °C, at an output of 20 mA.



The setting of the AO display scaling function becomes valid in manual mode.

■ Output calibration function

If some deviation occurs between the output value of the H-AO module and the actual operation of externally connected equipment, this function is used to forcibly correct the output signal of the H-AO modules at the zero and full scale points.

For example, if the number of motor revolutions is set using the H-AO module with an output signal of 1 to 5 V, but the voltage value corresponding the actual number of revolutions is 0.1 V lower than the output value of the H-AO module, a correction of +2.5 % at the zero point changes the output value of the H-AO module to 1.1 to 5.1 V, thereby matching the AO displayed value to the actual number of revolutions.

If the zero point is corrected, the full scale point is also corrected by the same amount.
If the full scale point is corrected, no zero point is corrected.

4. MOUNTING

⚠ WARNING

To prevent electric shock or instrument failure, always turn off the power before mounting or removing the instrument.

4.1 Mounting Cautions

(1) This instrument is intended to be used under the following environmental conditions. (IEC61010-1) [OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2]

(2) Use this instrument within the following environment conditions:

- Allowable ambient temperature: 0 to 50 °C
- Allowable ambient humidity: 45 to 85 % RH
  (Absolute humidity: MAX.W.C 29.3 g/m^3 dry air at 101.3 kPa)
- Installation environment conditions:
  Indoor use
  Altitude up to 2000 m

(3) Avoid the following conditions when selecting the mounting location:

- Rapid changes in ambient temperature which may cause condensation.
- Corrosive or inflammable gases.
- Direct vibration or shock to the mainframe.
- Water, oil, chemicals, vapor or steam splashes.
- Excessive dust, salt or iron particles.
- Excessive induction noise, static electricity, magnetic fields or noise.
- Direct air flow from an air conditioner.
- Exposure to direct sunlight.
- Excessive heat accumulation.

(4) In case this instrument is connected to a supply by means of a permanent connection a switch or circuit-breaker shall be included in the installation. This shall be in close proximity to the equipment and within easy reach of the operator. It shall be marked as the disconnecting device for the equipment.

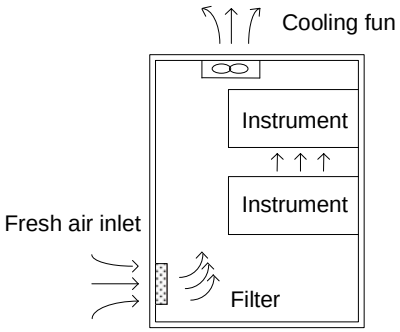
4.2 Mounting Position Within Panel

Mount this instrument in the panel most suited to the environment and to facilitate operation and maintenance.

(1) Mounting precautions

■ Temperature considerations

- Allow enough ventilation space.
- Do not mount this instrument directly above equipment which generates heat (heaters, transformers, large resistors, etc.).
- If the ambient temperature rises above 50 °C, cool the panel inside using a forced fan or cooler. Cooled air should not blow directly on this instrument.



Example of cooling panel

■ Humidity considerations

Condensation may form in the instrument due to rapid changes in temperatures by turning the air conditioner on or off. Such condensation can cause instrument malfunctions due to insulation deterioration or shorting. To prevent the risk of condensation, always turn on the power or pre-heat the instrument using space heaters.

■ Panel vibration or impact considerations

- Isolate the panel from external vibration or shock using rubber vibration insulators.
- If the electromagnetic switches cause vibration when they operate within the panel, isolate the switches using rubber vibration insulators.

■ Environment considerations

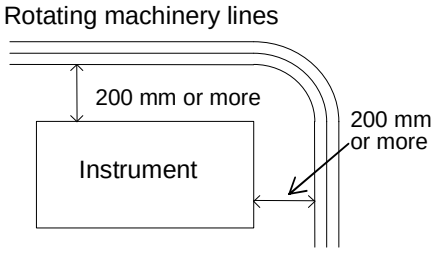
If dust, steam, soot or poisonous gas exists, purge the panel inside using clean air and create a slight positive pressure inside the panel to keep out the harmful gases.

■ Ease of operations and maintenance considerations

To ensure safety for maintenance and operation, separate the instrument from high voltage equipment or rotating machinery where possible.

■ Anti-noise considerations

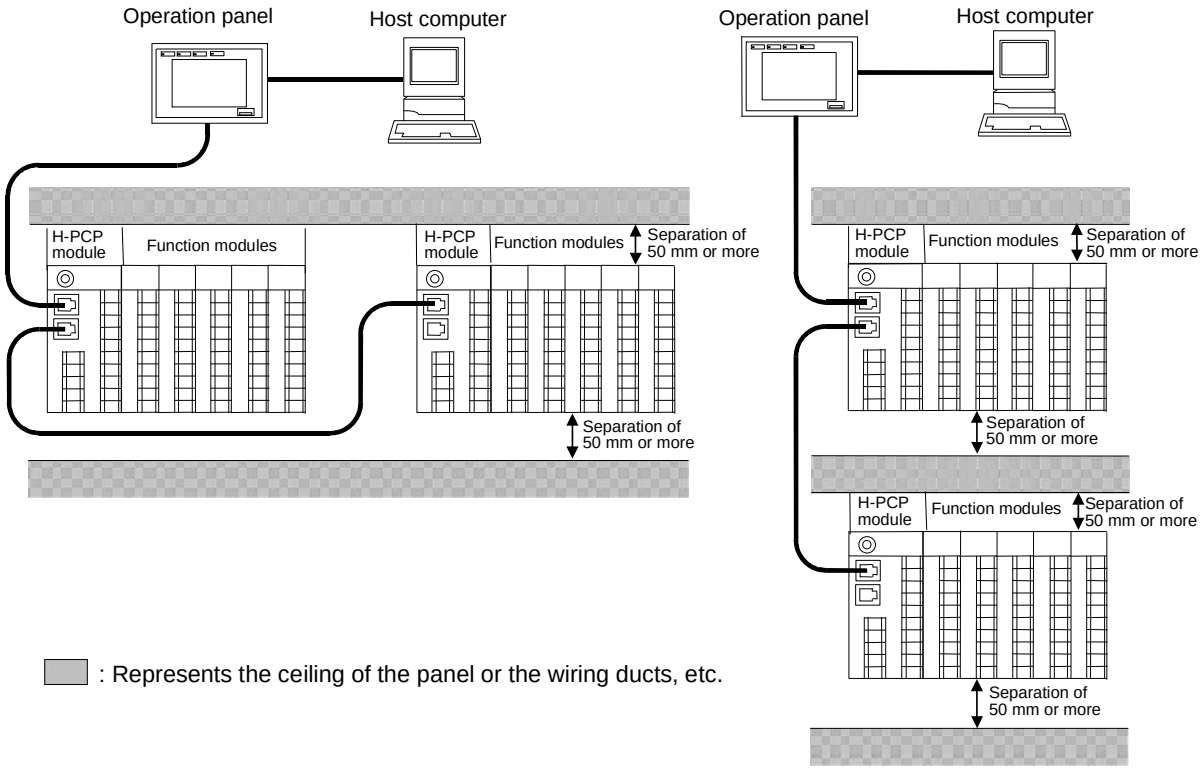
- Do not install the instrument in a panel where high-voltage equipment is installed.
- Separate the instrument from rotating machinery lines by more than 200 mm.



Distance from rotating machinery lines

(2) Example of mounting within panel

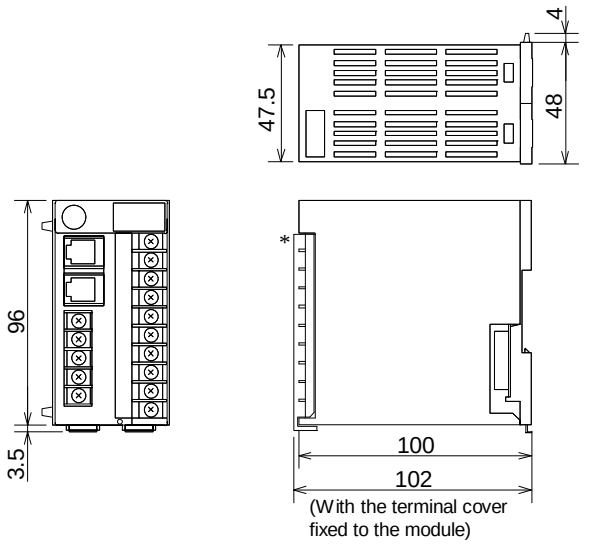
As the mounting position of the H-PCP module is fixed to be on the left hand end of the function modules, be careful not to neglect to take this position when mounting the modules. (Refer to the following figure)



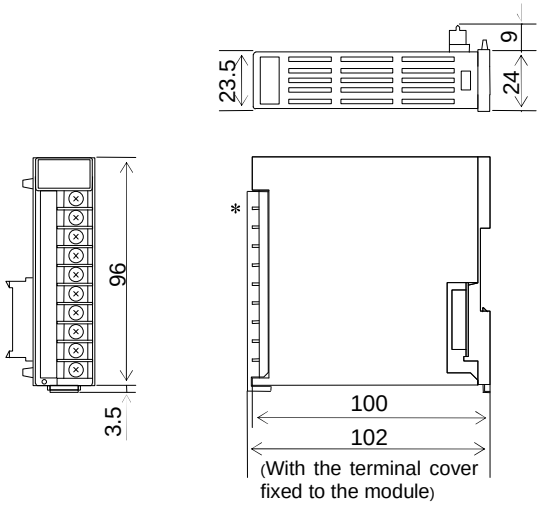
4.3 Dimensions

■ External dimensions

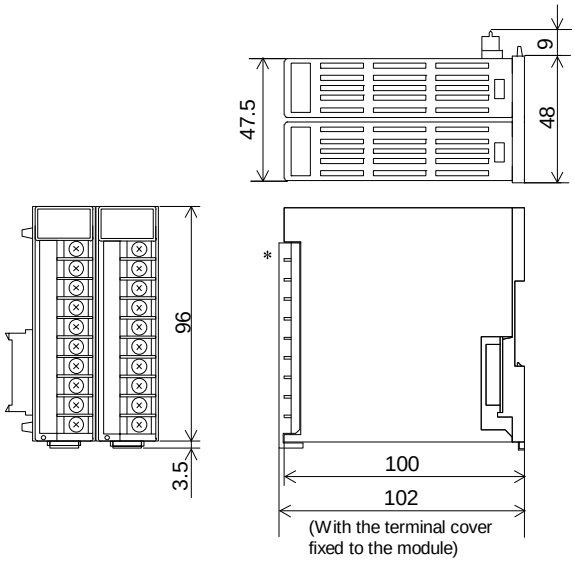
(Unit: mm)



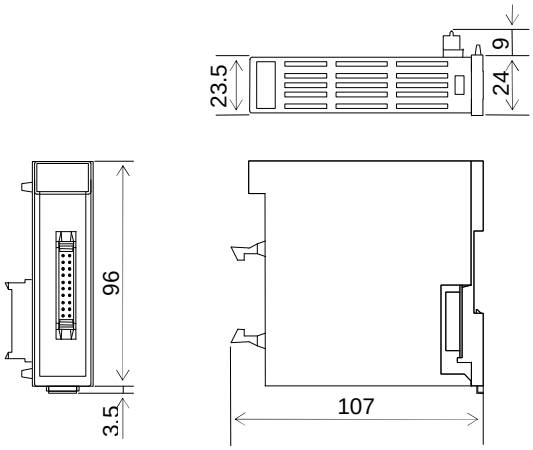
H-PCP module



Single type module



Double type module



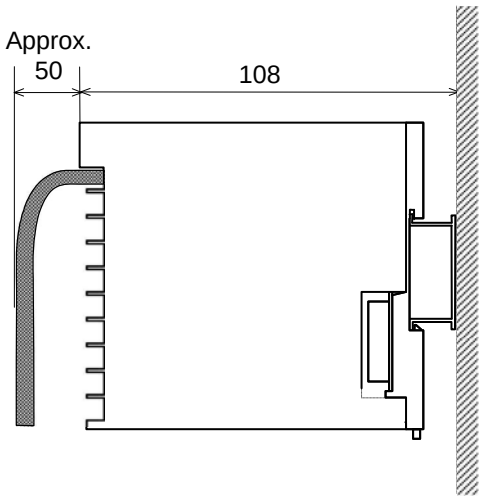
H-DO-D module

*Dotted-line section: Terminal cover

■ Module mounting depth (For DIN rail mounting)

The mounting depth of each module is 108 mm from the mounting surface inside the panel to the front of the module with the module mounted on the DIN rail. However, when modular connector cables are plugged in, additional depth is required.

(Unit: mm)



4.4 Mounting the Mother Block

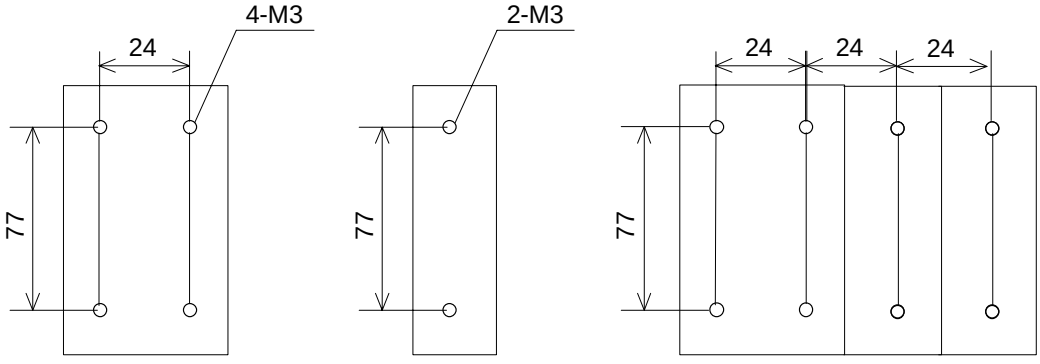
The mother block can be mounted to a panel or DIN rail.

Mount the H-PCP module on the left side of the control unit.

■ Panel mounting directions

1. Refer to both the panel mounting dimensions below and the **4.3 Dimensions (P. 90)** when selecting the location.

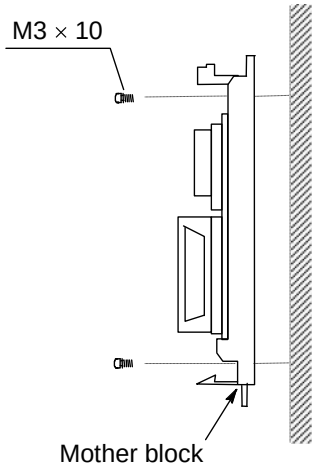
(Unit: mm)



Double type module | Single type module | Dimensions for multiple module mounting.

2. Remove the module from the mother block. For details of removing the module, refer to **4.7 Removing the Module Mainframe (P. 94)**.

3. Connect the mother blocks together before tightening the screws on the panel.
(Customer must provide the set screws)



Tightening torque
Recommended value: 0.3 N·m (3 kgf·cm)

When the mother block is mounted on the panel, 50 mm or more space is required at the top and bottom of the mother block to attach the module mainframe.

■ DIN rail mounting directions

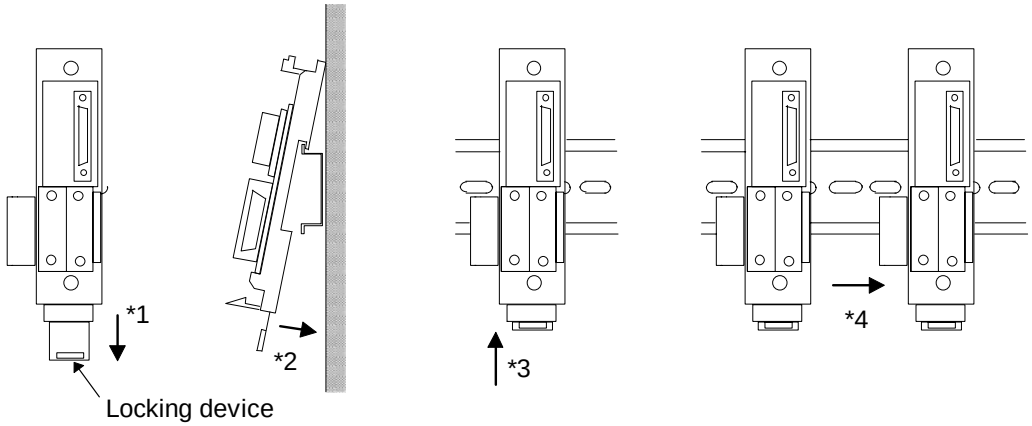
1. Remove the module mainframe from the mother block. For details of removing the module mainframe, refer to **4.7 Removing the Module Mainframe (P. 94)**.

2. Pull down the locking device at the bottom of the mother block. (*1)
For the double type, as there are two locking devices, pull down both of them.

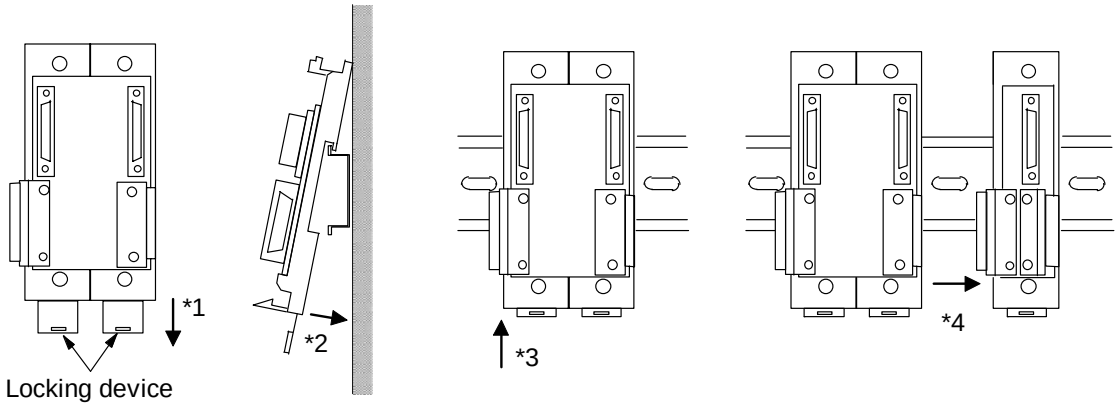
3. Attach the top bracket of the mother block to the DIN rail and push the lower section into place on the DIN rail. (*2)

4. Slide the locking devices up to secure the mother block to the DIN rail. (*3)

5. Slide connectors together to complete mother block installation. (*4)



Single type mother block mounting



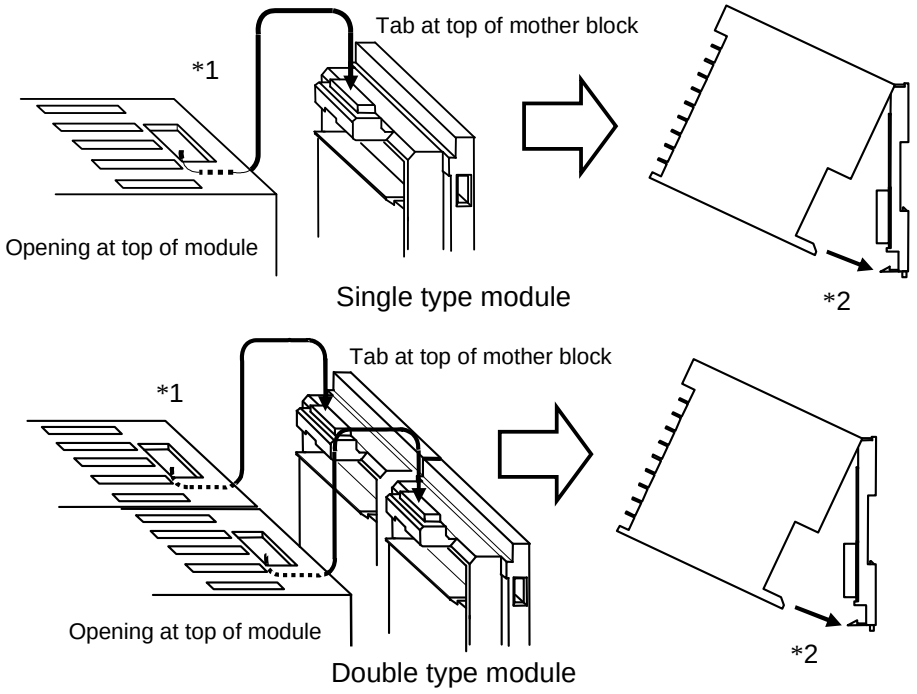
Double type mother block mounting

When the mother block is mounted on panel, 50 mm or more space is required at the top and bottom of the mother block to attach the module mainframe.

4.5 Mounting the Module Mainframe

It engages the module with the mother block that is mounted on DIN rail or a panel.

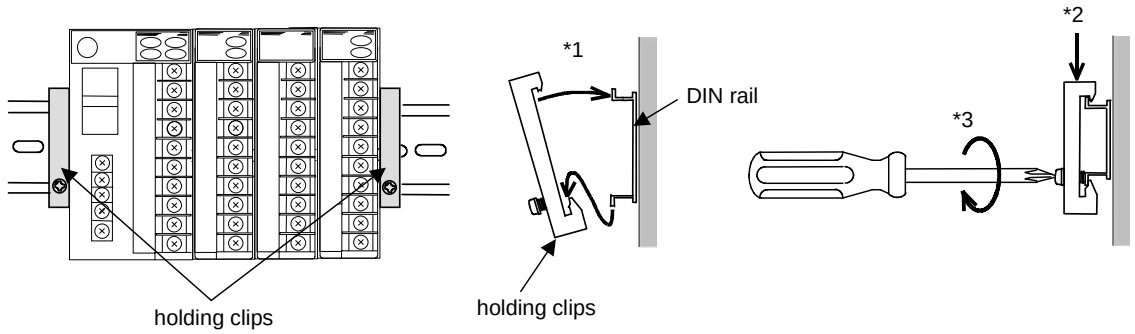
1. Place the module mainframe opening on top of the mother block tab. (*1)
2. Snap the lower part of module mainframe on to the mother block. (*2)
   A snapping sound will be heard when module mainframe is securely connected to mother block.



4.6 Fixing of the Control Unit (For DIN Rail Mounting)

Mounting the fixture (accessory) to the both end of control unit.

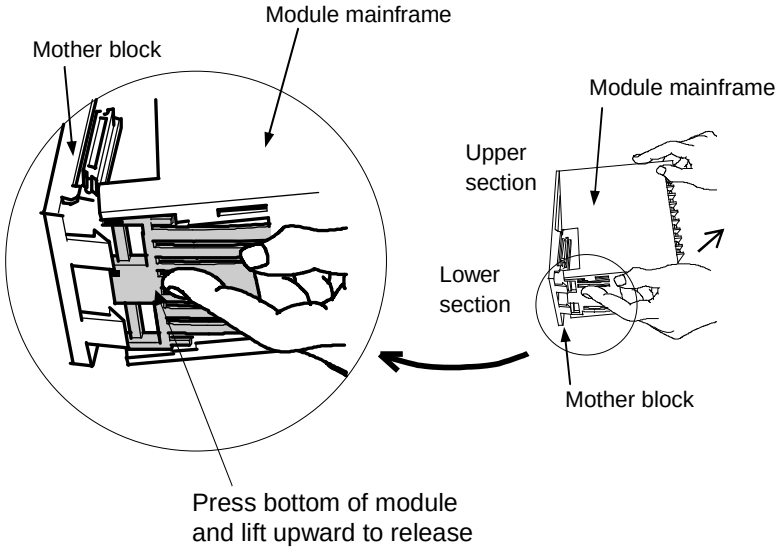
1. ***1.*** Attach the bottom of the holding clips to the DIN rail and push the top section into place on the DIN rail. (*1)
2. ***2.*** After the top of the holding clips is snugly attached to the top of the DIN rail. (*2)
3. ***3.*** Tighten the screw with a screwdriver. (*3)



4.7 Removing the Module Mainframe

It detaches the module from the mother block that is mounted on DIN rail or a panel.

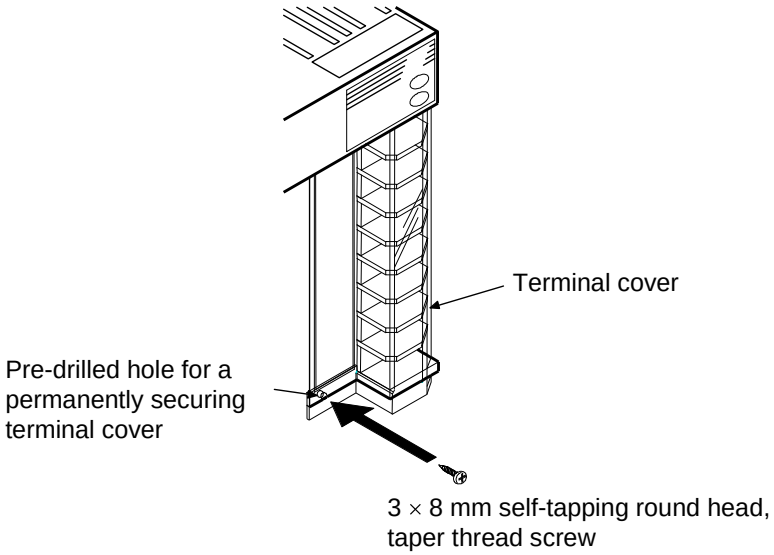
To separate the module mainframe from the mother block, press the bottom on the module, lifting upward, to release connection.



The figures above are for the double type module. The single type module can also be removed in the same way.

4.8 Terminal Covers

Terminal covers snap on to protect the module terminals. These covers can be permanently secured to the module using a 3 × 8 mm self-tapping round head, taper thread screw. (Customer must provide screws)



5. WIRING

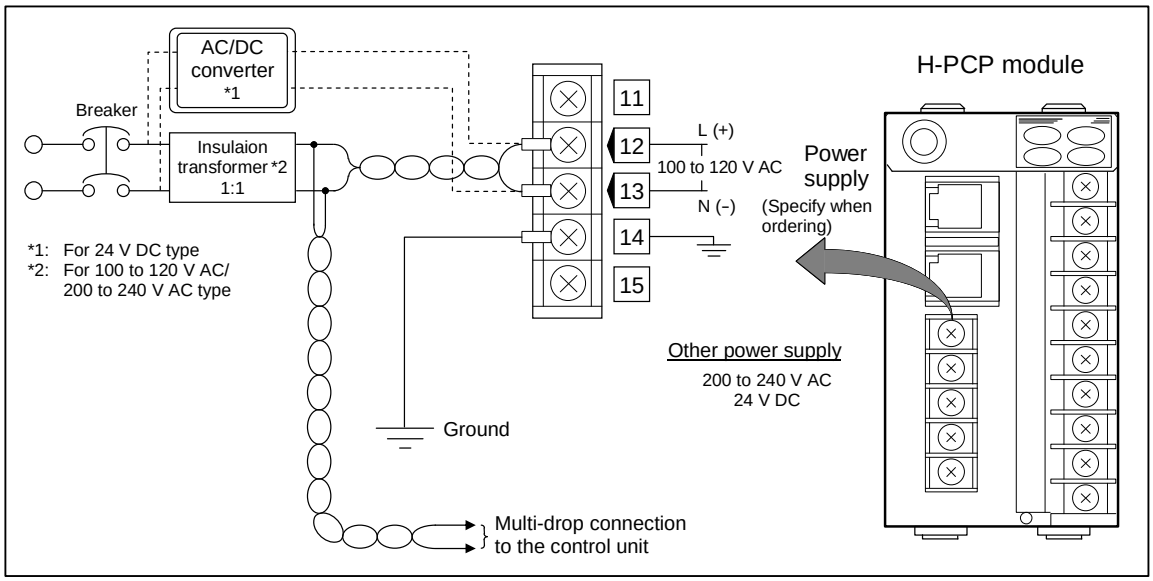
⚠ WARNING

To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.

5.1 Wiring Cautions

■ Power supply wiring

- Use power supply as specified in power supply rated voltage range.
- Power supply wiring must be twisted and have a low voltage drop.
- Provide separate power supply for this instrument independent of other input/output circuits, motors, equipment and operating circuits.
- If there is electrical noise in the vicinity of the instrument that could affect operation, use a noise filter.
  - Shorten the distance between the twisted power supply wire pitches to achieve the most effective noise reduction.
  - Always install the noise filter on a grounded panel.
  - Minimize the wiring distance between the noise filter output and the instrument power supply terminals to achieve the most effective noise reduction.
  - Do not connect fuses or switches to the noise filter output wiring as this will reduce the effectiveness of the noise filter.
  - Take into consideration the instrument power supply voltage and filter frequency characteristics when selecting the most effective noise filter.

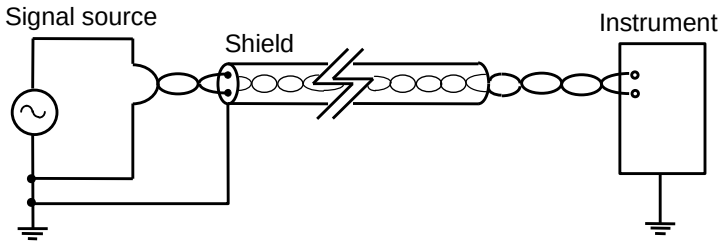


- For an instrument with 24 V power supply, supply input, supply power from “SELV” circuit defined as IEC 60950-1.
- A suitable power supply should be considered in end-use equipment. The power supply must be in compliance with a limited-energy circuits (maximum available current of 8 A).

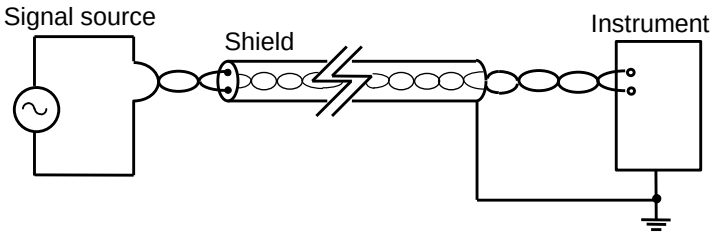
■ Input/Output wiring

- For thermocouple input, use the appropriate compensation wire.
- For RTD input, use low resistance lead wire with no difference in resistance between the three lead wires.
- Signal connected to Voltage input and Current input shall be low voltage defined as “SELV” circuit per IEC 60950-1.
- Use independent ducts for the input/output wires and power circuits inside and outside the panel.
- If input/output wires have to be placed in the same duct as the power circuits, use shielded wires. Ground the shield to reject any noise generated by the floating capacitance between the cores and shield or by a grounding potential.

Example: When signal source is grounded, ground the shield to the signal source side.

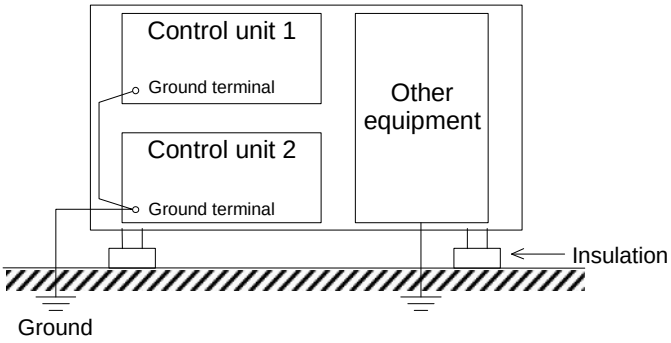


Example: When signal source is not grounded, ground the shield to the instrument side.



■ Ground wiring

- Use grounding wires with a cross section area of 2.0 mm^2 or more.



■ FAIL output wiring

Configure the external relay circuit of the FAIL output so that instrument failure does not affect the entire system. Configuration of an emergency stop circuit is also required to protect the system.

5.2 Wiring of Each Modules

☞ For details on terminal configuration of each modules, refer to **3. DESCRIPTION OF EACH MODULES (P. 28)**.

■ Re-confirmation of the specifications

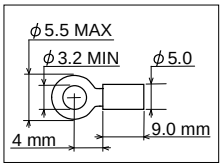
Re-confirm the input/output specifications of each module.
In particular, take adequate care of the input current and voltage for the inputs, and the output current and voltage for the outputs. If a voltage is applied or if a current flows exceeding the maximum opening/closing capacity, this will cause the problems such as breakdowns, damage, fires, etc.

■ Cautions for wiring

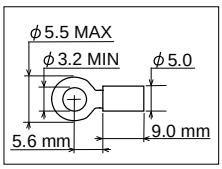
- Configure the wiring so that it will be easy to carry out the replacement of modules.
- Confirm that each module is securely attached to the mother block.
- Confirm that the terminal panels and connectors are securely attached to the modules.
- Do not excessively tighten the terminal screws. In addition, use the solderless terminal appropriate to the screw size.

  Screw size:
  Power supply terminals (H-PCP-A/B): M3×7
  Input/Output terminals: M3×6 (with 5.8×8 square washer)
  Recommended tightening torque: 0.4 N·m (4 kgf·cm)
  Applicable wire: Solid/twisted wire of 0.25 to 1.65 mm^2
  Specified solderless terminals:
  Power supply terminals (H-PCP-A/B): Circular terminal with isolation V1.25-3 *
  Input/Output terminals: Circular terminal with isolation V1.25-MS3
  Manufactured by J.S.T MFG CO., LTD.
  * If solderless terminal lugs are used, a terminal cover is not kept.

V1.25–3



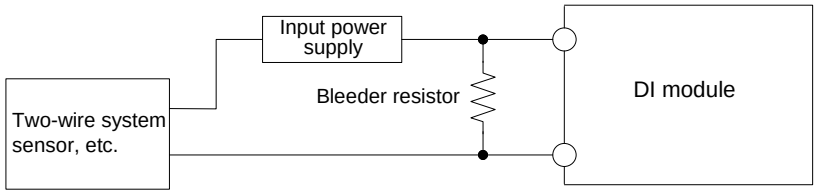
V1.25–MS3



- Make sure that during field wiring parts of conductors can not come into contact with adjacent conductive parts.

■ Leakage current at 24 V DC input

When a two-wire system sensor (proximity switch or photoelectric switch) or limit switch with LED is used, the lamp may light due to leakage current or incorrect input.
No problem arises for a leakage current of less than 0.75 mA, but for 0.75 mA or more, connect a bleeder resistor as shown in figure to lower the input impedance.



$$R = \frac{41.6}{10.4\,I - 4}\ k\Omega \text{ or smaller}$$

$$W = \frac{2.3}{R}\ W \text{ or larger}$$

I: Device leakage current
R: Bleeder resistance value (Ω)
W: Watt generated in bleeder resistor (W)

[Reference] The above equations are obtained from the following equations.

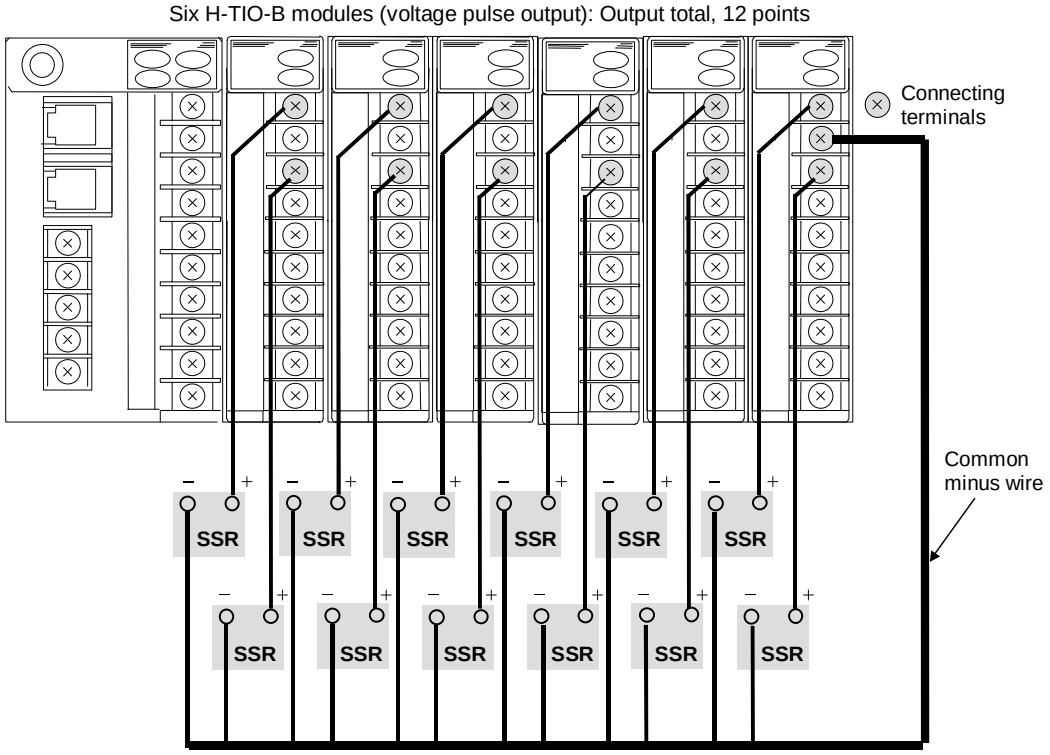
$$I \times \frac{R \times \dfrac{\text{Input voltage (24)}}{\text{Input voltage (2.3)}}}{R + \dfrac{\text{Input voltage (24)}}{\text{Input voltage (2.3)}}} \leq \text{OFF voltage (4)}$$

■ H-TIO module wiring saving

As the output terminals for voltage pulse output or 1 to 5 V DC voltage output commonly use the minus line in the control unit, it is possible to omit the remaining wiring on the minus side by commonly using a minus terminal on one module.
Connect a common minus wire to any of the minus side output terminals on the H-TIO module (any of OUT1 or OUT2 is available).

[Example]

When twelve SSR units are connected to six H-TIO-B voltage pulse output type modules



For control output types other than voltage pulse output and 1 to 5 V DC voltage output, no common minus can be connected.

6. IN CASE OF TROUBLE

6.1 Troubleshooting

This section lists some basic causes and solutions to be taken when any problem would arise in this instrument. If you can not solve a problem, please contact RKC sales office or the agent, on confirming the type name and specifications of the product.
If the instrument is necessary to be replaced, observe the following warning.

⚠ WARNING

- To prevent electric shock or instrument failure, always turn off the system power before replacing the instrument.
- To prevent electric shock or instrument failure, always turn off the power before mounting or removing the instrument.
- To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.
- To prevent electric shock or instrument failure, do not touch the inside of the instrument.
- All wiring must be performed by authorized personnel with electrical experience in this type of work.

CAUTION

- **All wiring must be completed before power is turned on to prevent electric shock, instrument failure, or incorrect action. The power must be turned off before repairing work for input break and output failure including replacement of sensor, contactor or SSR, and all wiring must be completed before power is turned on again.**
- **If you add or delete a function module, or change the arrangement of the modules, or replace a module with a different model, be sure to perform "Module initialization (identifier CL)" before setting the data. "Module initialization" stores the new module configuration in the H-PCP module. If data is set before "Module initialization" is performed, the H-PCP module will set the previously stored initial data of the old modules in the new modules, which may cause malfunction.**

☞ For details on how to initialize the module, refer to **SR Mini/SR Mini HG SYSTEM Supplementary Information Initialize Settings [Extended Communications] (IMSRM07-E□)**.

(1) H-PCP module

Problem	Probable cause	Solution
RUN lamp does not light up	Power not being supplied	Check external breaker etc.
	Appropriate power supply voltage not being supplied	Check the power supply
	Power supply terminal contact defect	Tighten more
	Power supply section defect	Replace H-PCP module
RUN lamp stays lit	Module out of place	Install back in place
	The module was not initialized after the module configuration was changed	Execute **Module initialization** or return the configuration to its original specifications
RX1, RX2 (data reception) lamp does not flash TX1, TX2 (data transmission) lamp does not flash	Wrong connection, no connection or disconnection of the communication cable	Confirm the connection method or condition and connect correctly
	Breakage, wrong wiring, or imperfect contact of the communication cable	Confirm the wiring or connector and repair or replace the wrong one
	CPU section defect	Replace H-PCP module
DO is not output	Output allocation defect	Check the allocation settings
	Output circuit defect	Replace H-PCP module
FAIL is output	H-PCP module CPU section, power section defect	Replace H-PCP module
FAIL is output (but FAIL lamp not lit up) RUN lamp stays lit	The module was not initialized after the module configuration was changed	Execute **Module initialization** or return the configuration to its original specifications
	Module out of place	Install back in place

(2) H-DI, H-AI, H-TI module

Problem	Probable cause	Solution
RUN lamp does not flash	Power line defect	Replace mother block
	Power supply section defect	Replace H-PCP module
	CPU section breakdown	Replace module
RUN lamp stays lit	Module different from system specifications inserted	Replace with module matching specifications
	Maximum number of linkable units exceeded	Eliminate a module
FAIL lamp lit up	CPU section breakdown	Replace module
No input values change	System set to Unused mode	Switch to Used mode
	Main CPU section breakdown	Replace H-PCP module
	Bus line defect	Replace mother block
Specific input value does not change	Sensor break	Replace sensor
	Terminal improperly tightened	Tighten more
	System set to Unused mode	Switch to Used mode
	Input circuit, CPU breakdown	Replace module

(3) H-TIO, H-CIO module

Problem	Probable cause	Solution
RUN lamp does not flash	Power line defect	Replace mother block
	Power supply section defect	Replace H-PCP module
	CPU section breakdown	Replace module
RUN lamp stays lit	Module different from system specifications inserted	Replace with module matching specifications
	Maximum number of linkable units exceeded	Eliminate a module
FAIL lamp lit up	CPU section breakdown	Replace module
Specific output not output	Input cut line	Replace sensor
	External operating device defect	Inspect external operating devices
	Output section miss-wiring, cut line	Inspect wiring; replace as necessary
	Terminal screw loose	Tighten more
	Output circuit, CPU breakdown	Replace module
	Bus line defect	Replace mother block
No outputs operate	System set to **STOP** mode	Switch to **RUN** mode
	System set to **Unused** mode	Switch to **Used** mode
	Load power not supplied	Supply power
	Load power supply voltage outside rating	Change to voltage within rating
	Main CPU section breakdown	Replace H-PCP module
	Bus line defect	Replace mother block
Specific output relay does not go off	Output relay contacts stuck	Replace module
	External operation device recovery defect due to leakage current at surge killer etc.	Reevaluate surge killer; reevaluate external operating device
	Output circuit, CPU breakdown	Replace module
No output relays go off	Main CPU section breakdown	Replace H-PCP module
Output chattering ON/OFF with extremely short period	Terminal tightening defect	Tighten more
ON/OFF with extremely short period	Control period too short	Change period setting
	Malfunction due to excess noise	Investigate noise filter installation
No input values change	System set to **Unused** mode	Switch to **Used** mode
	Main CPU section breakdown	Replace H-PCP module
	Bus line defect	Replace mother block

Continued on the next page.

Continued from the previous page.

Problem	Probable cause	Solution
Specific input value does not change	Sensor break	Replace sensor
	Terminal improperly tightened	Tighten more
	System set to **Unused** mode	Switch to **Used** mode
	Input circuit, CPU breakdown	Replace module
Control unstable	PID constant values inappropriate	Execute autotuning and change the PID constant settings
	Terminal improperly tightened	Tighten more
	External operating device operation defects	Inspect the external operating device
	Output circuit, CPU breakdown	Replace module

(4) H-DO, H-AO module

Problem	Probable cause	Solution
RUN lamp does not flash	Power line defect	Replace mother block
	Power supply section defect	Replace module
	CPU section breakdown	Replace module
RUN lamp stays lit	Module different from system specifications inserted	Replace with module matching specifications
	Maximum number of linkable units exceeded	Eliminate a module
FAIL lamp lit up	CPU section breakdown	Replace module
Specific output not operating (RUN lamp flashing)	External operating device defect	Inspect external operating device
	Output section mis-wiring, cut line	Inspect wiring; replace as necessary
	Terminal screw loose	Tighten more
	Output circuit, CPU breakdown	Replace module
	Bus line defect	Replace mother block
No outputs operate	Load power not supplied	Supply power
	Load power supply voltage outside rating	Change to voltage within rating
	Main CPU section breakdown	Replace H-PCP module
	Bus line defect	Replace mother block
Specific output relay does not go off	Output relay contacts stuck	Replace module
	External operation device recovery defect due to leakage current at surge killer etc.	Reevaluate surge killer; reevaluate external operating device
	Output circuit, CPU breakdown	Replace module
No output relays go off	Main CPU section breakdown	Replace H-PCP module
Output chattering ON/OFF with extremely short period	Terminal tightening defect	Tighten more
ON/OFF with extremely short period	Control period too short	Change period setting
	Malfunction due to excess noise	Investigate noise filter installation

(5) H-CT module

Problem	Probable cause	Solution
RUN lamp does not flash	Power line defect	Replace mother block
	Power supply section defect	Replace module
	CPU section breakdown	Replace module
RUN lamp stays lit	Module different from system specifications inserted	Replace with module matching specifications
	Maximum number of linkable units exceeded	Eliminate a module
FAIL lamp lit up	CPU section breakdown	Replace module
Electrical current read-in value abnormal	CT sensor different from module specifications used	Replace CT sensor
	Heater break	Inspect heater
	Terminal loose, miss-wiring between channels	Tighten terminals, check wiring
	Input circuit, CPU breakdown	Replace module

6.2 Module Replacement Procedure

■ H-PCP module replacement

As all data on PID constants, alarm set values, etc. is managed by the H-PCP module, it is necessary to re-enter and re-set all data when the H-PCP module is replaced. However, re-entry and re-set are not required in the following cases.

- **When data backup software is operating in the module by the external host computer.**
- **When it is set on the operation panel so that data on the operation panel side is transferred to the control unit side when the power is turned on again.**

To remove the H-PCP module from the mother block, follow the reverse order of module mounting.

● Replacement procedure

1. Turn off the power to the control unit.

2. Remove the module mainframe from the mother block.

3. Mount the normal module mainframe.
A snapping sound will be heard when module mainframe is securely connected to mother block.

4. Turn on the power to the control unit.

5. Replacement end

☞ For details on mounting/removing the module mainframe, refer to the **4.5 Mounting the Module Mainframe (P. 93)** and **4.7 Removing the Module Mainframe (P. 94)**.

■ Function module replacement

CAUTION

If you add or delete a function module, or change the arrangement of the modules, or replace a module with a different model, be sure to perform "Module initialization (identifier CL)" before setting the data. "Module initialization" stores the new module configuration in the H-PCP module. If data is set before "Module initialization" is performed, the H-PCP module will set the previously stored initial data of the old modules in the new modules, which may cause malfunction.

☞ For details on how to initialize the module, refer to **SR Mini/SR Mini HG SYSTEM Supplementary Information Initialize Settings [Extended Communications] (IMSRM07-E□)**.

📖 **When replacing the function module with the same model code, initialization of a module is unnecessary. Before replacing the present module with a new one, set channel operation mode used in the former to Unused mode. Be careful not to remove the module without first setting this channel to the Unused mode, otherwise a failure will be output from the H-PCP module. However, the FAIL lamp of the H-PCP module will not light at this time.**

📖 In this instrument, even if a function module is detached, the operation of the other channels can be continued as before. After mounting the normally operating module, set the channel used by this module to the Normal mode. This operation causes the previously used temperature set value, PID constants, etc. to be transmitted from the H-PCP module, and it is possible to use the module as before.

To remove the function module from the mother block, follow the reverse order of module mounting.

- **Replacement procedure (When replacing the function module with the same model code)**

1. Switch the used channel of the faulty module to **Unused** mode.
2. Turn off the power to the control unit.
3. Remove the module mainframe from the mother block.
4. Mount the normal module mainframe.
5. Turn on the power to the control unit.
6. Switch the used channel to **Normal** mode.
This operation causes the previously used temperature set value, PID constants, etc. to be transmitted from the H-PCP module, and it is possible to use the module as before.
7. Replacement end

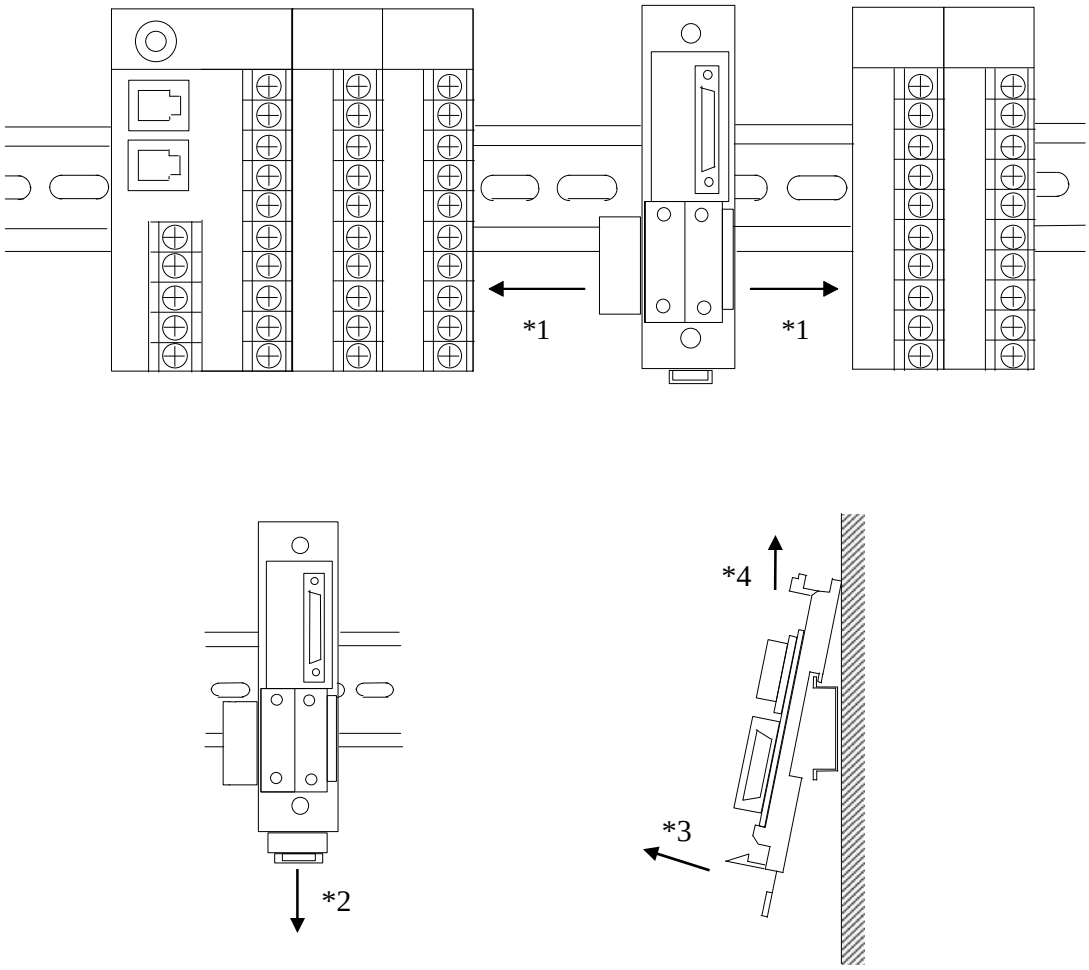
☞ For details on mounting/removing the module mainframe, refer to the **4.5 Mounting the Module Mainframe (P. 93)** and **4.7 Removing the Module Mainframe (P. 94)**.

■ Mother block replacement

To remove the mother block, follow the reverse order of mother block mounting.

● Replacement procedure

1. Turn off the power to the control unit.
2. Remove the module mainframe from the mother block.
3. Slide the other modules, then separate the mother block from the mother block connector. (*1)
4. Pull down the locking device to remove the mother block. (*2 to *4)
5. After replacing the mother block, mount the module mainframe, then turn on the power.
6. Replacement end



Mother block replacement

7. FUNCTIONS

7.1 Inputs

(1) PV bias

The value set in the PV bias is added to the actual input value to correct the input value.
The PV bias is used to correct the individual variations in the sensors or when there is difference between the measured values (PV) of other instruments.

[Example]
When the temperature is measured by two instruments. When the measured values (PV) are as shown in the diagram:

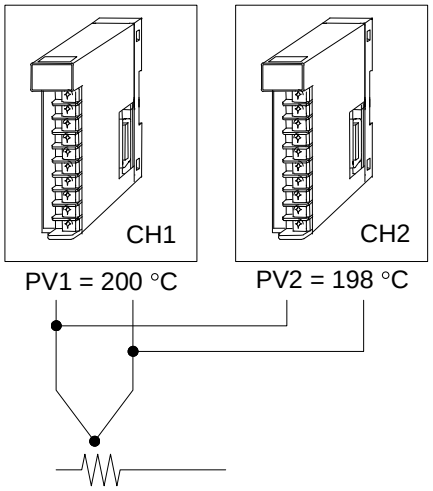
CH1 = 200 °C
CH2 = 198 °C

If a PV bias correction value of +2 °C is added to the measured value of CH2, the displayed value will become:

Displayed value = measured value (PV) + PV bias
= 198 °C + 2 °C = 200 °C

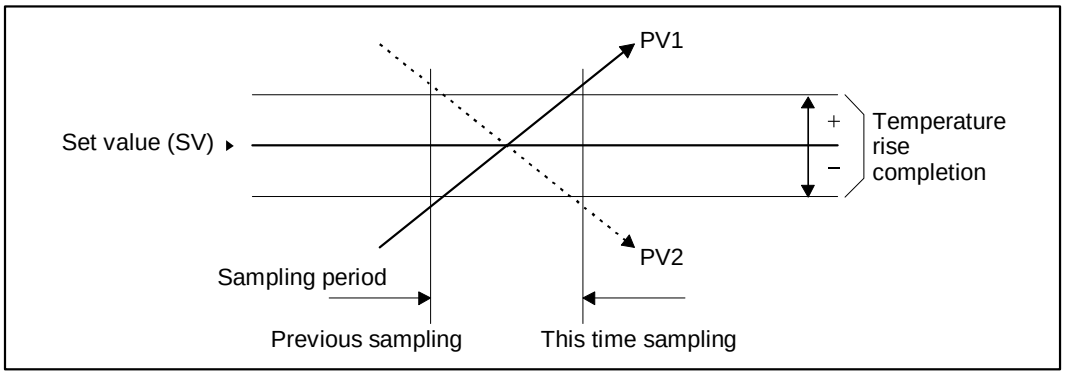
In this instrument, for a span of 400 °C, the PV bias should be set to:

PV bias = 0.5 %
(400 × 0.5 % = 2 °C)



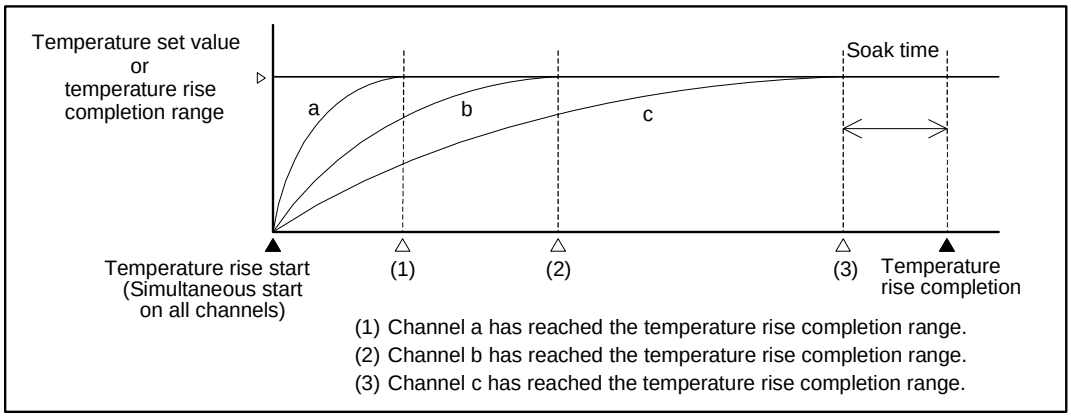
(2) Temperature rise completion function

During the sampling of temperature input, when the measured temperature value (PV) comes within the temperature rise completion range, the temperature rise completion will occur. Further in considering the case that where the temperature rise completion range has been set in a narrow range, etc., even if the measured temperature value (PV1) passes through the temperature rise completion range in the time between the sampling periods (Previous sampling period - This time sampling period), it is also judged as the temperature rise completion.
But it is only limited to the channel which is the object of the judgement.



(3) Soak time

This is the time period between the time that all the channels reach the temperature set value and the time of the occurrence of the temperature rise completion.



(4) First order lag digital filter

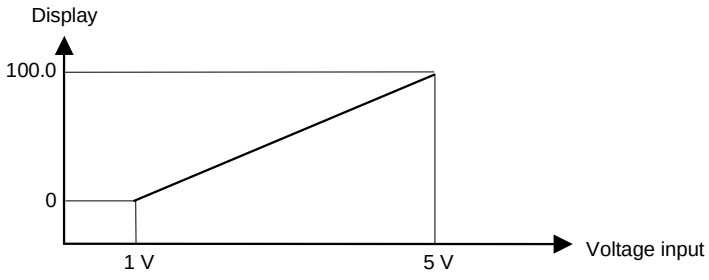
This is a software filter which reduces input value variations caused by noise. If the time constant of this filter is set appropriately to match the characteristics of the controlled object and the noise level, the effects of input noise can be suppressed. However, if the time constant is too small, the filter may not be effective, while if the time constant is too large, then the input response may actually deteriorate.

(5) Input programmable range function

This function is used to scale the decimal point position and display range from –1999 to +9999 for voltage/current input.

[Example]

The display range is set form 0.0 to 100.0 for a voltage input of 1 to 5 V DC

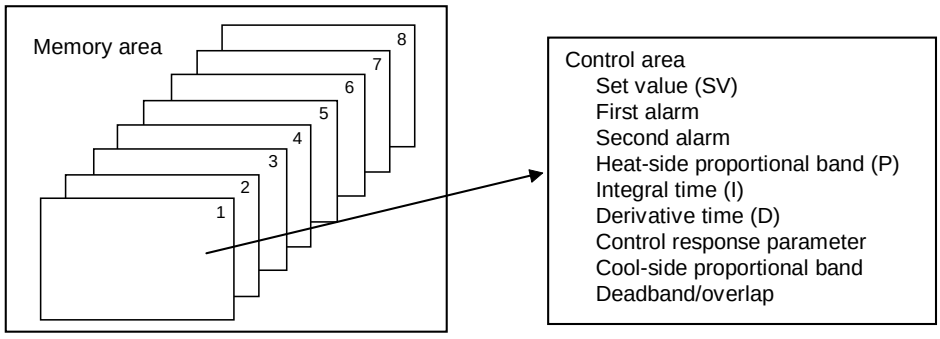


Decimal point position	Range
□□□□	–1999 to +9999
□□□. □	–199.9 to +999.9
□□. □□	–19.99 to +99.99
□. □□□	–1.999 to +9.999

7.2 Settings

(1) Memory area function

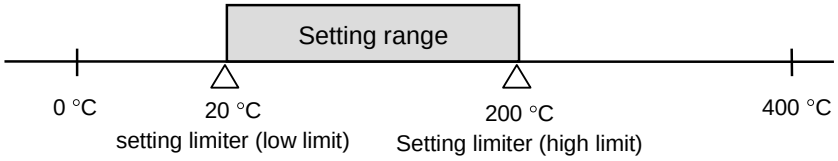
This function is to store the parameters such as set value (SV), etc. in up to eight memories. The parameters which can be stored as one of memories are set value (SV), first alarm, second alarm, heat-side proportional band (P), integral time (I), derivative time (D), control response parameter, cool-side proportional band and deadband/overlap.
The parameters stored in one of eight memories retrieved at necessity and used for control. The memory area used for this control is called the control area.



(2) Setting limiter

The setting limiter is used to restrict the setting range of the set value (SV).

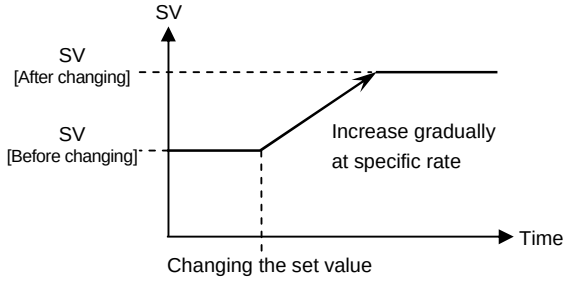
[Example]
For a setting range of 0 to 400 °C, a setting limiter (high limit) of 200 °C and a setting limiter (low limit) of 20 °C.



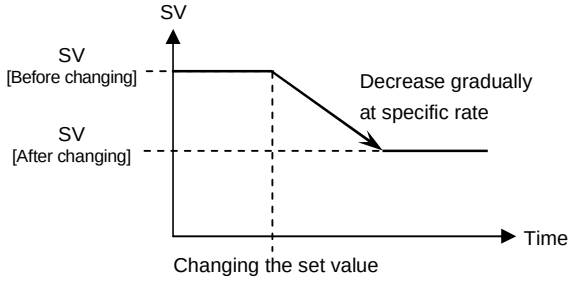
(3) Setting change rate limiter

This function is used to set the set value change per one minute when the set value is changed.

• Increasing the SV to a higher value



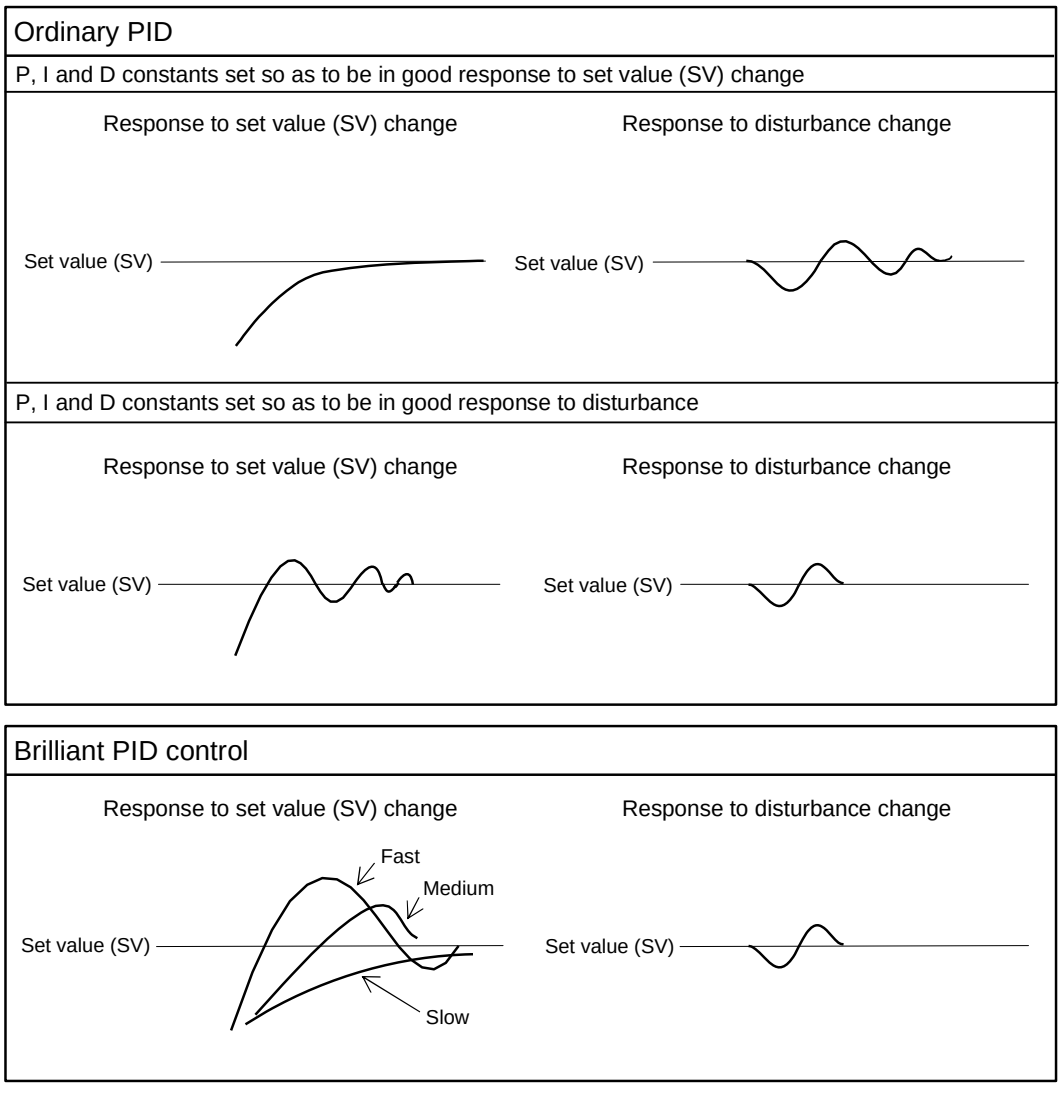
• Decreasing the SV to a lower value



7.3 Controls

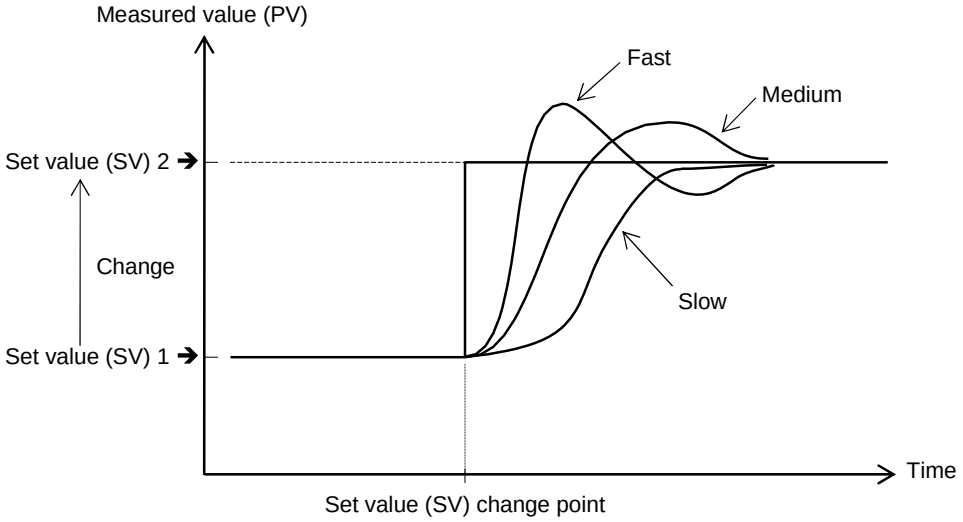
(1) Brilliant PID control

PID control is a control method of achieving stabilized control result by setting P (Proportional band), I (Integral time) and D (Derivative time) constants, and is widely used. However even in this PID control if P, I and D constants are set so as to be in good “response to setting,” “response to disturbances” deteriorates. In contrast, if PID constants are set so as to be in good “response to disturbances,” “response to setting” deteriorates. In brilliant PID control a form of “response to setting” can be selected from among **Fast**, **Medium** and **Slow** with PID constants remaining unchanged so as to be in good “response to disturbances.”



(2) Control response parameter

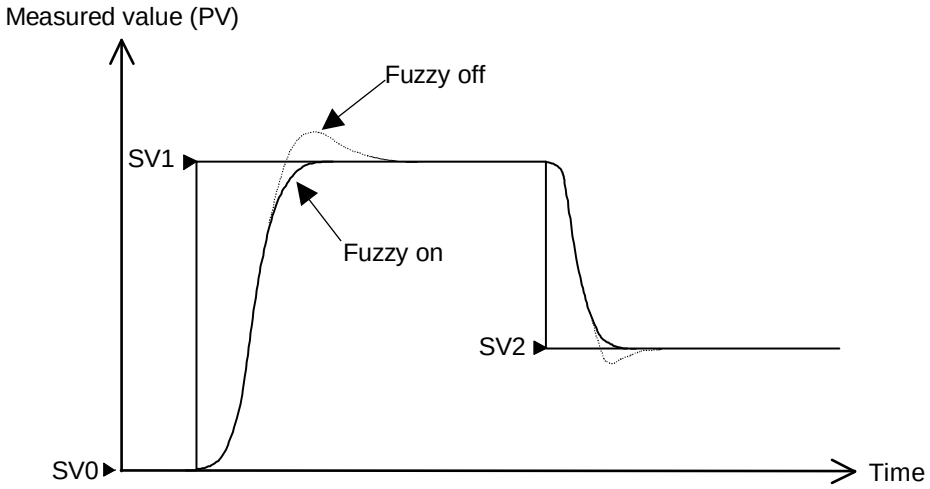
This is the function of enabling the setting of response to set value (SV) change in select any one of 3 steps (**Slow**, **Medium**, **Fast**) in PID control.
In order to achieve faster controlled object response to set value (SV) change, select **Fast**. However, slight overshoot is unavoidable when selecting **Fast**. Depending on the controlled object, specify **Slow** if overshoot should be avoided.



(3) Fuzzy function

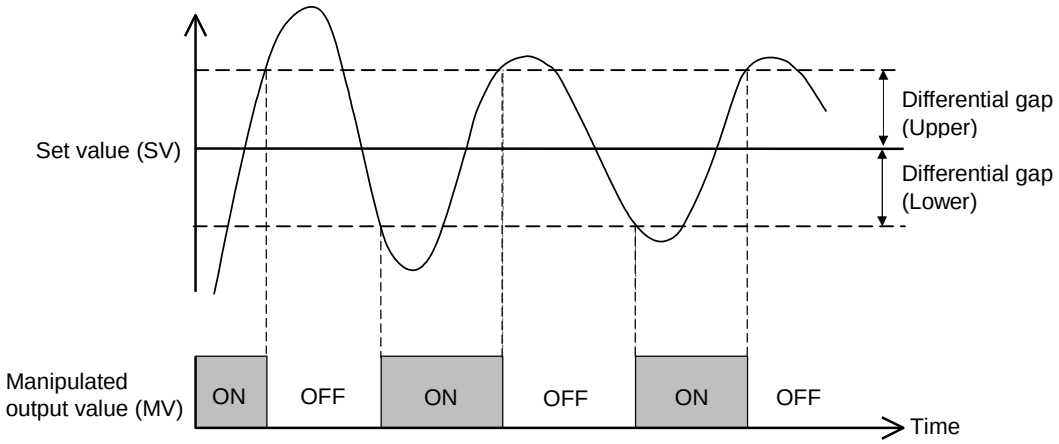
The fuzzy function is effective to smoothly start operation and to limit overshooting or undershooting when the set value is changed.
When executing PID control by the fuzzy function, specify **Fast**.

Response characteristic when fuzzy control is used



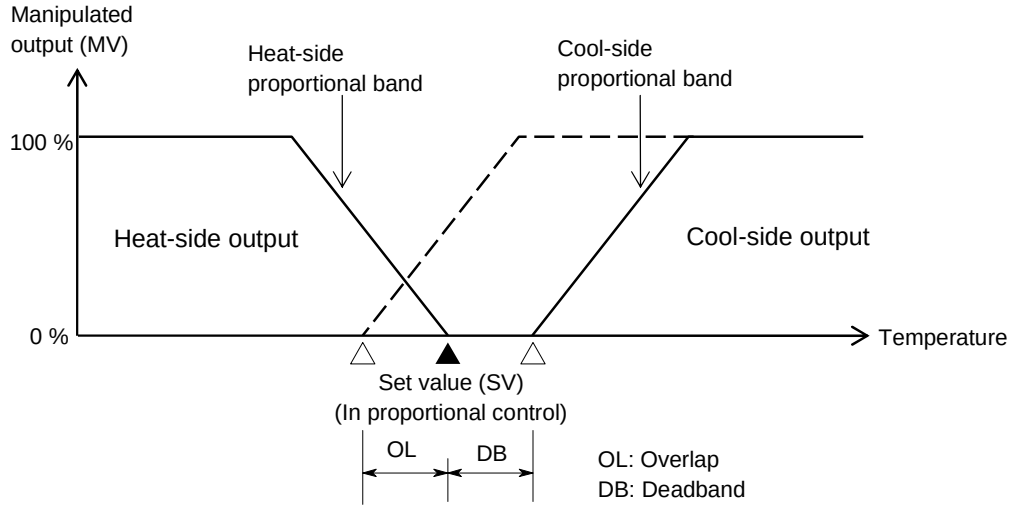
(4) ON/OFF control

In ON/OFF control, the manipulated output (MV) is turned on and off depending on whether measured value (PV) is larger or smaller than set value (SV). Differential gap setting can prevent relay contact from on or off repetition around set value (SV).



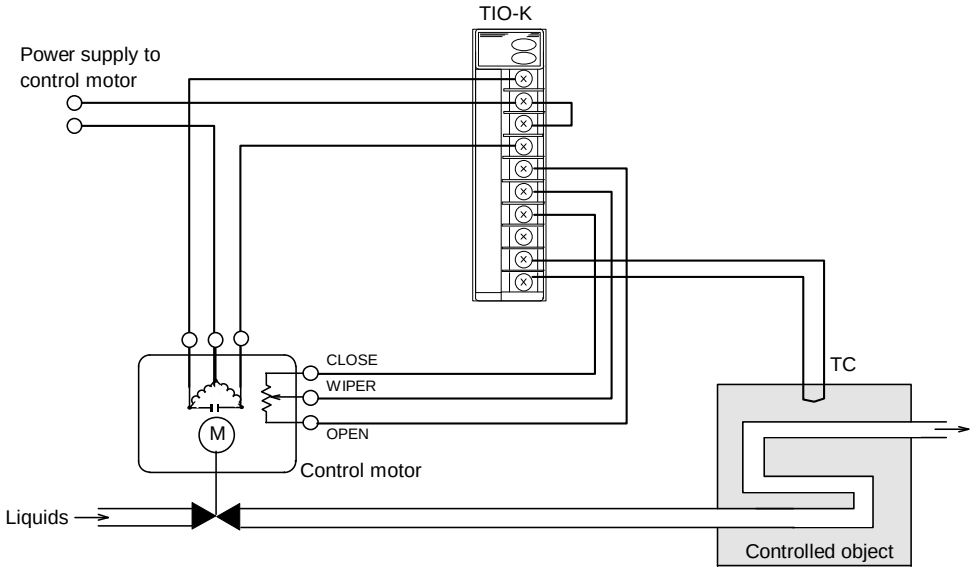
(5) Heat/Cool control

In Heat/Cool control, only one module enables heat and cool control. For example, this is effective when cool control is required in extruder cylinder temperature control.



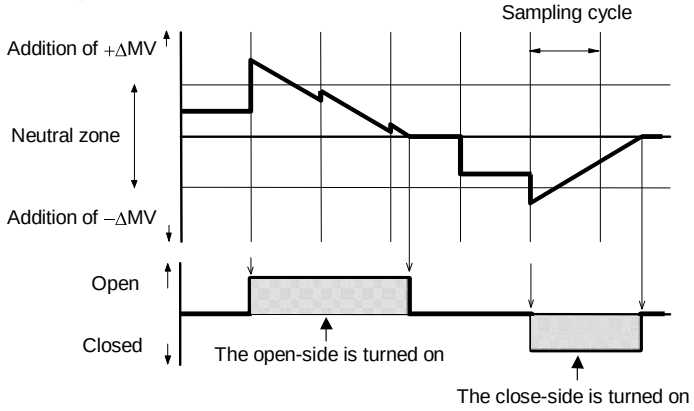
(6) Position proportioning control

Both valve opening signal (feedback resistance input) from the control motor and measured value (PV) from the controlled object are fed back to perform control.



● Neutral zone

The neutral zone is an area where the output between open-side and close-side outputs is turned off. This zone is used to prevent the output signal from being frequently output to the control motor.
The output addition value within the neutral zone is temporarily held and when it is out of the neutral zone, the output to the control motor starts.



The opening output is not turned on until the control computation result (ΔMV) becomes the neutral zone value or more.

● Integrated output limiter

This function is used to integrate the open-side (or close-side) output when this output is continuously output and to turn off the output when it reaches the integrated output limiting value preset. However, if the output signal on the opposite side is output once, the integrated value is reset.
This value is set within the range from 100.0 to 200.0 % of motor driving time.

(7) Cascade control

Cascade control monitors the controlled object temperature in the master unit and then corrects the set value in the slave unit depending on the deviation between the target value (set value) and actual temperature. The slave unit controls the non-controlled object. As a result, this control matches the controlled object temperature to the target value.
This cascaded control is suitable when there is a large time lag between the heat source (heater) and section whose temperature is necessary to be stabilized.

● Cascade gain/Cascade bias

The conversion rate when the manipulated output (%) in the master channel is converted to the relevant cascade signal (°C) can by changed from 0.0 to 100.0 % by the cascade gain.
The cascade bias is a bias added to the input value on the slave side for sensor correction, etc.

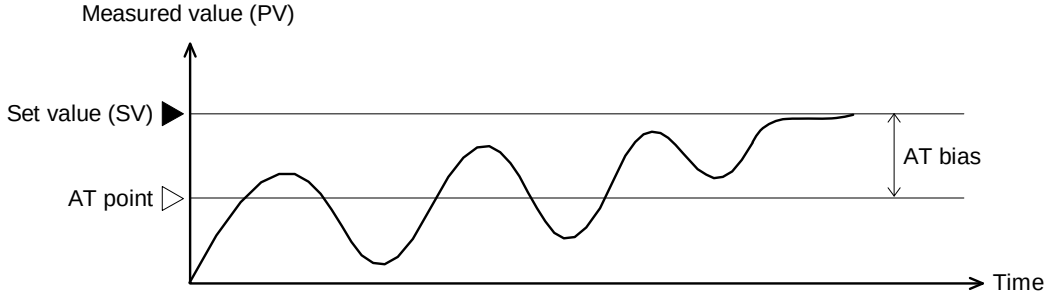
(8) Enhanced autotuning

The enhanced autotuning function is used to automatically measure, calculate and set the optimum PID constants centering around the temperature set value. This function can start from any state after power on, during a rise in temperature or in stable control. In addition, the **AT bias** can be set.

● AT bias

The AT bias is set when the autotuning function in which the measured value (PV) does not exceed the set value (SV) is activated. Our autotuning method performs ON/OFF control centering around the set value (SV), then calculates and sets each of the PID constants by hunting the measured value (PV). However, overshooting caused by this hunting may not be preferable depending on the controlled object. In such a case, the desired AT bias is set.
If it is set, another set value (SV) to activate the autotuning function [AT point] can be set.

When AT bias is set to the minus (-) side



(9) Direct/Reverse action

No selection can be made for heat/cool control.

- Direct action: The manipulated output value (MV) increases as the measured value (PV) increases. This action is used generally for cool control.
- Reverse action: The manipulated output value (MV) decreases as the measured value (PV) increases. This action is used generally for heat control.

(10) Auto/Manual transfer

By this function the manipulated output value (MV), can be changed over between the output amount calculated against the set value (SV) [Auto mode] and the manually set output amount [Manual mode].

(11) Balanceless/bumpless

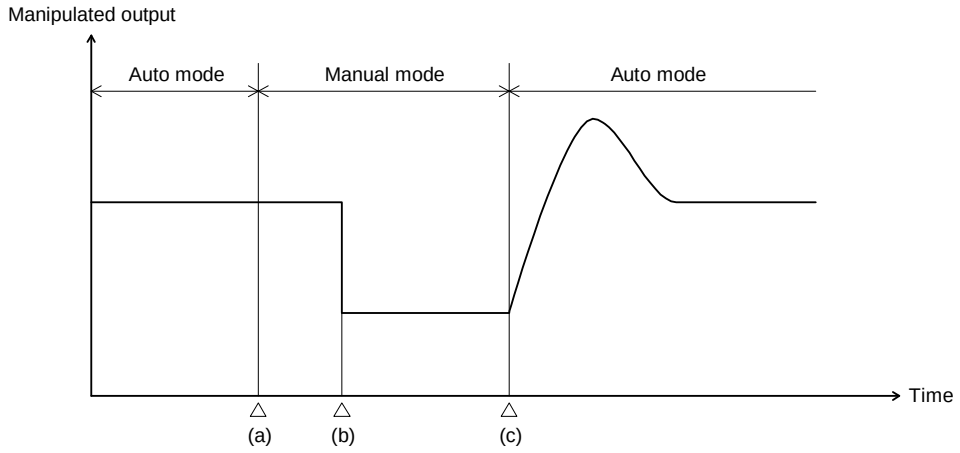
This function is used to prevent overload caused by the manipulated output value (MV) suddenly changing when auto mode is transferred to manual mode and vice versa.

● Operation during transfer from auto mode to manual mode

When the mode is transferred to manual mode the manipulated output value (MV) follows that in auto mode.

● Operation during transfer from manual mode to auto mode

When manual mode is transferred to auto mode, the manipulated output changes to that calculated with respect to the set value.

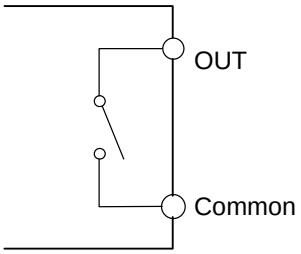


(a) Transfer from auto mode to manual mode. However, when the mode is transferred to manual mode, the manipulated output follows that in auto mode.
(b) The manipulated output changed (manual mode function).
(c) Transfer from manual mode to auto mode. When the mode is transferred to auto mode, the manipulated output becomes that calculated with respect to the set value.

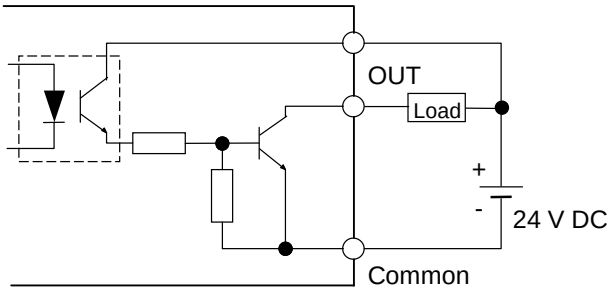
7.4 Alarms

Alarm (ALM) function sets up the alarm status when the measured value (PV) or the deviation reaches the alarm set values. In the alarm status, the alarm output is output, and the alarms are used to drive the equipment danger signals or the safety equipment.
The output specifications are the relay contact output or the open collector output.
(Specify when ordering)

Relay contact output circuit diagram



Open collector output circuit diagram



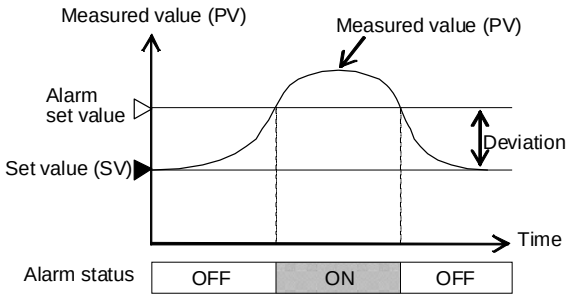
(1) Deviation alarm

If the deviation [Measured value (PV) - Set value (SV)] reaches the alarm set value, the alarm status is set up. Consequently, if the set value (SV) changes, the alarm set value will also change.

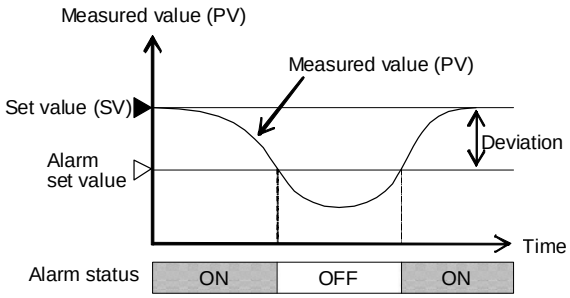
- **Deviation high alarm**

When the deviation [Measured value (PV) - Set value (SV)] is the alarm set value or more, the alarm status is set up.

– When the deviation is on the positive side



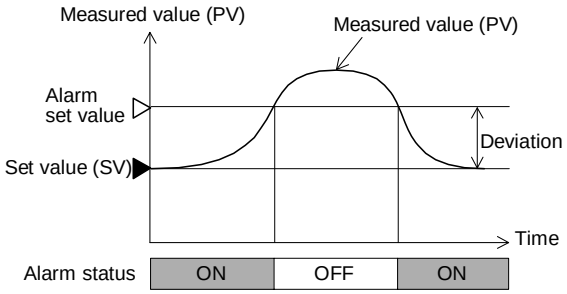
– When the deviation is on the negative side



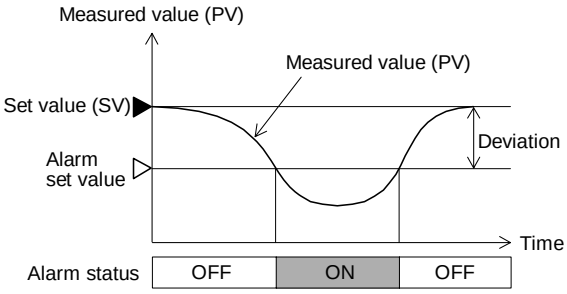
● **Deviation low alarm**

When the deviation [Measured value (PV) - Set value (SV)] is the alarm set value or less, the alarm status is set up.

– When the deviation is on the positive side

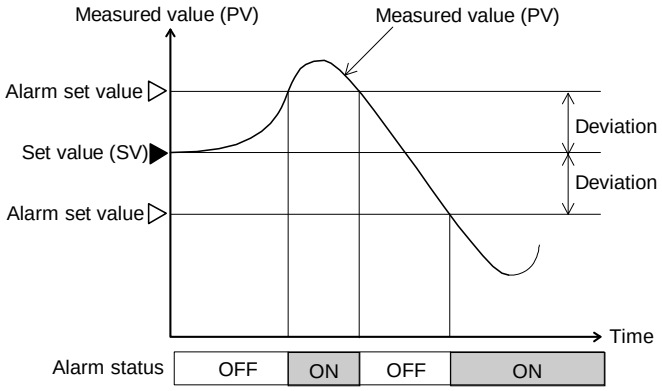


– When the deviation is on the negative side



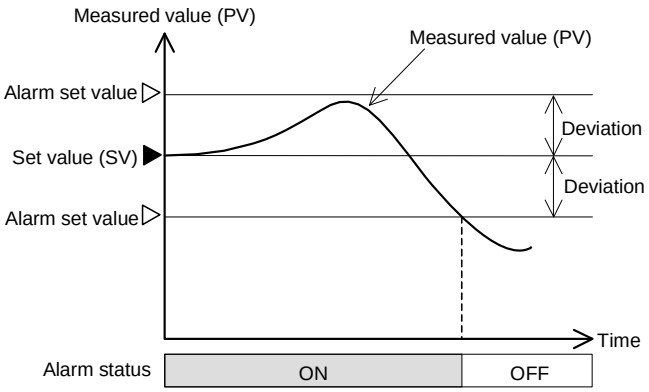
● **Deviation high/low alarm**

When the absolute deviation | Measured value (PV) - Set value (SV) | is the alarm set value or more/less, the alarm status is set up.



● **Band alarm**

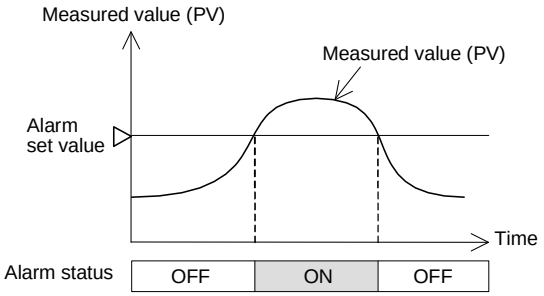
When the absolute deviation | Measured value (PV) - Set value (SV) | is within the alarm set values, the alarm status is set up.



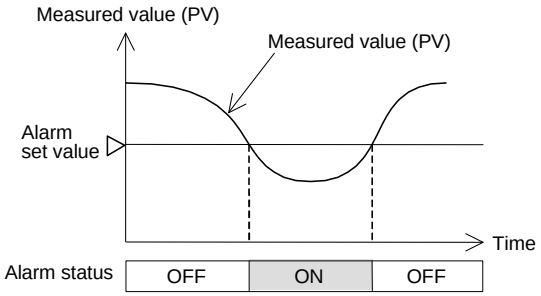
(2) Process alarm

When the measured value (PV) reaches the alarm set value, the alarm status is set up.

– Process high alarm



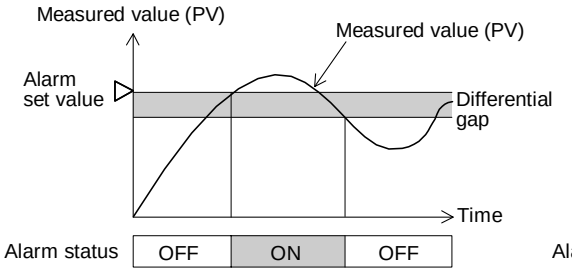
– Process low alarm



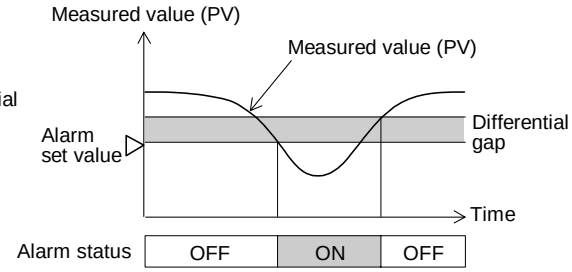
(3) Alarm differential gap

If measured value (PV) is close to the alarm set value, the alarm relay contact may repeatedly turn on and off due to input fluctuations. If the alarm differential gap is set, repeated turning on and off of the relay contact can be prevented.

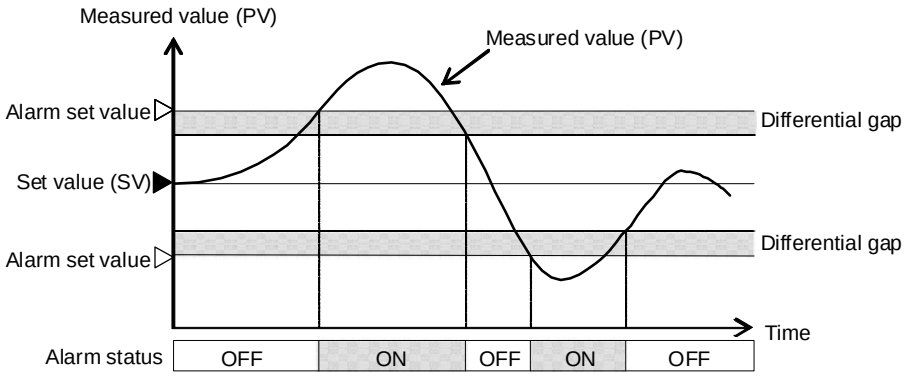
– High alarm (Deviation/process)



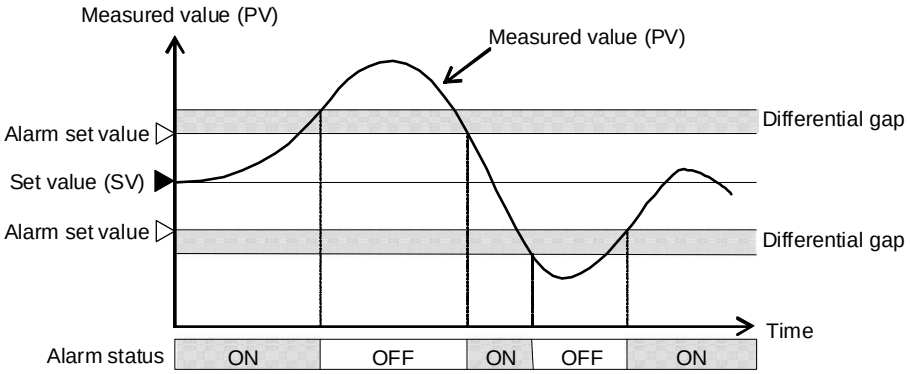
– Low alarm (Deviation/process)



– High/low alarm



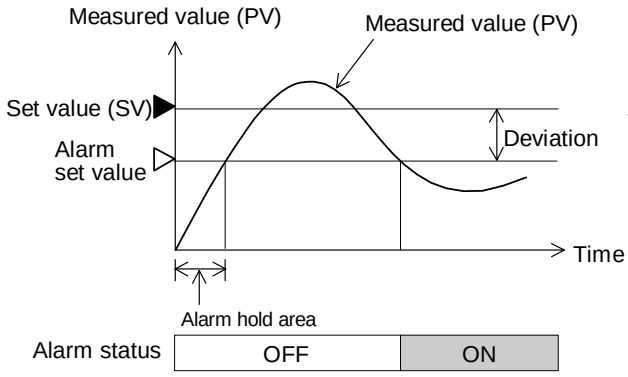
– Band alarm



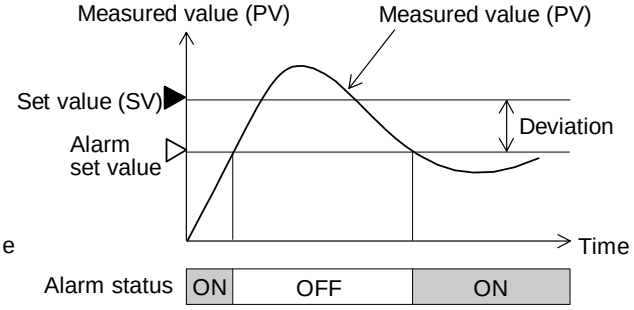
(4) Alarm hold function

In the alarm hold function, the alarm function is kept invalid even if the measured value (PV) is in the alarm range when the power is on or the operation mode is switched to Run from Stop. The alarm function is held until the measured value (PV) goes out of the alarm state once.

– With alarm hold action



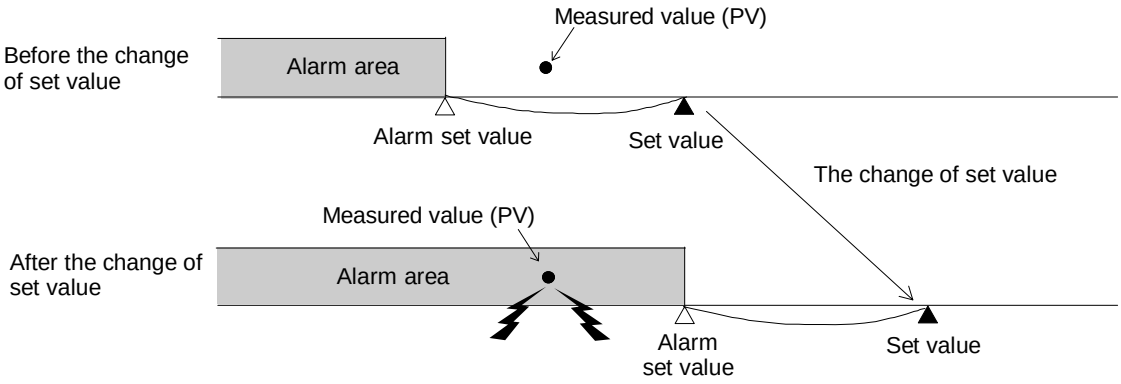
– Without alarm hold action



When high alarm with hold action is used for alarm function, alarm does not turn on while hold action is in operation. Use in combination with a high alarm without hold action in order to prevent overheating which may occur by failure of control devices, such as welding of relays.

(5) Alarm re-hold function

In the alarm hold function, the holding is effective if the input value is in the alarm range at the power on and is cancelled if the input value will go out of the alarm range. While, in the alarm re-hold function the hold function becomes effective when the temperature set value is changed again. This function can be only selected for deviation alarm.



When the measured value (PV) is in the position as shown in the above figure before the change of set value and then the set value is changed as shown in the figure, the measured value goes into the alarm area and the alarm is set up. To hold this alarm, the alarm re-hold function can be used effectively.

In the application where the set value is changed continuously by a host computer or a similar equipment, be careful that alarm is not output if the alarm re-hold function is selected.

When high alarm with re-hold action is used for alarm function, alarm does not turn on while hold action is in operation. Use in combination with a high alarm without hold action in order to prevent overheating which may occur by failure of control devices, such as welding of relays.

(6) Heater break alarm

The heater break alarm (HBA) function is used to detect the current flowing through the load (heater) by using a current transformer (CT), to compare the current thus detected to the heater break alarm set value, and thus to produce a heater break alarm when any of the following causes occurs.

- When the heater current does not flow: Heater break or abnormality in the operating unit, etc.
  When the control output is on and the current transformer (CT) input value is the HBA set value or less, the alarm is set up.

- When the heater current does not stop: The melting of relay, etc.
  When the control output is off and the current transformer (CT) input value is the HBA set value or more, the alarm is set up.

(7) Loop break alarm

The loop break alarm (LBA) function is used to detect a load (heater) break or a failure in the external actuator (magnet relay, etc.), or a failure in the control loop caused by an input (sensor) break.
This function monitors the measured value (PV) variation at LBA setting time intervals from the time the output exceeds 100 % (or output limiter: high limit) or falls below 0 % (or output limiter: low limit), then detects a heater or input break.

■Alarm action

The LBA function produces the alarm when any of the following causes occurs.

Heat control (LBA triggering width: 2 °C [°F] fixed)

- **When the output falls below 0 % (or output limiter: low limit)**
  For direct action: This alarm is produced when the measured value (PV) does not rise beyond the LBA triggering width within the LBA setting time.
  For reverse action: This alarm is produced when the measured value (PV) does not fall below the LBA triggering width within the LBA setting time.
- **When the output exceeds 100 % (or output limiter: high limit)**
  For direct action: This alarm is produced when the measured value (PV) does not fall below the LBA triggering width within the LBA setting time.
  For reverse action: This alarm is produced when the measured value (PV) does not rise beyond the LBA triggering width within the LBA setting time.

Heat/Cool control (LBA triggering width: 2 °C [°F] fixed)

- **When the heat-side output exceeds 100 % (or output limiter: high limit) and the cool-side output falls below 0 %**
  This alarm is produced when the measured value (PV) does not rise beyond the LBA triggering width within the LBA setting time.
- **When the heat-side output falls below 0 % and the cool-side output exceeds 100 % (or output limiter: low-limit)**
  This alarm is produced when the measured value (PV) does not rise beyond the LBA triggering width within the LBA setting time.

Position proportioning control (LBA triggering width: 2 °C [°F] fixed)

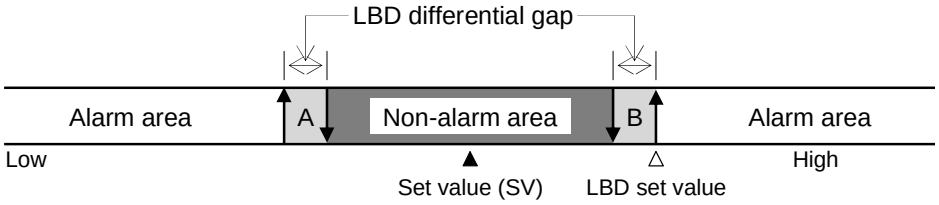
- **When the opening exceeds 100 % (or output limiter: high limit)**
  This alarm is produced when the measured value (PV) does not rise beyond the LBA triggering width within the LBA setting time.
- **When the opening less than 0 % (or output limiter: low limit)**
  This alarm is produced when the measured value (PV) does not rise beyond the LBA triggering width within the LBA setting time.

📖 If the autotuning function is used, the LBA setting time twice as large as the integral time is automatically set. The LBA setting time does not change even if the integral time is changed.

📖 In position proportioning control, the output limiter setting functions as the LBA high/low limit. (The output limited does not function as a control limited.)

■ LBA deadband (LBD)

The LBA may be produced by disturbances (other heat sources) even if the control system is not abnormal. In such a case, an area in which no alarm is produced can be set by setting the desired LBA deadband (LBD).
When the measured value (PV) is within the LBD area, no alarm is produced even if all of the conditions to produce the alarm are satisfied. Therefore, carefully set the LBD.



A: During temperature rise: Alarm area During temperature fall: Non-alarm area
B: During temperature rise: Non-alarm area During temperature fall: Alarm area

The LBA function detects an error occurring in the control loop, but cannot specify the erroneous location. Therefore, check the control loop in order.

The LBA function is not activated when any of the following cases occurs.
- When the autotuning function is being executed.
- When operation mode is not in **Normal** mode.

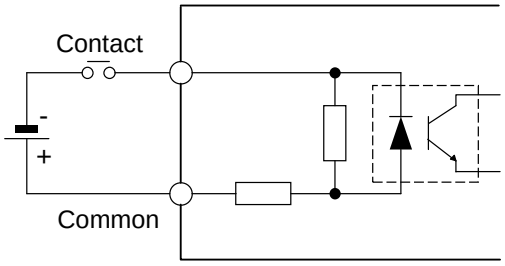
When the LBA setting time is extremely short or does not meet the controlled object, the LBA may be turned on and off, or may not be turned on. In such a case, change the LBA setting time depending on the situation.

The LBA output is turned off when any of the following cases occurs with the LBA output turned on.
- When the measured value (PV) rises beyond (or falls below) the LBA triggering width within the LBA setting time.
- When the measured value (PV) is within the LBA deadband.

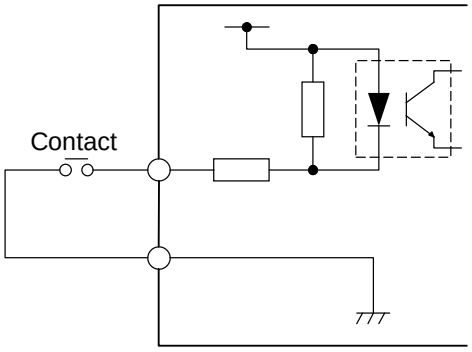
7.5 Contact Inputs

An external contact signal selects the operation status or alarm interlock release.

Voltage input circuit diagram



Dry contact input circuit diagram

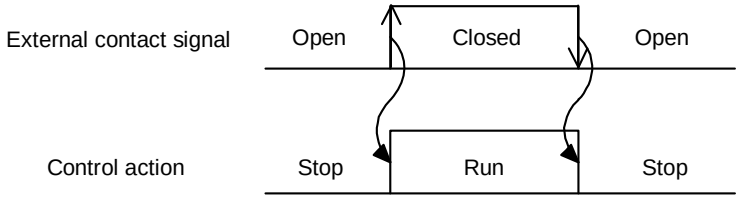


■ Memory area selection

An external contact signal selects one control area from among eight stored control areas.

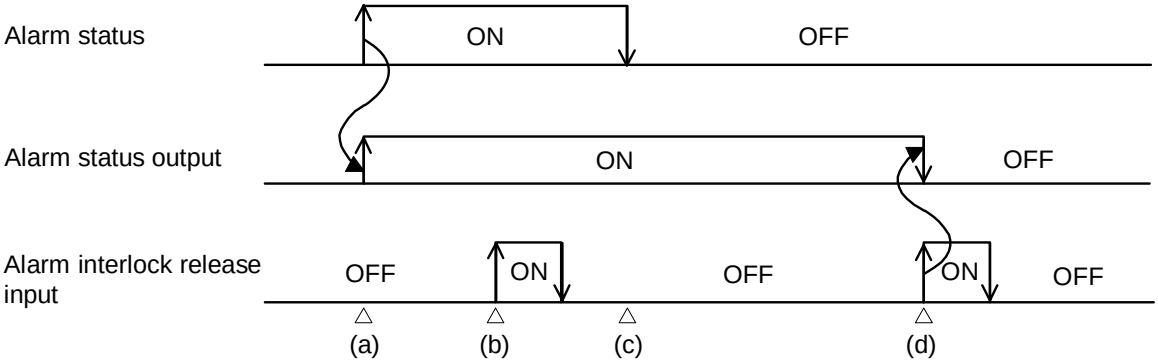
■ Control RUN/STOP selection

An external contact signal starts or stops control.



■ Alarm interlock release

When the alarm status is output from the digital output, an external contact signal can release the alarm status.



(a) When the alarm status is set up, the alarm status output becomes on.

(b) When the alarm interlock release input is set to on in the alarm status, the alarm status output does not become off because the alarm status output is on.
(Alarm interlock release input: Invalid)

(c) The alarm status has been canceled.

(d) If the alarm interlock release input is set to on while the alarm status is still canceled, the alarm status output becomes off.

8. SPECIFICATIONS

8.1 H-PCP Module

■ Basic functions

Data supervision: Operating and system data

Control unit diagnosis: Function modules configuration check

Self-diagnostic: Check item: ROM/RAM check, Watchdog timer and CPU power supply monitoring

If error occurs in self-diagnosis, the hardware will automatically return the module outputs to the OFF position.

Memory backup:

- **Module with non-volatile memory*:**

  Backed up by non-volatile memory (FeRAM)

  Number of writing: Approximately ten billion times
  Depending on storage and operating conditions.

  Data storage period: Approximately 10 years

- **Module with lithium battery*:**

  Lithium battery for RAM backup, approximate 10 years life for data retention.

* To distinguish your module between the above two types, please contact RKC office or the agent.

■ Power input

Power supply voltage:
90 to 132 V AC (50/60 Hz) [Including power supply voltage variation]
(Rating: 100 to 120 V AC)
180 to 264 V AC (50/60 Hz) [Including power supply voltage variation]
(Rating: 200 to 240 V AC)
21.6 to 26.4 V DC [Including power supply voltage variation]
(Rating: 24 V DC)
Specify when ordering

Power consumption:
H-PCP-A: 100 to 120 V AC: 20 VA max. 24 V DC: 30 W max.
200 to 240 V AC: 20 VA max.
H-PCP-B: 100 to 120 V AC: 25 VA max. 24 V DC: 30 W max.
200 to 240 V AC: 25 VA max.
(CE/UL/cUL (or CSA) approved instrument:
100 to 120 V AC: 40 VA max. 24 V DC: 21 W max.
200 to 240 V AC: 50 VA max.)

Surge current: 30 A or less

■ Power output (For function modules)

Output voltage/current:
H-PCP-A: 5 V DC: 1.6 A max. 12 V DC: 0.4 A max.
H-PCP-B: 5 V DC: 1.6 A max. 12 V DC: 1.0 A max.
CE/UL/cUL (or CSA) approved instrument:
5 V DC, 1.7 A max. 12 V DC, 1.0 A max.
Must be used within the maximum power consumption value.

Overcurrent protection: Fold-back limiting method: 5 V

■ Digital output

Failure output: **Relay contact output**

Number of outputs:	1 point
Rating:	250 V AC, 0.1 A (Resistive load) [CE/UL/cUL (or CSA) approved instrument: 30 V DC, 0.1 A]
Electrical life:	300,000 times or more (Rated load)
Contact type:	1a contact
Failure action:	Open at error occurrence

Digital output: [1-2] **Relay contact output**

Number of outputs:	4 points (H-PCP-B type: 2 points)
Rating:	250 V AC, 0.1 A (Resistive load) [CE/UL/ cUL (or CSA) approved instrument: 30 V DC, 0.1 A]
Electrical life:	300,000 times or more (Rated load)
Contact type:	1a contact

Open collector output

Number of outputs:	4 points (H-PCP-B type: 2 points)
Load voltage:	12 to 24 V DC
Maximum load current:	0.1 A/point, 0.8 A/common

[1] Specify either relay contact output or open collector output when ordering.

[2] Digital output can be selected from the following:

- Temperature alarm (alarm 1, alarm 2)
- AI alarm (alarm 1, alarm 2)
- Heater break alarm (HBA)
- Burnout alarm
- Loop break alarm (LBA)
- Temperature rise completion

■ Digital input (Only for H-PCP-B type)

Number of inputs:	3 points
Input type:	Source type
Rated input voltage:	24 V DC
Input voltage range:	21.6 to 26.4 V DC
Rated input current:	6.7 mA/point (24 V DC)
Input impedance:	3.6 kΩ
Input operating voltage:	ON voltage: 18.5 V DC OFF voltage: 9.0 V DC
Allocated functions:	1. Memory area transfer (8 memory areas) 2. Control RUN/STOP and memory area transfer (4 memory areas) 3. Alarm interlock release, control RUN/STOP and memory area transfer (2 memory areas) Selectable

■ Communication functions

Communication interface: Based on RS-422A, EIA standard
Based on RS-232C, EIA standard
Specify when ordering

Connection method: RS-422A: 4-wire system, half-duplex multi-drop connection
RS-232C: Point-to-point connection

Protocol:

● Based on ANSI X3.28-1976 subcategory 2.5 B1

Error control:	Vertical parity (when parity bit is selected) Horizontal parity
Data types:	ASCII 7-bit code
Data bit configuration:	Start bit: 1 Data bit: 7 or 8 Parity bit: Without, Odd, Even Without for 8 data bits Stop bit: 1

● Non-protocol type (Ladder communication: Z-190 specification)

Data type:	Text: BCD code Control code: STX (02H), CR (0DH), LF (0AH) The code in ( ) expressed hexadecimal numeral
Block length:	128 bytes or less
Data bit configuration:	Start bit: 1 Data bit: 8 Parity bit: Without Stop bit: 1

● Modbus (Z-1021 specification)

Signai transmission mode:	Remote Terminal Unit (RTU) mode
Function code:	03H Read holding registers 06H Preset single register 08H Diagnostics (loopback test) 10H Preset multiple registers
Error check method:	CRC-16
Data bit configuration:	Start bit: 1 Data bit: 8 Parity bit: Without, Odd, Even Stop bit: 1

● MEMOBUS (Z-1001 specification)

Signal transmission mode:	Remote Terminal Unit (RTU) mode
Function code:	03H Read holding registers 08H Diagnostics (loopback test) 10H Preset multiple registers
Error check method:	CRC-16
Data bit configuration:	Start bit: 1 Data bit: 8 Parity bit: Without, Odd, Even Stop bit: 1

Synchronous method: Start/stop synchronous type

Communication speed: 2400 bps, 4800 bps, 9600 bps, 19200 bps
Selectable

■ System setting items

Temperature alarm (alarm 1 and alarm 2):

Deviation high alarm	Process high alarm
Deviation low alarm	Process low alarm
Deviation high/low alarm	Process high alarm (with alarm hold)
Deviation band alarm	Process low alarm (with alarm hold)
Deviation high alarm (with alarm hold)	Deviation high alarm (with alarm re-hold)
Deviation low alarm (with alarm hold)	Deviation low alarm (with alarm re-hold)
Deviation high/low alarm (with alarm hold)	Deviation high/low alarm (with alarm re-hold)

Specify when ordering

Alarm action of each module in the control unit is that selected here.

TI alarm (alarm 1 and alarm 2) and AI alarm (alarm 1 and alarm 2):

Process high alarm
Process low alarm
Process high alarm (with alarm hold)
Process low alarm (with alarm hold)
Specify when ordering
Alarm action of each module in the control unit is that selected here.

Temperature rise completion function:

Completion trigger range:	±1 to ±10 °C (Value from main set value)
Temperature rise completion soak time:	0 to 360 minutes

■ General specifications

Dimensions: 48 (W) × 96 (H) × 100 (D) mm
Weight: 320 g

8.2 H-TIO Module

8.2.1 Temperature control module (H-TIO-A, B, C, D, P)

■ Input

Number of inputs: 1 channel or 2 channels
Isolated between each channel and between input and output

Input type: Thermocouple input: K, J, R, S, B, E, T, N, PLII, W5Re/W26Re, U, L
RTD input: JPt100, Pt100
Specify when ordering

Input range: Refer to **Input range table (P. 14)**
Specify when ordering

Resolution: 1 °C (°F) or 0.1 °C (°F)

Sampling cycle: 0.5 seconds

Signal source resistance effect: Approx. 0.35 μV/Ω (Only for thermocouple input)

Input impedance: 1 MΩ or more (Only for thermocouple input)

Sensor current: Approx. 0.25 mA (Only for RTD input)

Allowable influence of input lead: 20 Ω or less (Only for RTD input)

Input filter: First order lag digital filter
Time constant: Settable from 1 to 100 seconds
(Setting *0*: Filter off)

PV bias: -5.00 to +5.00 % of span

Action at input break: Upscale

■ Performance

Measured accuracy: ±0.3 % of span ±1 digit
However, the accuracy of a thermocouple B type input of 0 to 399 °C (0 to 799 °F) is not guaranteed.

Cold junction temperature compensation error:
Within ±1.0 °C (Range of 0 to 50 °C)
Within ±2.0 °C between -100 to -150 °C
Within ±3.0 °C between -150 to -200 °C
Only for thermocouple input

■ Control action

Control method: ON/OFF action (Only for H-TIO-A and B types)
Brilliant PID control (PI control can also be used.)

Control cycle: 0.5 seconds

Other functions: Overshoot prevention function (RFB limiter method)
Enhanced autotuning function (Excluding H-TIO-C and D types)
Fuzzy function (Only for H-TIO-P type)

■ Setting range

Set value (SV):	Same as input range
Heat-side proportional band:	0.1 to 1000.0 % of span
Cool-side proportional band:	0.1 to 1000.0 % of span (Only for H-TIO-C and D types)
Integral time:	1 to 3600 seconds
Derivative time:	1 to 3600 seconds (PI control when set to 0 second)
Overlap/Deadband:	-10.0 to +10.0 % of span (Only for H-TIO-C and D types)
Control response parameter:	Slow, Medium and Fast (3-step selection)
Proportioning cycle:	1 to 100 seconds (H-TIO-C and D types: Heat and cool are individually selectables)

■ Control output

Relay contact output:	Rating:	250 V AC, 3 A (Resistive load)
	Electrical life:	300,000 times or more (Rated load)
	Contact type:	1a contact
	Cycle:	1 to 100 seconds variable
Voltage pulse output:	Rating:	0/12 V DC
	Allowable load resistance:	600 Ω or more
	Cycle:	1 to 100 seconds variable
Current output:	Output current:	0 to 20 mA DC and 4 to 20 mA DC Specify when ordering
	Resolution:	9 bits or more
	Allowable load resistance:	500 Ω or less
	Output impedance:	5 MΩ or more
	(Output minus terminals cannot be connected in common.)	
Voltage output:	Output voltage:	0 to 1 V DC, 0 to 5 V DC, 0 to 10 V DC and 1 to 5 V DC Specify when ordering
	Resolution:	9 bits or more
	Allowable load resistance:	1 kΩ or more
	Output impedance:	0.1 Ω or less
	(Output minus terminals can be connected in common only for an output of 1 to 5 V DC.)	
Triac output:	Capacity:	0.5 A (At an ambient temperature of 40 °C)
	Zero-cross method	
	Maximum load voltage:	250 V AC
Open collector output:	Load voltage:	12 to 24 V DC
	Maximum load current:	100 mA
	Leak current when OFF:	0.1 mA or less
	Maximum voltage drop at ON:	2.4 V or less (At a load current of 100 mA) 0.7 V or less (At a load current of 10 mA)
	The minus terminals of the output with the two channels specification are internally contacted in common.	

■ Temperature alarm function

Number of alarms: 2 points

Alarm types:

Deviation high alarm	Process high alarm
Deviation low alarm	Process low alarm
Deviation high/low alarm	Process high alarm (with alarm hold)
Deviation band alarm	Process low alarm (with alarm hold)
Deviation high alarm (with alarm hold)	Deviation high alarm (with alarm re-hold)
Deviation low alarm (with alarm hold)	Deviation low alarm (with alarm re-hold)
Deviation high/low alarm (with alarm hold)	Deviation high/low alarm (with alarm re-hold)

Specify when ordering (Alarm action is specified for the H-PCP module.)

Setting range:

-span to +span:	Deviation high alarm, Deviation low alarm, Deviation high alarm (with alarm hold), Deviation low alarm (with alarm hold)
0 to span:	Deviation high/low alarm, Deviation band alarm, Deviation high/low alarm (with alarm hold)
Same as input range:	Process high alarm, Process low alarm, Process high alarm (with alarm hold), Process low alarm (with alarm hold)

Specify when ordering (Alarm action is specified for the H-PCP module.)

Setting resolution: Same as input resolution

Alarm output: This module outputs alarm status to the H-PCP module as data.

■ Alarm output (Only for H-TIO-A type) [Optional]

Number of outputs: 1 point
Select any of temperature alarm output 1 (ALM1), temperature alarm output 2 (ALM2), heater break alarm output (HBA) or loop break alarm output (LBA).

Relay contact output:

Rating:	250 V AC 24 V DC 2 A (Resistive load)
Electrical life:	300,000 times or more (Rated load)
Contact type:	1a contact
Minimum switching voltage and current:	5 V DC 1 mA

Isolation method: Photocoupler isolation

■ Heater break alarm function (Only for H-TIO-A, C and D type) [Optional]

Number of inputs: 1 point/control loop
Setting range: 0.0 to 100.0 A
Accuracy of heater current measurement:
5 % of input value or ±2 A (The value whichever is greater)
Input current: 0 to 30 A: CTL-6-P-N
0 to 100 A: CTL-12-S56-10L-N
Current transformer: CTL-6-P-N, CTL-12-S56-10L-N
Specify when ordering
Input rating: Maximum current: 130 mA
Input impedance: 10 Ω
Alarm output: This module outputs alarm status to the H-PCP module as data.

■ Loop break alarm function

Setting range: LBA setting time: 1 to 7200 seconds
LBA deadband (LBD): Same as input range
(LBD is automatically as the value of two times of integral value after the completion of autotuning.)
Alarm output: This module outputs alarm status to the H-PCP module as data.

■ Self-diagnostic

Check item: RAM check
Adjustment data check
Input value check
Watchdog timer
Operation at error occurrence in self-diagnosis:
FAIL lamp lights
All channel control outputs are turned off.
Reset state

■ Manual setting function

Auto/Manual transfer: Either Auto or Manual control can be selected.
Setting range: -5.0 to +105.0 %
Balanceless bumpless: Balanceless bumpless transfer between Auto and Manual (both directions).

■ General specifications

Dimensions: H-TIO-A, B, C, P: 24 (W) × 96 (H) × 100 (D) mm
H-TIO-D: 48 (W) × 96 (H) × 100 (D) mm
Weight: H-TIO-A, B, C, P: 120 g
H-TIO-D: 240 g

8.2.2 High accuracy temperature control module (H-TIO-E, F, G, R)

■ Input

Number of inputs: 1 channel or 2 channels
Isolated between input and output
(For H-TIO-F type, not isolated between each channel)

Input type: Thermocouple input: K, J, R, S, B, E, T, N, PLII, W5Re/W26Re, U, L
RTD input: JPt100, Pt100
Specify when ordering

Input range: Refer to **Input range table (P. 14)**
Specify when ordering

Resolution: 1 °C (°F) or 0.1 °C (°F)
0.01 °C (Only for H-TIO-E type RTD input)

Sampling cycle: H-TIO-E, G, R: 0.1 seconds
H-TIO-F: 0.2 seconds

Signal source resistance effect: Approx. 0.3 μV/Ω (Only for thermocouple input)

Input impedance: 1 MΩ or more (Only for thermocouple input)

Sensor current: Approx. 0.3 mA (Only for RTD input)

Allowable influence of input lead: 10 Ω or less (Only for RTD input)

Input filter: First order lag digital filter
Time constant: Settable from 0.1 to 100.0 seconds (Setting 0.0: Filter off)

PV bias: -5.00 to +5.00 % of span

Action at input break: Upscale or downscale can be selected

■ Performance

Measured accuracy: H-TIO-E, G, R: ±0.1 % of span ±1 digit
H-TIO-F: ±0.2 % of span ±1 digit
However, the accuracy of a thermocouple B type input of 0 to 399 °C (0 to 799 °F) is not guaranteed.

Cold junction temperature compensation error:
Within ±0.5 °C (Range of 0 to 50 °C)
Within ±2.0 °C between -100 to -150 °C
Within ±3.0 °C between -150 to -200 °C
Only for thermocouple input

■ Control action

Control method: ON/OFF action (Only for H-TIO-E, F and R types)
Brilliant PID control (PI control can also be used.)

Control cycle: H-TIO-E, G, R: 0.1 seconds
H-TIO-F: 0.2 seconds

Other functions: Overshoot prevention function (RFB limiter method)
Enhanced autotuning function (Excluding H-TIO-G type)
Fuzzy function (Only for H-TIO-R type)

■ Setting range

Set value (SV):	Same as input range
Heat-side proportional band:	0.1 to 1000.0 % of span
Cool-side proportional band:	0.1 to 1000.0 % of span (Only for H-TIO-G type)
Integral time:	1 to 3600 seconds
Derivative time:	1 to 3600 seconds (PI control when set to 0 second)
Overlap/Deadband:	-10.0 to +10.0 % of span (Only for H-TIO-G type)
Control response parameter:	Slow, Medium and Fast (3-step selection)
Proportioning cycle:	1 to 100 seconds (H-TIO-G type: Heat and cool are individually selectables)

■ Control output

Relay contact output:	Rating:	250 V AC, 3 A (Resistive load)
	Electrical life:	300,000 times or more (Rated load)
	Contact type:	1a contact
	Cycle:	1 to 100 seconds variable
Voltage pulse output:	Rating:	0/12 V DC
	Allowable load resistance:	600 Ω or more
	Cycle:	1 to 100 seconds variable
Current output:	Output current:	0 to 20 mA DC and 4 to 20 mA DC Specify when ordering
	Resolution:	11 bits or more
	Allowable load resistance:	500 Ω or less
	Output impedance:	5 MΩ or more
	(Output minus terminals cannot be connected in common.)	
Voltage output:	Output voltage:	0 to 1 V DC, 0 to 5 V DC, 0 to 10 V DC and 1 to 5 V DC Specify when ordering
	Resolution:	11 bits or more
	Allowable load resistance:	1 kΩ or more
	Output impedance:	0.1 Ω or less
	(Output minus terminals can be connected in common only for an output of 1 to 5 V DC.)	
Triac output:	Capacity:	0.5 A (At an ambient temperature of 40 °C)
	Zero-cross method	
	Maximum load voltage:	250 V AC
Open collector output:	Load voltage:	12 to 24 V DC
	Maximum load current:	100 mA
	Leak current when OFF:	0.1 mA or less
	Maximum voltage drop at ON:	2.4 V or less (At a load current of 100 mA) 0.7 V or less (At a load current of 10 mA)
	The minus terminals of the output with the two channels specification are internally contacted in common.	

■ Temperature alarm function

Number of alarms: 2 points

Alarm types:

Deviation high alarm	Process high alarm
Deviation low alarm	Process low alarm
Deviation high/low alarm	Process high alarm (with alarm hold)
Deviation band alarm	Process low alarm (with alarm hold)
Deviation high alarm (with alarm hold)	Deviation high alarm (with alarm re-hold)
Deviation low alarm (with alarm hold)	Deviation low alarm (with alarm re-hold)
Deviation high/low alarm (with alarm hold)	Deviation high/low alarm (with alarm re-hold)

Specify when ordering (Alarm action is specified for the H-PCP module.)

Setting range:

-span to +span:	Deviation high alarm, Deviation low alarm, Deviation high alarm (with alarm hold), Deviation low alarm (with alarm hold)
0 to span:	Deviation high/low alarm, Deviation band alarm, Deviation high/low alarm (with alarm hold)
Same as input range:	Process high alarm, Process low alarm, Process high alarm (with alarm hold), Process low alarm (with alarm hold)

Specify when ordering (Alarm action is specified for the H-PCP module.)

Setting resolution: Same as input resolution

Alarm output: This module outputs alarm status to the H-PCP module as data.

■ Alarm output (Only for H-TIO-E and R types) [Optional]

Number of outputs: 1 point

Select any of temperature alarm output 1 (ALM1), temperature alarm output 2 (ALM2), heater break alarm output (HBA) or loop break alarm output (LBA).

Relay contact output:

Rating: 250 V AC 24 V DC 2 A (Resistive load)

Electrical life: 300,000 times or more (Rated load)

Contact type: 1a contact

Minimum switching voltage and current: 5 V DC 1 mA

Isolation method: Photocoupler isolation

■ Loop break alarm function

Setting range:

LBA setting time: 1 to 7200 seconds

LBA deadband (LBD): Same as input range

(LBD is automatically as the value of two times of integral value after the completion of autotuning.)

Alarm output: This module outputs alarm status to the H-PCP module as data.

■ Self-diagnostic

Check item: RAM check
Adjustment data check
Input value check
Watchdog timer

Operation at error occurrence in self-diagnosis:
FAIL lamp lights
All channel control outputs are turned off.
Reset state

■ Manual setting function

Auto/Manual transfer: Either Auto or Manual control can be selected.
Setting range: -5.0 to +105.0 %
Balanceless bumpless: Balanceless bumpless transfer between Auto and Manual (both directions).

■ General specifications

Dimensions: 24 (W) × 96 (H) × 100 (D) mm
Weight: 120 g

8.2.3 High accuracy temperature control module (H-TIO-H, J) [Voltage/Current input]

■ Input

Number of inputs: 1 channel or 2 channels
Isolated between input and output
(For H-TIO-J type, not isolated between each channel)

Input type: Voltage input: 0 to 10 mV DC, 0 to 100 mV DC, 0 to 1 V DC,
0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC, -5 to +5 V DC,
-10 to +10 V DC, -1 to +1 V DC
Current input: 0 to 20 mA DC, 4 to 20 mA DC
Specify when ordering

Input range: -5 to +105 % of span
Refer to **Input range table (P. 14)**

Resolution: 1/10000

Sampling cycle: H-TIO-H: 0.1 seconds
H-TIO-J: 0.2 seconds

Input impedance: Voltage input: 1 MΩ or more
Current input: 250 Ω

Analog input filter: Cut-off frequency: Approx. 11.6 Hz
Rise time: Approx. 33 ms
Response of 90 %

Digital input filter: First order lag digital filter
Time constant: Settable from 0.1 to 100.0 seconds
(Setting 0.0: Filter off)

Action at input break: Indicates value near zero

Measured accuracy: ±0.1 % of span ±1 digit

Input scaling range: -9999 to +10000
However, scaling is possible within a span of 10000 maximum.
Decimal point position can be varied down to 3 digit.

Noise rejection ratio: Normal mode: Refer to item **Input filter**
Common mode: -120 dB or more (50/60 Hz)

■ Control action

Control method: ON/OFF action
Brilliant PID control (PI control can also be used.)

Control cycle: H-TIO-H: 0.1 seconds
H-TIO-J: 0.2 seconds

Other functions: Overshoot prevention function (RFB limiter method)
Enhanced autotuning function

■ Setting range

Set value (SV):	Same as scaling range
Proportional band:	0.1 to 1000.0 % of span
Integral time:	1 to 3600 seconds
Derivative time:	1 to 3600 seconds (PI control when set to 0 second)
Control response parameter:	Slow, Medium and Fast (3-step selection)
Proportioning cycle:	1 to 100 seconds

■ Control output

Relay contact output:	Rating:	250 V AC, 3 A (Resistive load)
	Electrical life:	300,000 times or more (Rated load)
	Contact type:	1a contact
	Cycle :	1 to 100 seconds variable
Voltage pulse output:	Rating:	0/12 V DC
	Allowable load resistance:	600 Ω or more
	Cycle :	1 to 100 seconds variable
Current output:	Output current:	0 to 20 mA DC and 4 to 20 mA DC Specify when ordering
	Resolution:	11 bits or more
	Allowable load resistance:	500 Ω or less
	Output impedance:	5 MΩ or more
	(Output minus terminals cannot be connected in common.)	
Voltage output:	Output voltage:	0 to 1 V DC, 0 to 5 V DC, 0 to 10 V DC and 1 to 5 V DC Specify when ordering
	Resolution:	11 bits or more
	Allowable load resistance:	1 kΩ or more
	Output impedance:	0.1 Ω or less
	(Output minus terminals can be connected in common only for an output of 1 to 5 V DC.)	
Triac output:	Capacity:	0.5 A (At an ambient temperature of 40 °C)
	Zero-cross method	
	Maximum load voltage:	250 V AC
Open collector output:	Load voltage:	12 to 24 V DC
	Maximum load current:	100 mA
	Leak current when OFF:	0.1 mA or less
	Maximum voltage drop at ON:	2.4 V or less (At a load current of 100 mA) 0.7 V or less (At a load current of 10 mA)
	The minus terminals of the output with the two channels specification are internally contacted in common.	

■ Temperature alarm function

Number of alarms: 2 points

Alarm types:

Deviation high alarm	Process high alarm
Deviation low alarm	Process low alarm
Deviation high/low alarm	Process high alarm (with alarm hold)
Deviation band alarm	Process low alarm (with alarm hold)
Deviation high alarm (with alarm hold)	Deviation high alarm (with alarm re-hold)
Deviation low alarm (with alarm hold)	Deviation low alarm (with alarm re-hold)
Deviation high/low alarm (with alarm hold)	Deviation high/low alarm (with alarm re-hold)

Specify when ordering (Alarm action is specified for the H-PCP module.)

Setting range:

-span to +span:	Deviation high alarm, Deviation low alarm, Deviation high alarm (with alarm hold), Deviation low alarm (with alarm hold)
0 to span:	Deviation high/low alarm, Deviation band alarm, Deviation high/low alarm (with alarm hold)
Same as input range:	Process high alarm, Process low alarm, Process high alarm (with alarm hold), Process low alarm (with alarm hold)

Specify when ordering (Alarm action is specified for the H-PCP module.)

Setting resolution: Same as input resolution

Alarm output: This module outputs alarm status to the H-PCP module as data.

■ Alarm output (Only for H-TIO-H type) [Optional]

Number of outputs: 1 point

Select any of temperature alarm output 1 (ALM1), temperature alarm output 2 (ALM2), heater break alarm output (HBA) or loop break alarm output (LBA).

Relay contact output:

Rating: 250 V AC 24 V DC 2 A (Resistive load)

Electrical life: 300,000 times or more (Rated load)

Contact type: 1a contact

Minimum switching voltage and current: 5 V DC 1 mA

Isolation method: Photocoupler isolation

■ Self-diagnostic

Check item:

RAM check

Adjustment data check

Input value check

Watchdog timer

Operation at error occurrence in self-diagnosis:

FAIL lamp lights

All channel control outputs are turned off.

Reset state

■ Manual setting function

Auto/Manual transfer: Either Auto or Manual control can be selected.
Setting range: -5.0 to +105.0 %
Balanceless bumpless: Balanceless bumpless transfer between Auto and Manual (both directions).

■ General specifications

Dimensions: 24 (W) × 96 (H) × 100 (D) mm
Weight: 120 g

8.2.4 Temperature control module for control motor drive (H-TIO-K)

■ Input

Number of inputs: 1 channel
Isolated between input and output

Input type: Thermocouple input: K, J, R, S, B, E, T, N, PLII, W5Re/W26Re, U, L
RTD input: JPt100, Pt100
Specify when ordering

Input range: Refer to **Input range table (P. 14)**
Specify when ordering

Resolution: 1 °C (°F) or 0.1 °C (°F)

Sampling cycle: 0.5 seconds

Signal source resistance effect: Approx. 0.35 μV/Ω (Only for thermocouple input)

Input impedance: 1 MΩ or more (Only for thermocouple input)

Sensor current: Approx. 0.25 mA (Only for RTD input)

Allowable influence of input lead: 20 Ω or less (Only for RTD input)

Input filter: First order lag digital filter
Time constant: Settable from 0.1 to 100.0 seconds
(Setting 0.0: Filter off)

PV bias: -5.00 to +5.00 % of span

Action at input break: Upscale

■ Performance

Measured accuracy: ±0.3 % of span ±1 digit
However, the accuracy of a thermocouple B type input of 0 to 399 °C (0 to 799 °F) is not guaranteed.

Cold junction temperature compensation error:
Within ±1.0 °C (Range of 0 to 50 °C)
Within ±2.0 °C between -100 to -150 °C
Within ±3.0 °C between -150 to -200 °C
Only for thermocouple input

Feedback resistance input: ±0.3 % of span ±1 digit

■ Control action

Control method: PID control (Speed type)
PI control can also be used.

Control cycle: 0.5 seconds

Other functions: Autotuning function
Manual output function

■ Setting range

Set value (SV): Same as input range

Proportional band: 0.1 to 1000.0 % of span

Integral time: 1 to 3600 seconds

Derivative time: 1 to 3600 seconds (PI control when set to 0 second)

Control response parameter: Slow, Medium and Fast (3-step selection)

Neutral zone: 0.1 to 10.0 % of motor driving time
(The time does not become less than 50 ms.)
The output is not turned on until the accumulated value of the control computation result becomes the neutral zone value or more.

Integrated output limiter: 100.0 to 200.0 %
When Open (Closed) is output in succession, its output is accumulated. If the accumulated value reaches the set value of the accumulated output limiter, the Open output is not turned on, hereafter.
However, if Closed (Open) is output once, the accumulated output is reset.

■ Control output

Relay contact output:

Rating:	250 V AC, 3 A (Resistive load)
Electrical life:	300,000 times or more (Rated load)
Contact type:	1a contact
Cycle:	1 to 100 seconds variable

■ Feedback resistance input

Input type: Feedback resistance input from control motor
(O: Open, W: Wiper, C: Closed)
Only input display. (No relation with control.)

Input resistance value: 135 Ω standard
Can specify any one of 100 Ω, 500 Ω, 1 kΩ, 5 kΩ and 10 kΩ
Specify when ordering

Display at input break: Displayed from -199.9 to +199.9 %
Manual output is impossible at input abnormality.

Input sampling: 1 second

Input range: 0.0 to 100.0 % (Full open to full closed)
Adjustable
(Motor driving time can be also automatically set during adjustment)

■ Temperature alarm function

Number of alarms: 2 points

Alarm types:

Deviation high alarm	Process high alarm
Deviation low alarm	Process low alarm
Deviation high/low alarm	Process high alarm (with alarm hold)
Deviation band alarm	Process low alarm (with alarm hold)
Deviation high alarm (with alarm hold)	Deviation high alarm (with alarm re-hold)
Deviation low alarm (with alarm hold)	Deviation low alarm (with alarm re-hold)
Deviation high/low alarm (with alarm hold)	Deviation high/low alarm (with alarm re-hold)

Specify when ordering (Alarm action is specified for the H-PCP module.)

Setting range:

-span to +span:	Deviation high alarm, Deviation low alarm, Deviation high alarm (with alarm hold), Deviation low alarm (with alarm hold)
0 to span:	Deviation high/low alarm, Deviation band alarm, Deviation high/low alarm (with alarm hold)
Same as input range:	Process high alarm, Process low alarm, Process high alarm (with alarm hold), Process low alarm (with alarm hold)

Specify when ordering (Alarm action is specified for the H-PCP module.)

Setting resolution: Same as input resolution

Alarm output: This module outputs alarm status to the H-PCP module as data.

■ Loop break alarm function

Setting range:

LBA setting time:	1 to 7200 seconds
LBA deadband (LBD):	Same as input range

(LBD is automatically as the value of two times of integral value after the completion of autotuning.)

Alarm output: This module outputs alarm status to the H-PCP module as data.

■ Self-diagnostic

Check item:
RAM check
Adjustment data check
Input value check
Watchdog timer

Operation at error occurrence in self-diagnosis:
FAIL lamp lights
All channel control outputs are turned off.
Reset state

■ Manual setting function

Auto/Manual transfer: Either Auto or Manual control can be selected.

Setting operation: Manual output setting: -5.0 to +105.0 % (Valid in manual mode)

The output can not be normal when feedback resistance input error occurs.

Output timing (Manual mode):

- At the change of settings
- At power-up
- At Auto/Manual transfer
- At RUN/STOP transfer to control Run

In above operation, the output is made three times to the set value.

■ General specifications

Dimensions: 24 (W) × 96 (H) × 100 (D) mm

Weight: 120 g

8.3 H-TI Module

■ Input

Number of inputs: H-TI-A, C: 4 channels
Isolated between each channel and between input and CPU (For H-TI-A type, not isolated between each channel)
H-TI-B: 2 channels
Isolated between each channel and between input and CPU

Input type: Thermocouple input (H-TI-C, B):
K, J, R, S, B, E, T, N, PLII, W5Re/W26Re, U, L
RTD input (H-TI-A, B): JPt100, Pt100
Specify when ordering

Input range: Refer to **Input range table (P. 14)**
Specify when ordering

Resolution: 1 °C (°F) or 0.1 °C (°F)
0.01 °C (Only for H-TI-B type RTD input)

Sampling cycle: H-TI-A, C: 0.5 seconds
H-TI-B: 0.1 seconds

Signal source resistance effect: Approx. 0.3 μV/Ω (Only for thermocouple input)

Input impedance: 1 MΩ or more (Only for thermocouple input)

Sensor current: Approx. 0.3 mA (Only for RTD input)

Allowable influence of input lead: 10 Ω or less (Only for RTD input)

Input filter: First order lag digital filter
Time constant: Settable from 0.1 to 100.0 seconds
(Setting *0.0*: Filter off)

PV bias: -5.00 to +5.00 % of span

Action at input break: Upscale

■ Performance

Measured accuracy: H-TI-A, C: ±0.3 % of span ±1 digit
H-TI-B: ±0.1 % of span ±1 digit
However, the accuracy of a thermocouple B type input of 0 to 399 °C (0 to 799 °F) is not guaranteed.

Cold junction temperature compensation error:
H-TI-B: Within ±0.5 °C (Range of 0 to 50 °C)
Thermocouple J, T type: Within ±1.0 °C
H-TI-C: Within ±1.0 °C (Range of 0 to 50 °C)
Within ±2.0 °C between -100 to -150 °C
Within ±3.0 °C between -150 to -200 °C
Only for thermocouple input

■ Temperature alarm function

Number of alarms: 2 points

Alarm types: Process high alarm
Process low alarm
Process high alarm (with alarm hold)
Process low alarm (with alarm hold)
The alarm type can be selected for each alarm.
(Alarm action is specified for the H-PCP module)

Setting range: Same as input range: Process high alarm, Process low alarm, Process high alarm (with alarm hold), Process low alarm (with alarm hold)
The alarm type can be selected for each alarm.

Setting resolution: Same as input resolution

Alarm output: This module outputs alarm status to the H-PCP module as data.

■ Self-diagnostic

Check item: RAM check
Adjustment data check
Input value check
Watchdog timer

Operation at error occurrence in self-diagnosis:
FAIL lamp lights
All channel control outputs are turned off.
Reset state

■ General specifications

Dimensions: 24 (W) × 96 (H) × 100 (D) mm

Weight: 140 g

8.4 H-CIO Module

8.4.1 Cascade control module (H-CIO-A) [Temperature input]

■ Input

Number of inputs:: 2 points (Master input/slave input)
Isolated between input and output
For RTD input, not isolated between input and output

Input type: Thermocouple input: K, J, R, S, B, E, T, N, PLII, W5Re/W26Re, U, L
RTD input: JPt100, Pt100
Specify when ordering

Input range: Refer to **Input range table (P. 14)**
Specify when ordering

Resolution: 1 °C (°F) or 0.1 °C (°F)

Sampling cycle: 0.1 seconds

Signal source resistance effect: Approx. 0.3 μV/Ω (Only for thermocouple input)

Input impedance: 1 MΩ or more (Only for thermocouple input)

Sensor current: Approx. 0.3 mA (Only for RTD input)

Allowable influence of input lead: 10 Ω or less (Only for RTD input)

Input filter: First order lag digital filter
Time constant: Settable from 0.1 to 100.0 seconds
(Setting *0.0*: Filter off)

PV bias: -5.00 to +5.00 % of span

Action at input break: Upscale

■ Performance

Measured accuracy: ±0.1 % of span ±1 digit
However, the accuracy of a thermocouple B type input of 0 to 399 °C (0 to 799 °F) is not guaranteed.

Cold junction temperature compensation error:
Within ±0.5 °C (Range of 0 to 50 °C)
Within ±2.0 °C between -100 to -150 °C
Within ±3.0 °C between -150 to -200 °C
Only for thermocouple input

■ Control action

Control method: Brilliant PID control (PI control can also be used.)
Heat/Cool control can be also selected for the slave channel.
Specify when ordering

Control cycle: 0.1 seconds

Other functions: Overshoot prevention function (RFB limiter method)
Enhanced autotuning function

■ Setting range

Set value (SV):	Same as input range
Heat-side proportional band:	0.1 to 1000.0 % of span
Cool-side proportional band:	0.1 to 1000.0 % of span
Integral time:	1 to 3600 seconds
Derivative time:	1 to 3600 seconds (PI control when set to 0 second)
Overlap/Deadband:	-10.0 to +10.0 % of span
Control response parameter:	Slow, Medium and Fast (3-step selection)
Proportioning cycle:	1 to 100 seconds

■ Control output

Relay contact output:	Rating:	250 V AC, 3 A (Resistive load)
	Electrical life:	300,000 times or more (Rated load)
	Contact type:	1a contact
	Cycle:	1 to 100 seconds variable
Voltage pulse output:	Rating:	0/12 V DC
	Allowable load resistance:	600 Ω or more
	Cycle:	1 to 100 seconds variable
Current output:	Output current:	0 to 20 mA DC and 4 to 20 mA DC Specify when ordering
	Resolution:	11 bits or more
	Allowable load resistance:	500 Ω or less
	Output impedance:	5 MΩ or more
	(Output minus terminals cannot be connected in common.)	
Voltage output:	Output voltage:	0 to 1 V DC, 0 to 5 V DC, 0 to 10 V DC and 1 to 5 V DC Specify when ordering
	Resolution:	11 bits or more
	Allowable load resistance:	1 kΩ or more
	Output impedance:	0.1 Ω or less
	(Output minus terminals can be connected in common only for an output of 1 to 5 V DC.)	
Triac output:	Capacity:	0.5 A (At an ambient temperature of 40 °C)
	Zero-cross method	
	Maximum load voltage:	250 V AC
Open collector output:	Load voltage:	12 to 24 V DC
	Maximum load current:	100 mA
	Leak current when OFF:	0.1 mA or less
	Maximum voltage drop at ON:	2.4 V or less (At a load current of 100 mA) 0.7 V or less (At a load current of 10 mA)

■ Temperature alarm function

Number of alarms: 2 points

Alarm types:

Deviation high alarm	Process high alarm
Deviation low alarm	Process low alarm
Deviation high/low alarm	Process high alarm (with alarm hold)
Deviation band alarm	Process low alarm (with alarm hold)
Deviation high alarm (with alarm hold)	Deviation high alarm (with alarm re-hold)
Deviation low alarm (with alarm hold)	Deviation low alarm (with alarm re-hold)
Deviation high/low alarm (with alarm hold)	Deviation high/low alarm (with alarm re-hold)

Specify when ordering (Alarm action is specified for the H-PCP module.)

Setting range:

-span to +span:	Deviation high alarm, Deviation low alarm, Deviation high alarm (with alarm hold), Deviation low alarm (with alarm hold)
0 to span:	Deviation high/low alarm, Deviation band alarm, Deviation high/low alarm (with alarm hold)
Same as input range:	Process high alarm, Process low alarm, Process high alarm (with alarm hold), Process low alarm (with alarm hold)

Specify when ordering (Alarm action is specified for the H-PCP module.)

Setting resolution: Same as input resolution

Alarm output: This module outputs alarm status to the H-PCP module as data.

■ Loop break alarm function

Setting range: LBA setting time: 1 to 7200 seconds

LBA deadband (LBD): Same as input range

(LBD is automatically as the value of two times of integral value after the completion of autotuning.)

Alarm output: This module outputs alarm status to the H-PCP module as data.

■ Digital input

Input type: Dry contact

Resistance value at OPEN: 500 kΩ or more

Resistance value at CLOSE: 10 Ω or less

Number of inputs: 2 points

Voltage at OPEN: 12 V DC

Contact current: Approx. 3 mA/point

Function: Mode selection

Isolation method: Photocoupler isolation

External connection: Terminals

■ Cascade function

Monitor item: Cascade monitor: ±Input range

Normal setting value: Cascade bias: -99.99 to +100.0 % of span

Cascade gain: -9.999 to +10.000 (No engineering unit)

Cascade ON/OFF: 0: OFF
1: ON
Cascade control is turned ON/OFF via communication or by digital input.

Initial setting value: Cascade data selection: 0: Output values
1: Measured values
2: Local set values
3: Set value monitoring
4: Deviation (Local set values - Measured values)

Tracking function: 0: OFF
1: ON

Digital input selection function:
0: Function OFF
1: Cascade ON/OFF
2: Master channel Auto/Manual transfer
3: Valid for both 1 and 2

■ Self-diagnostic

Check item: RAM check
Adjustment data check
Input value check
Watchdog timer

Operation at error occurrence in self-diagnosis:
FAIL lamp lights
All channel control outputs are turned off.
Reset state

■ Manual setting function

Auto/Manual transfer: Either Auto or Manual control can be selected.

Setting range: -5.0 to +105.0 %

Balanceless bumpless: Balanceless bumpless transfer between Auto and Manual (both directions).

■ General specifications

Dimensions: 48 (W) × 96 (H) × 100 (D) mm

Weight: 260 g

8.4.2 Cascade control module (H-CIO-A) [Current/voltage input]

■ Input

Number of inputs: 2 points (Master input/slave input)
Isolated between input and input, and between input and output.

Input type: Voltage input: 0 to 10 mV DC, 0 to 100 mV DC, 0 to 1 V DC,
0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC, -5 to +5 V DC,
-10 to +10 V DC, -1 to +1 V DC
Current input: 0 to 20 mA DC, 4 to 20 mA DC
Specify when ordering

Input range: -5 to +105 % of span
Refer to **Input range table (P. 14)**

Resolution: 1/10000

Sampling cycle: 0.1 seconds

Input impedance: Voltage input: 1 MΩ or more
Current input: 250 Ω

Analog input filter: Cut-off frequency: Approx. 11.6 Hz
Rise time: Approx. 33 ms
Response of 90 %

Digital input filter: First order lag digital filter
Time constant: Settable from 0.1 to 100.0 seconds
(Setting *0.0*: Filter off)

Action at input break: Indicates value near zero

Measured accuracy: ±0.1 % of span ±1 digit

Input scaling range: -9999 to +10000
However, scaling is possible within a span of 10000 maximum.
Decimal point position can be varied down to 1 digit.

Noise rejection ratio: Normal mode: Refer to item **Input filter**
Common mode: -120 dB or more (50/60 Hz)

■ Control action

Control method: Brilliant PID control (PI control can also be used.)
Heat/Cool control is not available.

Control cycle: 0.1 seconds

Other functions: Overshoot prevention function (RFB limiter method)
Enhanced autotuning function

■ Setting range

Set value (SV):	Same as scaling range
Proportional band:	0.1 to 1000.0 % of span
Integral time:	1 to 3600 seconds
Derivative time:	1 to 3600 seconds (PI control when set to 0 second)
Control response parameter:	Slow, Medium and Fast (3-step selection)
Proportioning cycle:	1 to 100 seconds

■ Control output

Relay contact output:	Rating:	250 V AC, 3 A (Resistive load)
	Electrical life:	300,000 times or more (Rated load)
	Contact type:	1a contact
	Cycle:	1 to 100 seconds variable
Voltage pulse output:	Rating:	0/12 V DC
	Allowable load resistance:	600 Ω or more
	Cycle:	1 to 100 seconds variable
Current output:	Output current:	0 to 20 mA DC and 4 to 20 mA DC Specify when ordering
	Resolution:	11 bits or more
	Allowable load resistance:	500 Ω or less
	Output impedance:	5 MΩ or more
	(Output minus terminals cannot be connected in common.)	
Voltage output:	Output voltage:	0 to 1 V DC, 0 to 5 V DC, 0 to 10 V DC and 1 to 5 V DC Specify when ordering
	Resolution:	11 bits or more
	Allowable load resistance:	1 kΩ or more
	Output impedance:	0.1 Ω or less
	(Output minus terminals can be connected in common only for an output of 1 to 5 V DC.)	
Triac output:	Capacity:	0.5 A (At an ambient temperature of 40 °C)
	Zero-cross method	
	Maximum load voltage:	250 V AC
Open collector output:	Load voltage:	12 to 24 V DC
	Maximum load current:	100 mA
	Leak current when OFF:	0.1 mA or less
	Maximum voltage drop at ON:	2.4 V or less (At a load current of 100 mA) 0.7 V or less (At a load current of 10 mA)

■ Temperature alarm function

Number of alarms: 2 points

Alarm types:

Deviation high alarm	Process high alarm
Deviation low alarm	Process low alarm
Deviation high/low alarm	Process high alarm (with alarm hold)
Deviation band alarm	Process low alarm (with alarm hold)
Deviation high alarm (with alarm hold)	Deviation high alarm (with alarm re-hold)
Deviation low alarm (with alarm hold)	Deviation low alarm (with alarm re-hold)
Deviation high/low alarm (with alarm hold)	Deviation high/low alarm (with alarm re-hold)

Specify when ordering (Alarm action is specified for the H-PCP module.)

Setting range:

-span to +span:	Deviation high alarm, Deviation low alarm, Deviation high alarm (with alarm hold), Deviation low alarm (with alarm hold)
0 to span:	Deviation high/low alarm, Deviation band alarm, Deviation high/low alarm (with alarm hold)
Same as input range:	Process high alarm, Process low alarm, Process high alarm (with alarm hold), Process low alarm (with alarm hold)

Specify when ordering (Alarm action is specified for the H-PCP module.)

Setting resolution: Same as input resolution

Alarm output: This module outputs alarm status to the H-PCP module as data.

■ Loop break alarm function

Setting range:

LBA setting time:	1 to 7200 seconds
LBA deadband (LBD):	Same as input range

(LBD is automatically as the value of two times of integral value after the completion of autotuning.)

Alarm output: This module outputs alarm status to the H-PCP module as data.

■ Digital input

Input type: Dry contact

Resistance value at OPEN:	500 kΩ or more
Resistance value at CLOSE:	10 Ω or less

Number of inputs: 2 points

Voltage at OPEN: 12 V DC

Contact current: Approx. 3 mA/point

Function: Mode selection

Isolation method: Photocoupler isolation

External connection: Terminals

■ Cascade function

Monitor item: Cascade monitor: ±Input range

Normal setting value: Cascade bias: -99.99 to +100.0 % of span

Cascade gain: -9.999 to +10.000 (No engineering unit)

Cascade ON/OFF: 0: OFF
1: ON
Cascade control is turned ON/OFF via communication or by digital input.

Initial setting value: Cascade data selection: 0: Output values
1: Measured values
2: Local set values
3: Set value monitoring
4: Deviation (Local set values - Measured values)

Tracking function: 0: OFF
1: ON

Digital input selection function:
0: Function OFF
1: Cascade ON/OFF
2: Master channel Auto/Manual transfer
3: Valid for both 1 and 2

■ Self-diagnostic

Check item: RAM check
Adjustment data check
Input value check
Watchdog timer

Operation at error occurrence in self-diagnosis:
FAIL lamp lights
All channel control outputs are turned off.
Reset state

■ Manual setting function

Auto/Manual transfer: Either Auto or Manual control can be selected.

Setting range: -5.0 to +105.0 %

Balanceless bumpless: Balanceless bumpless transfer between Auto and Manual (both directions).

■ General specifications

Dimensions: 48 (W) × 96 (H) × 100 (D) mm

Weight: 260 g

8.5 H-CT Module

■ Input

Input type: Current transformer input (CT)
Number of inputs: 6 points
Number of common points: 3 points
(1-2 channel/common, 3-4 channel/common, 5-6 channel/common)
Isolation method: Photocoupler isolation
Input current: 0 to 30 A: CTL-6-P-N
0 to 100 A: CTL-12-S56-10L-N
Specify when ordering (Current transformer is sold separately)
Accuracy of heater current measurement:
5 % of input value or ±2 A (The value whichever is greater)

■ Heater break alarm function

Setting range: 0.0 to 100.0 A
Corresponding channel setting: 1 to 20 channels (Same channel can be set)
Alarm output: This module outputs alarm status to the H-PCP module as data.

■ Self-diagnostic

Check item: RAM check
Watchdog timer
Operation at error occurrence in self-diagnosis:
FAIL lamp lights
Reset state

■ General specifications

Dimensions: 24 (W) × 96 (H) × 100 (D) mm
Weight: 120 g

8.6 H-DI Module

8.6.1 Digital input module (H-DI-A)

■ Input

Input type: Source type
Number of inputs: 8 points
Rated input voltage: 24 V DC
Input voltage range: 21.6 to 26.4 V DC
Rated input current: 6.7 mA/point (24 V DC)
Input impedance: 3.6 kΩ
Input operation voltage: ON voltage: 18.5 V DC
OFF voltage: 9.0 V DC
Number of common points: 4 points/common
Isolation method: Photocoupler isolation
External connection: Terminals

■ Functions

Memory area transfer: Possible to transfer eight memory area.
Control RUN/STOP transfer: Possible to transfer RUN/STOP of temperature control.
Alarm interlock release: Possible to release the alarm interlock on all channels.

■ Self-diagnostic

Check item: RAM check
Watchdog timer
Operation at error occurrence in self-diagnosis:
FAIL lamp lights
Reset state

■ General specifications

Dimensions: 24 (W) × 96 (H) × 100 (D) mm
Weight: 120 g

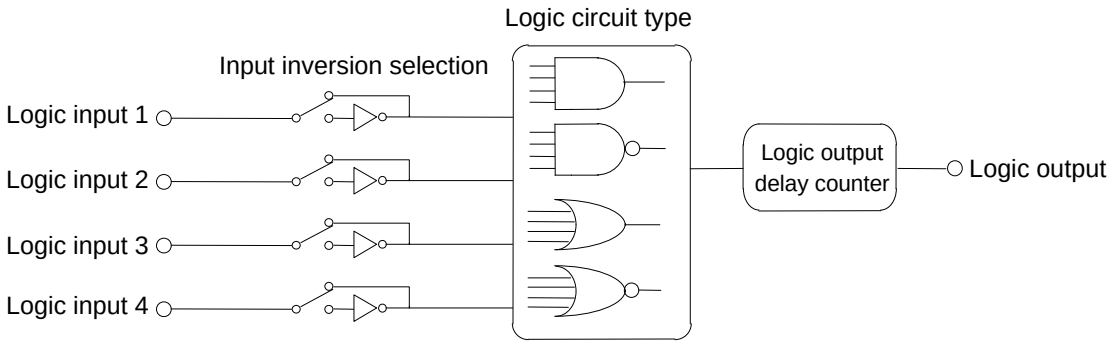
8.6.2 Event digital input module (H-DI-B)

■ Input

Input type: Source type
Number of inputs: 8 points
Rated input voltage: 24 V DC
Input voltage range: 21.6 to 26.4 V DC
Rated input current: 6.7 mA/point (24 V DC)
Input impedance: 3.6 kΩ
Input operation voltage: ON voltage: 18.5 V DC
OFF voltage: 9.0 V DC
Number of common points: 4 points/common
Isolation method: Photocoupler isolation
External connection: Terminals

■ Functions

DI monitor: 8 points/module (Maximum 80 points/10 modules)
Logic circuit software: Number of logic circuits: 8 pieces/module
Logic circuit type: 4 types (*AND*, *NAND*, *OR* and *NOR*)
Number of logic inputs: 4 × 8 points
Input inversion selection: 4 × 8 points
Number of logic outputs: 1 × 8 points
Logic output delay counts: 0 to 255 counts (0.2 seconds/cycle)



Logic input type:	Event DI input:	1 to 80 CH
	Event DI logic output:	1 to 80 CH
	Event DO output:	1 to 72 CH
	Temperature alarm 1:	1 to 18 CH
	Temperature alarm 2:	1 to 18 CH
	TIO burnout status:	1 to 18 CH
	TIO heater break status:	1 to 18 CH
	TIO loop break status:	1 to 18 CH
	AI alarm 1:	1 to 36 CH
	AI alarm 2:	1 to 36 CH
	TI alarm 1:	1 to 36 CH
	TI alarm 2:	1 to 36 CH
	TI burnout status:	1 to 36 CH
	H-PCP module error status:	Provided/Not provided
	TIO temperature rise completion status:	Completed/Not completed
	TIO's PID/AT logical add:	Normally all channels are under control/ Either of channels are under autotuning

■ Self-diagnostic

Check item:
RAM check
Watchdog timer

Operation at error occurrence in self-diagnosis:
FAIL lamp lights
Reset state

■ General specifications

Dimensions: 24 (W) × 96 (H) × 100 (D) mm
Weight: 120 g

8.7 H-DO Module

8.7.1 Digital output module (H-DO-A, B)

■ Output

Output type: H-DO-A: Relay contact output or open collector output (Sink load)
H-DO-B: Relay contact output

Number of outputs: H-DO-A: 8 points
H-DO-B: 4 points

Number of common points: Relay contact output:
2 points (4 points/common): H-DO-A type
All channel independent common output: H-DO-B type
Open collector output:
1 point (8 points/common)

Isolation method: Photocoupler isolation

Relay contact output: Rating: 250 V AC, 24 V DC
Maximum load current:
1 A/point (Resistive load)
4 A/common (Resistive load) [Only for H-DO-A type]
Minimum switching voltage/current:
5 V DC, 10 mA
Contact type: 1a contact

Open collector output: Load voltage: 12 to 24 V DC
Maximum load current:
0.1 A/point
0.8 A/common
Only for H-DO-A type

■ Functions

Temperature alarm output: Select alarm (alarm 1 or alarm 2) is output to each channels.

AI alarm output: Select AI alarm (alarm 1 or alarm 2) is output to each channels.

Heater break alarm output: A heater break alarm is output for each channel when the heater is broken.

Burnout alarm output: A burnout alarm is output for each channel when the input sensor is broken.

Loop break alarm output: A loop break alarm is output for each channel when an error occurs in the control system.

■ Self-diagnostic

Check item: RAM check
Watchdog timer

Operation at error occurrence in self-diagnosis:
FAIL lamp lights
Reset state

■ General specifications

Dimensions: 24 (W) × 96 (H) × 100 (D) mm
Weight: H-DO-A: 140 g
H-DO-B: 130 g

8.7.2 Digital output module (H-DO-D)

■ Output

Output type:	Open collector output	
Number of outputs:	16 points	
Number of common points:	Vcc:	2 points (8 points/common)
	GND:	2 points (8 points/common)
Isolation method:	Photocoupler isolation	
Open collector output:	Load voltage:	12 to 24 V DC
	Maximum load current:	0.05 A/point
		0.4 A/common
Setting method:	Set by H-PCP module via serial communication.	
	The alarm type is set for each block consisting of eight channels.	
Alarm output type:	Temperature alarm 1	
	Temperature alarm 2	
	Burnout alarm	
	Heater break alarm	
	Loop break alarm	
	AI alarm 1	
	AI alarm 2	
	Unused	

■ Self-diagnostic

Check item: RAM check
Watchdog timer

Operation at error occurrence in self-diagnosis:
FAIL lamp lights
Reset state

■ General specifications

Dimensions: 24 (W) × 96 (H) × 100 (D) mm
Weight: 140 g

8.7.3 Event digital output module (H-DO-C)

■ Output

Output type: Open collector output
Number of outputs: 8 points
Number of common points: 1 point (8 points/common)
Isolation method: Photocoupler isolation
Open collector output: Load voltage: 12 to 24 V DC
Maximum load current: 0.1 A/point
0.8 A/common
Setting method: Set by H-PCP module via serial communication.
Alarm output types:

Temperature alarm 1 status	Status output
Temperature alarm 2 status	
Temperature burnout alarm status	
Heater break alarm status	
AI alarm 1 status	
AI alarm 2 status	
Loop break alarm status	
PID/AT status	
TI alarm 1 status	
TI alarm 2 status	
TI burnout alarm status	
Event DI logic output status	
Temperature deviation alarm	Alarm output
Temperature process alarm	
Temperature set value alarm	
AI process alarm	
TI process alarm	
Temperature process value comparison	Comparison output
Temperature set value comparison	
AI process value comparison	
TI process value comparison	

■ Output function

Status output functions: Output on/off data such as temperature alarm 1 status, etc. owned by the H-PCP module.
Channel numbers of H-TIO modules, etc. can be selected.

Alarm output functions:

Temperature deviation alarm:
- Deviation high alarm
- Deviation low alarm
- Deviation high/low alarm
- Deviation band alarm
- Deviation high alarm (with alarm hold)
- Deviation low alarm (with alarm hold)
- Deviation high/low alarm (with alarm hold)
- Deviation high alarm (with alarm re-hold)
- Deviation low alarm (with alarm re-hold)
- Deviation high/low alarm (with alarm re-hold)

Temperature process alarm:
- Process high alarm
- Process low alarm
- Process high alarm (with alarm hold)
- Process low alarm (with alarm hold)

Temperature set value alarm:
- High alarm
- Low alarm

AI process alarm:
- Process high alarm
- Process low alarm
- Process high alarm (with alarm hold)
- Process low alarm (with alarm hold)

TI process alarm:
- Process high alarm
- Process low alarm
- Process high alarm (with alarm hold)
- Process low alarm (with alarm hold)

- Unit common setting for both Alarm delay timer and Alarm differential gap.
- Channel numbers of H-TIO modules, etc. can be selected.
- With interlock function

Comparison output functions:

Temperature process value comparison:
- Comparison between PV and PV of H-TIO module

Temperature set value comparison:
- Comparison between SV and SV of H-TIO module

AI process value comparison:
- Comparison between PV and PV of H-AI module

TI process value comparison:
- Comparison between PV and PV of H-TI module

- Unit common setting for both Alarm delay timer and Alarm differential gap.
- Channel numbers of H-TIO modules, etc. can be selected.
- With interlock function

■ Self-diagnostic

Check item: RAM check
Watchdog timer

Operation at error occurrence in self-diagnosis:
FAIL lamp lights
Reset state

■ General specifications

Dimensions: 24 (W) × 96 (H) × 100 (D) mm
Weight: 140 g

8.8 H-AI Module

■ Input

Number of inputs: H-AI-A: 4 points
(Isolated between input and CPU. Not isolated between each channel.)
H-AI-B: 2 points
(Isolated between each channel and between input and CPU.)

Input type: Voltage input: 0 to 10 mV DC, 0 to 100 mV DC, 0 to 1 V DC,
0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC, -5 to +5 V DC,
-10 to +10 V DC, -1 to +1 V DC
Current input: 0 to 20 mA DC, 4 to 20 mA DC
Specify when ordering

Input range: -5 to +105 % of span

Resolution: 1/10000

Sampling cycle: H-AI-A: 0.2 seconds
H-AI-B: 0.1 seconds

Input impedance: Voltage input: 1 MΩ or more
Current input: 250 Ω

Analog input filter: Cut-off frequency: Approx. 11.6 Hz
Rise time: Approx. 33 ms
Response of 90 %

Digital input filter: First order lag digital filter
Time constant: Settable from 0.1 to 100.0 seconds
(Setting 0.0: Filter off)
Moving average:
Moving average of four times (Used/unused can be selected)
Can be simultaneously used.

Action at input break: Indicates value near zero

Measured accuracy: ±0.1 % of span ±1 digit

Input scaling range: -9999 to +10000
However, scaling is possible within a span of 10000 maximum.
Decimal point position can be varied down to 3 digit.

Noise rejection ratio: Normal mode: Refer to item **Input filter**
Common mode: -120 dB or more (50/60 Hz)

Calibration function: Zero-point calibration function: Within -5 to +5 % of span
Full scale calibration function: Within -95 to +105 % of span

■ Alarm function

Number of alarms: 2 points

Alarm types: Process high alarm
Process low alarm
Process high alarm (with alarm hold)
Process low alarm (with alarm hold)
The alarm type can be selected for each alarm.
(Alarm action is specified for the H-PCP module)

Setting range: Same as input range: Process high alarm, Process low alarm, Process high alarm (with alarm hold), Process low alarm (with alarm hold)
The alarm type can be selected for each alarm.

Setting resolution: Same as input resolution

Alarm output: This module outputs alarm status to the H-PCP module as data.

■ Self-diagnostic

Check item: RAM check
Adjustment data check
Input value check
Watchdog timer

Operation at error occurrence in self-diagnosis:
FAIL lamp lights
Reset state

■ General specifications

Dimensions: 24 (W) × 96 (H) × 100 (D) mm

Weight: H-AI-A: 120 g
H-AI-B: 140 g

8.9 H-AO Module

■ Output

Number of inputs: H-AO-A: 4 points
(Isolated between output and CPU. Not isolated between each channel.)
H-AO-B: 2 points
(Isolated between each channel and between output and CPU.)

Output type: Voltage output: 0 to 10 mV DC, 0 to 100 mV DC, 0 to 1 V DC, 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC
Current output: 0 to 20 mA DC, 4 to 20 mA DC
Specify when ordering

Resolution: 12 bits or more

Output impedance: Voltage output: Approx. 10 Ω (0 to 10 mV DC, 0 to 100 mV DC)
0.1 Ω or less (0 to 1 V DC, 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC)
Current output: 5 MΩ or more

Allowable load resistance: Voltage output: 20 kΩ or more (0 to 10 mV DC, 0 to 100 mV DC)
1 kΩ or more (0 to 1 V DC, 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC)
Current output: 500 Ω or less

Setting method: Set via serial communication from the H-PCP module, or set from the dedicated operation panel.

Selection of AO function: Manual mode
Recorder mode: Temperature measured value (PV)
Temperature set value (SV)
Temperature deviation value
Heat-side manipulated output value
Cool-side manipulated output value
H-AI module input value
H-TI module input value
H-TIO-K module feedback resistance input

Calibration function: Correction of zero and full scale points

■ Recorder mode

Type/channel selection: Type to be freely output and channel can be selected by AO function/ channel selection.

Output zooming function: Measured value data to be output is expanded and then output to AO.

Output change cycle: 200 ms

■ Manual mode

Scaling: -10000 to +10000
However, scaling is possible within a span of 10000.
Output change rate limiter: 0.1 to 100.0 %/second
(0.0 second: The rate of output change limit is turned off.)
Rise/fall common setting

■ Self-diagnostic

Check item: RAM check
Adjustment data check
Watchdog timer
Operation at error occurrence in self-diagnosis:
FAIL lamp lights
All channel control outputs are turned off.
Reset state

■ General specifications

Dimensions: 24 (W) × 96 (H) × 100 (D) mm
Weight: 120 g

8.10 Common Specifications

■ Control unit

Power supply voltage: 90 to 132 V AC (50/60 Hz)
[Including power supply voltage variation]
(Rating: 100 to 120 V AC)
180 to 264 V AC (50/60 Hz)
[Including power supply voltage variation]
(Rating: 200 to 240 V AC)
21.6 to 26.4 V DC
[Including power supply voltage variation]
(Rating: 24 V DC)

Insulation resistance: Between power and ground terminals:
20 MΩ or more at 500 V DC
Between input/output and ground terminals:
20 MΩ or more at 500 V DC

Withstand voltage: Between power and ground terminals:
1500 V AC for 1 minute
Between input/output and ground terminals:
1000 V AC for 1 minute

Withstand noise: 1500 V (peak to peak)
Pulse width: 1 μs
Rise time: 1 ns
By noise simulator

Withstand vibration: Frequency: 5 to 9 Hz
Amplitude: 1.5 mm
Frequency: 9 to 150 Hz
Acceleration: 5.0 m/s
Sweep speed: 10 Hz/min
Vibration director: Front and back, Right and left, Up and down
(Three directions)
Vibration time: 1 hour, all directions

Power failure effect: No influence even under power failure of 20 ms or less.

Ambient temperature range: 0 to 50 °C

Ambient humidity range: 45 to 85 %RH
(Absolute humidity: MAX.W.C 29.3 g/m^3 dry air at 101.3 kPa)

Operating environment: No corrosive gases, no large amounts of dust or particulates.

Storage temperature range: -20 to +70 °C

Storage humidity range: 95 %RH or less (Non condensing)

Grounding resistance: 100 Ω or less

Cooling method: Natural cooling

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