High-performance Multi-point Control System

SR Mini HG SYSTEM

Hardware Instruction Manual

RKC INSTRUMENT INC.

IMSRM15-E4

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

- An external protection device must be installed if failure of this instrument could result in damage to the instrument, equipment or injury to personnel.
- 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 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 adequate 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.
- 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 or failure, protect the power line and the input/output lines from high currents with a protection device 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.

NOTICE

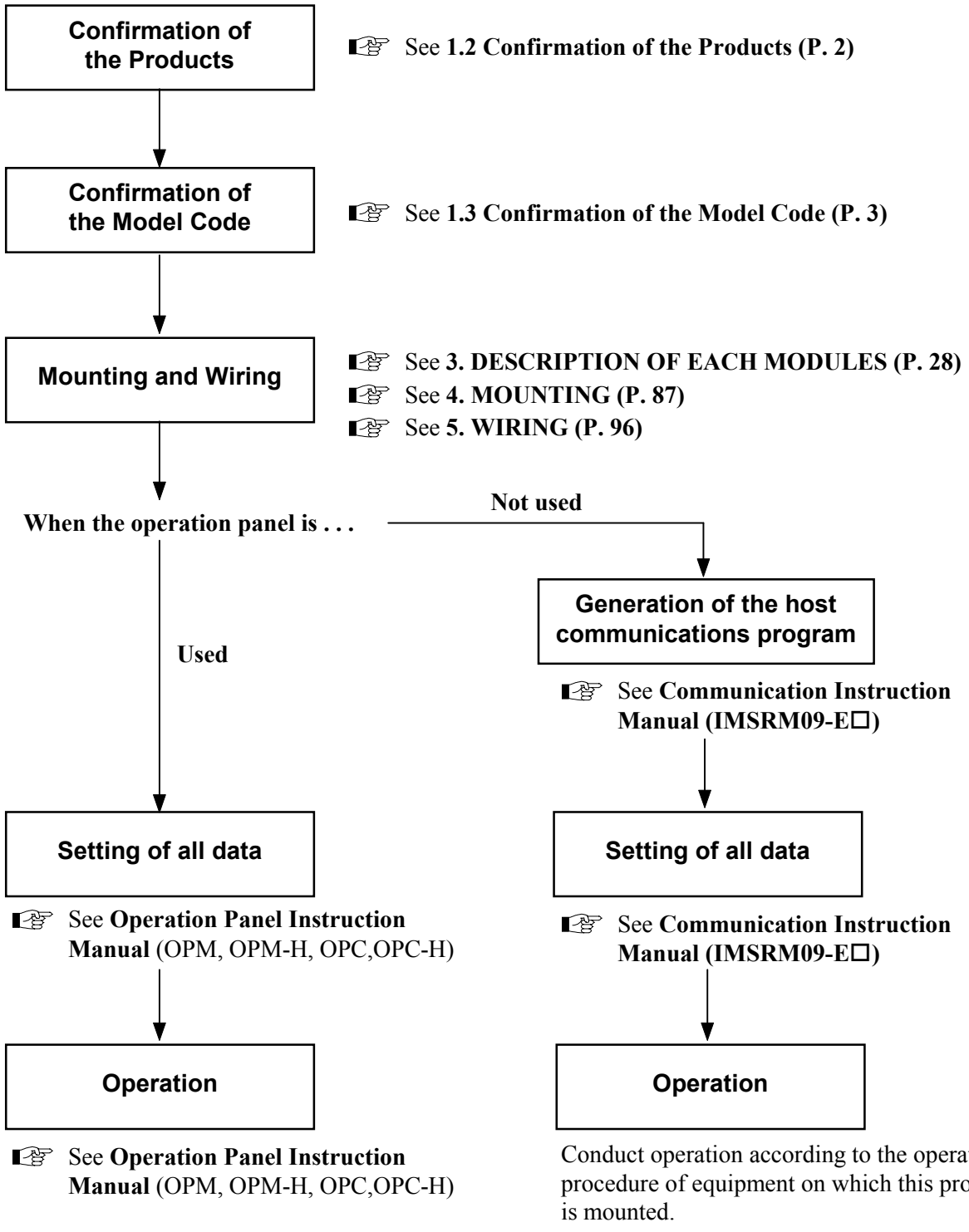
- This manual assumes that the reader has a fundamental knowledge of the principles of electricity, process control, computer technology and communications.
- The figures, diagrams and numeric values used in this manual are only for purpose of illustration.
- RKC is not responsible for any damage or injury that is caused as a result of using this instrument, instrument failure or indirect damage.
- 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.
- No portion of this document may be reprinted, modified, copied, transmitted, digitized, stored, processed or retrieved through any mechanical, electronic, optical or other means without prior written approval from RKC.

CONTENTS

1. OUTLINE

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.

☐ SR Mini HG SYSTEM control unit: Required number of sets

☐ Hardware Instruction Manual (IMSRM15-E☐): 1 copy

☐ Communication Instruction Manual (IMSRM09-E☐)*: 1 copy

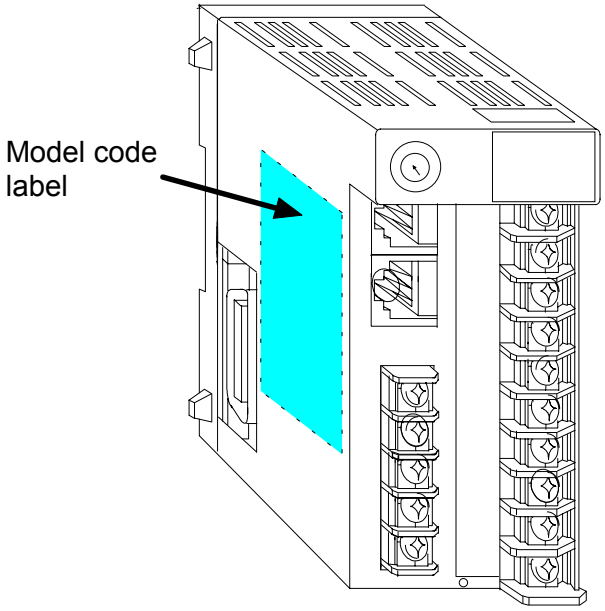
☐ DIN rail holding clips: 2 clips/unit

* See this instruction manual when the control unit is directly connected to the host computer (Personal computer). This instruction manual may not be attached depending on the system configuration of the purchased products.

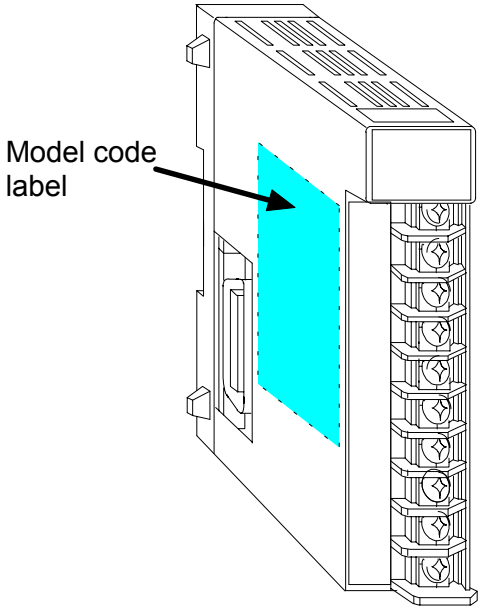
Modules for the SR Mini HG SYSTEM cannot be mixed with those for the SR Mini SYSTEM.

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.



PCP module



Single type function module

PCP module

MODEL	H-PCP-A-14N-M∗AB SR Mini HG SYSTEM
NO.	95C01010 /CE
SUPPLY	100 TO 120 V AC, 50/60 Hz 20 VA MAX

SYSTEM NO.	UNIT NO.
F0000203	01

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Serial number column

Single type function module
Double type function module

MODEL	H-TIO-B-FK02-M∗NN SR Mini HG SYSTEM
NO.	95C01011 /CE
SUPPLY	

INPUT	OUTPUT
0 TO 400 °C K	RELAY (250 V AC 3 A)

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Model code label

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

■ 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
□: See **Alarm Code Table**

(7) Second alarm function
N: No alarm function
□: See **Alarm Code Table**

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 PCP module with the ladder communication, special specification code *Z-190* must be specified at the end of the model code.

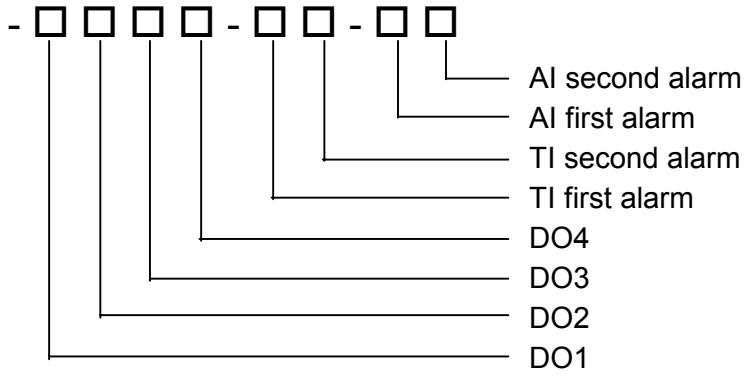
For the PCP module with the ladder communication, any of the DI-B, DO-C, TIO-K and CIO modules cannot be used.

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

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, see the following **Initial Code Table**.

Initial Code Table

DO function can be allocated by the customer on the operation panel. The customer who do not have the operation panel needs to add this settings to the customer's host communication program.



DO allocation code
- N: Unused
- 1: Temperature first alarm
- 2: Temperature second alarm
- 3: Heater break alarm
- 4: Burnout alarm
- 5: Temperature rise completion
- 6: AI first alarm
- 7: AI second alarm
- 8: Loop break alarm

(TI alarm output is common with temperature alarm output)

TI, AI alarm code
- N: Unused
- H: Process High
- J: Process Low
- K: Process High (with alarm hold)
- L: Process Low (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."

■ 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

□: See **Input Range Table (P. 14)**

(4) Range

□: See **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
(See **Output Code Table**)
□: Voltage output
(See **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
(See **Output Code Table**)
□: Voltage output
(See **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
1: CT input: CTL-6-P-N
2: 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 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

□: See **Input Range Table (P. 14)**

(4) Range

□: See **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 (See **Output Code Table**)
□: Voltage output (See **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 (See **Output Code Table**)
□: Voltage output (See **Output Code Table**)

(7) Alarm output

N: No function

(8) Current transformer input [5]

N: No function
1: CT input: CTL-6-P-N
2: 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 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.

■ 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

□: See **Input Range Table (P. 14)**

(4) Range

□: See **Input Range Table (P. 14)**

(5) Control output (Open-side)

M: Relay contact output

(6) Control output (Close-side)

M: Relay contact output

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

■ 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

□: See **Input Range Table (P. 14)**

(3) Range

□: See **Input Range Table (P. 14)**

■ 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

A: ON/OFF control (Reverse action)
C: ON/OFF control (Direct action)
F: PID control with autotuning function (Reverse action)
D: PID control with autotuning function (Direct action)

(3) Input type

□: See **Input Range Table (P. 14)**

(4) Range

□: See **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
(See **Output Code Table**)
□: Voltage output
(See **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
(See **Output Code Table**)
□: Voltage output
(See **Output Code Table**)

∗ Only possible to select for control action type F and D.

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 CIO module cannot be used to the PCP 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

□: See **Input Range Table (P. 14)** *

(4) Range

□: See **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
(See **Output Code Table**)
□: Voltage output
(See **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
(See **Output Code Table**)
□: Voltage output
(See **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 CIO module cannot be used to the PCP module with the specification of ladder communication.

■ Input Range Table

Thermocouple input

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	67
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 °F [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 TIO-E/G/F/R, TI-B or CIO-A module (high accuracy type).
[2] The range can be specified only by TIO-A/B/C/D [Z-1013 specification] or TI-C module.
[3] Accuracy is not guaranteed between 0 to 399 °C (0 to 799 °F) for type B thermocouple input.

RTD input

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 *	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	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 *	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	D	B8

* The range with the resolution of 1/100 can be specified only by TIO-E module.

Voltage input and Current input

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.

■ 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)

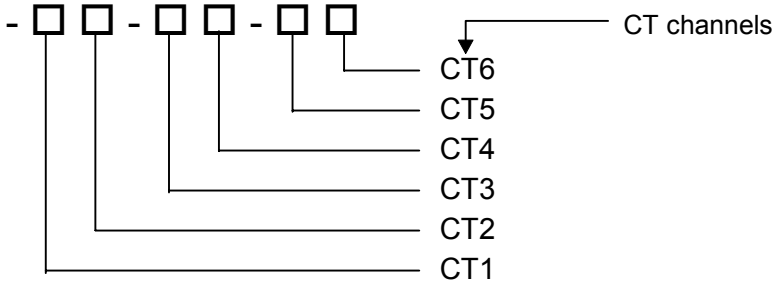
(2) CT type

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 Table

Each temperature control channel corresponding to each CT module can be allocated by the customer through operation panel. But those who do not have operation panel are necessary to add this settings to the customer's host communication program.



Note on allocation

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

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

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

■ 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)

📖 If the DI-A module without the memory area selection input terminal is requested, the special specification code of "Z-186" is added to the end of PCP module model code.

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

■ DO module (Digital output module) model code

H-DO- □ - □
(1) (2)

(1) Type

A: 8 points output type
B: 4 points output type (Open collector output can not be selected.)
C: 8 points event output type *
D: 16 points output type *
* For the C and D types, the 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 DO-C module cannot be used to the PCP module with the specification of ladder communication.

Initial Code Table

DO function can be allocated by the customer through operation panel. But those who do not have operation panel are necessary to add this settings to the customer's host communication program.

DO-A, DO-D

- □ □
  - Block 2 (DO-A: Lower 4 points of terminal) (DO-D: Lower 8 points of terminal)
  - Block 1 (DO-A: Upper 4 points of terminal) (DO-D: Upper 8 points of terminal)

DO-B

- □ N
  - Block 1 (All points of terminal)

DO module function allocation code list

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

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

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

■ 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

□: See **Analog Input Code Table**

(3) AI 2 input type

□: See **Analog Input Code Table**

(4) AI 3 input type *

□: See **Analog Input Code Table**

(5) AI 4 input type *

□: See **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

■ 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

□: See **Analog Output Code Table**

(3) AO 2 output type

□: See **Analog Output Code Table**

(4) AO 3 output type *

□: See **Analog Output Code Table**

(5) AO 4 output type *

□: See **Analog Output Code Table**

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

Analog Output Code Table

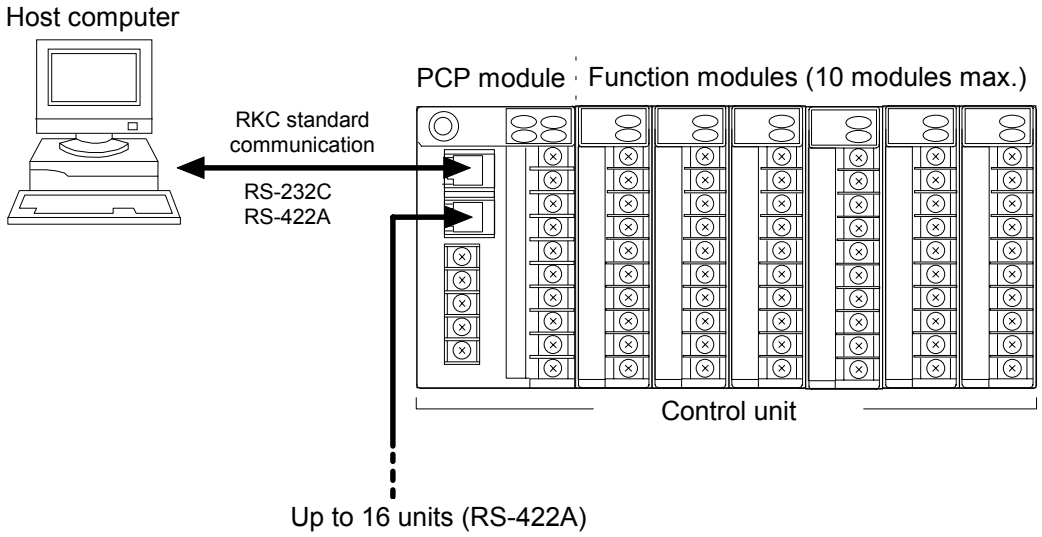
3: 0 to 1 V DC	4: 0 to 5 V DC	5: 0 to 10 V DC	6: 1 to 5 V DC
7: 0 to 20 mA DC	8: 4 to 20 mA DC	9: Others	

2. SYSTEM CONFIGURATION

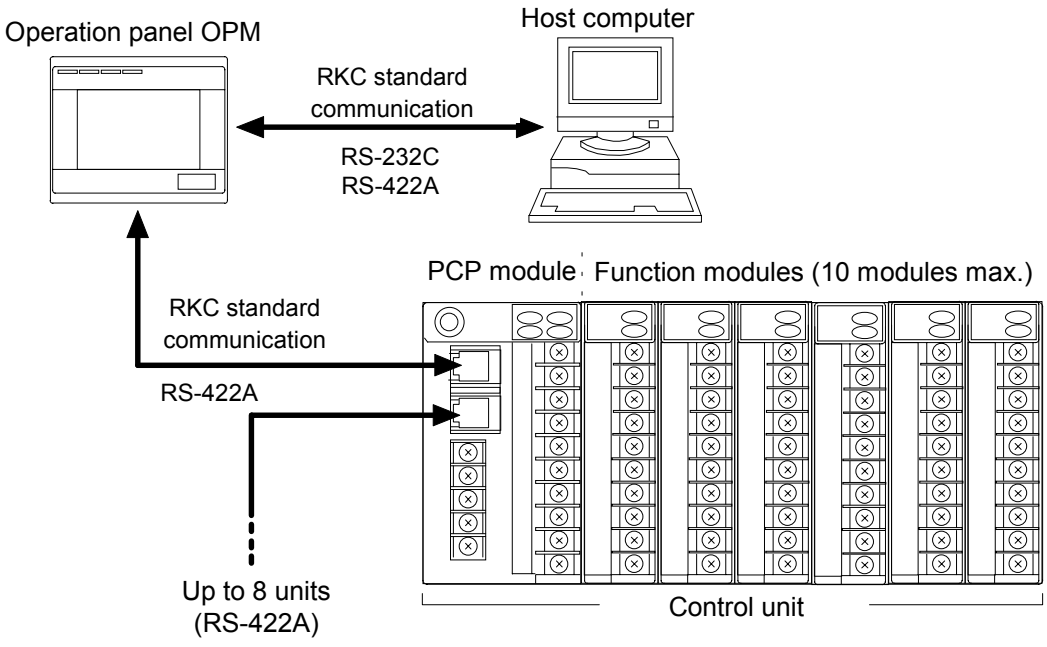
2.1 Basic Configuration

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

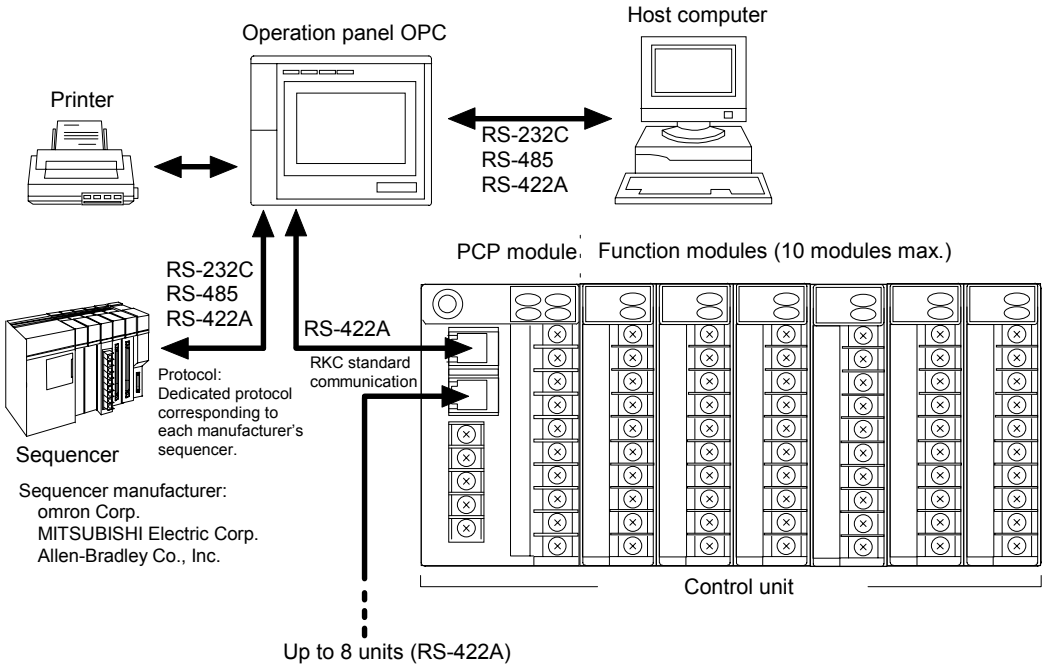
- **Example 1 (Connection with host computer)**



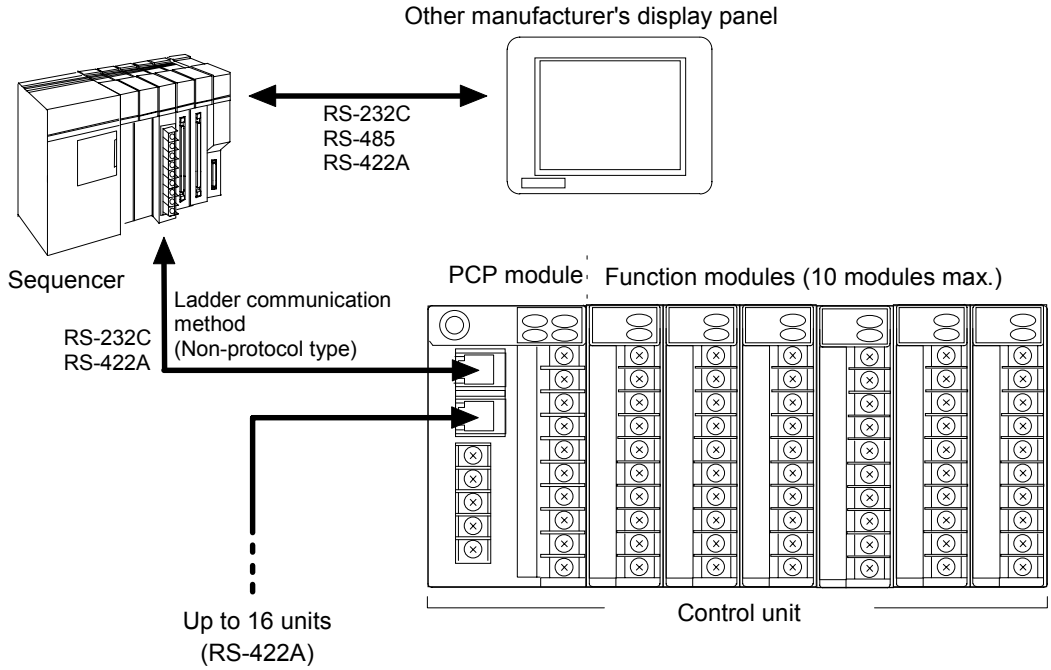
- **Example 2 (Connection with RKC operation panel OPM)**



- **Example 3 (Connection with RKC operation panel OPC)**



- **Example 4 (Connection with sequencer via ladder communication and with other manufacturer's display panel)**



2.2 Precautions for System Configuration

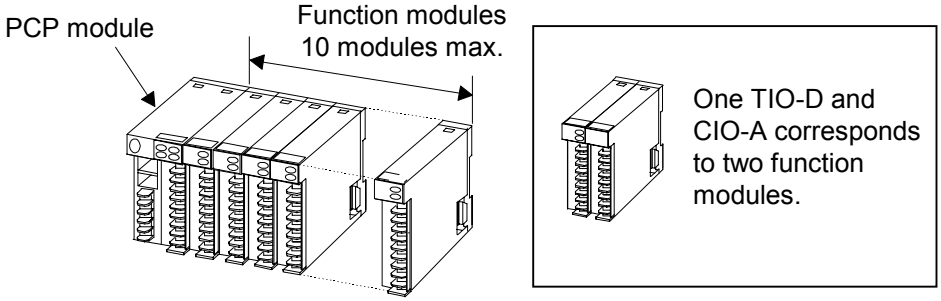
When configuring or extending the system, observe the following precautions.

When any function module is extended or removed, as it is necessary to store the new function module configuration in the PCP module, always initialize the module.

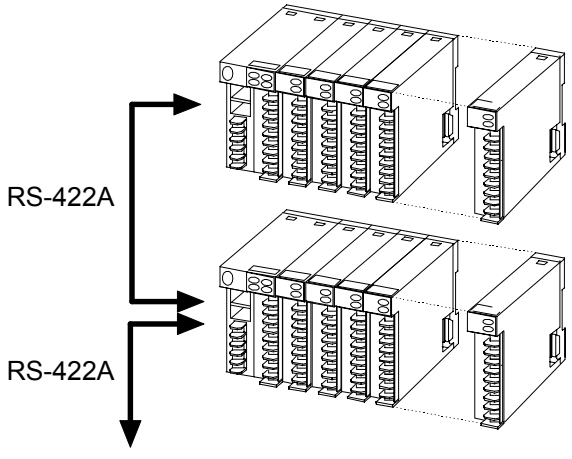
☞ For details on how to initialize the module, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

(1) When connecting modules

- The maximum number of function modules which can be connected to one control unit is 10, excluding the PCP module. However, in this case, one TIO-D module corresponds to two function modules. The number of function modules that can be connected is restricted depending on the module type. (☞ See P. 24)

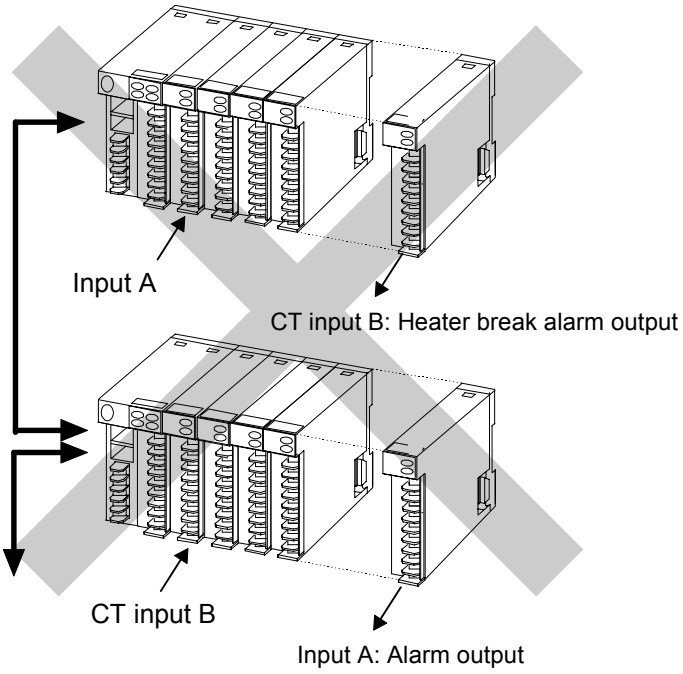


- If two or more control units are multi-drop connected, the communication specification of all PCP modules must be RS-422A. In addition, the maximum number of control units that can be connected is 16. (When connected to RKC operation panel: Up to 8 units)



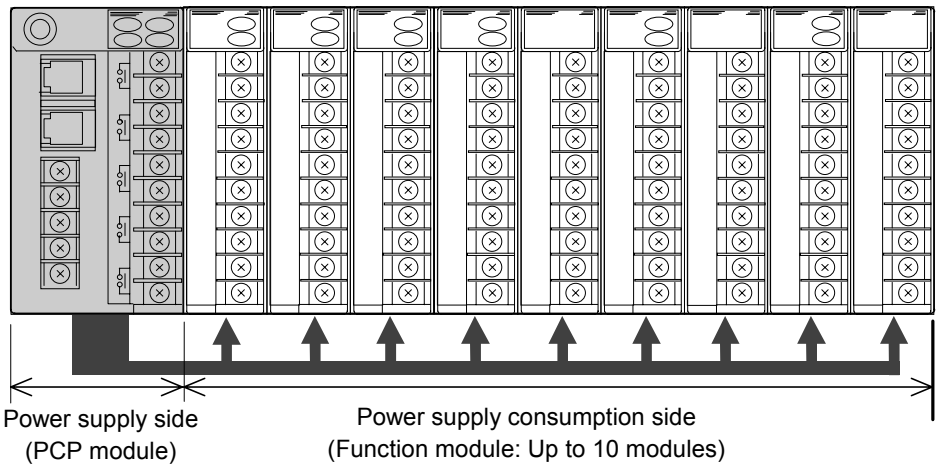
Up to 16 control units
(Up to eight units when the operation panel is connected.)

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



- Up to 10 function modules can be mounted. 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.

  If any function module is added to the existing modules, note that the total current consumed by all of the function modules at a power supply voltage of 5 V or 12 V does not exceed the maximum power supply capacity of the PCP module (for a power supply voltage of 5 V: 1700 mA in total, or for a power supply voltage of 12 V: 1000 mA in total) by referring to **Consuming current of each function module** on the next page.



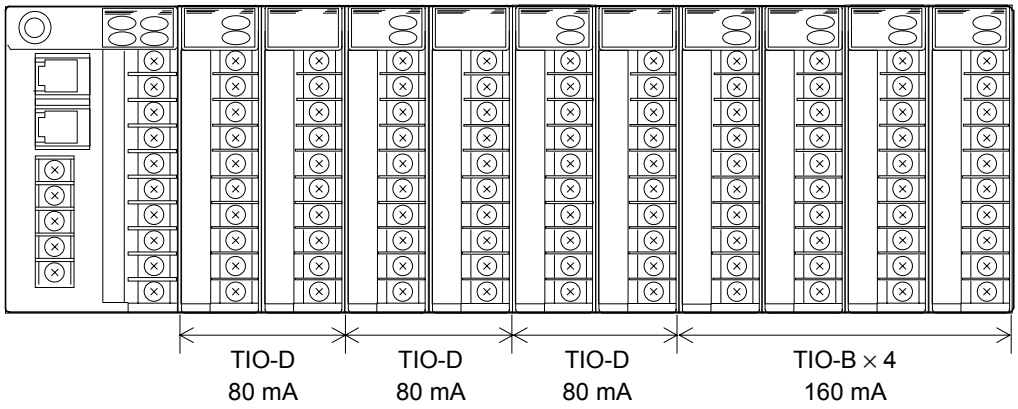
Consuming current of each function module

Function module	Power supply voltage of 5 V	Power supply voltage of 12 V
DO relay contact output module	45 mA	140 mA
DO open collector output module	45 mA	0 mA
DO-D module	70 mA	0 mA
AO-A module	40 mA	80 mA
AO-B module	40 mA	130 mA
TIO-D module	150 mA	80 mA
TIO-A, B, C, E, F, G, H, J, K, P and R module	150 mA	40 mA
CIO-A module	290 mA	40 mA
DI module	30 mA	0 mA
CT module	110 mA	0 mA
TI-A module	150 mA	0 mA
TI-B module	260 mA	0 mA
TI-C module	270 mA	0 mA
AI-A module	140 mA	0 mA
AI-B module	260 mA	0 mA

[Example]

Example in which the maximum number of function modules (mainly TIO modules) is mounted at a power supply voltage of 12V.

- **When TIO-D modules are mounted together with other function modules**



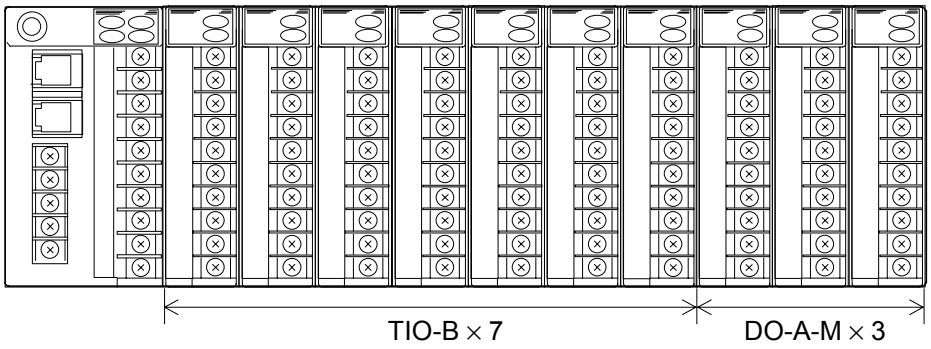
As the TIO-D module consumes an output current of 80 mA/slot and the TIO-B module, an output current of 40 mA, the following current is obtained.

For TIO-D (3 modules): $80 \times 3 =$ **240 mA**,

For TIO-B (4 modules): $40 \times 4 =$ **160 mA**

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

● **When DO modules are mounted together with other function modules**



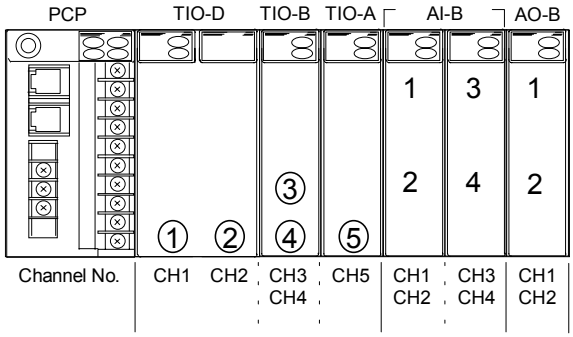
As an example in which the DO modules need to be added for outputting the alarm independently for each channel, when (DO modules: 3 modules) are added to (TIO-B modules: 7 modules) :
Each consuming output current becomes as follows.
For TIO modules (7 modules): 40 mA × 7 = **280 mA**,
For DO modules (3 modules): 140 mA × 3 = **420 mA**

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

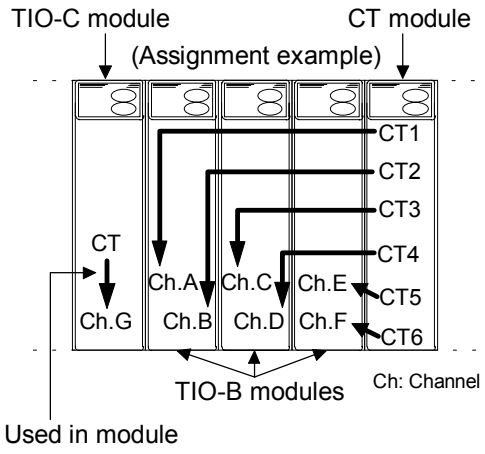
As the total current described above does not exceed the maximum power supply capacity (1000 mA), **up to 10 function modules** can be mounted.

(2) Assignment of channels and functions

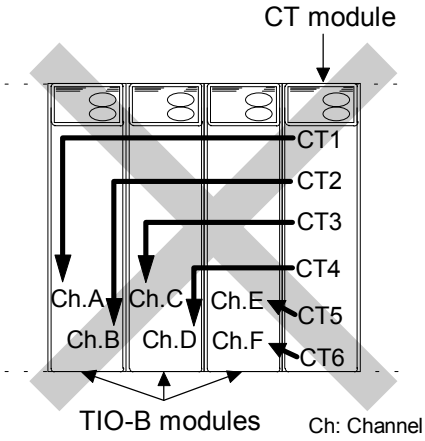
- Module channel numbers are automatically assigned from the left in order for each type of module.



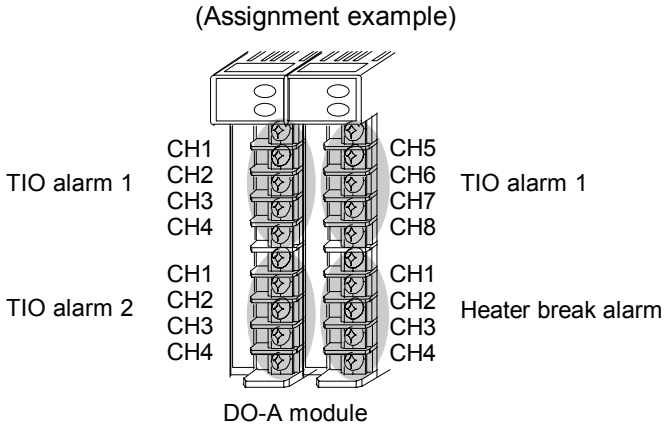
- For the TIO module with CT input (option), the CT input is processed within the TIO module. Therefore, it cannot be assigned to other channels.



- CT input cannot be assigned to the TIO module with voltage/current control output. (Because for voltage or current control output, the heater break alarm function cannot be used.)

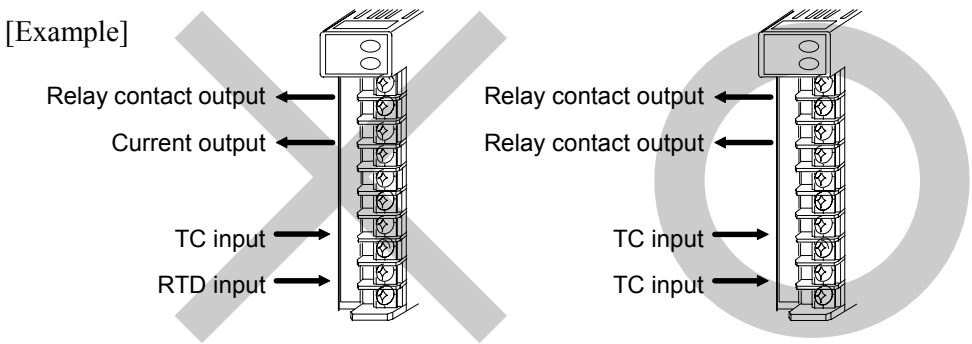


- For the DO-A and DO-B modules, duplicated alarms cannot be output. For the DO-A and DO-B modules, the functions assigned to each block consisting of four DO module output points. Channel numbers of the corresponding TIO module are automatically set in order from the top for each block of the functions 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 DO-C module.



(3) Others

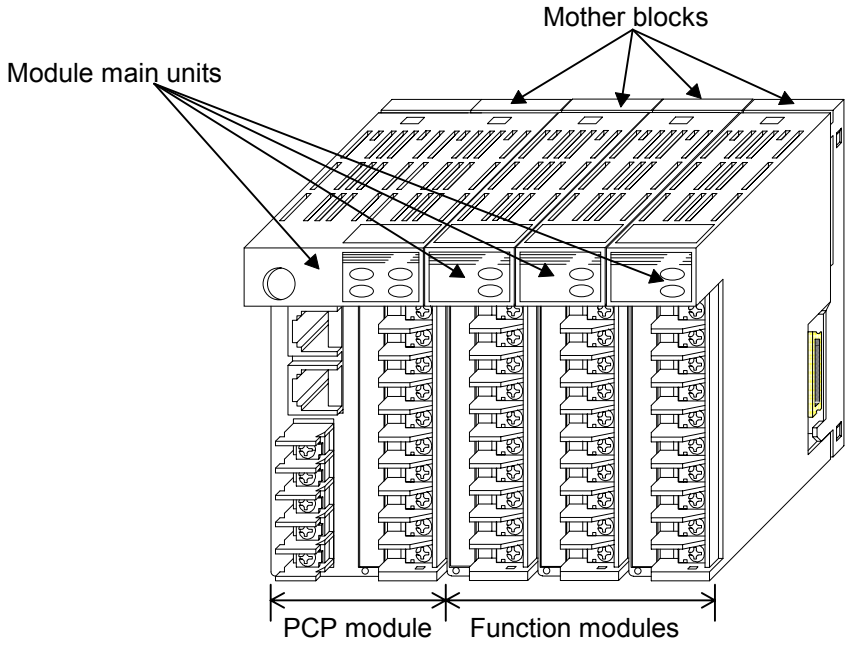
- The input and output specification of the two channels TIO module are the same for both channels.



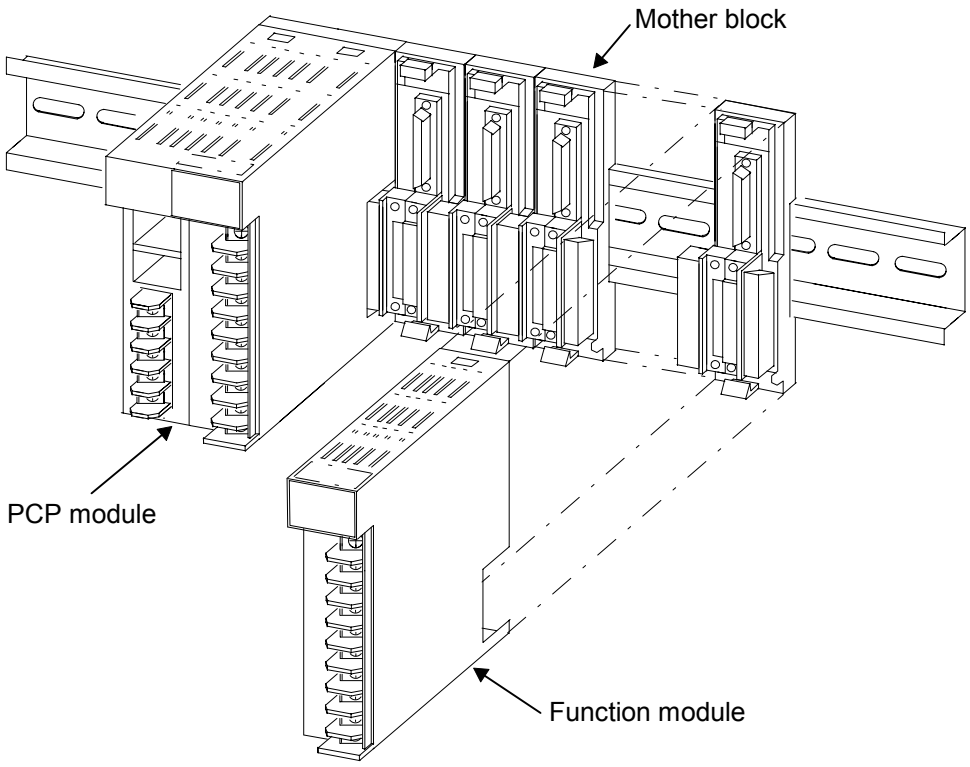
3. DESCRIPTION OF EACH MODULES

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 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

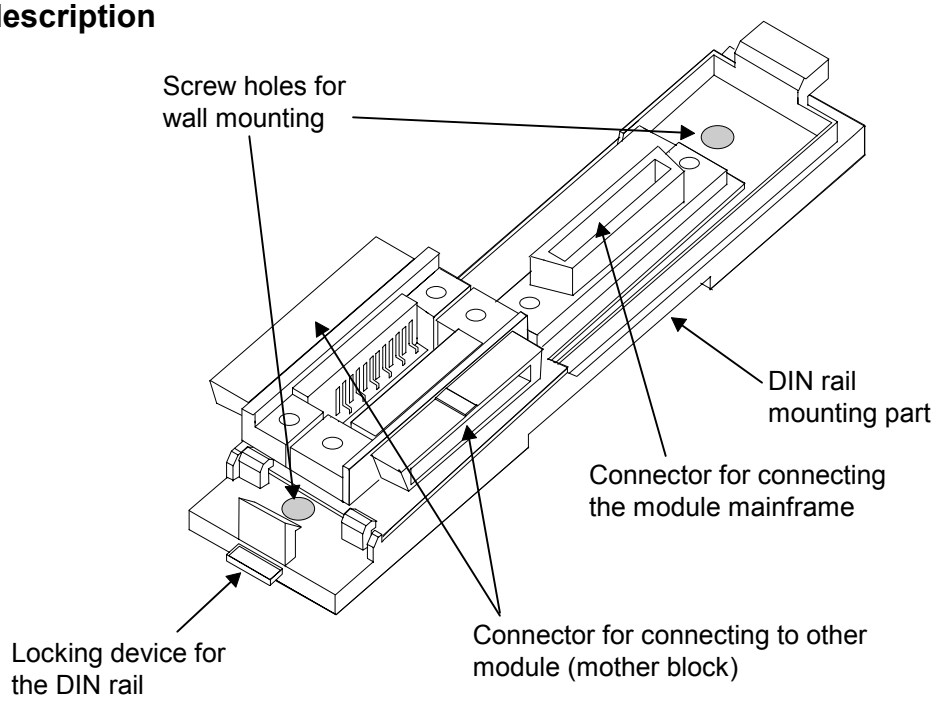
■ Outline

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 (PCP modules).

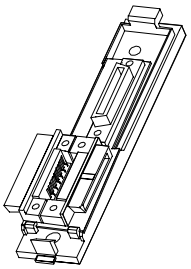
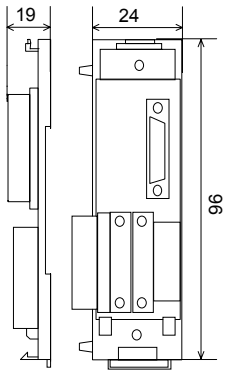
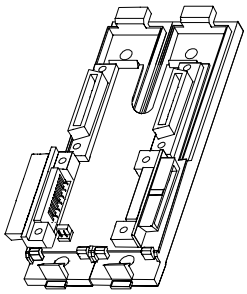
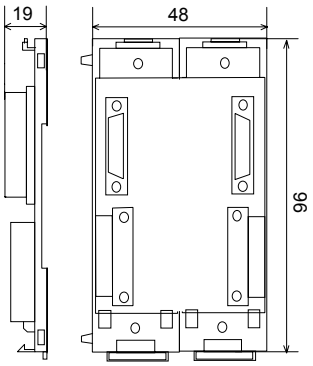
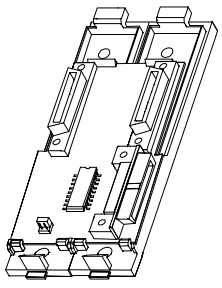
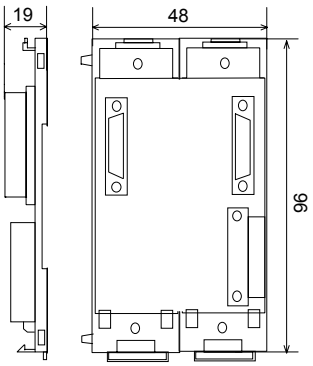
As the control unit can be detached from the mother block in a one-touch operation, modules can be easily changed in increasing the number of modules or in replacing equipment at maintenance etc.

■ Parts description



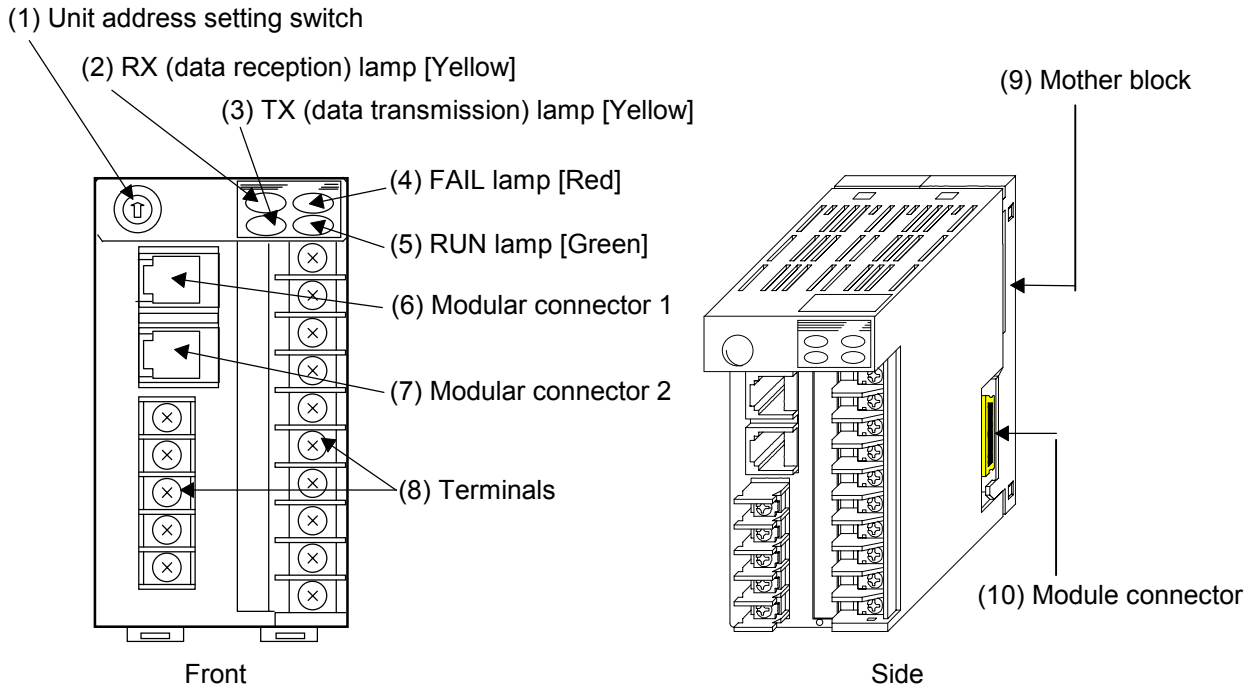
Mother block of single type module

■ 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
PCP module exclusive type			Mother block dedicated to PCP module connection

3.2.2 Parts description

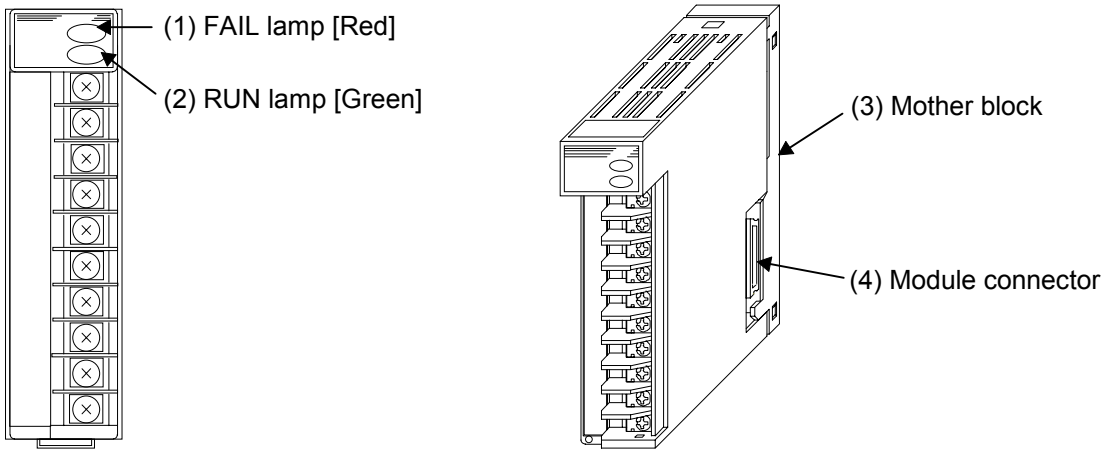
■ PCP module



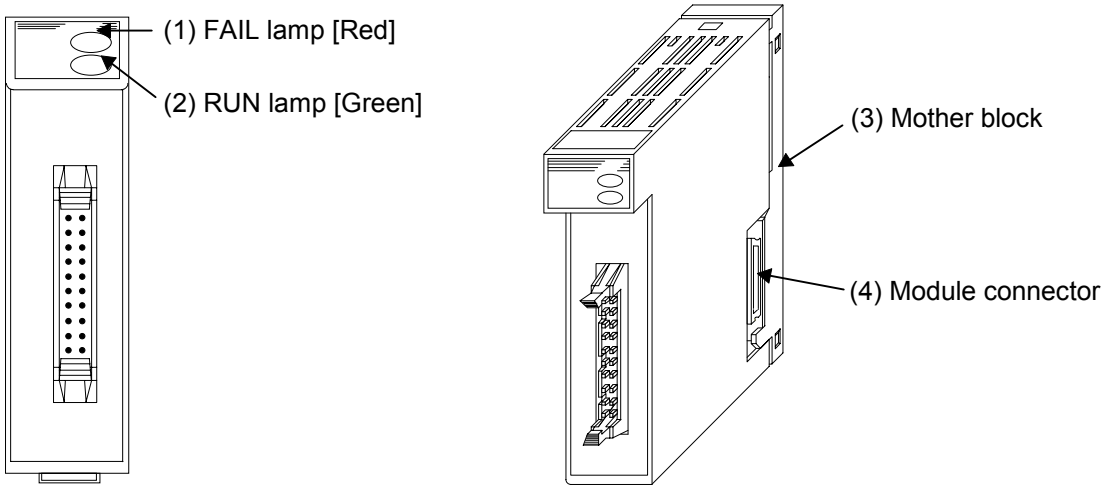
No.	Name	Description
(1)	Unit address setting switch	Set control unit slave address number Setting range: 0 to 15 (0 to F, hexadecimal)
(2)	RX (data reception) lamp [Yellow]	ON when data is correctly received
(3)	TX (data transmission) lamp [Yellow]	ON when data is correctly sent
(4)	FAIL lamp [Red]	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 RS-422A connection with other control unit
(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

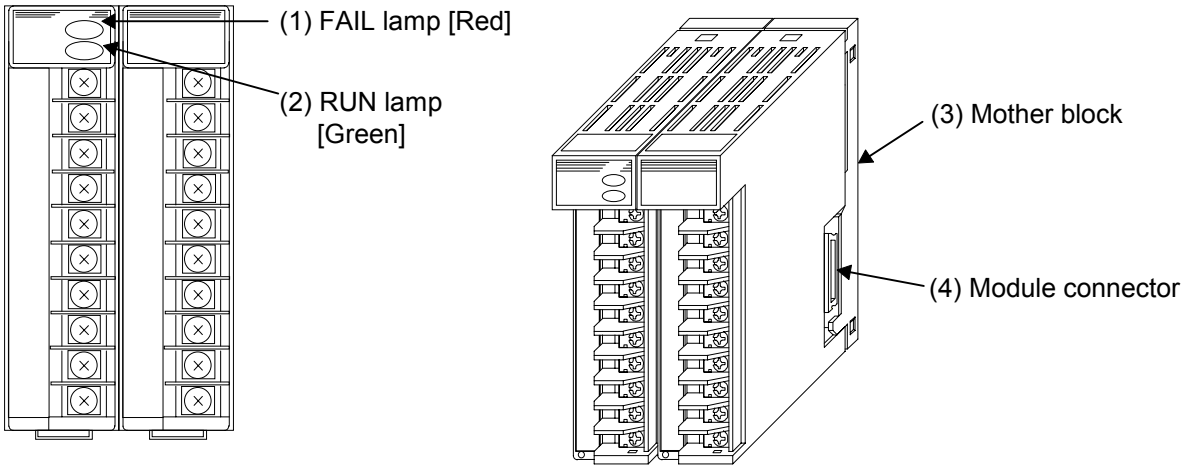


● Connector type (Only for DO-D type)



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

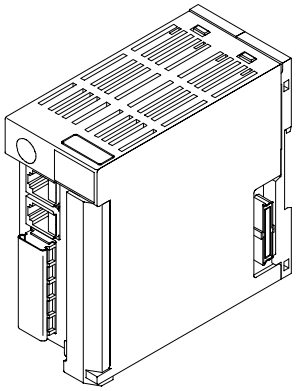
■ Double type module



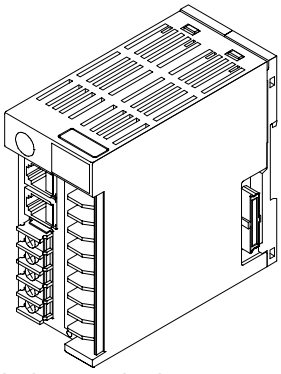
No.	Name	Description
(1)	FAIL lamp [Red]	ON during abnormal operation OFF during normal operation
(2)	RUN lamp [Green]	Flashing during normal operation
(3)	Mother block	Module DIN rail mounting connector
(4)	Module connector	Connector for power supply and bus connection

3.2.3 External view

■ PCP module



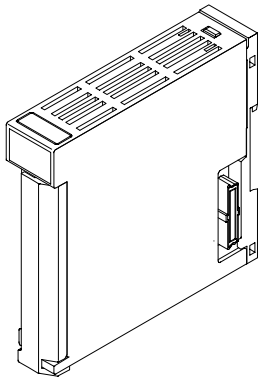
With the terminal cover fixed to the module



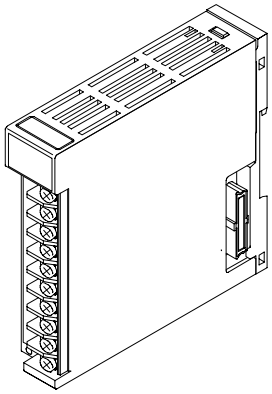
With the terminal cover removed from the module

■ Single type module

● Terminal type

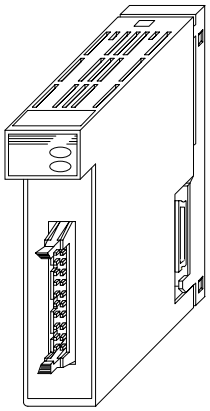


With the terminal cover fixed to the module



With the terminal cover removed from the module

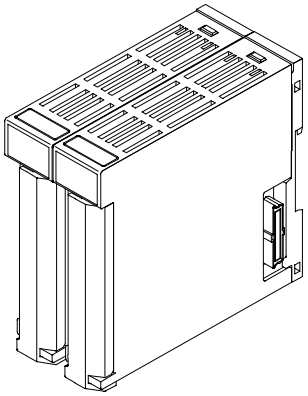
● **Connector type (Only for DO-D type)**



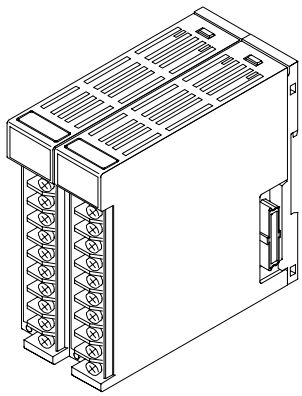
Connector type: MIL connector (AXM220011)
(DO-D module side)

Recommended connector:
AXM120415 (With strain relief)
Matsushita Electric Works, Ltd.

■ **Double type module**



With the terminal cover fixed to the module



With the terminal cover removed from the module

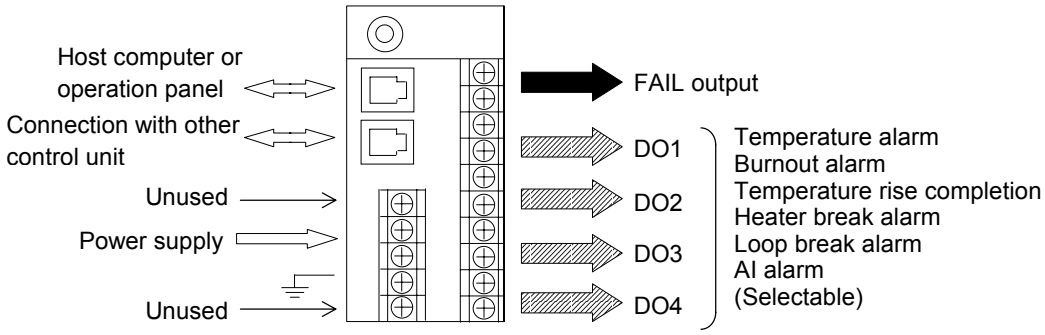
3.3 PCP Module

3.3.1 Outline

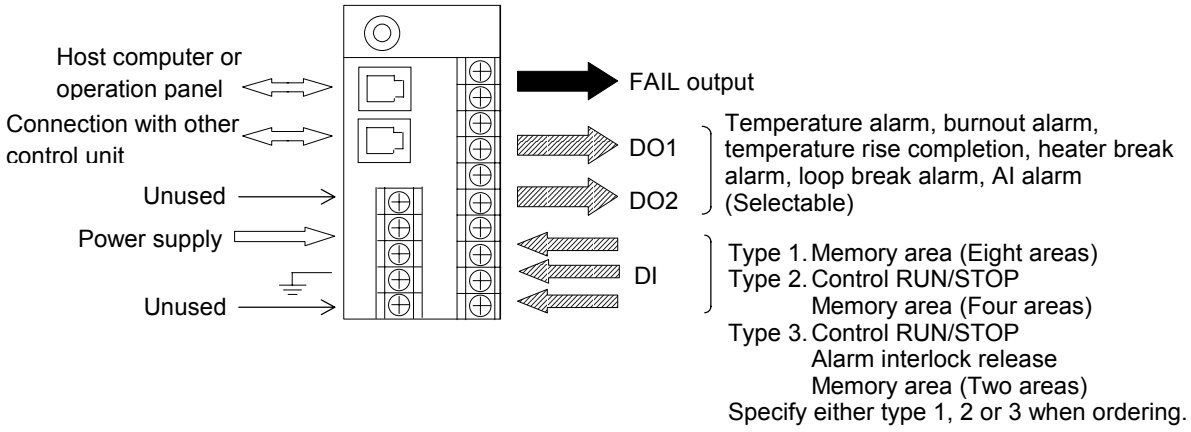
The PCP module is made up of the CPU section and the power supply section for the control unit. This module is indispensable to construct the control unit with other modules.

The 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 PCP modules according to the functions:

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

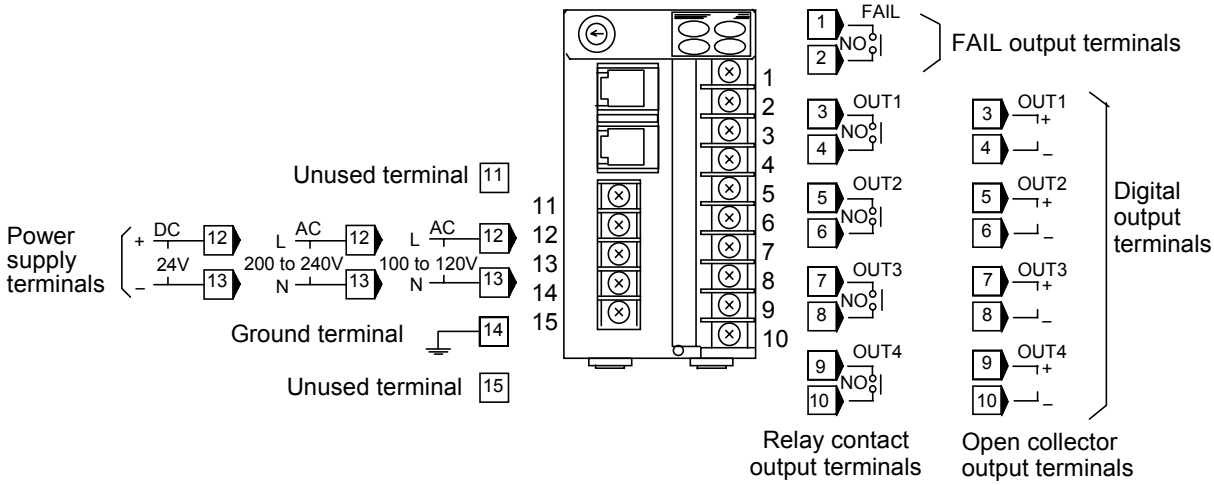


- **PCP-B type (Module with two DO points and three DI points)**

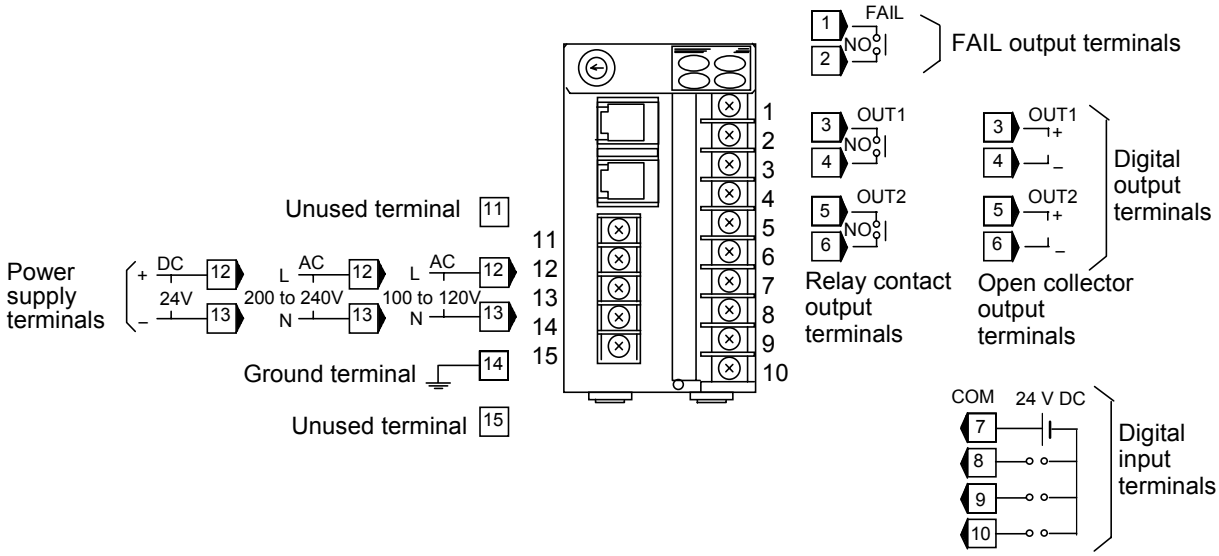


3.3.2 Terminal configuration

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



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



☞ For details on the operation panel or host computer connection, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

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 sequencer, 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/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 (due to the addition, deletion, or changing of the position of the function modules) without the module initialization, the FAIL output will be output. However in this situation the FAIL lamp will not light either.

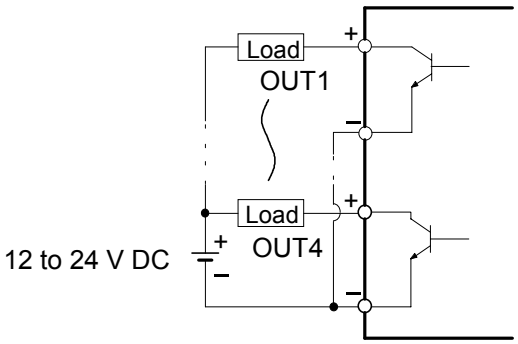
☞ For details on how to initialize the module, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

● Digital output (PCP-A and PCP-B)

The digital outputs can be optionally selected from the first alarm (ALM1), second alarm (ALM2), heater break alarm, burnout alarm, temperature rise completion, loop break alarm, AI first alarm or AI second alarm. For PCP-A type modules four points can be individually selected, and for PCP-B type modules two points can be individually selected.

- Number of outputs: 4 points (PCP-A type), 2 points (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/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 (TIO-A/C/D modules provided with CT input as option, or control unit without CT module), a heater break alarm cannot be selected.
- If there is no AI module in the control unit, an AI alarm cannot be selected.
- For the control unit consisting of only the TIO-H/J modules, a loop break alarm cannot be selected.
- For details on function selection with the digital output, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

■ Input function

● Digital input (PCP-B)

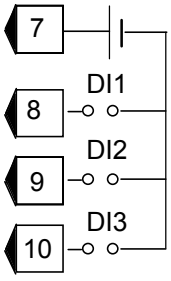
For digital input, memory area selection, control Run/Stop selection or alarm interlock release specifying can be performed. In addition, any of the following combinations of functions is available for digital input.

- 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 sequencer, 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 close 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 sequencer, if necessary.

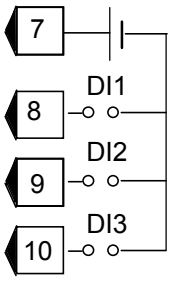


Control area / Terminal Nos.	1	2	3	4	5	6	7	8
7 - 8	–	×	–	×	–	×	–	×
7 - 9	–	–	×	×	–	–	×	×
7 - 10	–	–	–	–	×	×	×	×

–: Open ×: Close

Control Run/Stop selection, memory area selection (Type 2)

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



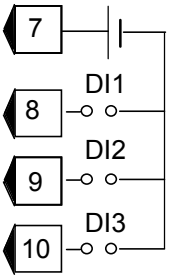
Control area / Terminal Nos.	1	2	3	4
7 - 8	–	×	–	×
7 - 9	–	–	×	×

–: Open ×: Close

Contact opened: 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 close state of terminal numbers 7 to 10.



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

Contact closed: Alarm interlock released

Contact opened: Control Stop Contact closed: Control Run

■ Communication function

The communication interface (RS-232C or RS-422A) is used for connecting each control unit to peripheral equipment. Communication types used are as follows depending on the peripheral equipment to be connected.

- Connection with dedicated operation panel ···· RS-422A
- Multi-drop connection of control units ····· RS-422A
- Connection with host computer ····· RS-232C or RS-422A

Two types of communication protocol are available: RKC standard communication (polling/selecting type) and ladder communication (non-protocol type).

- Communication with dedicated operation panel ·····RKC standard communication
- Communication with control unit (multi-drop connection) ···RKC standard communication
- Communication with host computer ·····RKC standard communication
- Communication with programmable controller ·····Ladder communication

📖 Special specification code *Z-190* must be specified for ladder communication.

📖 No event output function can be added to the PCP module for ladder communication. (No DO-C modules can be connected.)

📖 The event input function cannot be added to the ladder communication PCP module. (No DI-B module can be connected.)

Select the communication speed from the four types of 2400, 4800, 9600 and 19200 bps by the dip switch in the PCP module (Same for data configuration).

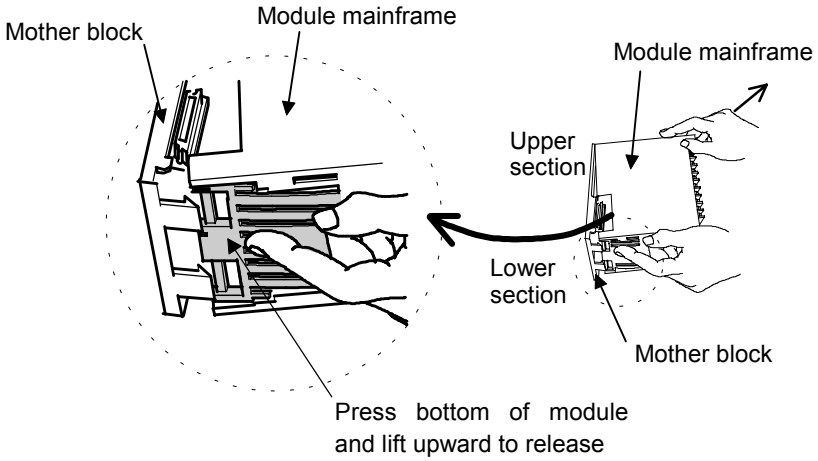
☞ For details on the dip switch settings, see **3.3.4 Settings before operation (P. 42)**.

3.3.4 Settings before operation

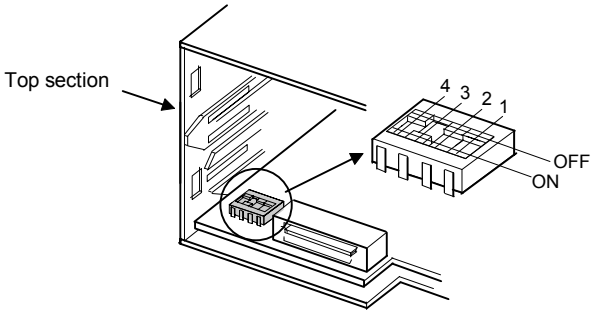
■ Communication setting directions

Using the dip switches inside the PCP 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 PCP module.



Rear view of module mainframe with mother block removed

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

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

* Factory set value

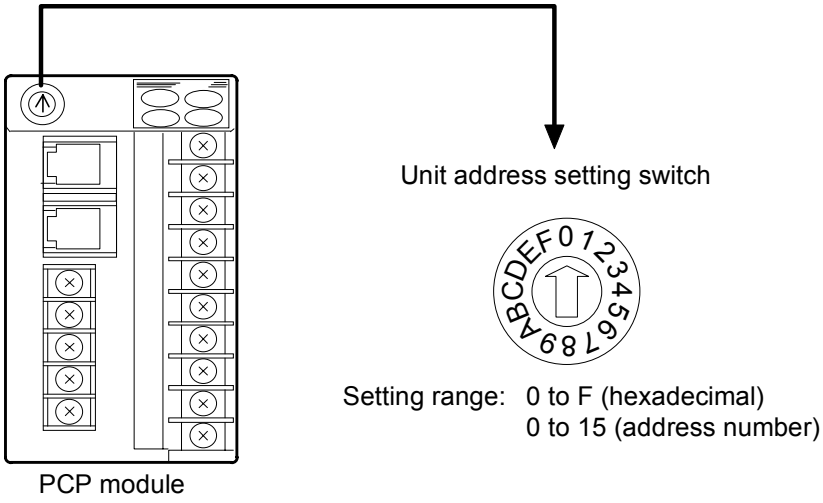
When using the ladder communication, always set the data configuration to "8-bit without parity."

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 PCP module.

Use a very small blade screwdriver to set the unit address on the unit address setting switch located on the front of each PCP module.



- Set the unit address such that it is different to the other addresses on the some line. Otherwise, problems or malfunction may result.
- If multi-drop connected to the host computer, can correspond to sixteen control units maximum.
- If multi-drop connected to the dedicated operation panel, can correspond to eight control units maximum. (Unit address setting switch: 0 to 7 max.)

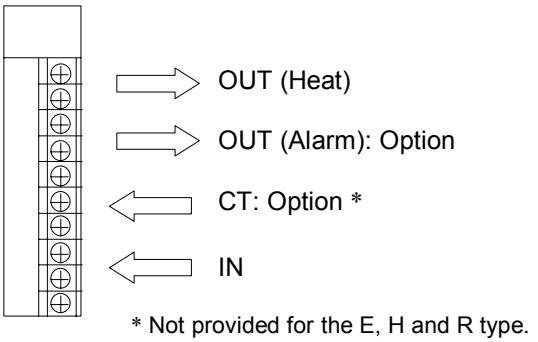
3.4 TIO Module

3.4.1 Outline

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

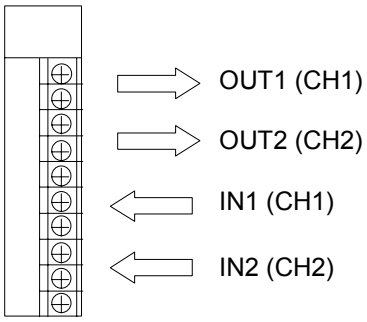
☞ For details on the limited number of TIO modules connected to the PCP module, see page 24.

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

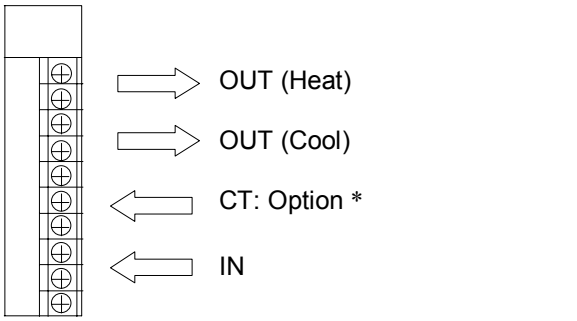


* Not provided for the E, H and R type.

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

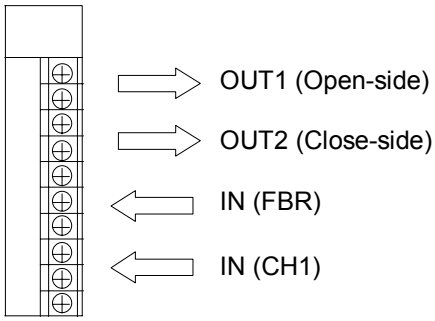


C and G type [1 channel heat/cool type]

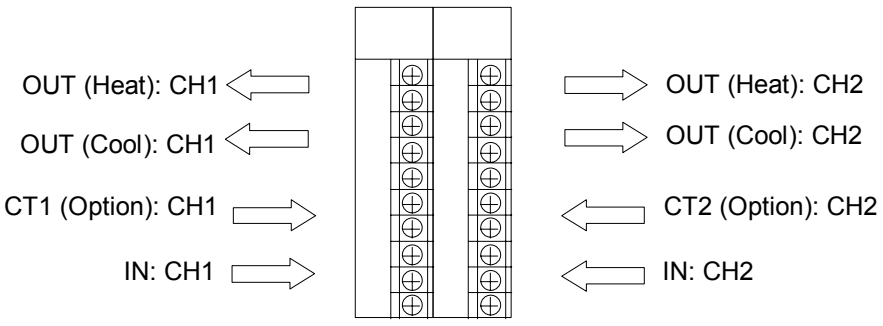


* Not provided for the G type.

K type [1 channel position proportioning type]

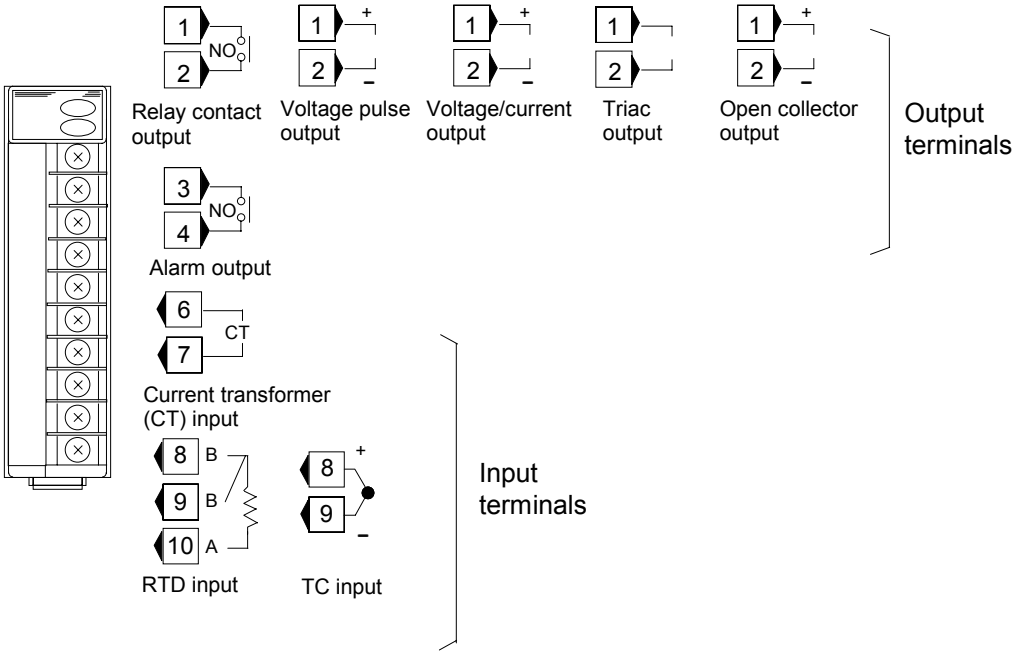


D type [2 channels heat/cool type]

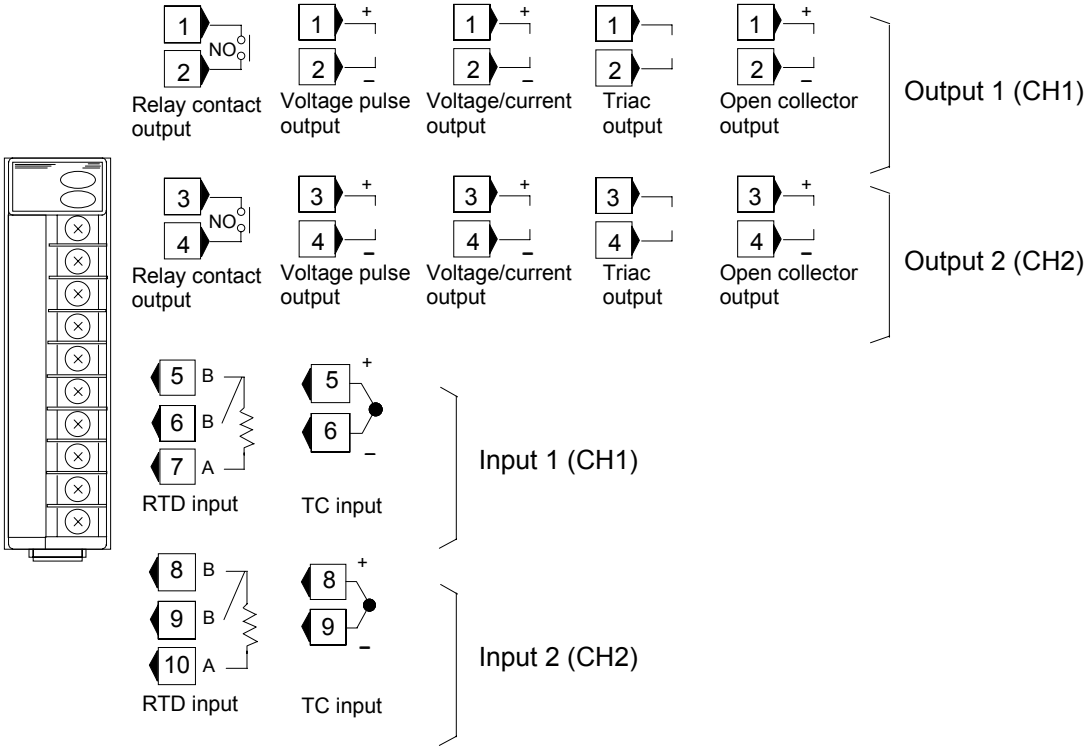


3.4.2 Terminal configuration

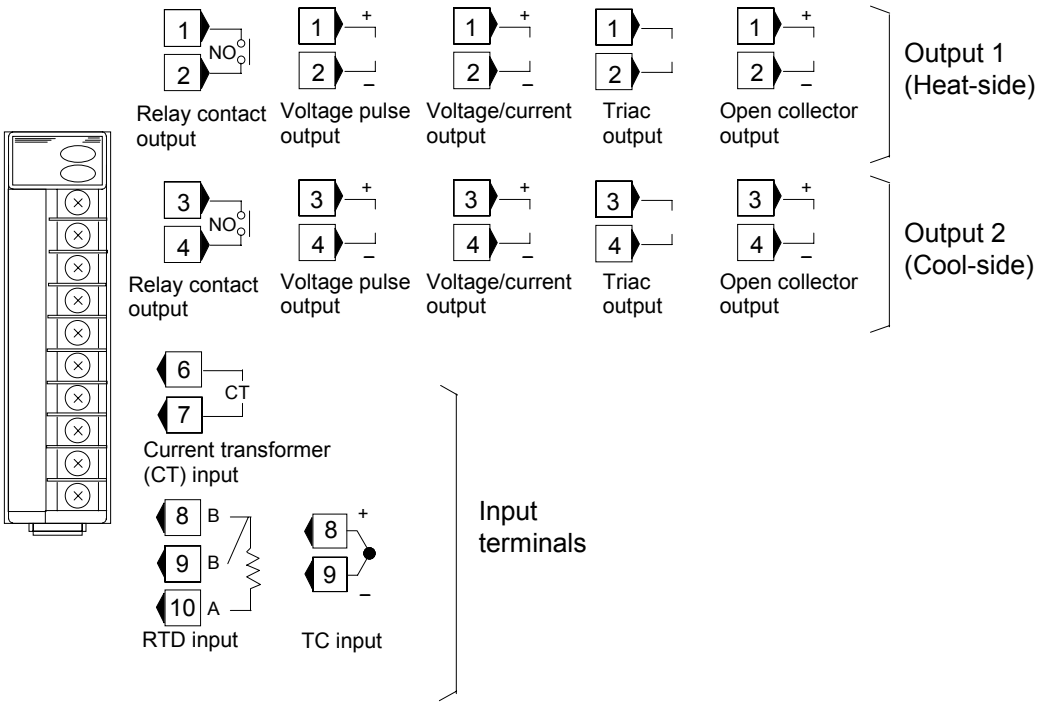
■ TIO-A type



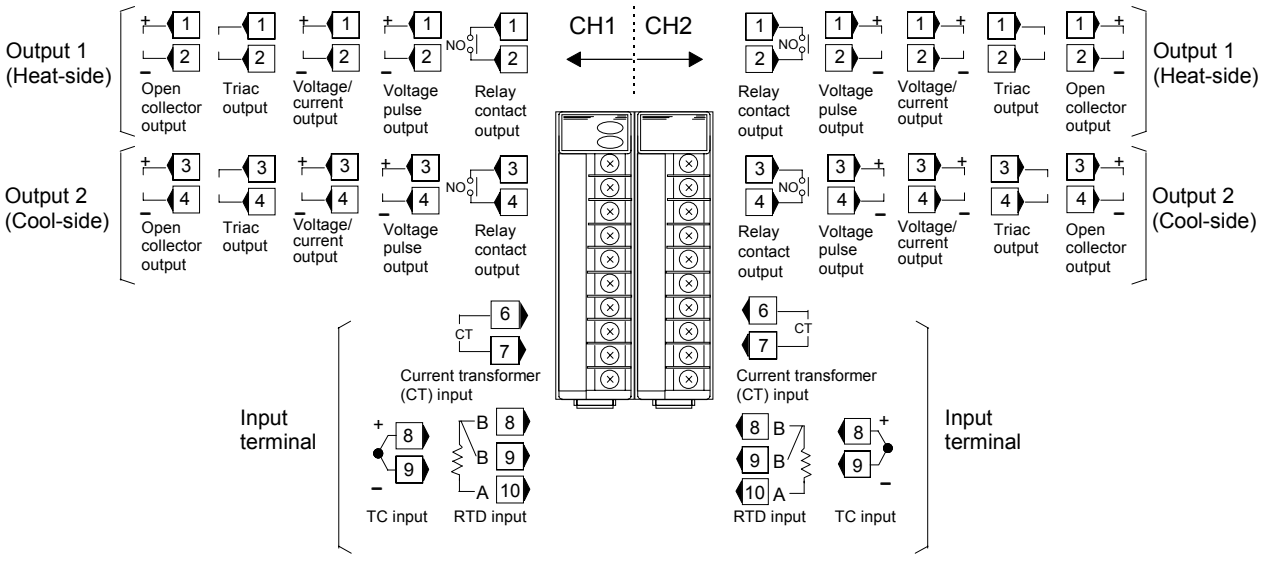
■ TIO-B type



■ TIO-C type

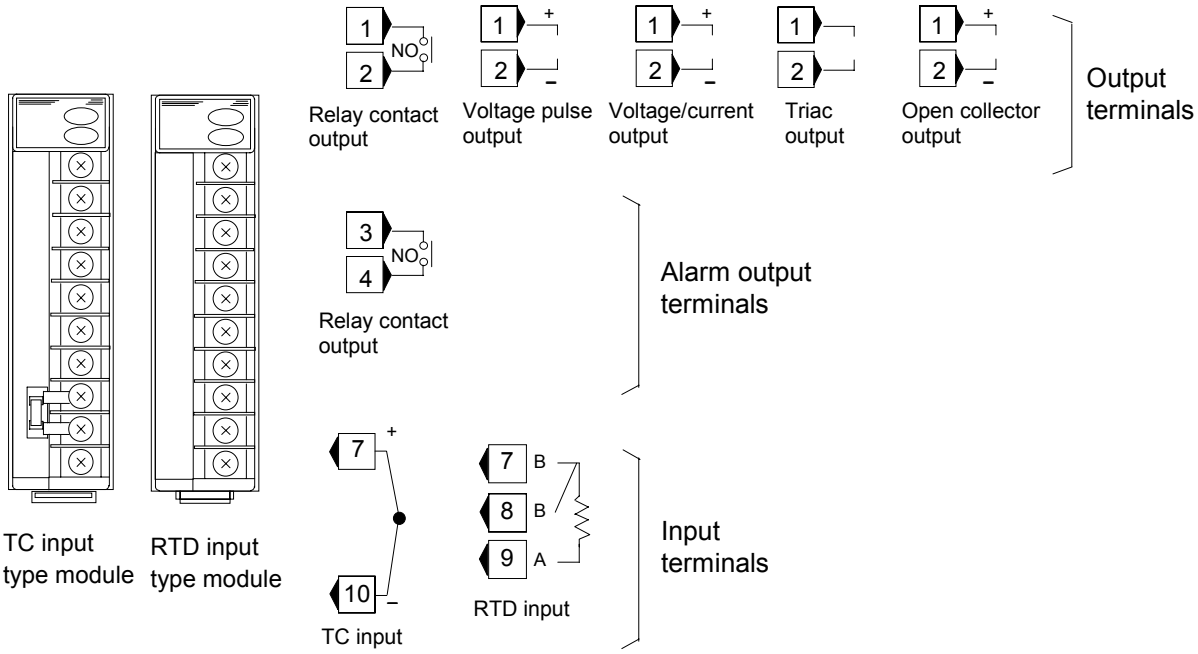


■ TIO-D type

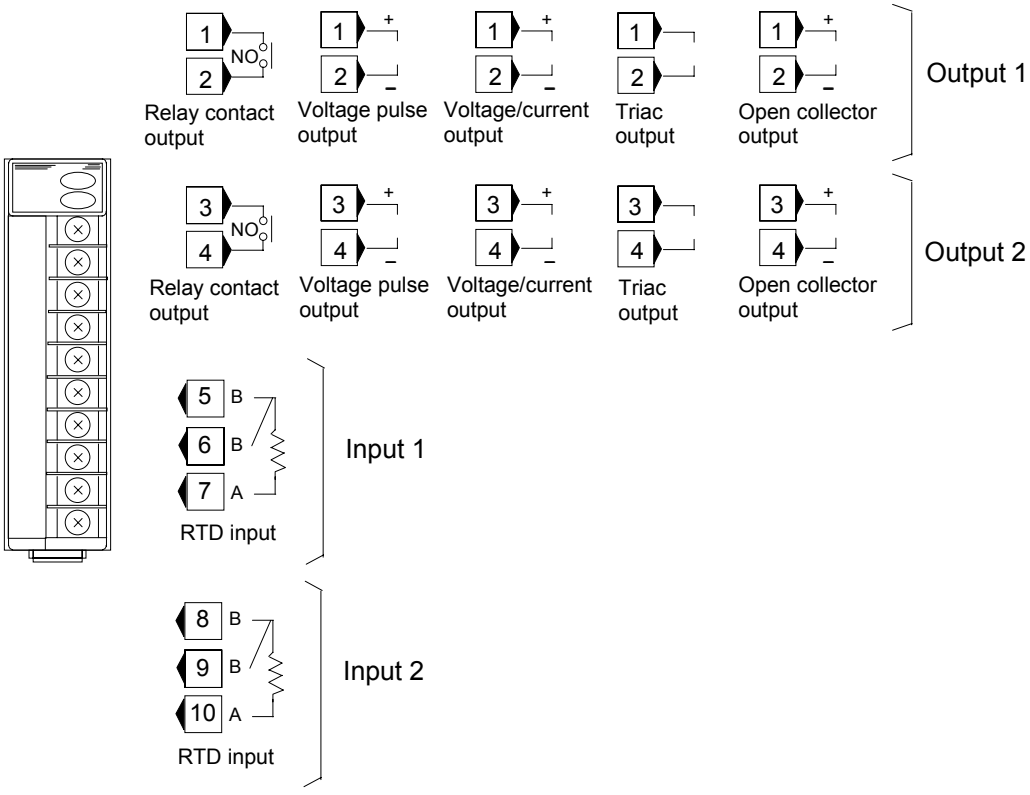


Although the terminal numbers are the same numbers for both channel 1 and channel 2, the left side as seen from the front panel of the module is channel 1 and the right side is channel 2.

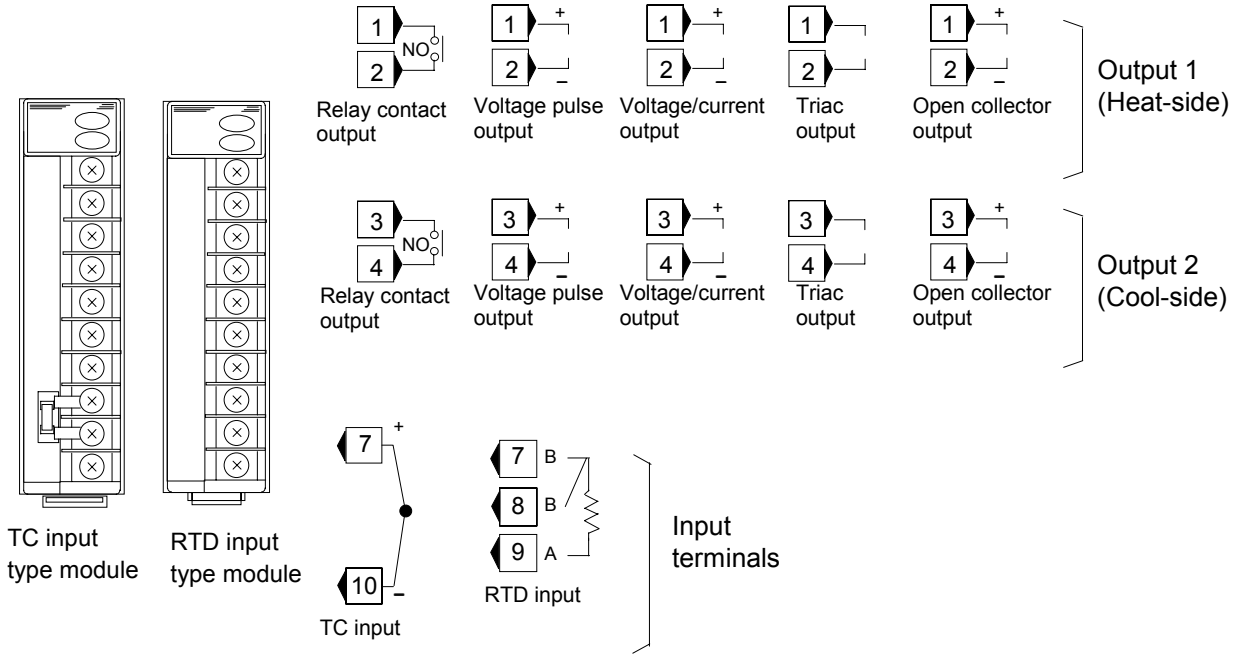
■ TIO-E type



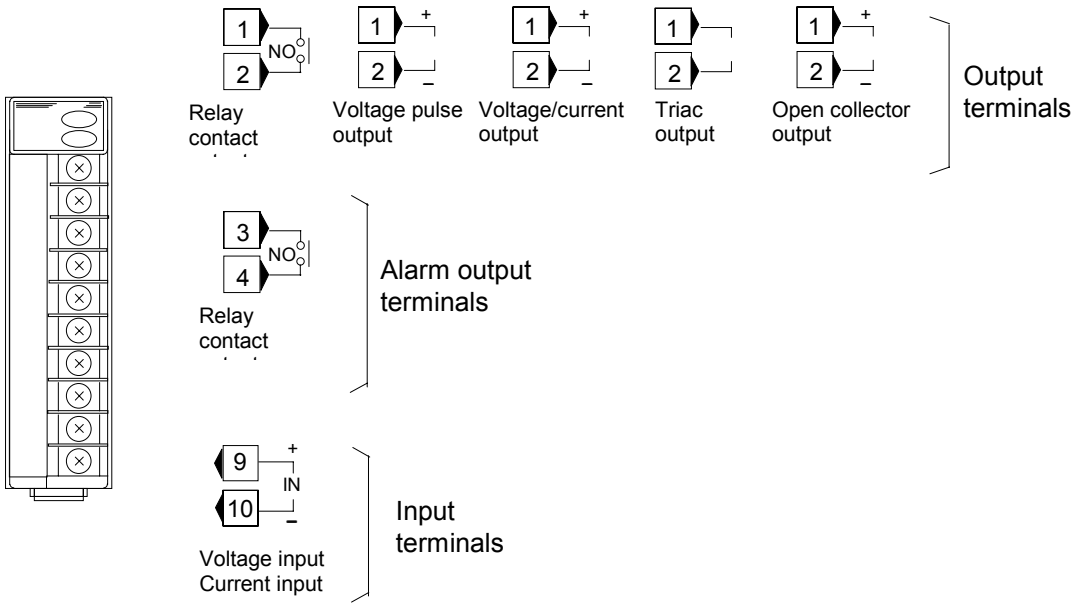
■ TIO-F type



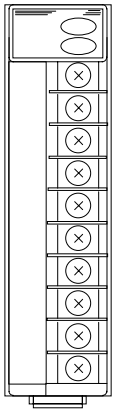
■ TIO-G type

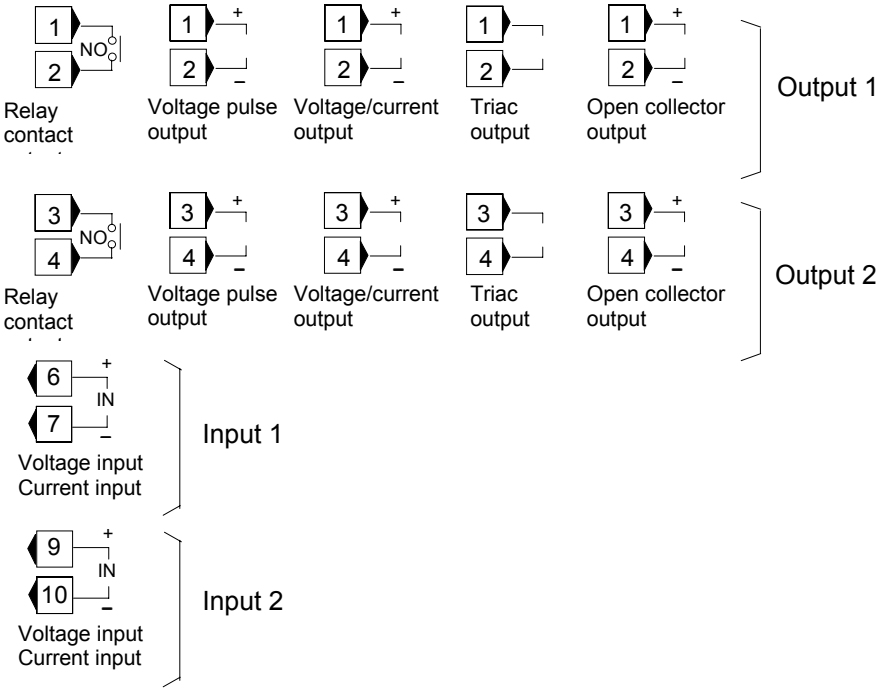


■ TIO-H type

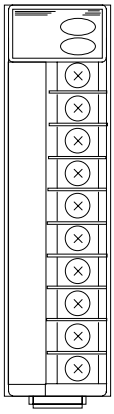


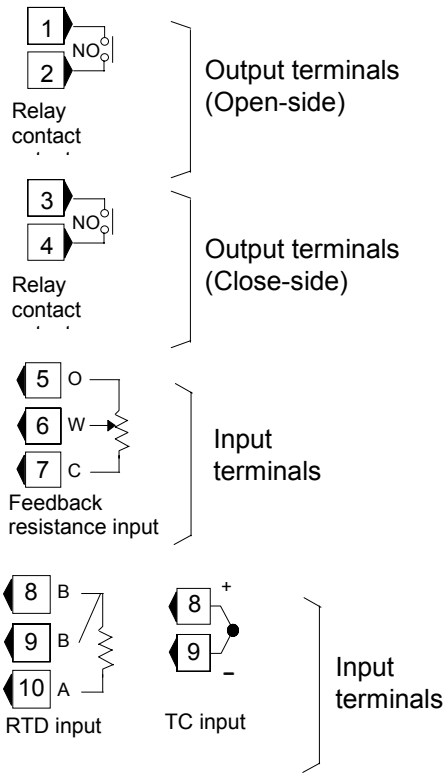
■ TIO-J type



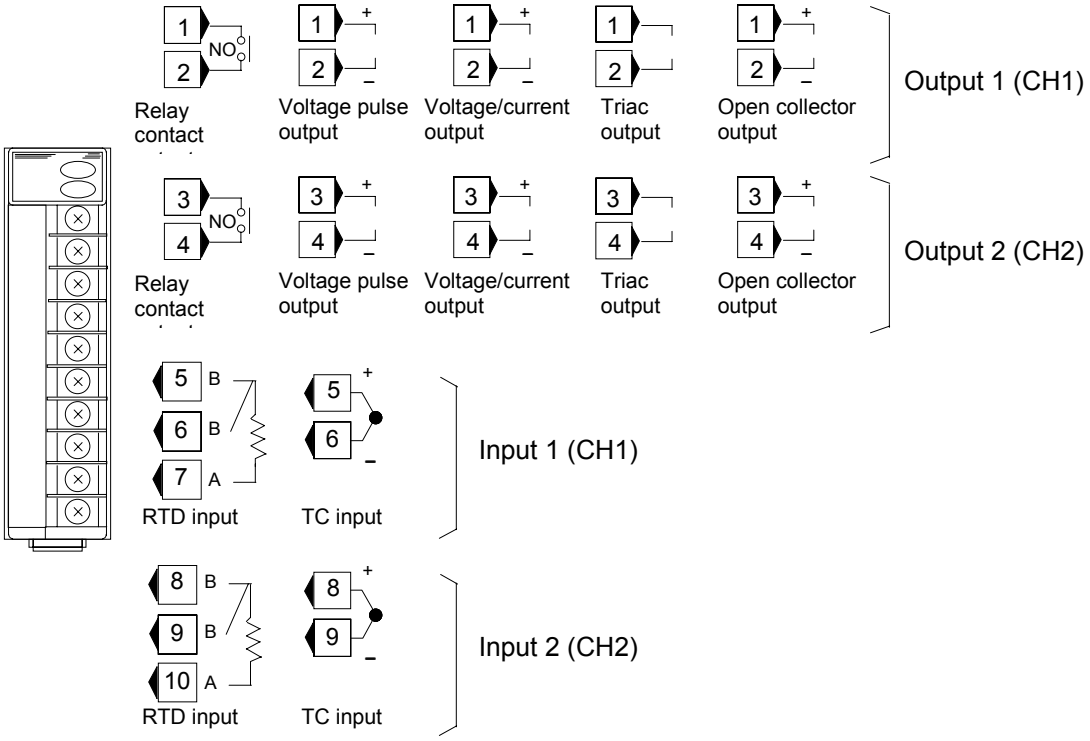


■ TIO-K type

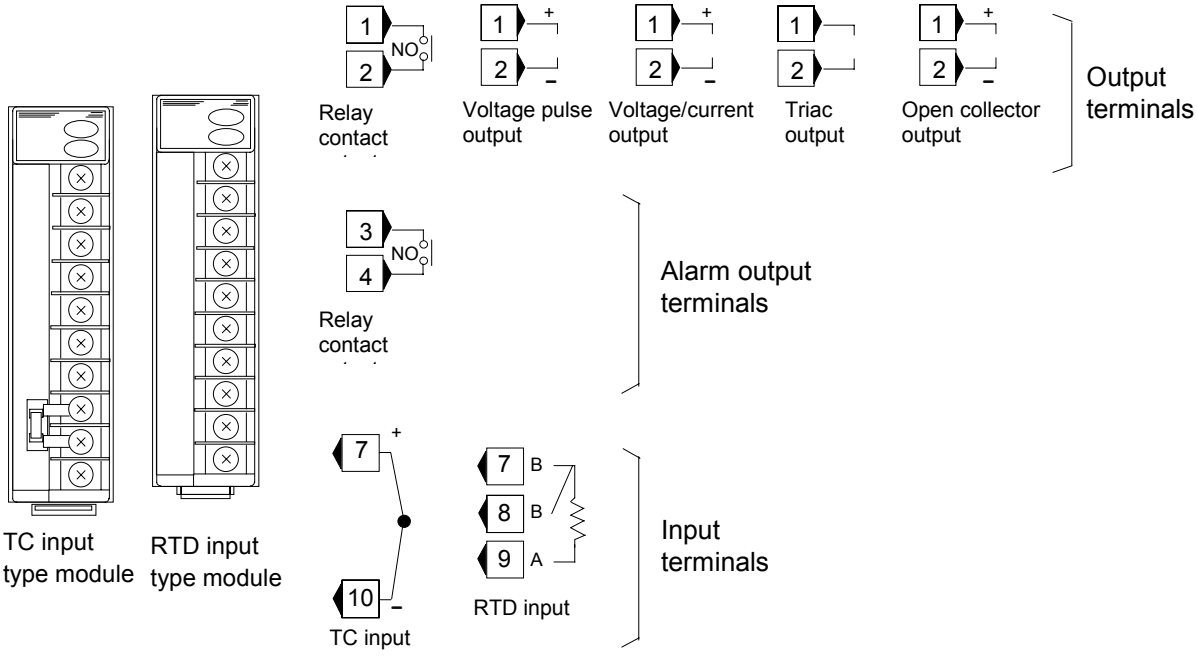




■ TIO-P type



■ TIO-R type

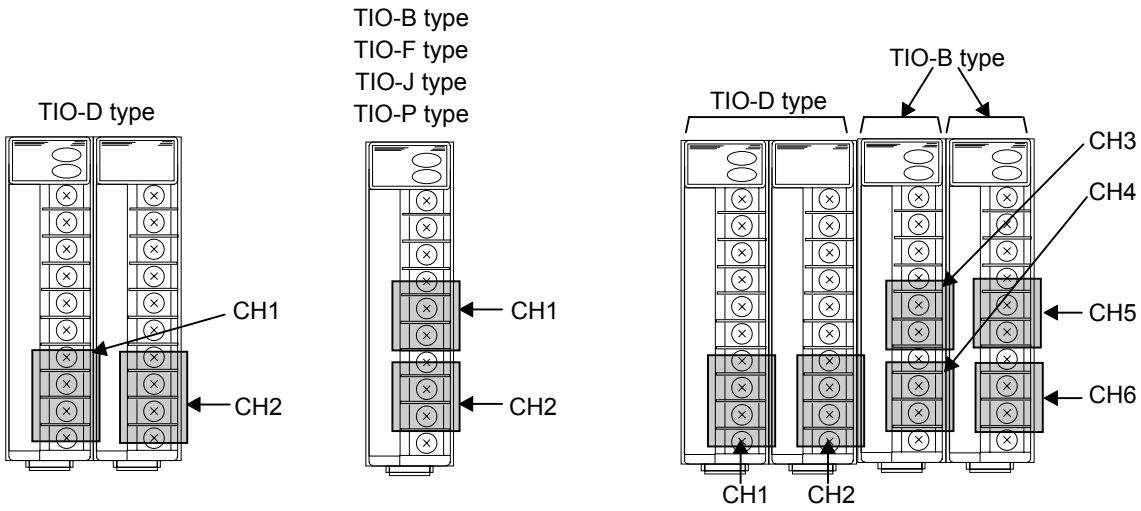


3.4.3 Functional description

(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 TIO module input types

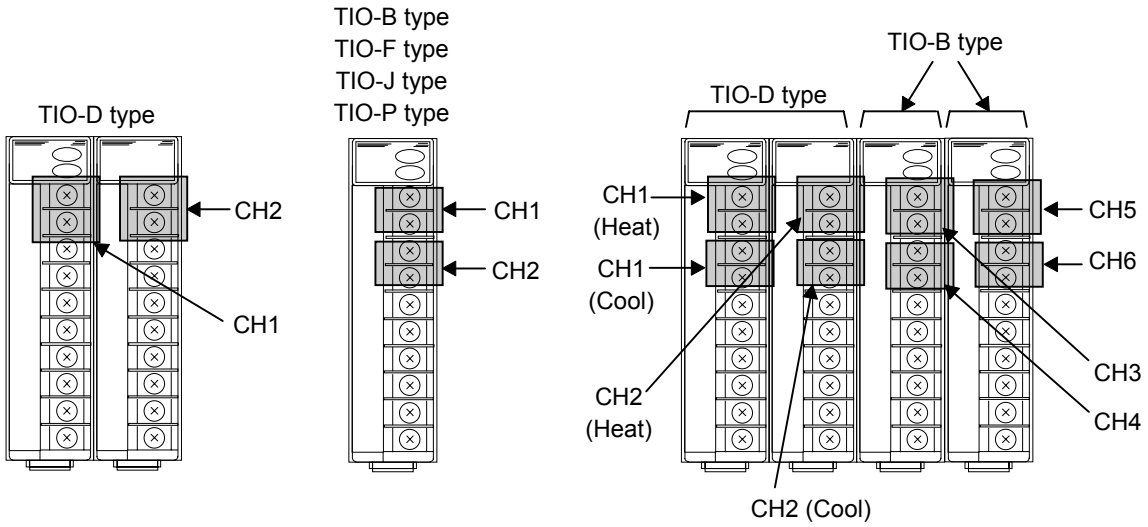
Input type	TIO module type
Thermocouple	TIO-A, TIO-B, TIO-C, TIO-D, TIO-E, TIO-G, TIO-K, TIO-P, TIO-R
RTD	TIO-A, TIO-B, TIO-C, TIO-D, TIO-E, TIO-F, TIO-G, TIO-K, TIO-P, TIO-R
Voltage/current	TIO-H, TIO-J

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

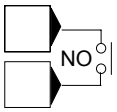
Any output type of relay contact output, voltage pulse output, voltage output, current output, triac output or open collector output can be selected for each heat output and heat/cool output.
(Specify when ordering)

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, see **8. SPECIFICATIONS (P. 128)** or the separate **GUIDE BOOK**.

● Relay contact output

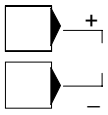
Output status: Independent 1a contact output (closed during outputting).



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

● Voltage pulse output

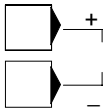
This output is for driving the SSRs and 12 V DC is output during the outputting.



Allowable load resistance: 600 Ω or more

● Current and voltage output

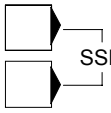
The current output can be selected from 4 to 20 mA DC or 0 to 20 mA DC, and the voltage output can be selected from 0 to 1 V DC, 0 to 5 V DC, 0 to 10 V DC or 1 to 5 V DC. (Specify when ordering)



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

● Triac output

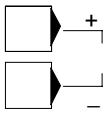
This output can directly drive AC power by the small SSR built in the module. The zero-cross control method is employed.



Capacity: 0.5 A (At an ambient temperature of 40 °C)

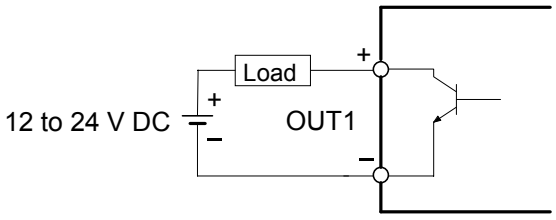
● Open collector output

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.

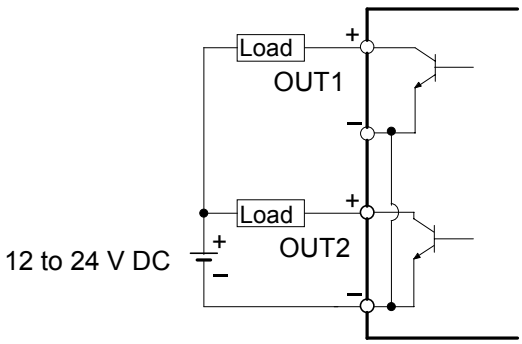


Maximum load current: 100 mA or less

Open Collector Output Wiring Example



TIO-A type



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

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.
(☞ See P. 99.)

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

(3) Alarm function

One TIO module is provided with two alarm points as standard. Each alarm status is output to the PCP module from the TIO module as data.
The respective alarm (ALM1/ALM2) can be output independently for each channel by connecting the DO module. (☞ See P. 119.)
For TIO-A/E/H/R type modules, an alarm can be output from each module (option).

☞ For details on outputting alarms, see **3.9 DO Module (P. 70)**, and for details on setting alarms, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

(4) Alarm output function (Option)

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

- Number of output points: One 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].

[1] Only TIO-A can be selected.
[2] Only TIO-A or TIO-E can be selected.

(5) Loop break alarm function (Excluding 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. (☞ See P. 124.)
The loop break alarm function is set by the dedicated operation panel, or host computer via communication (setting for each channel).
This loop break alarm can be output independently for each channel by connecting the DO module.

☞ For details on outputting loop break alarm, see **3.9 DO Module (P. 70)**, and for details on setting loop break alarm, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

(6) Heater break alarm function (Option)

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.
(☞ See P. 123.)
This function can be added only to the TIO-A, C or D type module.(1 point/control loop)

☞ For TIO module with voltage/current output, no heater break alarm function can be used.

(7) Control function

As standard, the TIO module employs the brilliant PID control method which can prevent overshoot or disturbance (excluding the TIO-K module). (☞ See P. 113.)
The selectable control action type differs depending on the TIO module type. (See 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
TIO-A	×	×	—	—	—
TIO-B	×	×	—	—	—
TIO-C	—	—	×	—	—
TIO-D	—	—	×	—	—
TIO-E	×	×	—	—	—
TIO-F	×	×	—	—	—
TIO-G	—	—	×	—	—
TIO-H	×	×	—	—	—
TIO-J	×	×	—	—	—
TIO-K	—	—	—	—	×
TIO-P	—	—	—	×	—
TIO-R	—	—	—	×	—

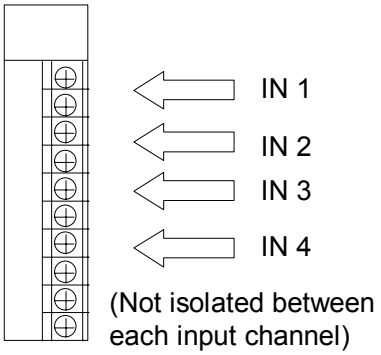
×: Selectable —: Not selectable

3.5 TI Module

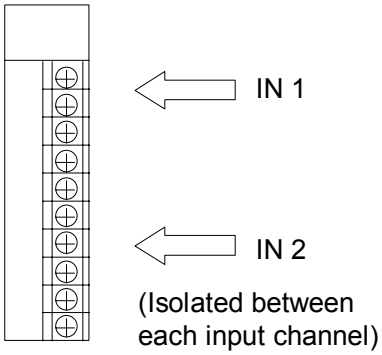
3.5.1 Outline

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

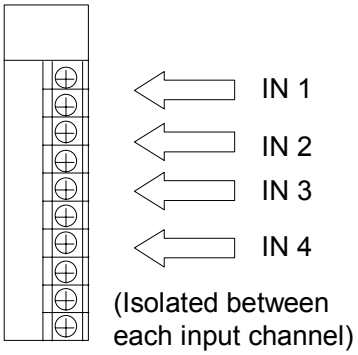
- TI-A type
  (RTD input)



- TI-B type
  (Thermocouple/ RTD input)

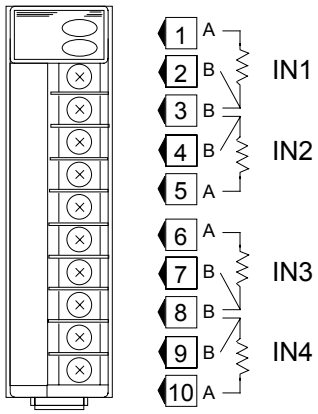


- TI-C type
  (Thermocouple input)



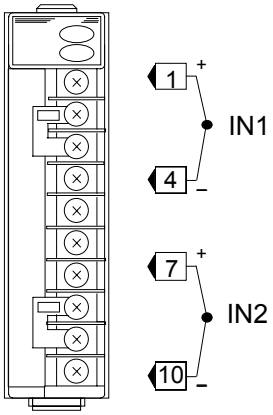
3.5.2 Terminal configuration

■ **TI-A type**

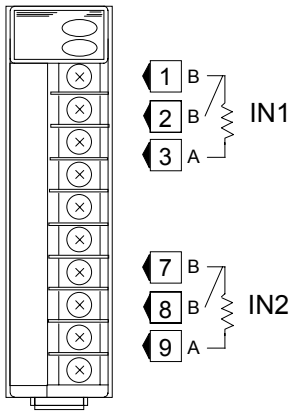


RTD input

■ **TI-B type**

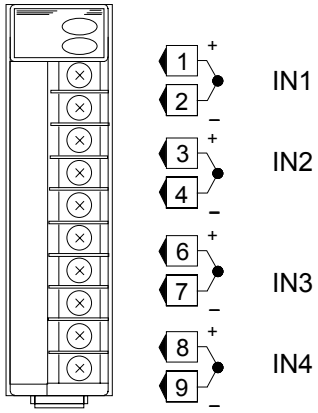


TC input



RTD input

■ TI-C type



TC input

3.5.3 Functional description

■ TI alarm function

As standard, the TI module is provided with 2 alarm types/channel (TI alarm 1 and TI alarm 2). Details on these alarm types are as follows.

● Alarm type

TI process high alarm, TI process low alarm, TI process high alarm (with hold action), and TI process low alarm (with hold action)

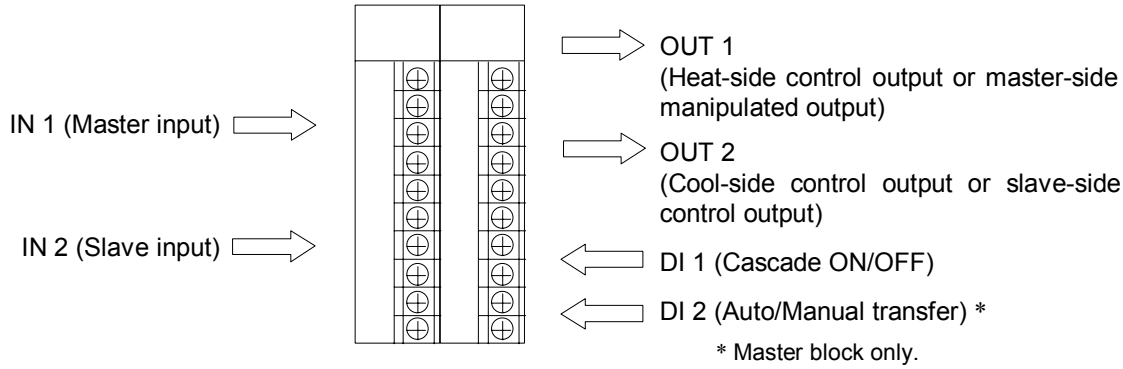
- Each TI alarm is different from a temperature alarm built in the TIO module.
- Each TI alarm can be output as summary output (*OR* output) from the digital output block in the PCP module (A or B type). If it is necessary to output the alarm independently for each channel, use the DO-C module.
- For details on the output state, see **3.9 DO Module (P. 70)**.
- Each TI alarm can be set from the dedicated Operation Panel, or host computer via communication. For details on how to set alarm, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

3.6 CIO Module

3.6.1 Outline

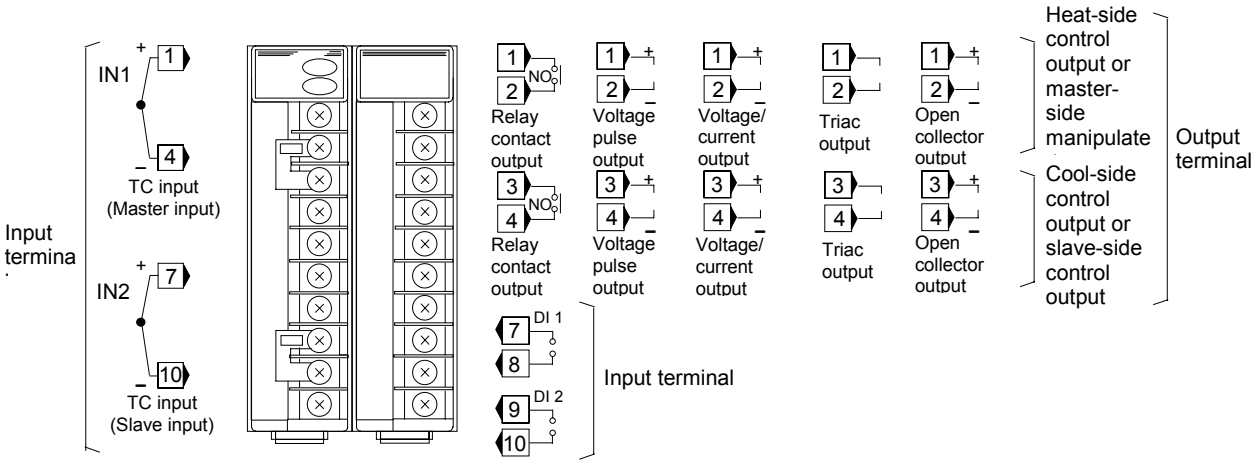
The CIO module is used to perform effective cascade control when there is a time lag between the controlled object and heat source.
The number of cascade control loops is 1 loop/module. The CIO modules corresponding to the required number of control points are connected to the PCP module. (Up to 5 loops/control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

- CIO-A type

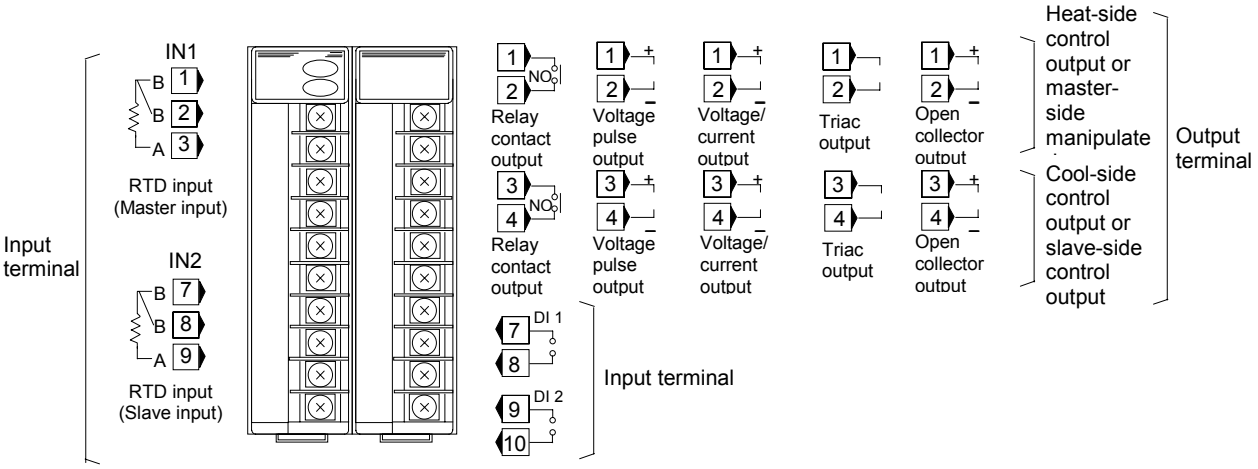


3.6.2 Terminal configuration

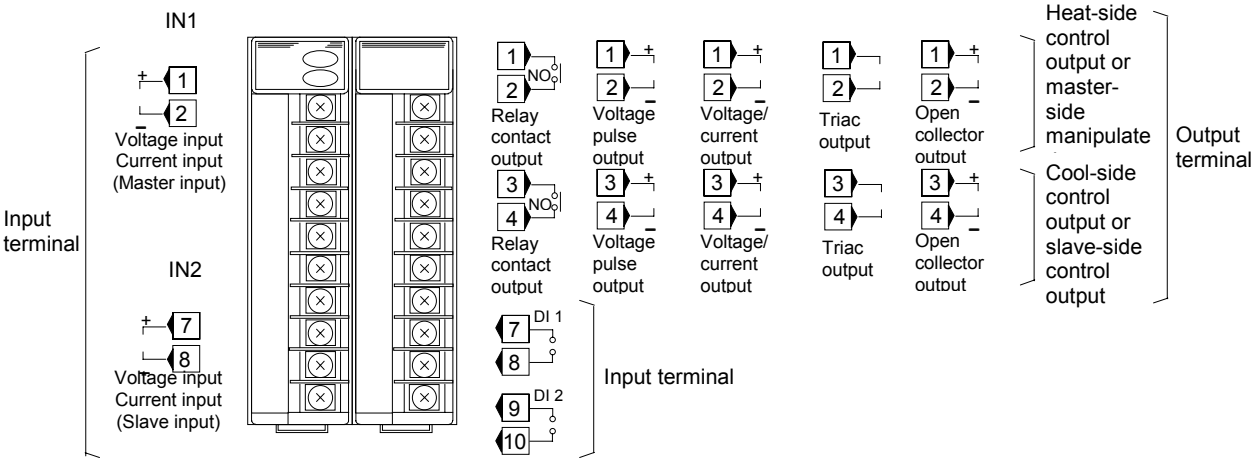
■ Thermocouple input type



■ RTD input type



■ Voltage/Current input type

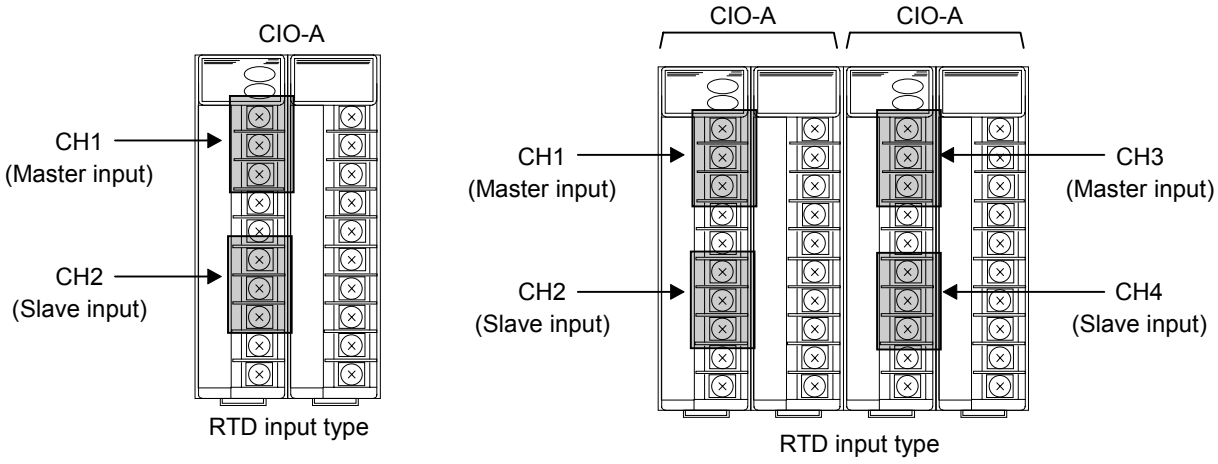


3.6.3 Functional description

(1) Input function

■ Channel number

For the CIO module, CH1 and CH2 are assigned to the input terminals of the CIO module order from the top.CH1 is for master input and CH2 is for slave input, respectively.
If several 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 CIO module input types

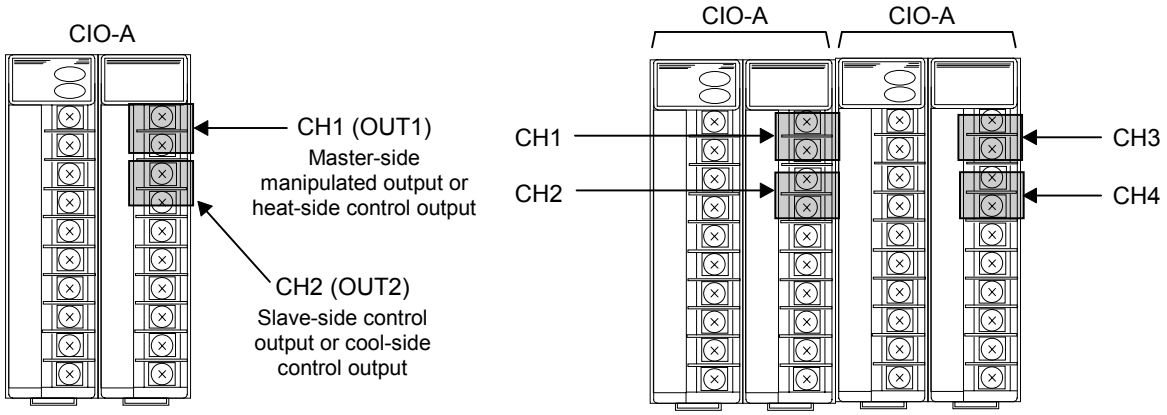
Input type	CIO module type
Thermocouple	CIO-A-F ☐ ☐ - ☐ ∗ ☐, CIO-A-D ☐ ☐ - ☐ ∗ ☐, CIO-A-B ☐ ☐ - ☐ ∗ ☐, CIO-A-W ☐ ☐ - ☐ ∗ ☐
RTD	CIO-A-F ☐ ☐ - ☐ ∗ ☐, CIO-A-D ☐ ☐ - ☐ ∗ ☐, CIO-A-B ☐ ☐ - ☐ ∗ ☐, CIO-A-W ☐ ☐ - ☐ ∗ ☐
Voltage/current	CIO-A-F ☐ ☐ - ☐ ∗ ☐, CIO-A-D ☐ ☐ - ☐ ∗ ☐

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 CIO module, CH1 and CH2 are assigned to the output terminals of the CIO module in order from the top.
If several 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	
	CIO-A-F or CIO-A-D type	**CIO-A-B or 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

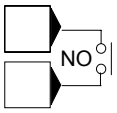
The desired output type can be selected from relay contact, voltage pulse, voltage, current, triac and open-collector outputs for each of OUT1 and OUT2. (Specify when ordering.)

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

For details on each output, see **8. SPECIFICATION (P. 128)** or the separate **GUIDE BOOK**.

● Relay contact output

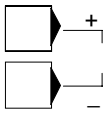
Output status: Independent 1a contact output (closed during outputting)



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

● Voltage pulse output

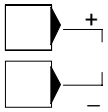
This output is for driving the SSRs and 12 V DC is output during the outputting.



Allowable load resistance: 600 Ω or

● Current and voltage output

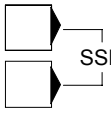
The current output can be selected from 4 to 20 mA DC or 0 to 20 mA DC, and the voltage output can be selected from 0 to 1 V DC, 0 to 5 V DC, 0 to 10 V DC or 1 to 5 V DC. (Specify when ordering)



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

● Triac output

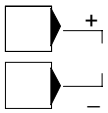
This output can directly drive AC power by the small SSR built in the module. The zero-cross control method is employed.



Capacity: 0.5 A (At an ambient temperature of 40 °C)

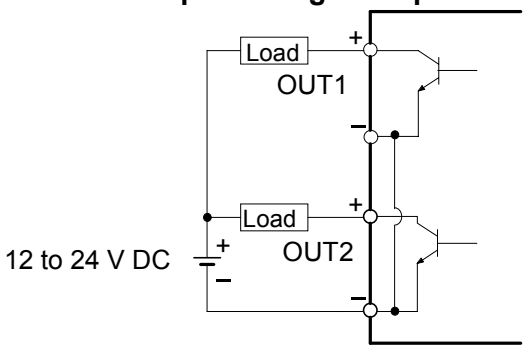
● Open collector output

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



CIO-A type

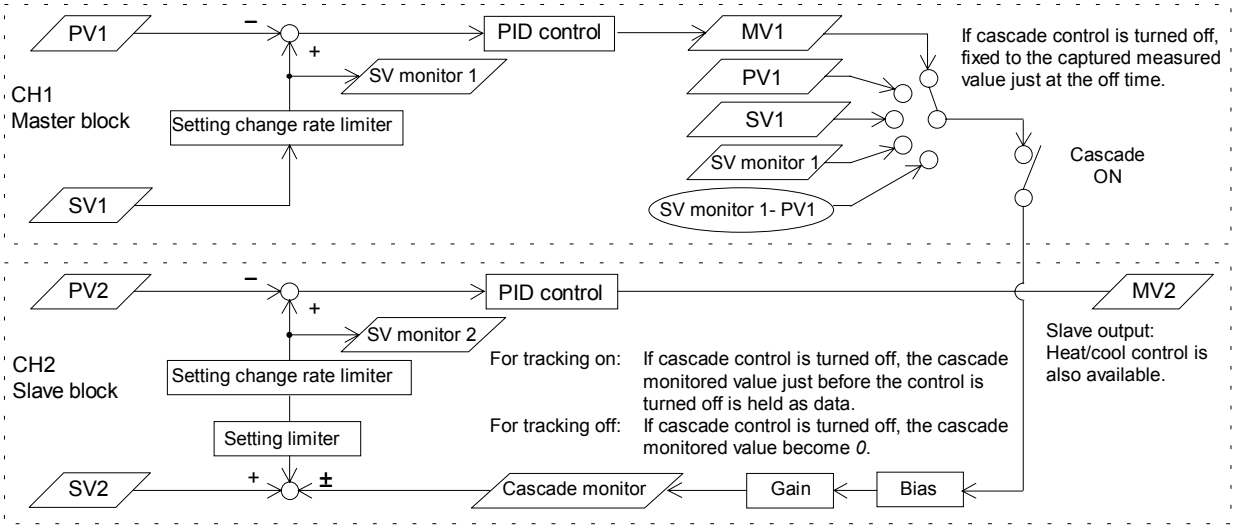
It is possible only in the 1 to 5 V DC voltage output to make a common connection of the minus terminals of the outputs, including the voltage pulse output.
(☞ See P. 99.)

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



☞ The cascade control function is set from the dedicated operation panel, or host computer via communication.
For details on how to set the function, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

(4) Alarm function

One CIO module is provided with two alarm points as standard. Each alarm status is output to the PCP module from the CIO module as data.
The respective alarms (ALM1/ALM2) can be output independently for each channel by connecting the DO module. (☞ See P. 119.)

☞ For details on outputting alarms, see **3.9 DO Module (P. 70)**, and for details on setting alarms, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

(5) Loop break alarm function

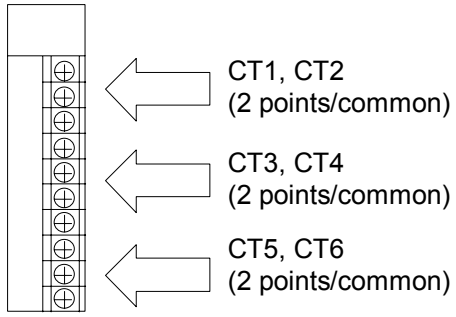
The loop break alarm function is used to detect a load (heater) break, a failure occurring in any external operating device (magnet relay, etc.) or a failure occurring in the control system (control loop) caused by an input (sensor) break. (☞ See P. 124.)
The loop break alarm function is set by the dedicated operation panel, or host computer via communication (setting for each channel).
This loop break alarm can be output independently for each channel by connecting the DO module.

☞ For details on outputting loop break alarm, see **3.9 DO Module (P. 70)**, and for details on setting loop break alarm, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

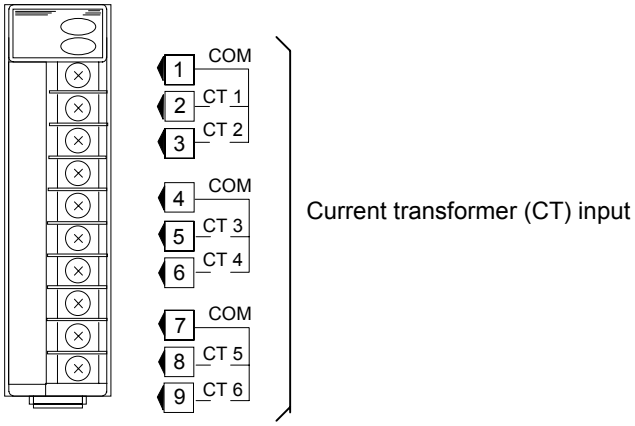
3.7 CT Module

3.7.1 Outline

The 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 CT module are available depending on the heater capacity used: 0 to 30 A and 0 to 100 A. (Specify when ordering)



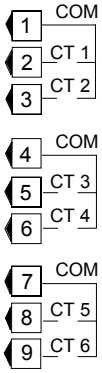
3.7.2 Terminal configuration



3.7.3 Functional description

■ Heater break alarm output function

The CT module, combined with the CT sensor or TIO module, can output a heater break alarm. It addition, it can output the alarm independently for each channel when combined with the DO module. Either one of the two module types can be selected depending on the heater capacity.
(Specify when ordering. No mixture of these two types is allowed.) ☞ See P. 123.



Up to six CT sensors can be connected to one CT module. The input terminals of the CT module consist of three blocks with one common terminal and two CT terminals per block.
In addition, as the CT sensor can capture several CT input points/control channel, the CT module can make easy the detection of a heater break by connecting two or more CT sensors even when heaters are delta-connected.

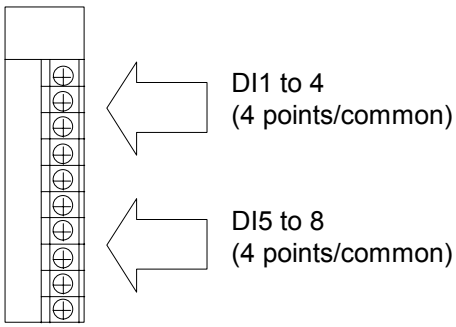
- For a heater capacity of 30 A or less, the CT module for 0 to 30A (CT sensor: CTL-6-P-N using type) should be used in view of the current detection sensitivity.
- A heater break alarm can be output as overall outputs (*OR* output) from DOs of PCP module (A or B type). Use the DO module if this alarm needs to be output independently for each channel.
- ☞ For details on the output status, see **3.9 DO Module (P. 70)**.
- ☞ Each input channel can be set by the dedicated operation panel or via communication by the host computer. For details on the setting, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

3.8 DI Module

3.8.1 Outline

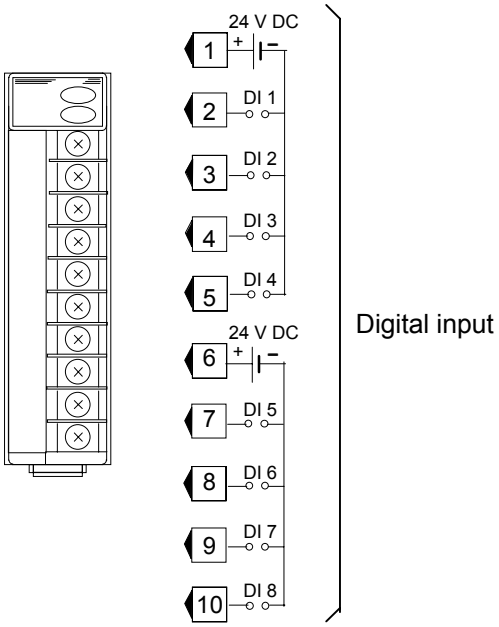
The DI module is used only for digital input.
The DI-A type module is used to select the operation status (memory area selection, control Run/Stop selection, or alarm interlock release) of the control unit by using external contacts, etc.
The DI-B type module is used to display various event inputs on 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 DO-C module.
Up to eight input points can be configured for each DI module.

- DI-A and DI-B type



3.8.2 Terminal configuration

■ DI-A and DI-B type



3.8.3 Functional description

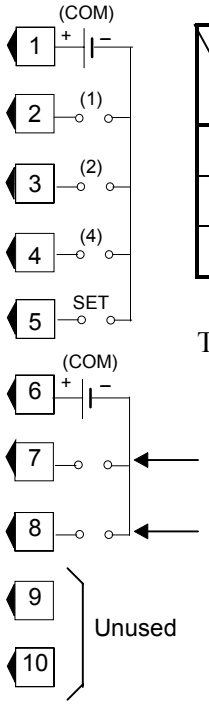
(1) Digital input function (DI-A)

The digital input function can be used to select the memory area in the control unit to which the DI-A module is connected, to select control Run/Stop or alarm interlock release.

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 sequencer, etc.

■ Memory area selection, control Run/Stop selection and alarm interlock release

Selection or release can be performed depending on the open or close state of terminal numbers 1 to 8.
For memory area selection, configure an external contact circuit or use a contact output signal from the sequencer, if necessary.



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

–: Open ×: Close

The memory area (control area) is established by closing terminal number 5.

Control Run/Stop selection (contact closed: Run, contact opened: Stop)

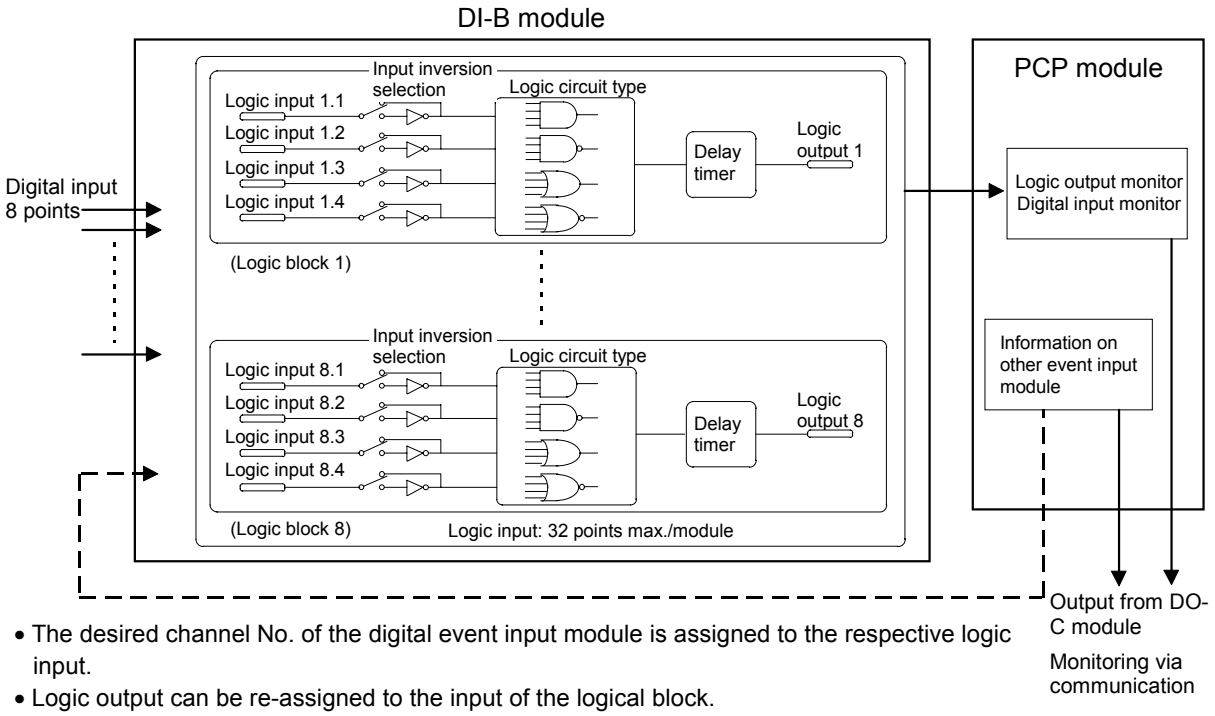
Alarm interlock release (contact closed: alarm interlock release)
(No alarm interlock function is activated if the contact is in the normally closed state.)

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

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

■ Logic input function

Each logic is built by four event inputs. Up to eight logic results (logic outputs) per DI-B module can be monitored through communication or can be output from event output module (DO-C).
In addition, this function can assign the input of the DI-B module to any channel number of the DO-C module to output the result.



- The desired channel No. of the digital event input module is assigned to the respective logic input.
- Logic output can be re-assigned to the input of the logical block.

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

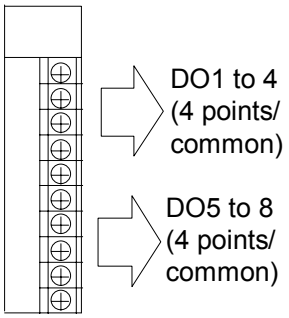
Event input can be set by the host computer via communication. For details on how to set the event input, see the **Communication Instruction Manual (IMSRM09-E□)**.

3.9 DO Module

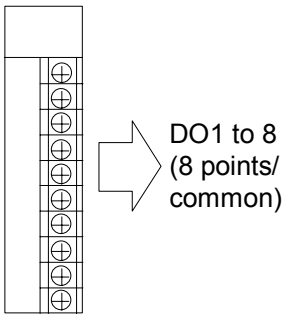
3.9.1 Outline

The DO module is used specially for digital output.
DO-A, DO-B and DO-D type modules can output alarm statuses such as temperature and heater break alarms independently for each channel. For DO-C type modules, dedicated alarms or control unit operations can be independently output as event outputs.
The DO-D module is used to output each of the temperature first, temperature second, burnout, heater break, loop break, AI first, and AI second alarms. A connector is used for external connection, and up to sixteen points per module can be output.

• DO-A (8 points output type)

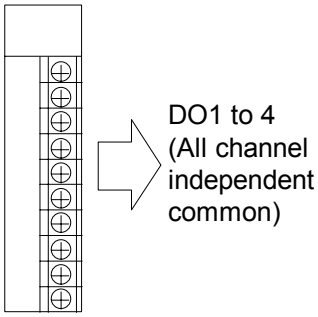


Relay contact output type



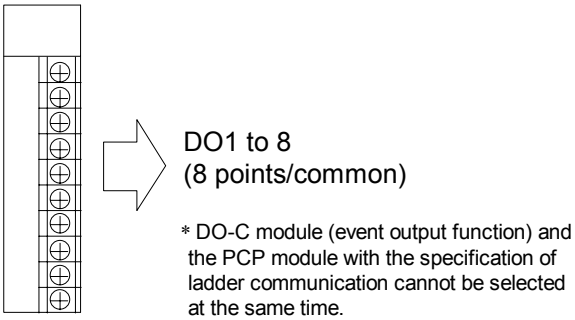
Open collector output type

• DO-B (4 points output type)



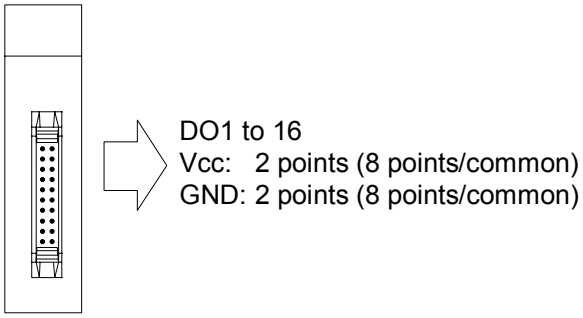
Relay contact output type

• DO-C (8 points output type) *



Open collector output type

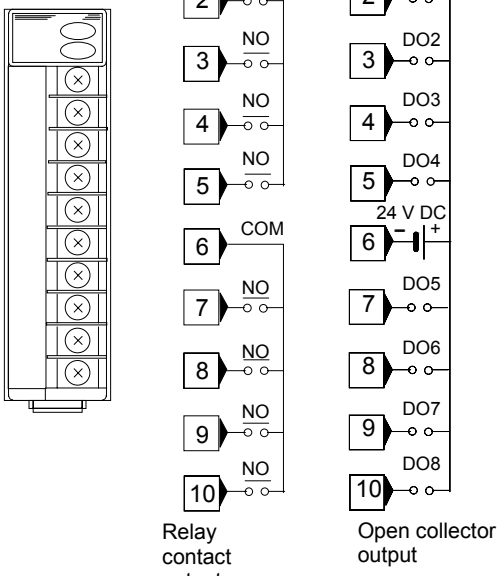
• DO-D (16 points output type)



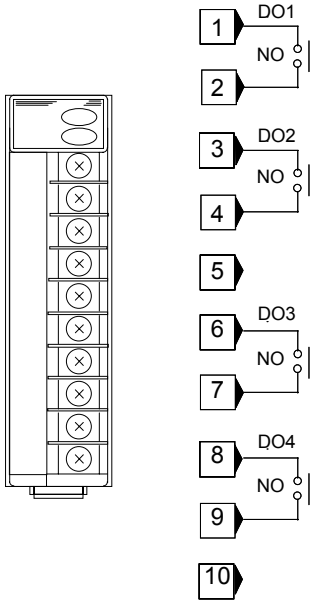
Open collector output type

3.9.2 Terminal configuration

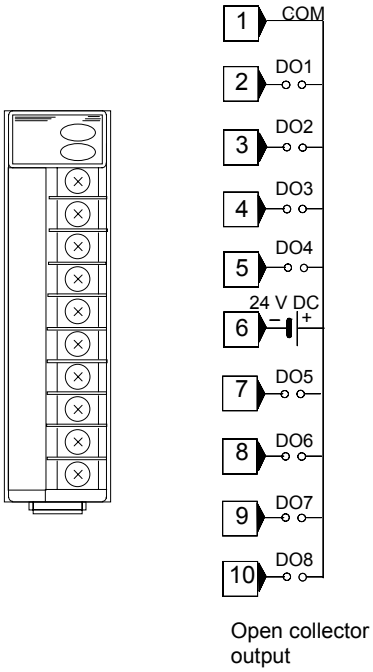
■ DO-A type



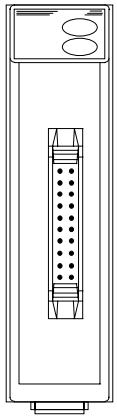
■ DO-B type

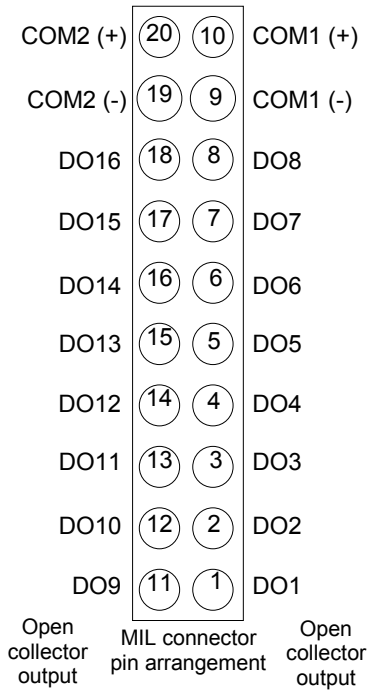


■ DO-C type



■ DO-D type





Connector type: MIL connector (AXM220011)
(DO-D module side)
Recommended connector:
AXM120415 (With strain relief)
Matsushita Electric Works, Ltd.

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

3.9.3 Functional description

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

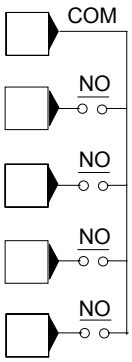
This alarm is output when the measured value (PV) of the AI module is within the AI alarm setting range. The AI alarm 1 and AI alarm 2 are output for each channel.

■ Output type

● Relay contact output

DO-A type

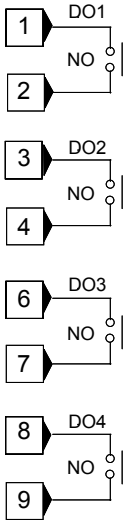
Output status: 1 a contact output
4 points/common



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

DO-B type

All point independent common output

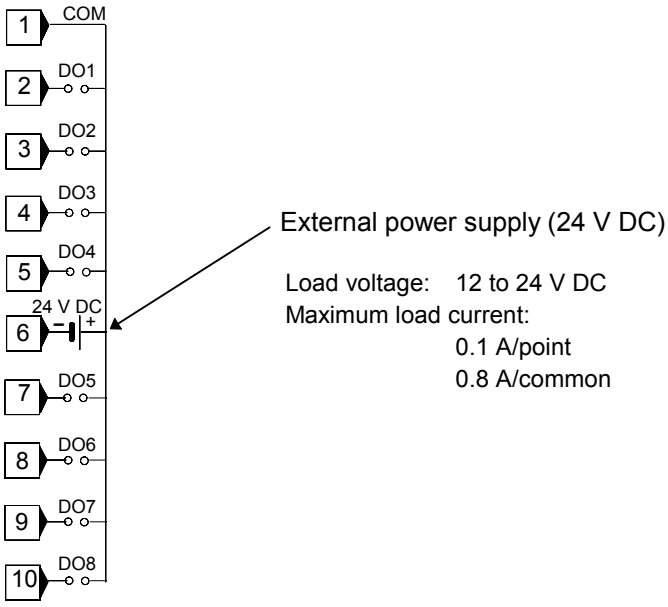


Rating: 250 V AC, 24 V DC
Maximum load current:
1 A/point (Resistive load)

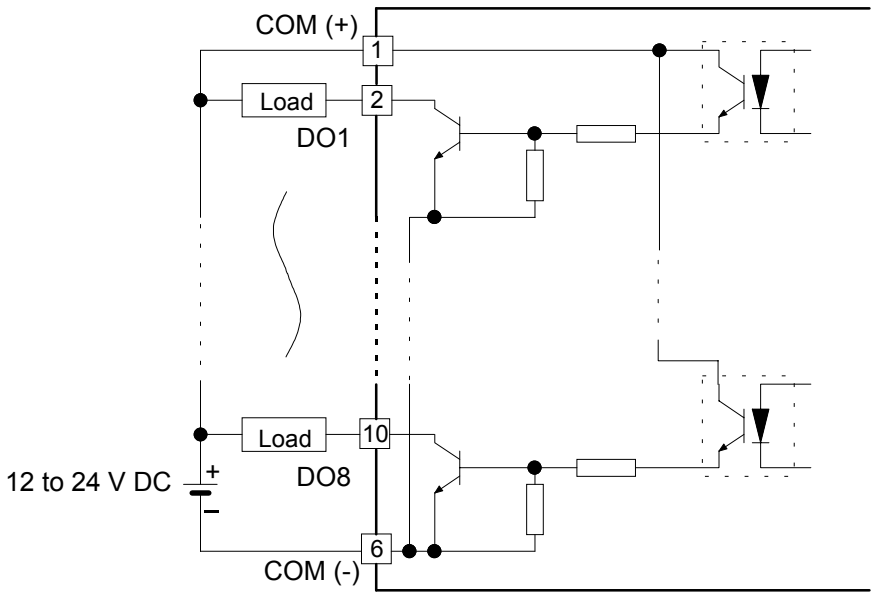
● Open collector output (DO-A and DO-C type)

The output status is an 8 points/common open collector output.
For the internal circuit driver of the DO module, connect the minus (-) terminal of an external power supply 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



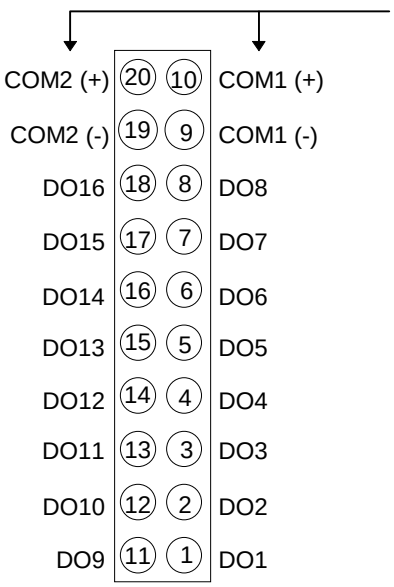
● Open collector output (DO-D type)

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 DO module, connect a minus line (-) of the external power supply 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 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.



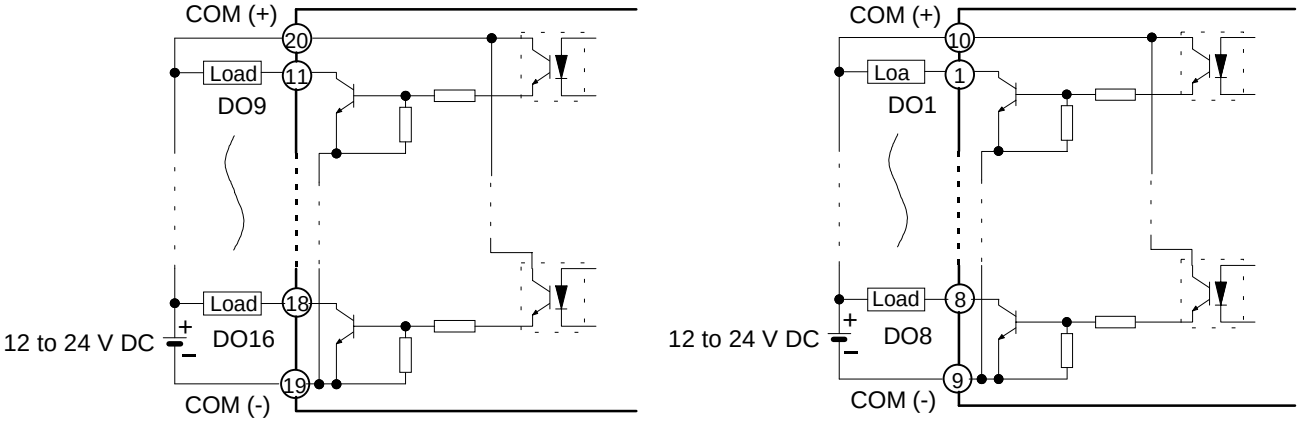
MIL connector pin arrangement
(Front view)

Load voltage: 12 to 24 V DC
Maximum load current:
0.1 A/point
0.8 A/common

Connector type: MIL connector (AXM220011)
(DO-D module side)

Recommended connector:
AXM120415 (With strain relief)
Matsushita Electric Works, Ltd.

Open Collector Output Wiring Example



■ Alarm assignment

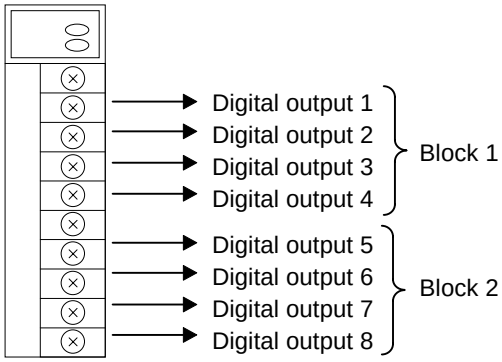
One DO-A or DO-B module is divided into each block (4 points/block) for the respective alarm type. Thus, four points per block are output.
One DO-D module is divided into each block (8 points/block) to output the respective alarm type. The alarm type to be output can be freely selected for each block.

● Alarm types

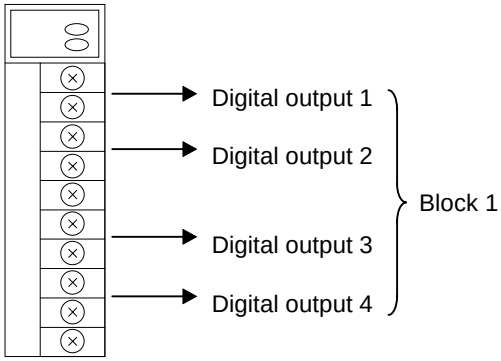
- Temperature alarm 1
- Temperature alarm 2
- Heater break alarm (HBA)
- Burnout alarm
- Loop break alarm (LBA)
- AI alarm 1
- AI alarm 2
- Unused (No alarm)

● Digital output(DO) grouping

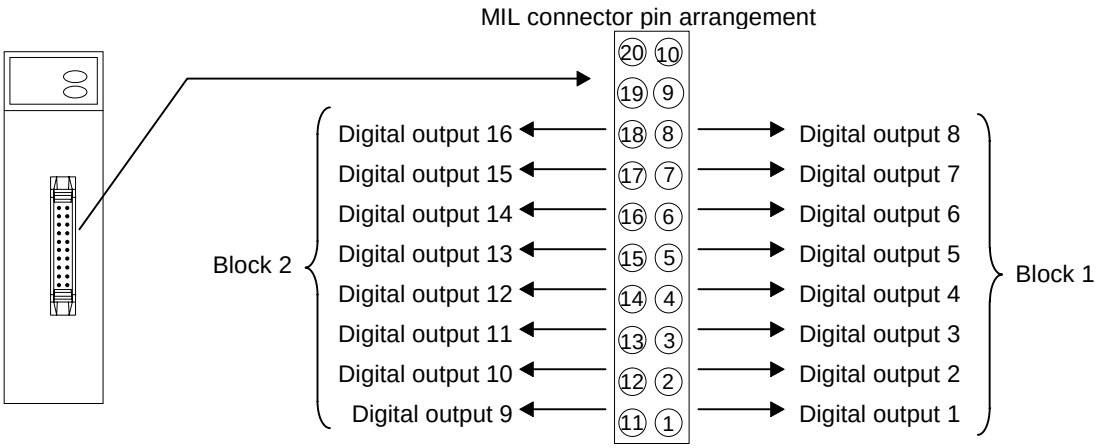
DO-A module



DO-B module

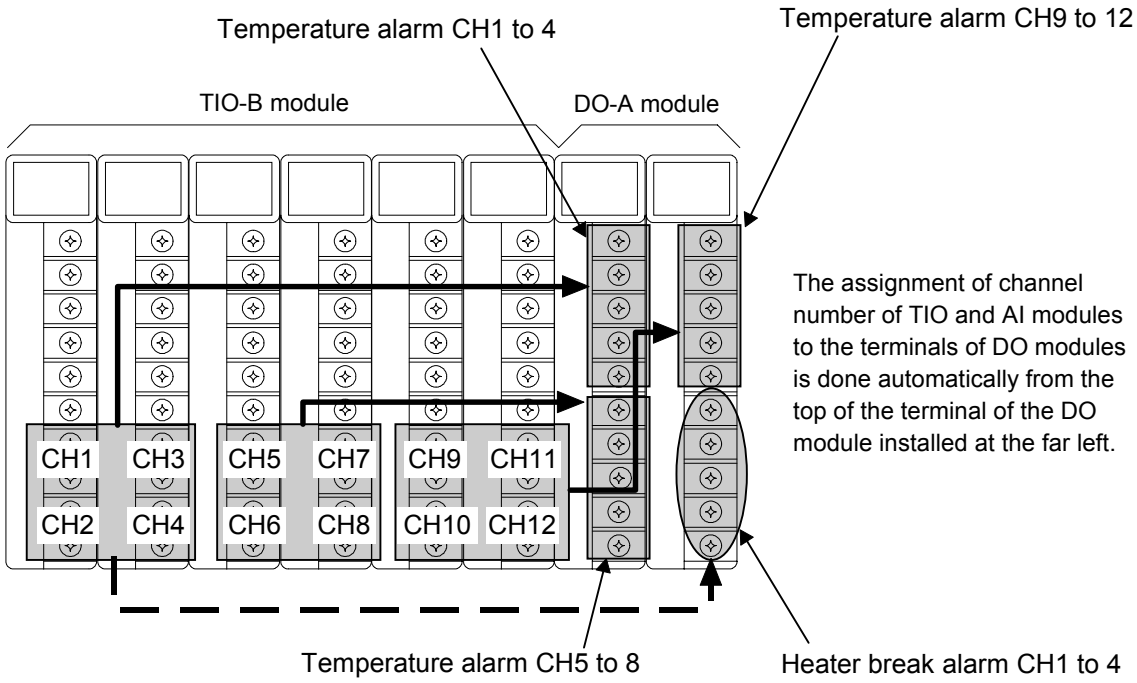


DO-C module



[Example]

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



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

For details on setting alarms, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

(2) Event output function (Only for 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 DO-C module.

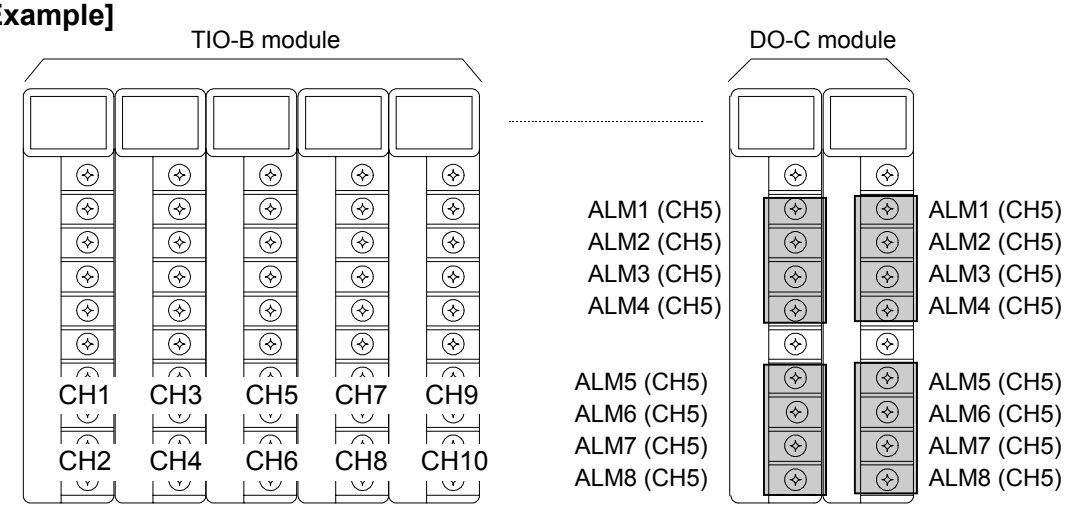
■ Extension alarm output function

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

- **Alarm types**

Temperature deviation alarm: 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: High alarm, Low alarm, High alarm [1], Low alarm [1]
Temperature set value alarm: High alarm, Low alarm
AI process alarm: High alarm, Low alarm, High alarm [1], Low alarm [1]
TI process alarm: High alarm, Low alarm, High alarm [1], Low alarm [1]
[1] With alarm hold [2] With alarm re-hold

[Example]



- DO-C module (event output function) and the PCP module with the specification of ladder communication cannot be selected at the same time.
- This output is different from the ordinary alarm output from the DO-A/B type module. Similarly, the ordinary alarm cannot be output from the DO-C type module (for event output).
- The alarm differential gap and alarm delay timer are commonly set.
- The event output function can be set by the dedicated operation panel or host computer via communication. For details on the setting, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-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.

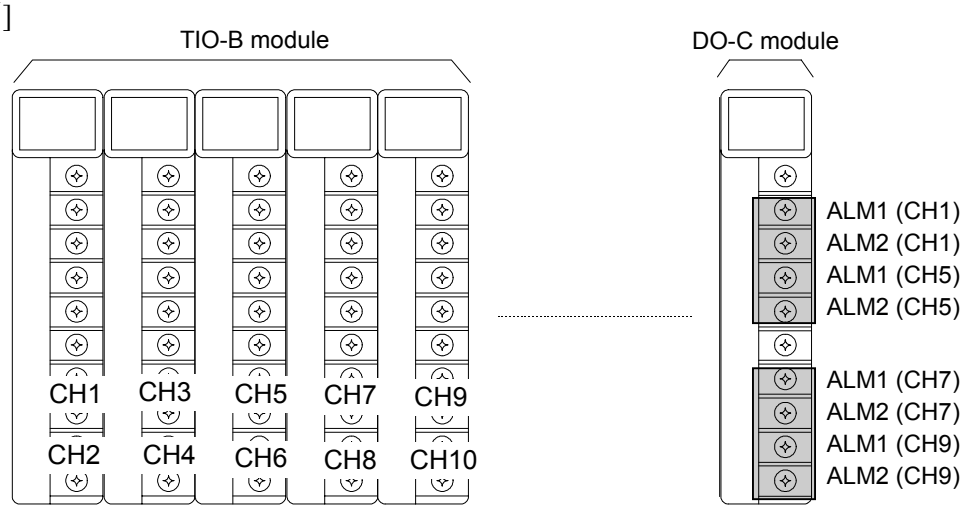
● Status output types

Temperature control status:
Temperature alarm 1 (ALM1), Temperature alarm 2 (ALM2), Heater break alarm (HBA), Loop break alarm (LBA), Burnout, PID/AT

AI status: AI alarm 1 (ALM1), AI alarm 2 (ALM2)

TI status: TI alarm 1 (ALM1), TI alarm 2 (ALM2), TI burnout

[例]



■ Data comparison output function

This function is used to output the result of comparison between the TIO module set value (SV) and TIO module or AI module AI (analog input) measured value within the same group.

● Data comparison output function types

TIO (Control input/output): Comparison between SV and SV, comparison between PV and SV
AI (Analog input): Comparison between PV and PV
TI (Temperature input): Comparison between PV and PV

📖 As AI and TI does not have set values (SV) only measured values (PV) compared.

● 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}

Specify whether PV or SV is compared by the function selection setting, then specify the channel numbers to be compared to Data 1 and 2.

☞ For detail on the setting, see the **Communication Instruction Manual (IMSRM09-E□)**.

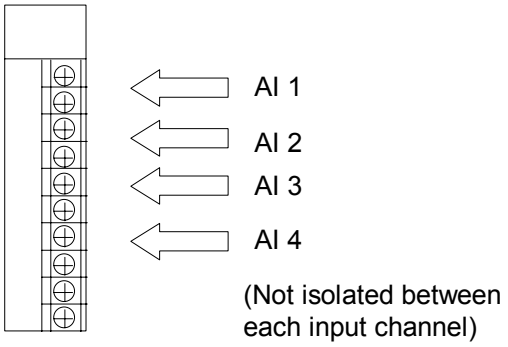
📖 The differential gap during comparison can be set. (All channel common setting)
Setting range: 0.00 to 10.00 % of input range

3.10 AI Module

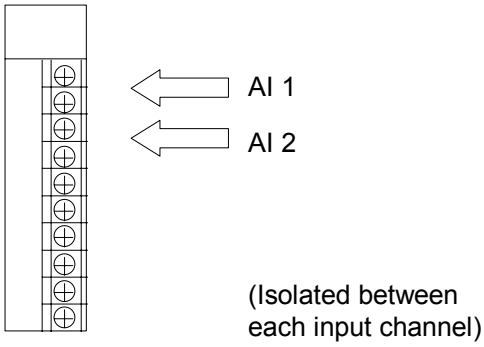
3.10.1 Outline

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

• AI-A type

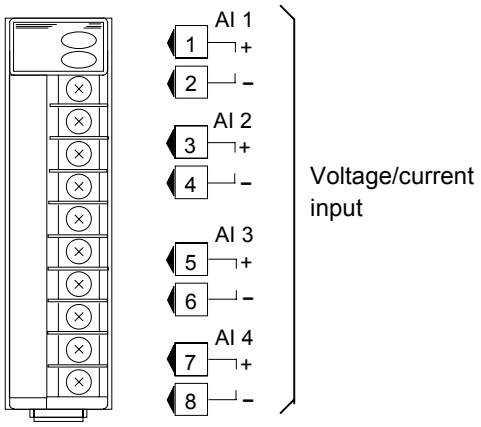


• AI-B type

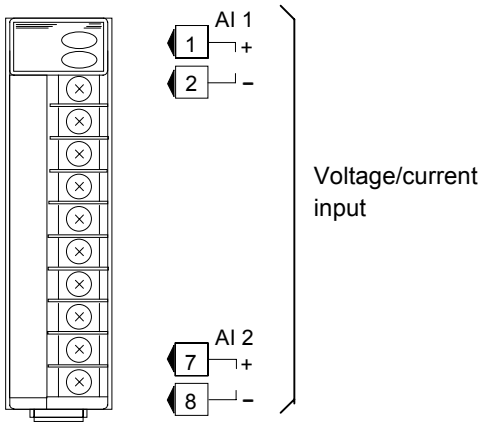


3.10.2 Terminal configuration

■ **AI-A type**



■ **AI-B type**

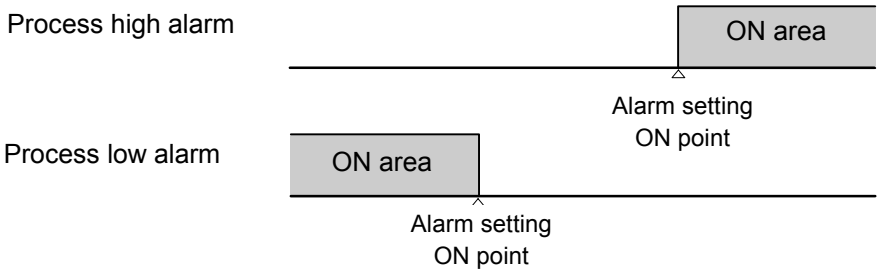


3.10.3 Functional description

■ AI alarm function

For the AI module, two types of alarm are available per channel as standard (AI alarm 1 and AI alarm 2). The alarm types are described below.

● AI alarm types



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

An AI alarm can be output from the DO of the PCP module (A or B type) as overall output (*OR* output). Use the DO module if this alarm needs to be output independently for each channel.

For details on the output status, see **3.9 DO Module (P. 70)**.

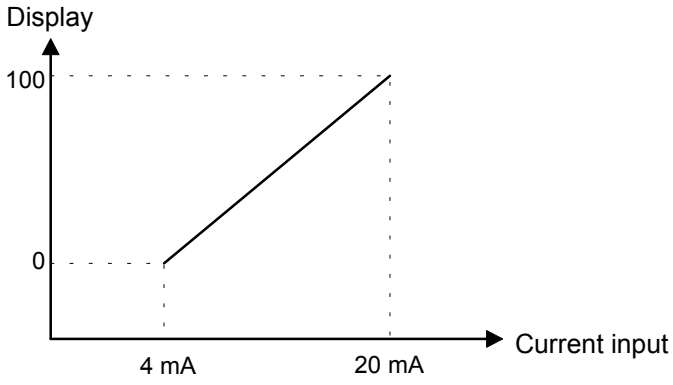
An AI alarm is set from the dedicated operation panel or host computer via communication. For details on the setting, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

■ Scaling function

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

[Example]

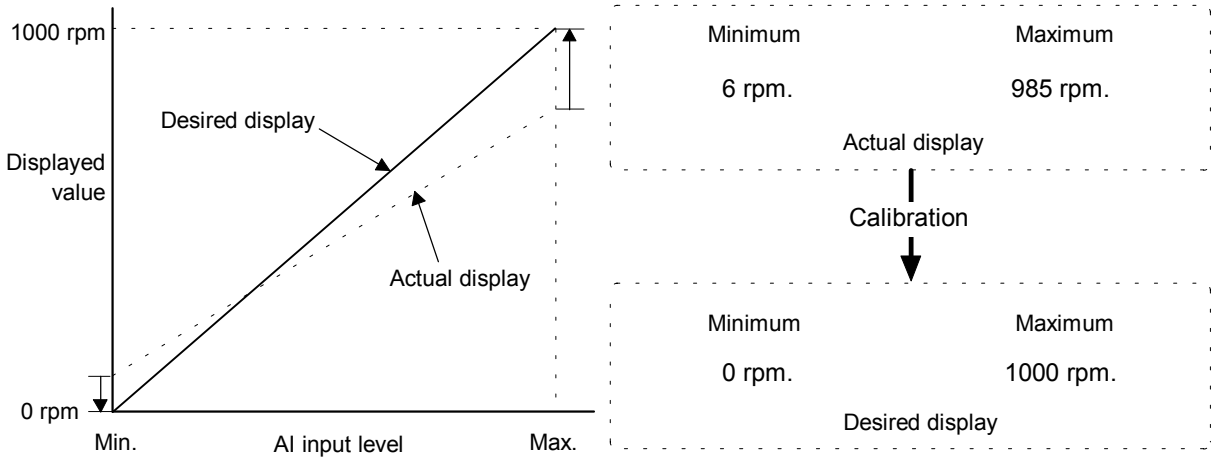
When the display range is scaled to 0 to 100 for a current input of 4 to 20 mA.



■ 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 AI module input value, the displayed value is calibrated (corrected) at its zero and full scale points so as to match the AI module input value.

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



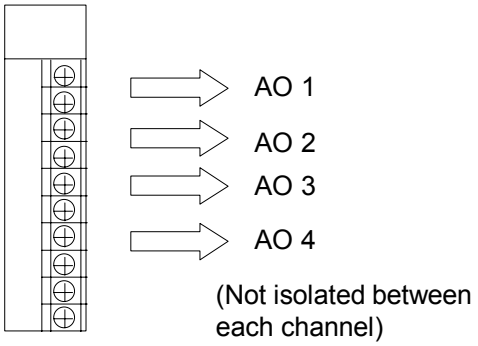
The maximum or minimum displayed value may deviate from the desired value due to an error occurring in the external motor r.p.m.* output signal, shunt resistor or current transformer.
At this time, the displayed value is forcibly matched with the input corresponding to the maximum or minimum value, thereby 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 AO Module

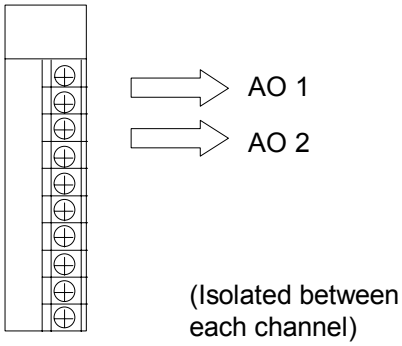
3.11.1 Outline

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 AI module.
* r.p.m: revolutions per minute

- AO-A type

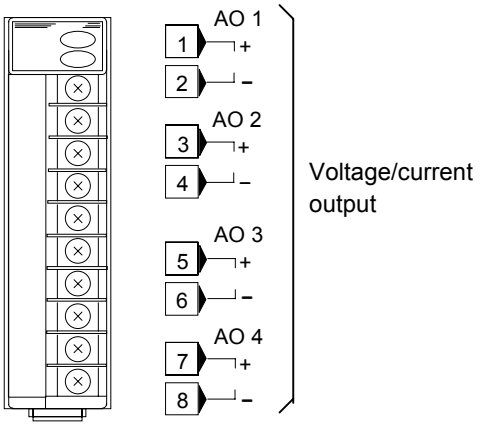


- AO-B type

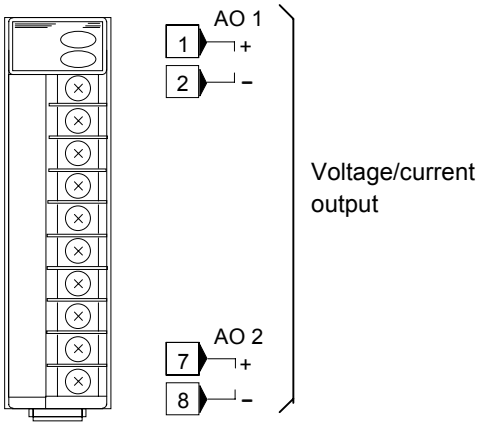


3.11.2 Terminal configuration

■ **AO-A type**



■ **AO-B type**



3.11.3 Functional description

■ Analog output function

The 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
Temperature set value (SV)	1 to 20 CH
Temperature deviation value *	1 to 20 CH
Heat-side control output value	1 to 20 CH
Cool-side control output value	1 to 20 CH
AI module input value	1 to 40 CH
TI module input value	1 to 40 CH
TIO-K module feedback resistance input value	1 to 10 CH

* Difference between temperature measured value (PV) and temperature set value (SV).

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.

The analog output function can be selected from the dedicated operation panel, or host computer via communication. For details on how to select the function, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

■ 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.

The output change rate limit function can be set from the dedicated Operation Panel, or host computer via communication. For details on how to set the function, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

■ Zooming function

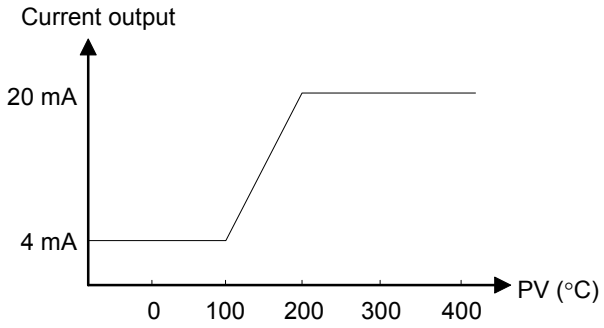
Can be set from 0 to 100 % for each of the high and low sides of the relevant output data. (High > Low)

[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.

The zooming function is set from the dedicated operation panel or host computer via communication. For details on the setting, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

■ AO display scaling function

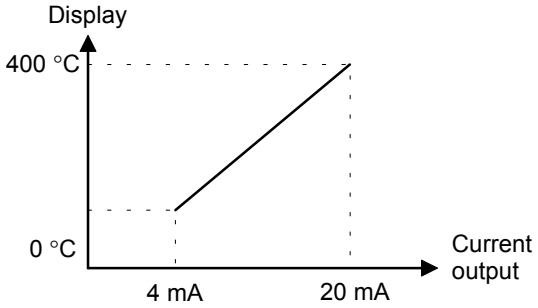
Any analog output from the AO module can match 1 to 5 V or 4 to 20 mA on the display.

[Example]

A screen display of 0 to 400 °C is required by using the 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.

The AO display scaling function is set from the dedicated operation panel or host computer via communication. For details on the setting, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

■ Output calibration function

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

For example, if the number of motor revolutions is set using the 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 AO module, a correction of +2.5 % at the zero point changes the output value of the 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.

The output calibration function is set from the dedicated operation panel or host computer via communication. For details on the setting, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

4. MOUNTING

⚠ WARNING

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

4.1 Mounting Environment

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

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

- Ambient temperature less than 0 °C or more than 50 °C.
- Ambient humidity of less than 45 % or more than 85 % RH.
- 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.

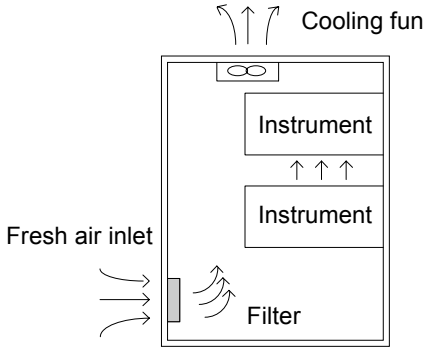
4.2 Mounting Position Within Panel

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. However, do not expose the control unit directly to the air. If exposed, this may cause an error.



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

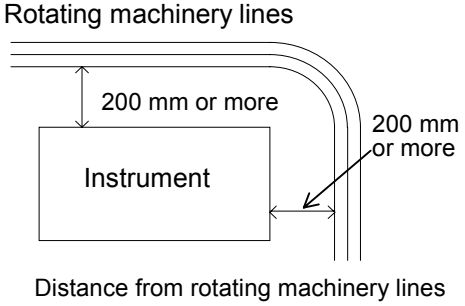
If dust, steam, soot or poisonous gas exists, purge the panel inside using clean air and create a slight positive pressure inside the panel to keep out the harmful gases.

■ 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.

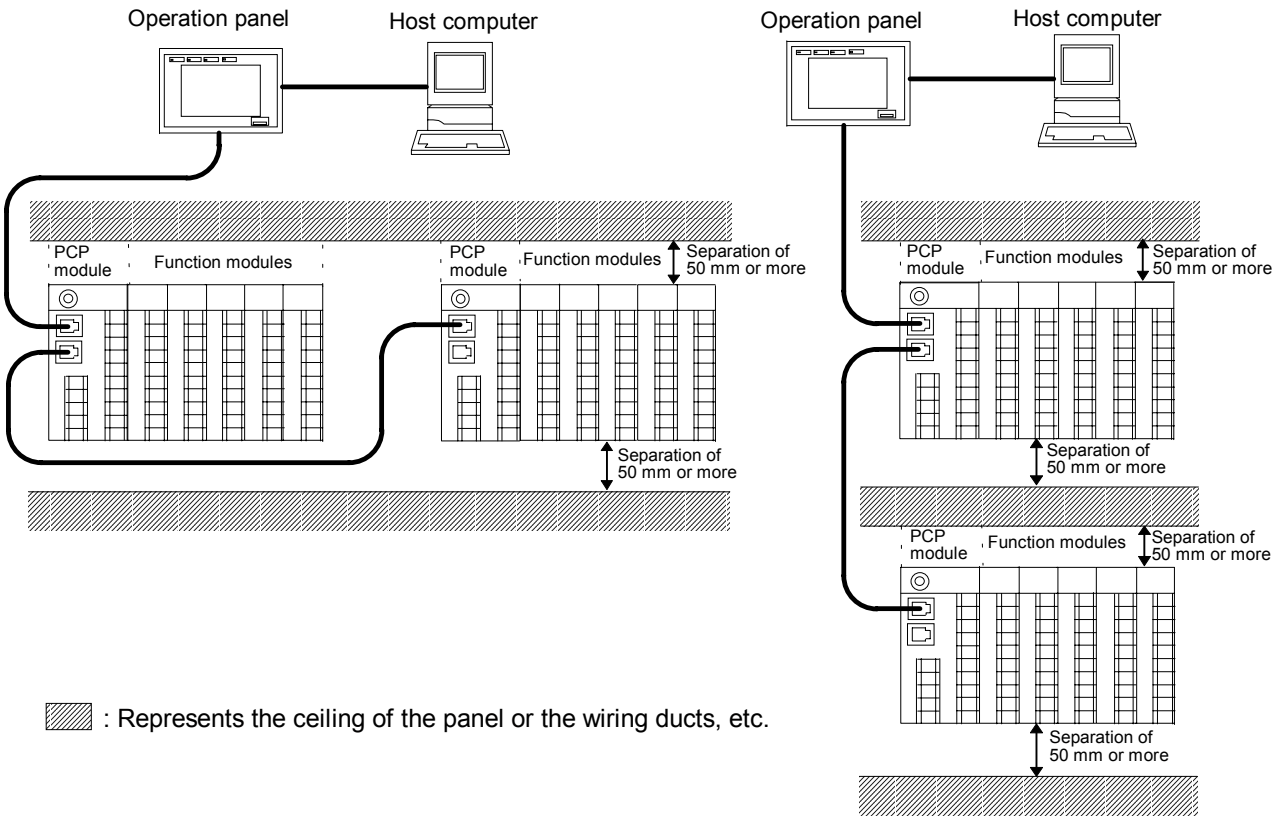
■ Anti-noise considerations

- 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**



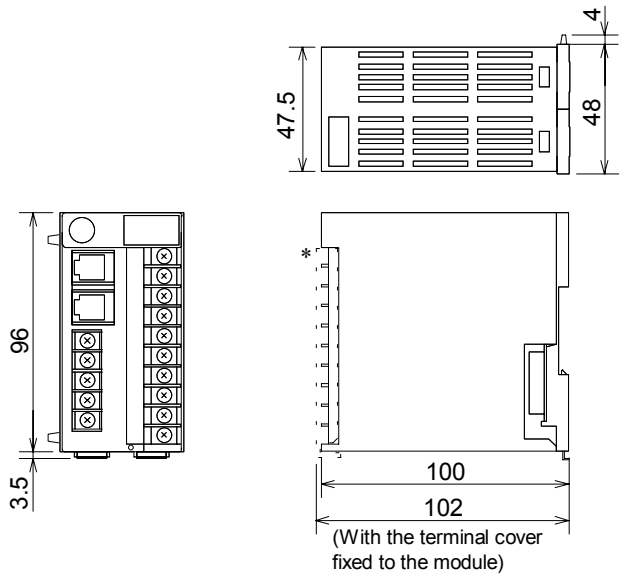
: Represents the ceiling of the panel or the wiring ducts, etc.

As the mounting position of the 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 above figure)

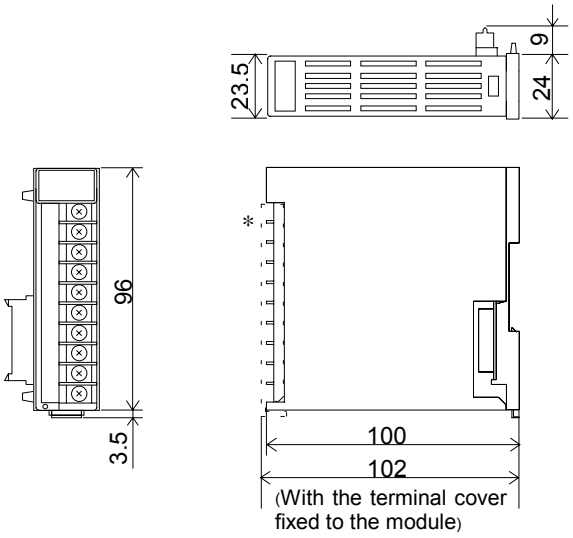
4.3 Dimensions

■ External dimensions

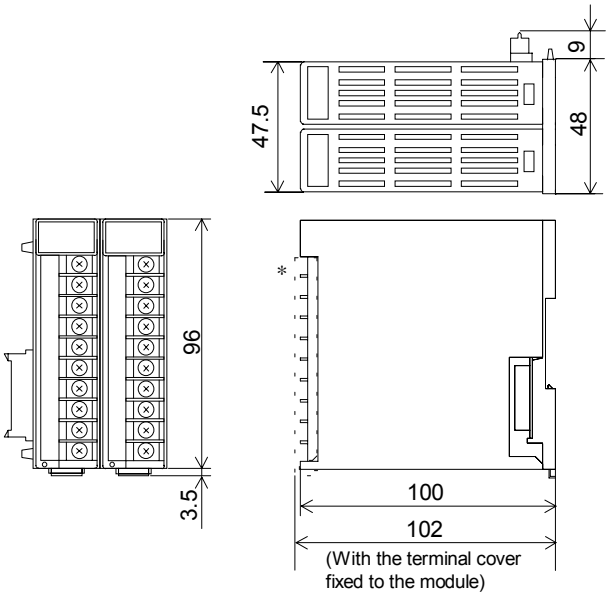
(Unit: mm)



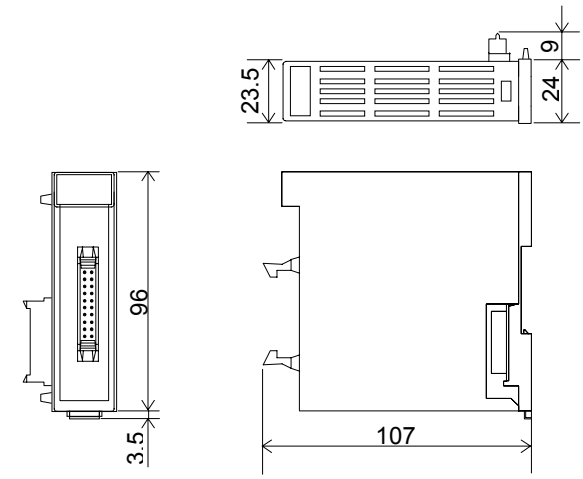
PCP module



Single type module



Double type module



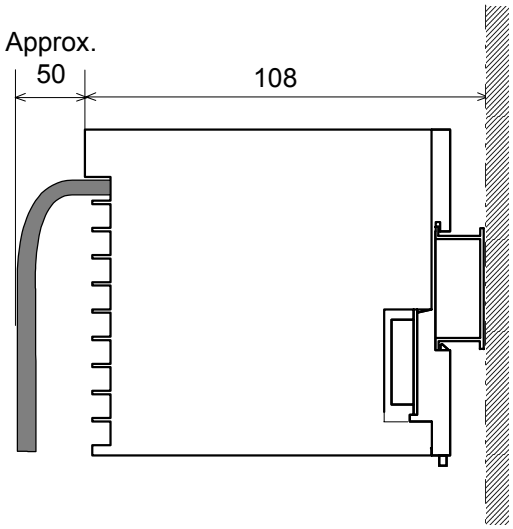
DO-D module

*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)



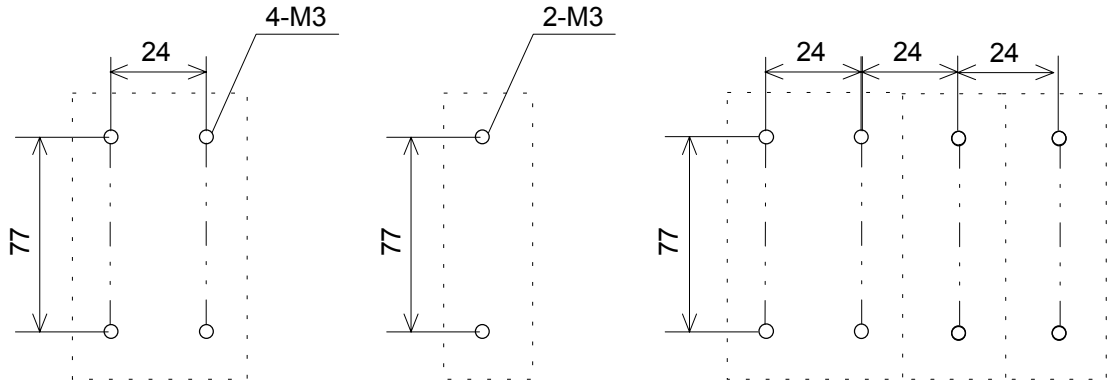
4.4 Mounting the Mother Block

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

■ Panel mounting directions

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

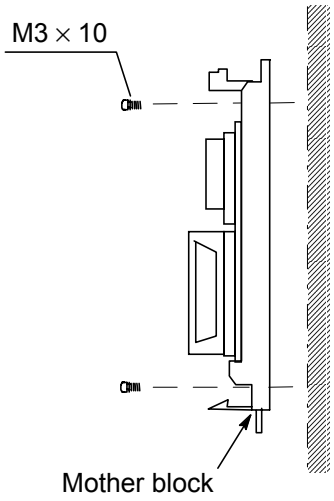
(Unit: mm)



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, see **4.6 Removing the Module Mainframe (P. 95)**.

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

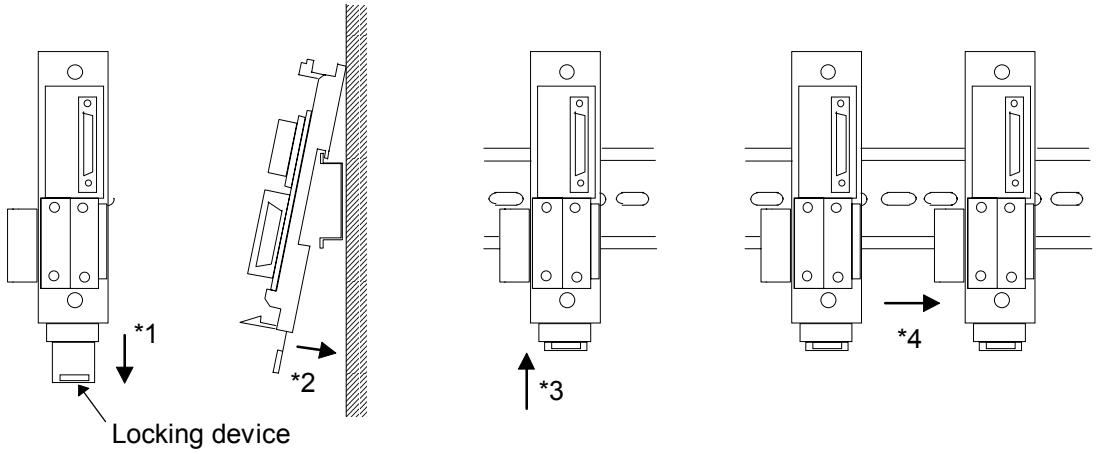


Tightening torque
Recommended value: 0.3 N·m (3 kgf·cm)

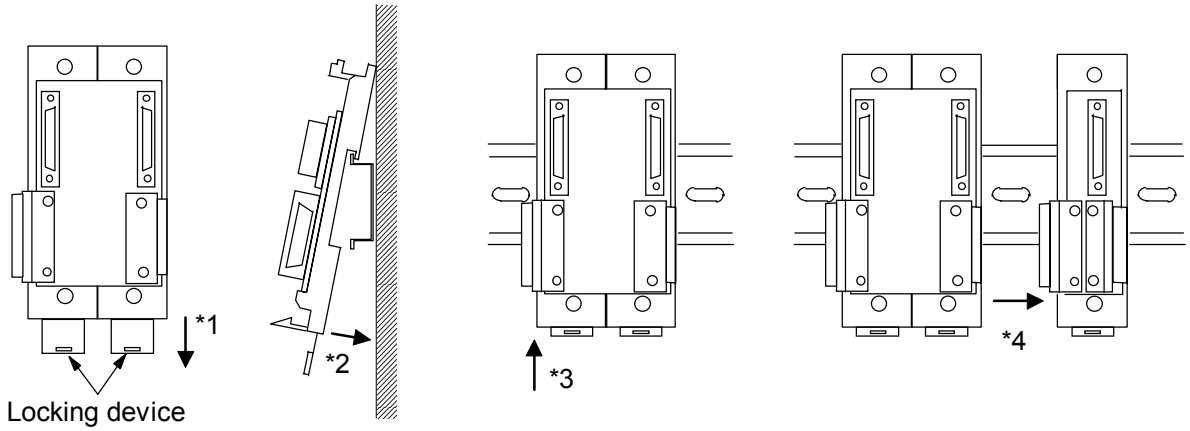
When the mother block is mounted on the panel, 50 mm or more space is required at the top and bottom of the mother block to attach the module mainframe.

■ DIN rail mounting directions

1. Remove the module mainframe from the mother block. For details of removing the module mainframe, see **4.6 Removing the Module Mainframe (P. 95)**.
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

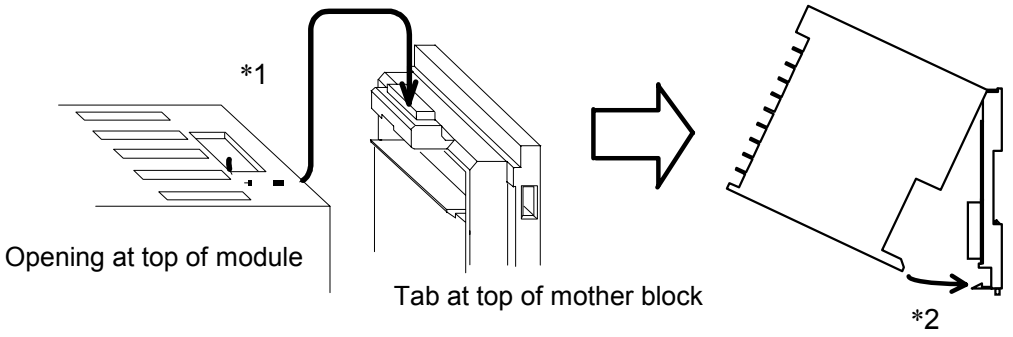
When the mother block is mounted on panel, 50 mm or more space is required at the top and bottom of the mother block to attach the module mainframe.

4.5 Mounting the Module Mainframe

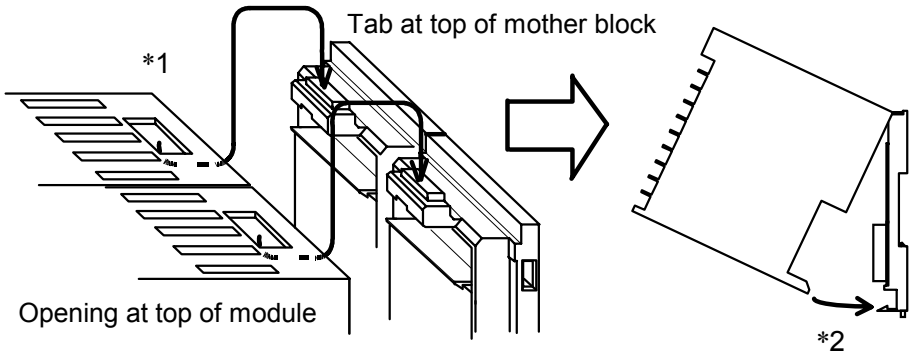
It engages the module with the mother block that is mounted on DIN rail or a panel.

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)



Single type module



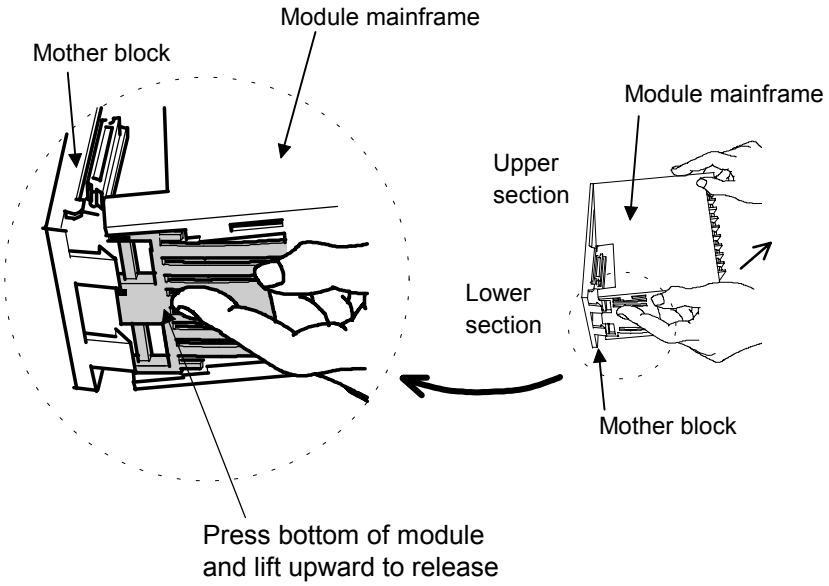
Double type module

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

4.6 Removing the Module Mainframe

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

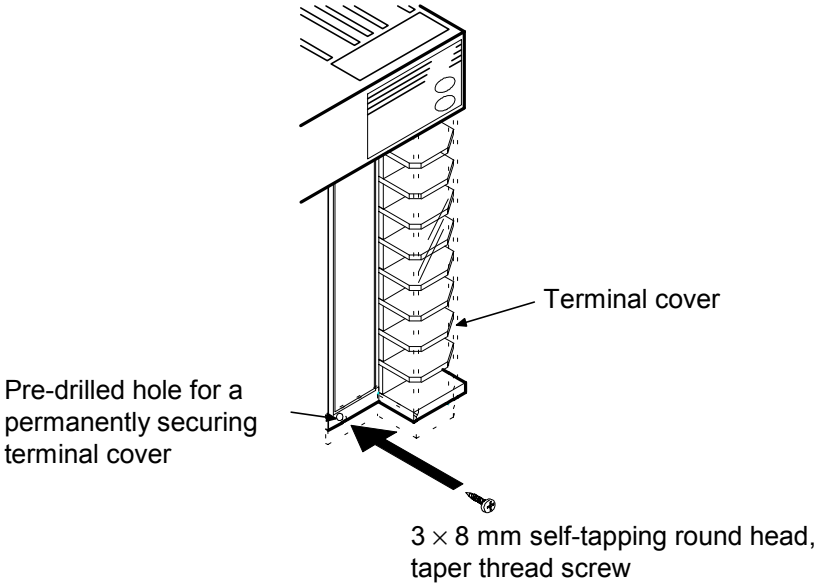
To separate the module mainframe from the mother block, press the bottom on the module, lifting upward, to release connection.



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

4.7 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

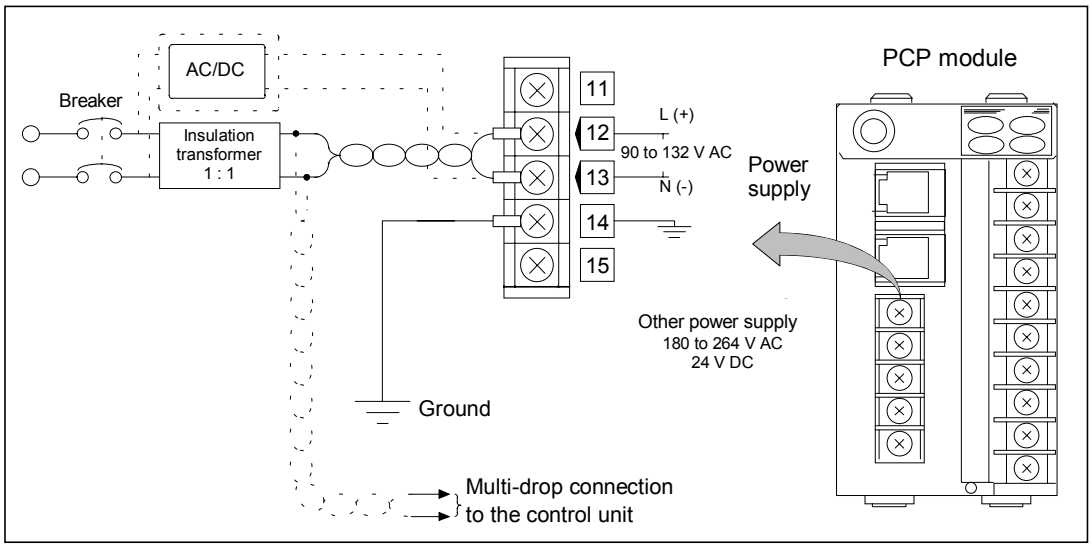
⚠ WARNING

To prevent electric shock or instrument failure, do not turn on the power until all the wiring is completed.

5.1 Wiring Precautions

■ Power supply wiring

- Use power supply as specified in power supply 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.

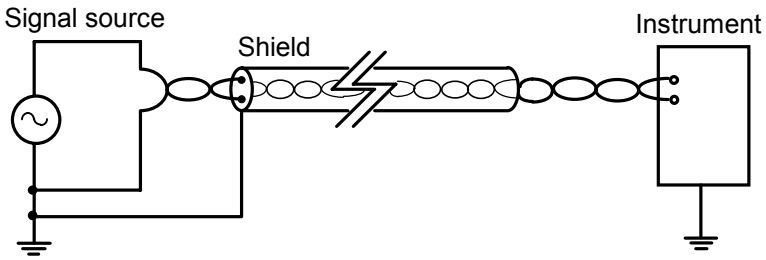


Wiring example

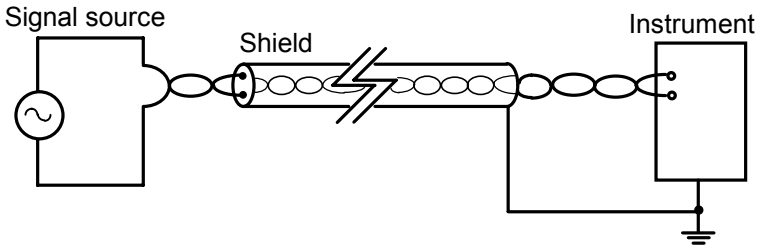
■ Input/output wiring

- 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.
- 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.

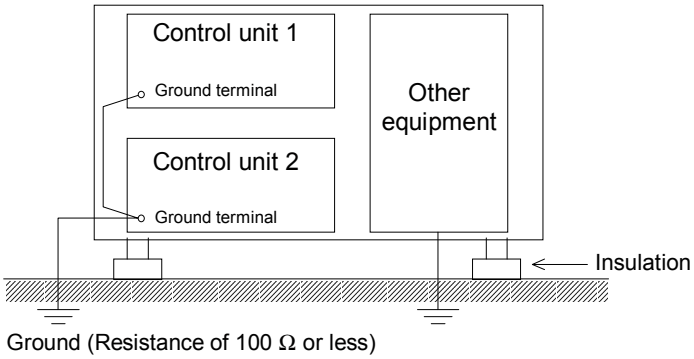


Example: When signal source is not grounded, ground the shield to the instrument side.



■ Ground wiring

- Ground the instrument separately from other equipment. The grounding resistance should be 100 Ω or less.
- Use grounding wires with a cross section area of 2.0 mm2 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 Module Wiring

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

■ Re-confirmation of the specifications

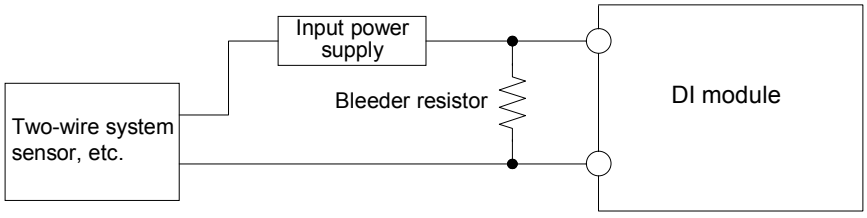
Re-confirm the input/output specifications of each module.
In particular, take adequate care of the input current and voltage for the inputs, and the output current and voltage for the outputs. If a voltage is applied or if a current flows exceeding the maximum opening/closing capacity, this will cause 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.
- Securely tighten the terminal screws to ensure that loose screws do not become the source of mis-operation.

■ Leakage current at 24V 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.



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

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

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.

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

$$W \geq \frac{\text{Input voltage (24)}}{R} \times \text{Input voltage (24)} \times \text{Allowance (4)}$$

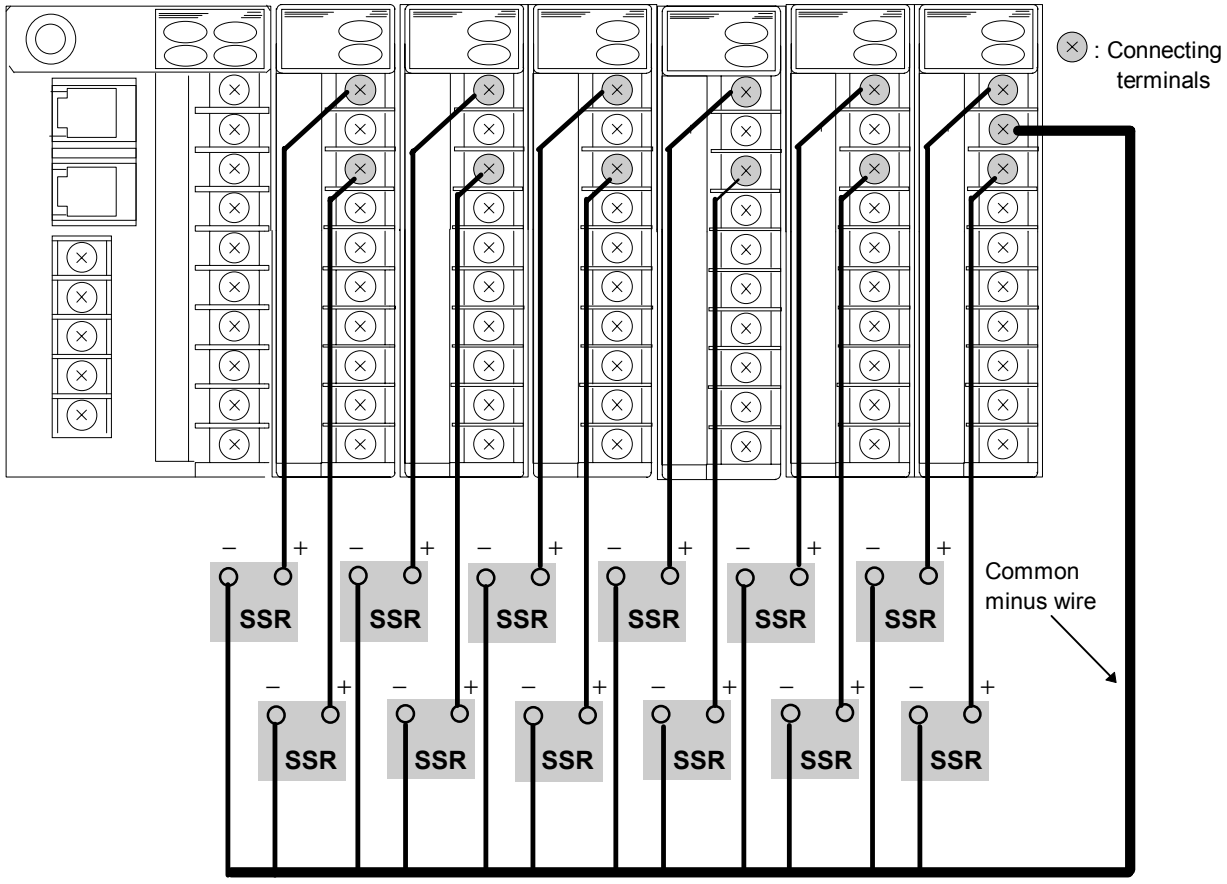
■ TIO module wiring saving

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.

[Example]

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

Six TIO-B module (voltage pulse output): Output total, twelve points



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

Connect a common minus wire to any of the minus side output terminals on the TIO module (any of OUT1 or OUT2 is available).

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 find a solution, please contact RKC sales office or the agent.

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 the wiring is completed.
- 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.

When replacing the module with a new one, always use the module with the same model code. In addition, when replacing the module with a new one of the different module type, please contact RKC sales office or the agent as it becomes necessary to initialize the module, etc.

☞ For details on replacing the instrument, carefully read **6.2 Module Replacement Procedure (P. 107)** or the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□, OPC: IMSRM08-E□)** and **Operation Panel OPC-H Hardware Instruction Manual (IMSRM37-E□)**.

(1) PCP module related

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	Retighten the terminals
	Power supply section defect	Replace 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
Data transmission and reception (TX, RX) lamps not lit up	Operation panel or host computer power not on	Check the power
	Operation panel connection cable disconnected	Inspect cable and replace as necessary
	CPU section defect	Replace PCP module
DO is not output	Output allocation defect	Check the allocation settings
	Output circuit defect	Replace the PCP module
FAIL is output	PCP module CPU section, power section defect	Replace the 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) DI module, AI module, and TI module related

Problem	Probable cause	Solution
RUN lamp does not flash	Power line defect	Replace mother block
	Power supply section defect	Replace 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 PCP module
	Bus line defect	Replace mother block
Specific input value does not change	Sensor cut line	Replace sensor
	Terminal improperly tightened	Retighten
	System set to **Unused** mode	Switch to **Used** mode
	Input circuit, CPU breakdown	Replace module
Error from certain module on	Head mother block defect in error module	Replace mother block
	Module connections disconnected	Check connections

(3) TIO module and CIO module related

Problem	Probable cause	Solution
RUN lamp does not flash	Power line defect	Replace mother block
	Power supply section defect	Replace 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 mis-wiring, cut line	Inspect wiring; replace as necessary
	Terminal screw loose	Retighten
	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 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 TIO module
No output relays go off	Main CPU section breakdown	Replace 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

Continued on the next page.

Continued from the previous page.

Problem	Probable cause	Solution
No input values change	System set to **Unused** mode	Switch to **Used** mode
	Main CPU section breakdown	Replace PCP module
	Bus line defect	Replace mother block
Specific input value does not change	Sensor cut line	Replace sensor
	Terminal improperly tightened	Retighten
	System set to **Unused** mode	Switch to **Used** mode
	Input circuit, CPU breakdown	Replace module
Error from certain module on	Head mother block defect in error module	Replace mother block
	Module connections disconnected	Check connections
Control unstable	PID constant values inappropriate	Execute autotuning and change the PID constant settings
	Terminal tightening defect	Tighten more
	External operating device operation defects	Inspect the external operating device
	Output circuit, CPU breakdown	Replace the TIO module

(4) DO module and AO module related

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 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 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
Error from certain module on	Head mother block defect in error module	Replace mother block
	Module connections disconnected	Check connections

(5) CT module related

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 cut line	Inspect heater
	Terminal loose, mis-wiring between channels	Tighten terminals, check wiring
	Input circuit, CPU breakdown	Replace module
Error from certain module on	Head mother block defect in error module	Replace mother block
	Module connections disconnected	Check connections

6.2 Module Replacement Procedure

■ PCP module replacement

To remove the 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

📖 As all data on PID constants, alarm set values, etc. is managed by the PCP module, it is necessary to re-enter and re-set all data when the 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.

  ☞ For details, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, and **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□).**

☞ For details on removing the module mainframe, see the **4.6 Removing the Module Mainframe (P. 95)**.

■ Function module replacement

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

● Replacement procedure

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.
7. Replacement end

📖 When replacing the module, always use the same model of module.

📖 Before replacing the present module with a new one, set channel operation mode used in the former to **Unused** mode.

📖 When the control unit specifications are changed by changing the module type, always set the **Module initialization**.

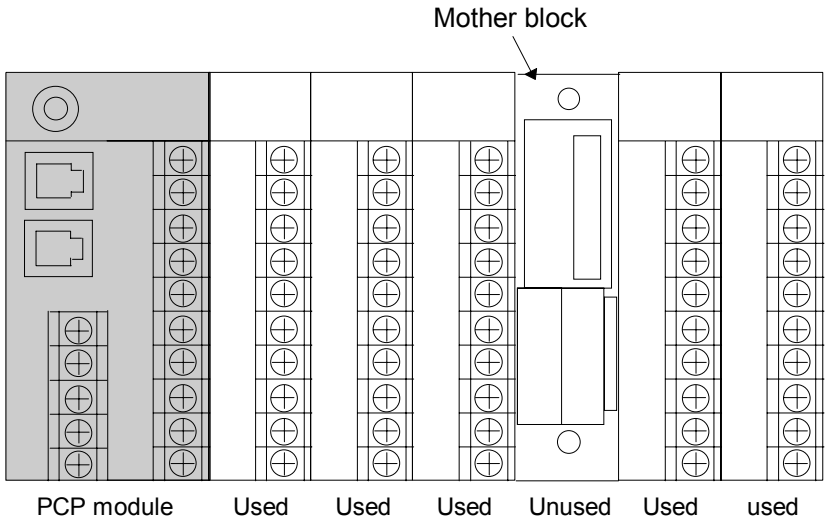
☞ For details on module initialization, see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.

☞ For details on removing the module mainframe, see the **4.6 Removing the Module Mainframe (P. 95)**.

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 PCP module, and it is possible to use the module as before.

☞ For more details of the operation methods, etc., see the **Operation Panel Instruction Manual (OPM: IMSRM18-E□, OPM-H: IMSRM24-E□)**, **Operation Panel Screen Operation Manual (OPC: IMSRM14-E□, OPC-H: IMSRM38-E□)**, and **Communication Instruction Manual (IMSRM09-E□)**.



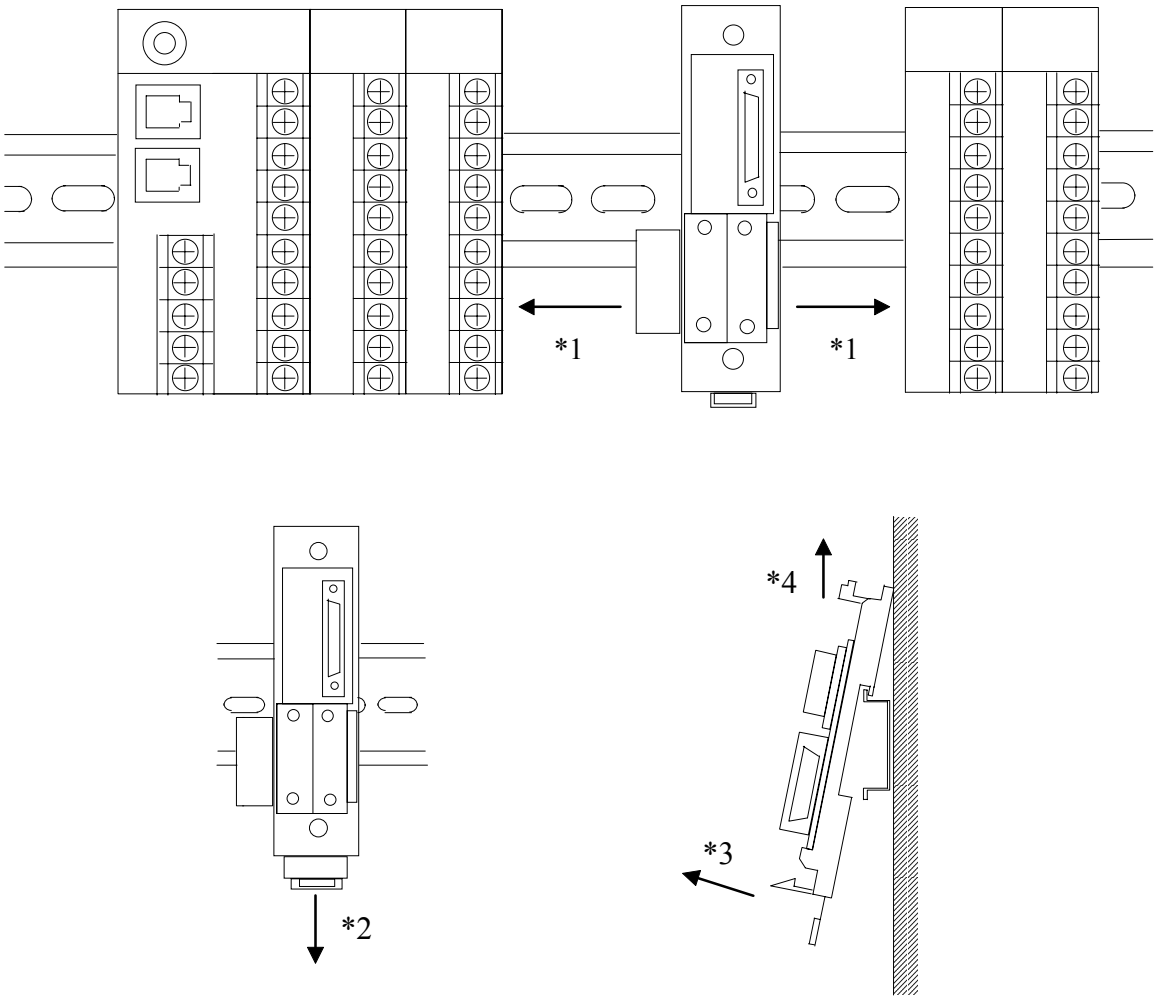
Be careful not to remove the module without first setting this channel to the **Unused** mode, otherwise a failure will be output from the PCP module. However, the FAIL lamp of the PCP module will not light at this time.

■ 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:

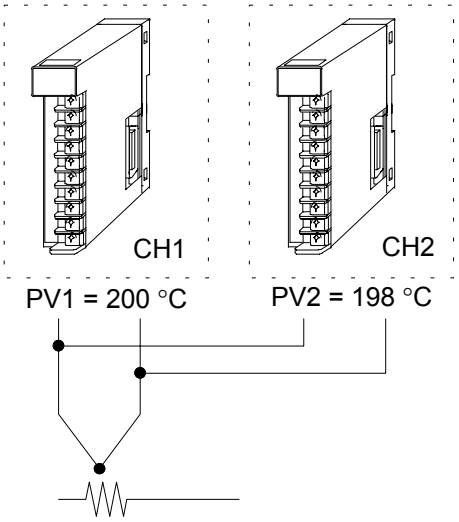
CH1 = 200 °C
CH2 = 198 °C

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

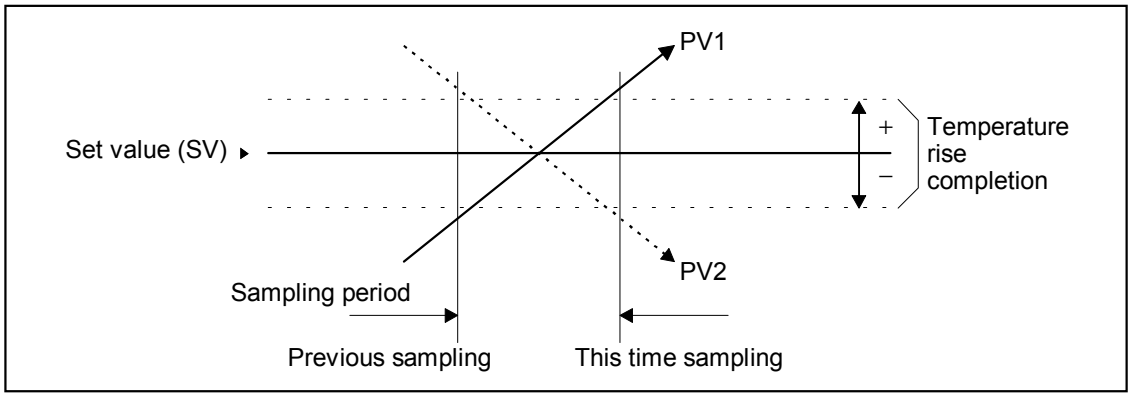
In this instrument, for a span of 400 °C, the PV bias should be set to:

PV bias = 0.5 %
(400 × 0.5 % = 2 °C)



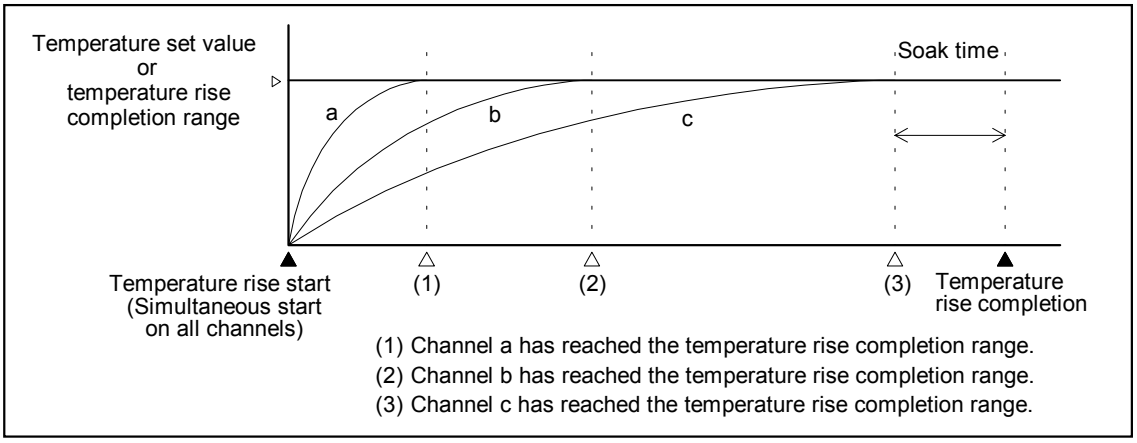
(2) Temperature rise completion function

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

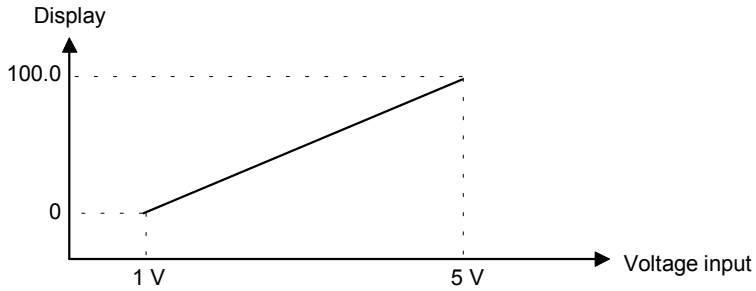
This is a software filter which reduces input value variations caused by noise. If the time constant of this filter is set appropriately to match the characteristics of the controlled object and the noise level, the effects of input noise can be suppressed. However, if the time constant is too small, 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

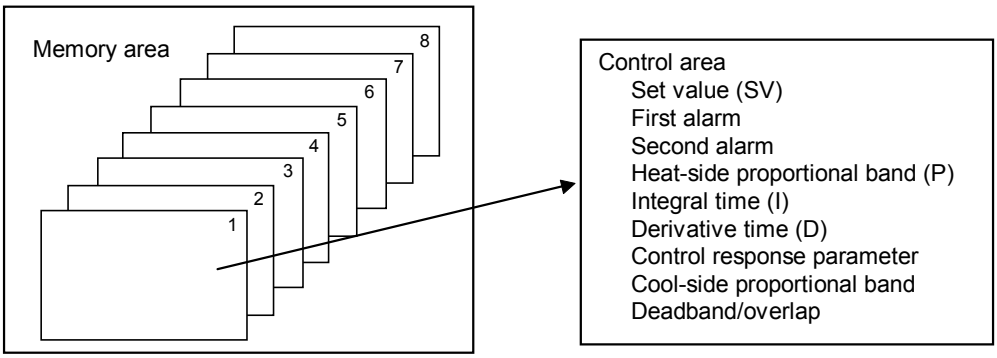


Decimal point position	Range
□□□□	-1999 to +9999
□□□. □	-199.9 to +999.9
□□. □□	-19.99 to +99.99
□. □□□	-1.999 to +9.999

7.2 Settings

(1) Memory area function

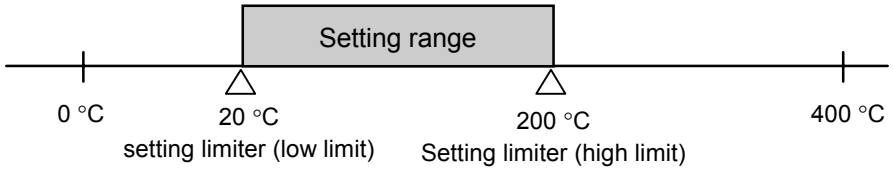
This function is to store the parameters such as set value (SV), etc. in up to eight memories. The parameters which can be stored as one of memories are set value (SV), first alarm, second alarm, heat-side proportional band (P), integral time (I), derivative time (D), control response parameter, cool-side 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

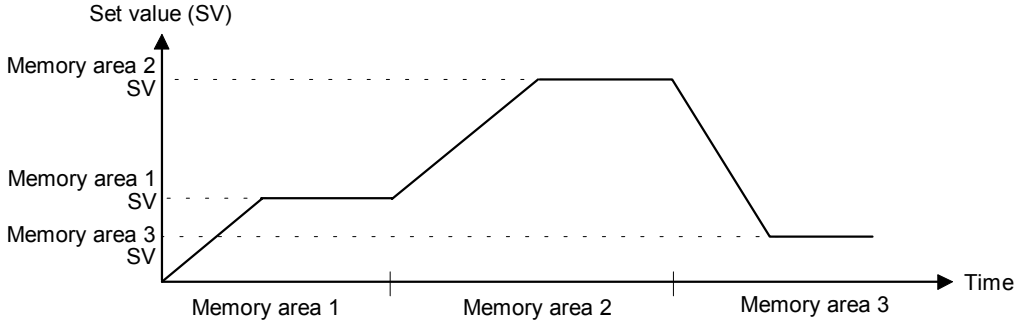
The setting limiter is used to restrict the setting range of the set value (SV).

[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

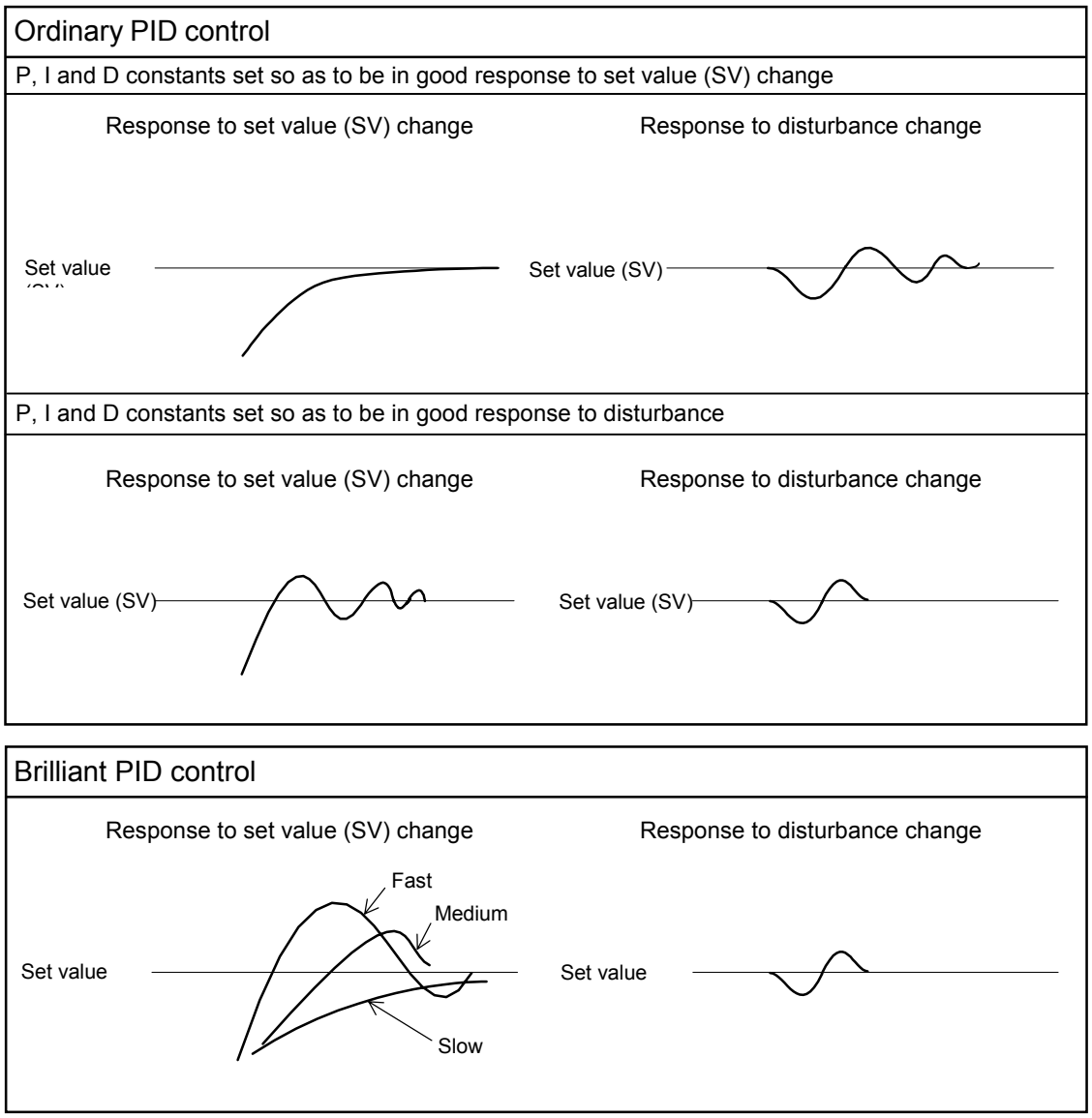
This function is used to set the set value change per one minute when the set value is changed.



7.3 Controls

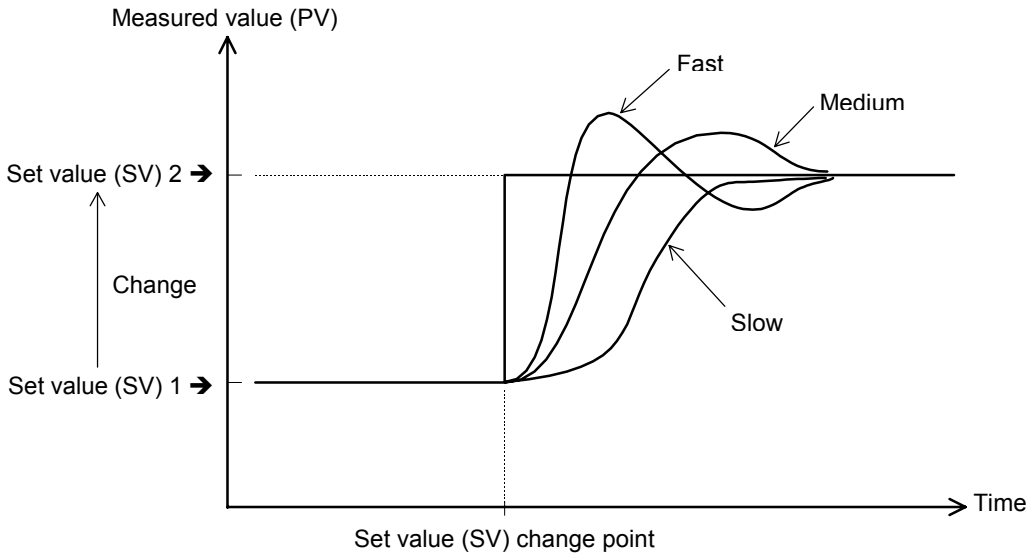
(1) Brilliant PID control

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

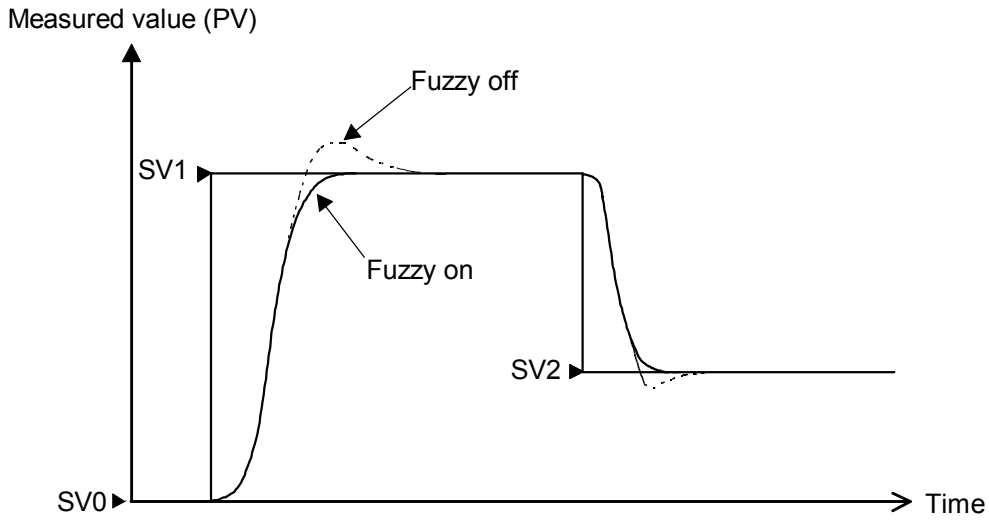
This is the function of enabling the setting of response to set value (SV) change in select any one of 3 steps (**Slow**, **Medium**, **Fast**) in PID control.
In order to achieve faster controlled object response to set value (SV) change, select **Fast**. However, slight overshoot is unavoidable when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



(3) Fuzzy function

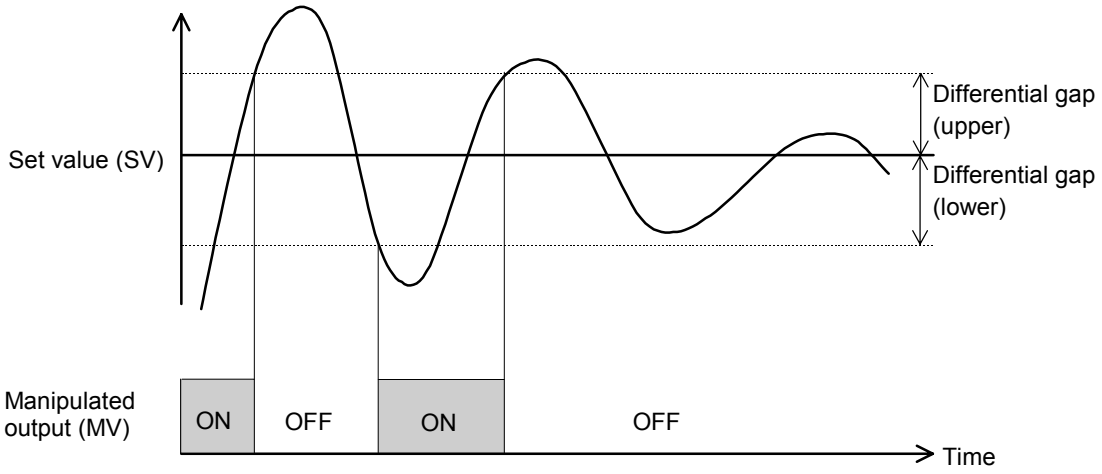
The fuzzy function is effective to smoothly start operation and to limit overshooting or undershooting when the set value is changed.
When executing PID control by the fuzzy function, specify **Fast**.

Response characteristic when fuzzy control is used



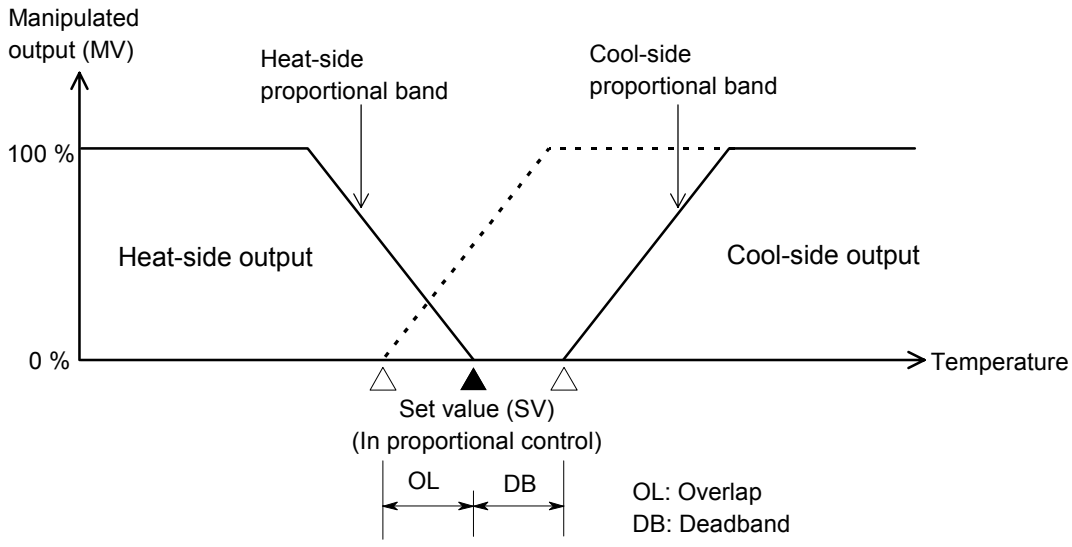
(4) ON/OFF control

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).



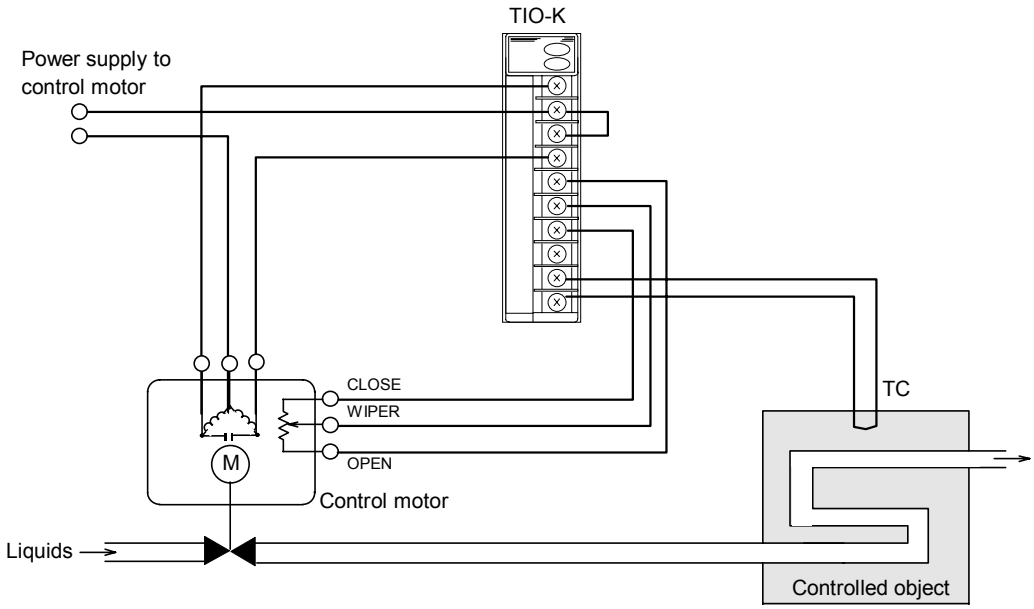
(5) Heat/cool control

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.



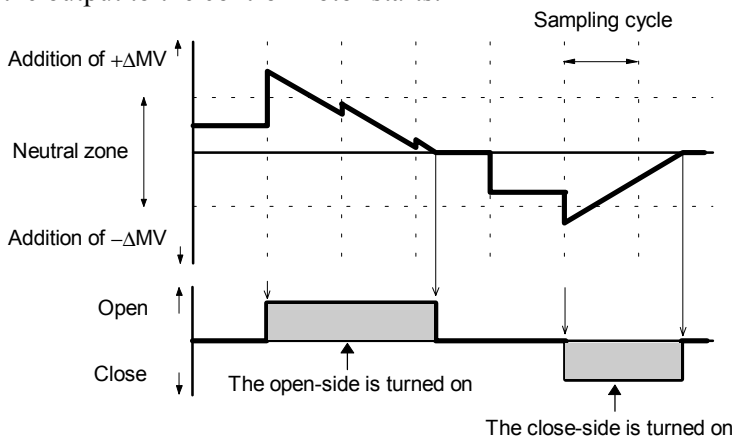
(6) Position proportioning control

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 moter.
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.

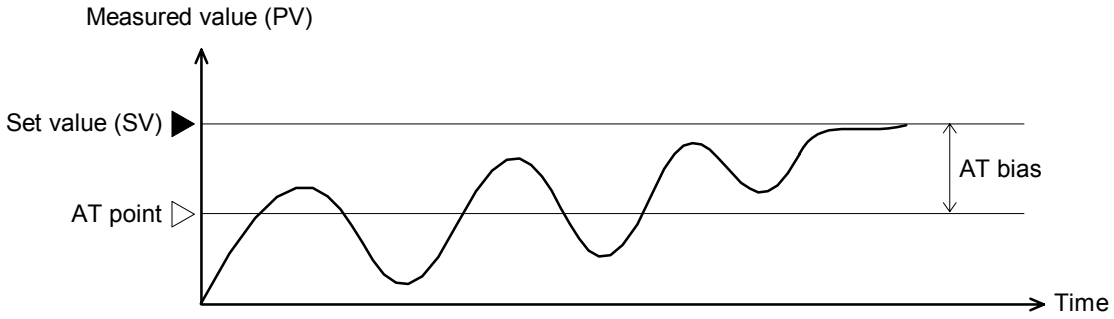
(8) Enhanced autotuning

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

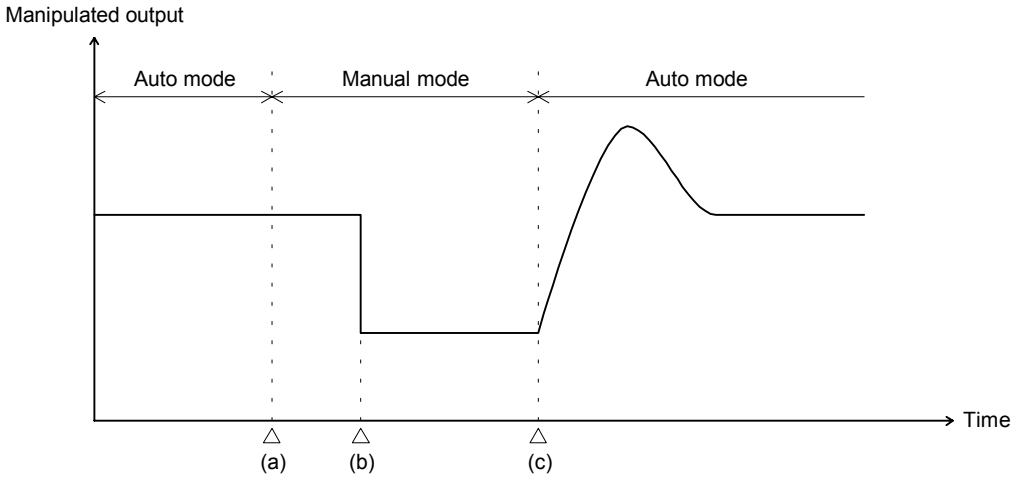
This function is used to prevent overload caused by the manipulated output value (MV) suddenly changing when auto mode is transferred to manual mode and vice versa.

● 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.

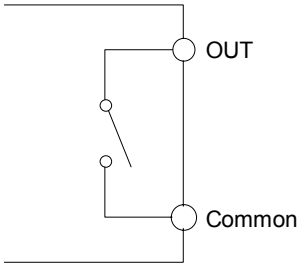


(a) Transfer from auto mode to manual mode. However, when the mode is transferred to manual mode, the manipulated output follows that in auto mode.
(b) The manipulated output changed (manual mode function).
(c) Transfer from manual mode to auto mode. When the mode is transferred to auto mode, the manipulated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

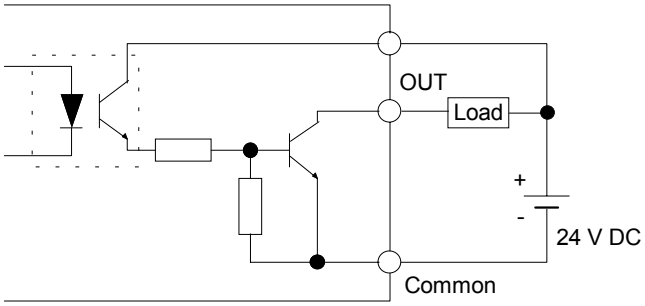
7.4 Alarms

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



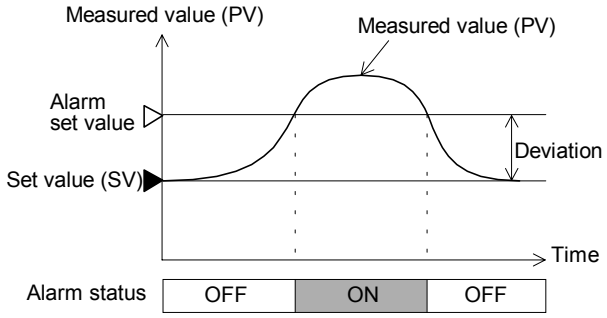
(1) Deviation alarm

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.

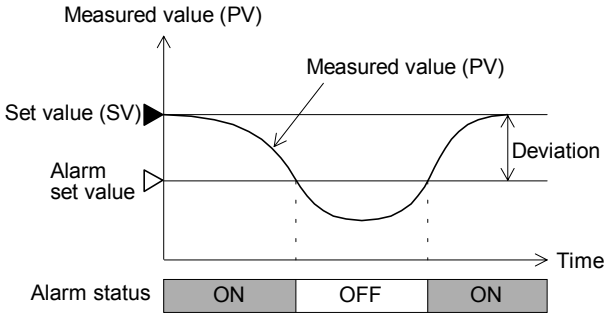
● Deviation high alarm

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



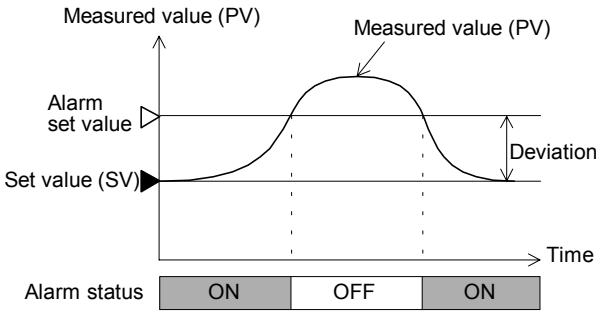
– When the deviation is on the negative side



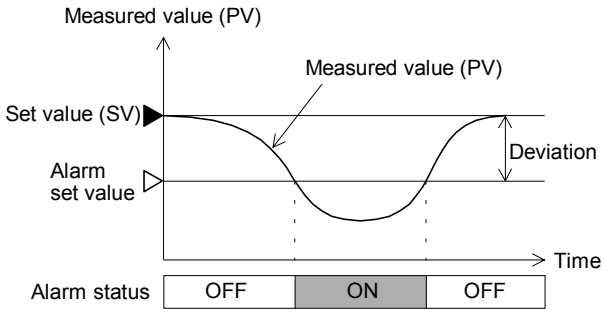
● Deviation low alarm

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

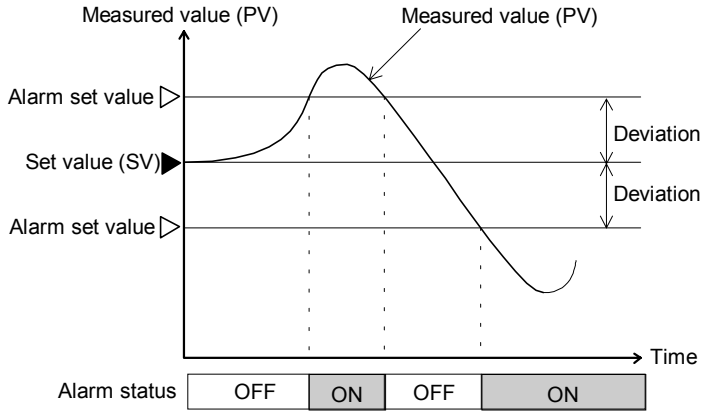


– When the deviation is on the negative side



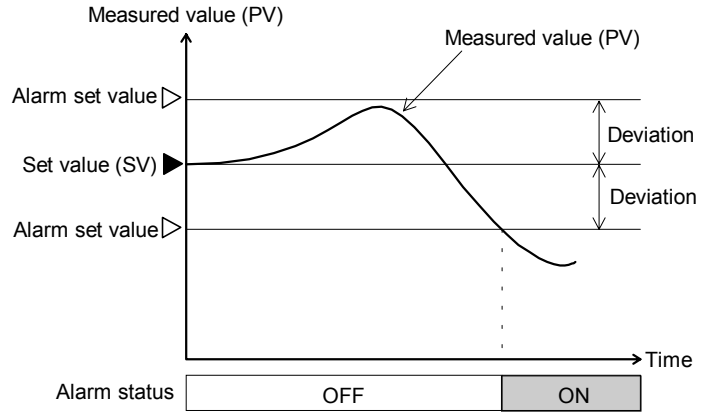
● Deviation high/low alarm

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

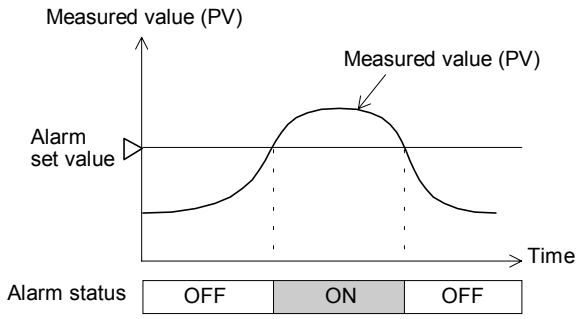
When the absolute deviation | Measured value (PV) - Set value (SV) | is within the alarm set values, the alarm status is set up.



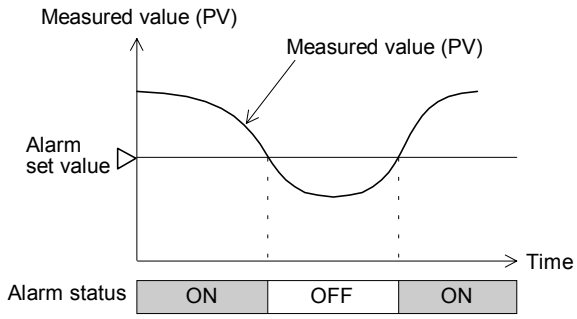
(2) Process alarm

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

– Process high alarm



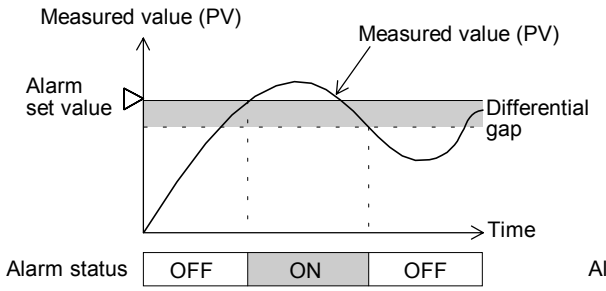
– Process low alarm



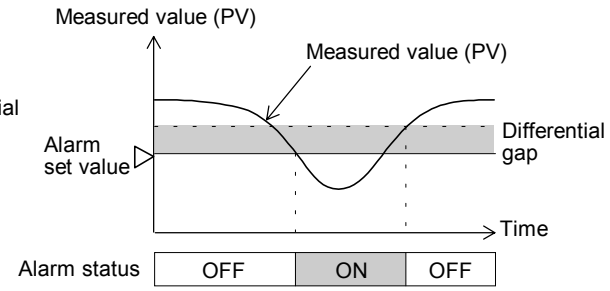
(3) Alarm differential gap

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.

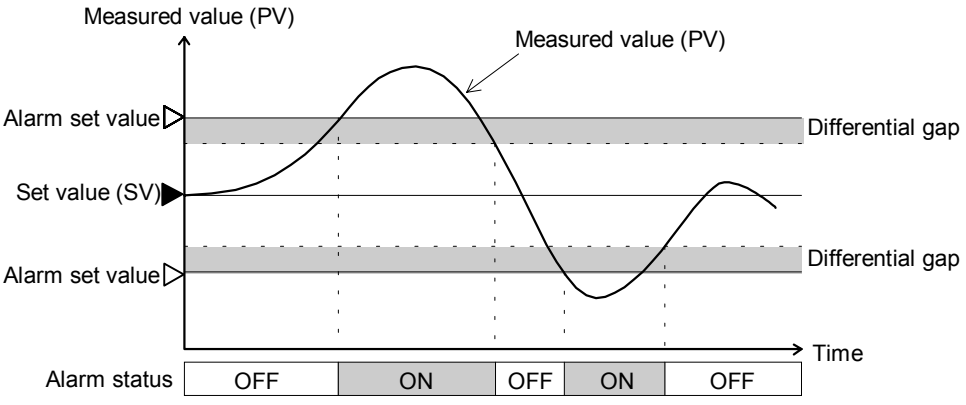
– High alarm (Deviation/process)



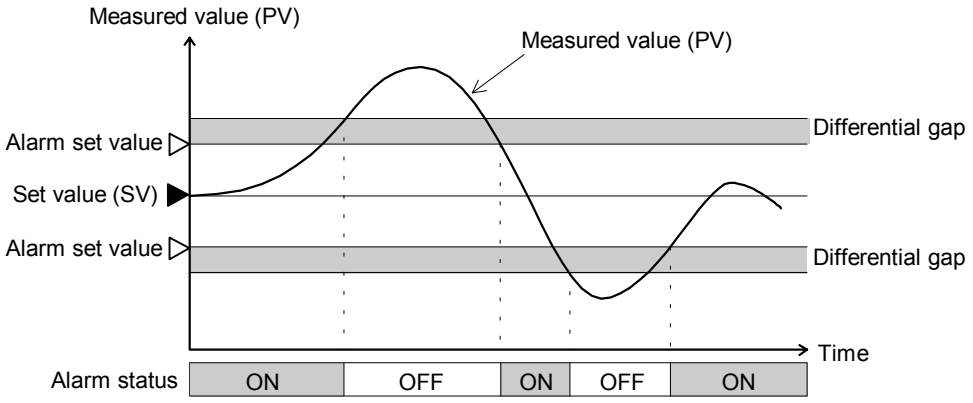
– Low alarm (Deviation/process)



– High/low alarm



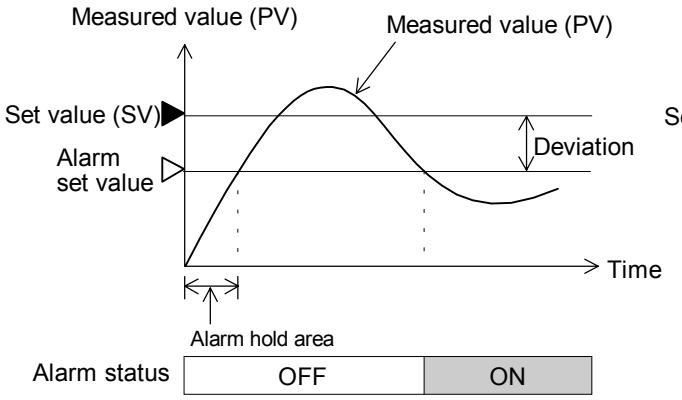
– Band alarm



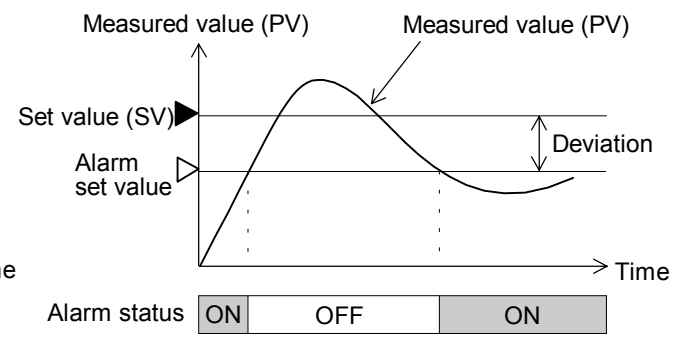
(4) Alarm hold function

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

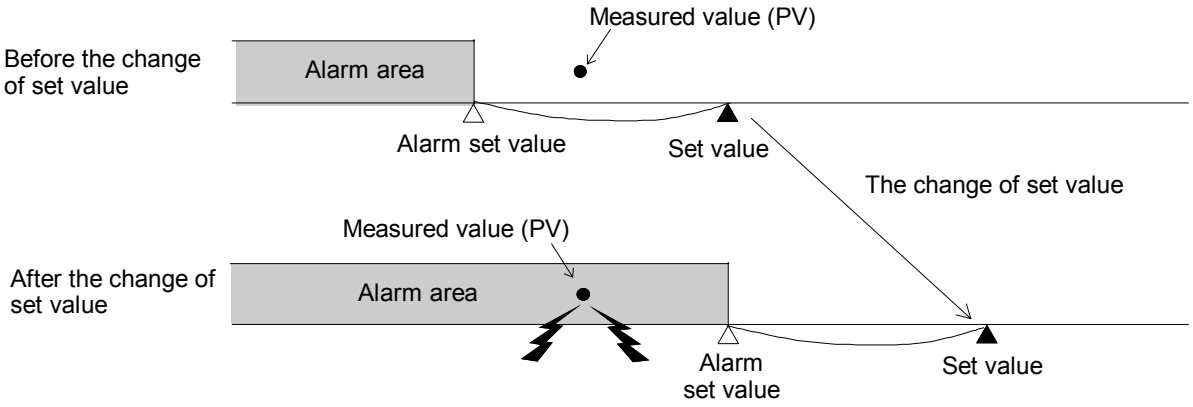


– Without alarm hold action



(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.

(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)

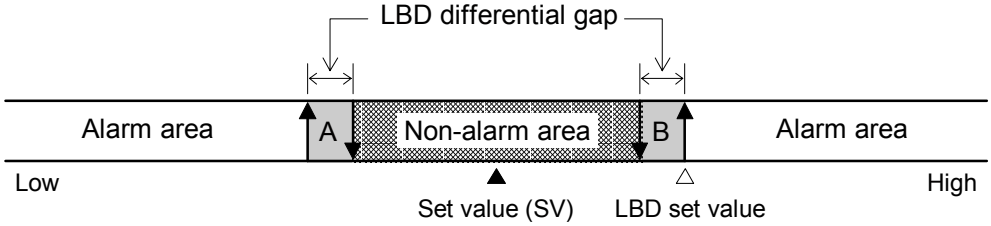
- **When the opening exceeds 100 % (or output limiter: high limit)**
  This alarm is produced when the measured value (PV) does not rise beyond the LBA triggering width within the LBA setting time.
- **When the opening less than 0 % (or output limiter: low limit)**
  This alarm is produced when the measured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

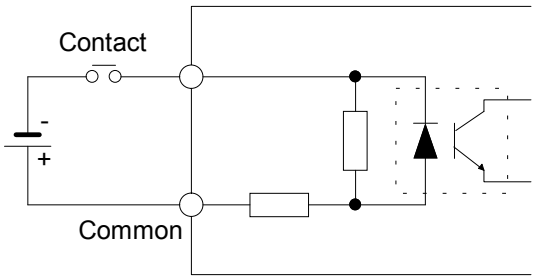
When the LBA setting time is extremely short or does not meet the controlled object, the LBA may be turned on and off, or may not be turned on. In such a case, change the LBA setting time depending on the situation.

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.

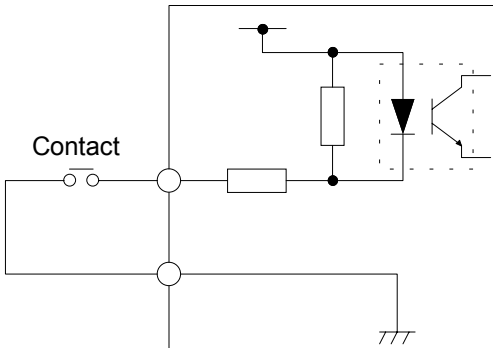
7.5 Contact Inputs

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

Voltage input circuit diagram



Dry contact input circuit diagram

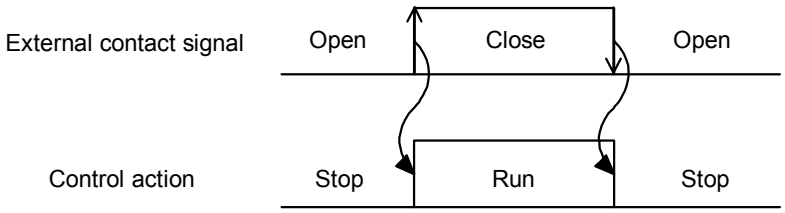


■ Memory area selection

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

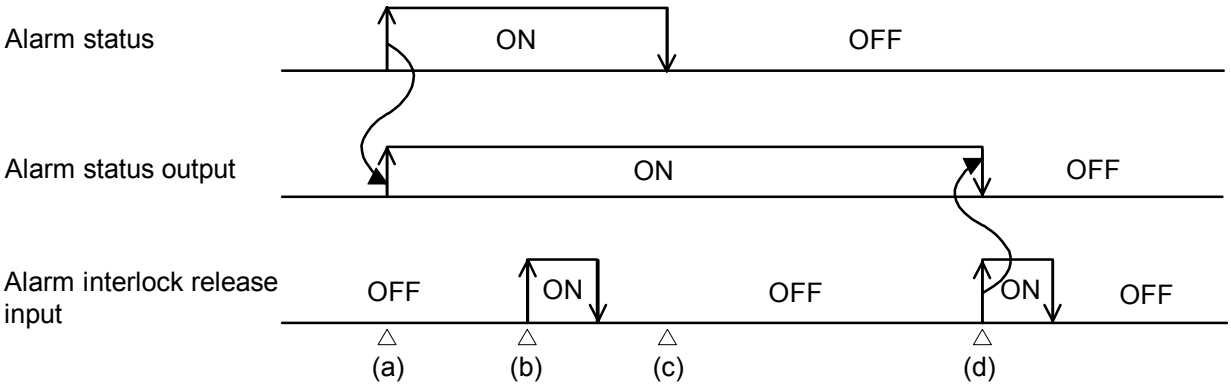
■ Control Run/Stop selection

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 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 CPU power supply monitoring If error occurs in self-diagnosis, the hardware will automatically return the module outputs to the OFF position.
Memory backup:	Lithium battery for RAM backup, approximate ten years life for data retention.

■ Power input

Power supply voltage:	100 to 120 V AC (50/60 Hz), 200 to 240 V AC (50/60 Hz) or 24 V DC Specify when ordering
Power supply voltage range:	100 to 120 V AC: 90 to 132 V AC 200 to 240 V AC: 180 to 264 V AC 24 V DC: 21.6 to 26.4 V DC
Power consumption:	100 to 120 V AC: 40 VA max. 200 to 240 V AC: 50 VA max. 24 V DC: 20 W max., 1 A or less
Surge current:	30 A or less

■ Power output (For function modules)

Output voltage/current:	5 V DC, 1.7 A max. 12 V DC, 1.0 A max.
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/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 (PCP-B type: 2 points)
Rating :	250 V AC, 0.1 A (Resistive load)
	[CE/UL/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 (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)
- Heater break alarm (HBA)
- Burnout alarm
- Loop break alarm (LBA)
- Temperature rise completion

■ Digital input (Only for 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

● RKC standard communication

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

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

Protocol: Based on ANSI X3.28 subcategory 2.5 B1

Synchronous method: Start/stop synchronous type

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

Data bit configuration: Start bit: 1
Data bit: 7 or 8
Parity bit: Without, Odd or Even
Without for 8 data bits
Stop bit: 1

Error control: Vertical parity (when parity bit is selected)
Horizontal parity

Data types: ASCII 7-bit code

● Ladder communication (Z-190)

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

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

Protocol: Non-protocol type

Synchronous method: Start/stop synchronous type

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

Data bit configuration: Start bit: 1
Data bit: 8
Parity bit: Without
Stop bit: 1

Data types: Text: BCD code
Control code: STX (02H)、CR (0DH)、LF (0AH)
The code in ( ) expressed hexadecimal numeral

Block length: 128 bytes or less

■ System setting items

Temperature alarm (alarm 1 and alarm 2) :

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)
Process high alarm
Process low alarm
Process high alarm (with alarm hold)
Process 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)

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 TIO Module

8.2.1 Temperature control module (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: See **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 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 TIO-C and D types)
Fuzzy function (Only for 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 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 TIO-C and D types)
Control response parameter:	Slow, Medium and Fast (3-step selection)
Proportioning cycle:	1 to 100 seconds (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
	Specify when ordering	
Voltage pulse output:	Rating:	0/12 V DC
	Allowable load resistance:	600 Ω or more
	Cycle :	1 to 100 seconds variable
	Specify when ordering	
Current output:	Output current:	0 to 20 mA DC and 4 to 20 mA DC
	Resolution:	9 bits or more
	Allowable load resistance:	500 Ω or less
	Output impedance:	5 MΩ or more
	Specify when ordering	
	(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
	Resolution:	9 bits or more
	Allowable load resistance:	1 kΩ or more
	Output impedance:	0.1 Ω or less
	Specify when ordering	
	(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	
	Specify when ordering	

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.
Specify when ordering

■ 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 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 PCP module.)

Setting resolution: Same as input resolution

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

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

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 TIO-A, C and D type) [option]

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

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

■ Input

Number of inputs: 1 channel or 2 channels
Isolated between input and output
(For 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: See **Input Range Table (P. 14)**
Specify when ordering

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

Sampling cycle: TIO-E, G, R: 0.5 seconds
TIO-F: 0.2 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. 0.3 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: TIO-E, G, R: ±0.1 % of span ±1 digit
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 TIO-E, F and R types) Brilliant PID control (PI control can also be used.)
Control cycle:	TIO-E, G, R: 0.1 seconds TIO-F: 0.2 seconds
Other functions:	Overshoot prevention function (RFB limiter method) Enhanced autotuning function (Excluding TIO-G type) Fuzzy function (Only for 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 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 TIO-G type)
Control response parameter:	Slow, Medium and Fast (3-step selection)
Proportioning cycle:	1 to 100 seconds (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
	Specify when ordering	
Voltage pulse output:	Rating:	0/12 V DC
	Allowable load resistance:	600 Ω or more
	Cycle :	1 to 100 seconds variable
	Specify when ordering	
Current output:	Output current:	0 to 20 mA DC and 4 to 20 mA DC
	Resolution:	11 bits or more
	Allowable load resistance:	500 Ω or less
	Output impedance:	5 MΩ or more
	Specify when ordering	
	(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
- Resolution: 11 bits or more
- Allowable load resistance: 1 kΩ or more
- Output impedance: 0.1 Ω or less
- Specify when ordering
- (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
- Specify when ordering

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.
- Specify when ordering

■ 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 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 PCP module.)

Setting resolution: Same as input resolution

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

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

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 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 (TIO-H, J) [Current/voltage input]

■ Input

Number of inputs: 1 channel or 2 channels
Isolated between input and output
(For 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
See **Input Range Table (P. 14)**

Resolution: 1/10000

Sampling cycle: TIO-H: 0.1 seconds
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: See 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: TIO-H: 0.1 seconds
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
	Specify when ordering	
Voltage pulse output:	Rating:	0/12 V DC
	Allowable load resistance:	600 Ω or more
	Cycle :	1 to 100 seconds variable
	Specify when ordering	
Current output:	Output current:	0 to 20 mA DC and 4 to 20 mA DC
	Resolution:	11 bits or more
	Allowable load resistance:	500 Ω or less
	Output impedance:	5 MΩ or more
	Specify when ordering	
	(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
	Resolution:	11 bits or more
	Allowable load resistance:	1 kΩ or more
	Output impedance:	0.1 Ω or less
	Specify when ordering	
	(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	
	Specify when ordering	

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.
Specify when ordering

■ 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 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 PCP module.)

Setting resolution: Same as input resolution

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

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

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 (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: See **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 computation result becomes the neutral zone value or more.
control	
Integrated output limiter:	100.0 to 200.0 % When Open (Close) 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 Close (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: Close) 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 close) Adjustable (Motor driving time can be also automatically set during adjustment)

■ Temperature alarm function

Number of alarms: 2 points

Alarm types:

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)
Process high alarm
Process low alarm
Process high alarm (with alarm hold)
Process 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)

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

Setting resolution: Same as input resolution

Alarm output: This module outputs alarm status to the 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 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 TI Module

■ Input

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

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

Input range: See **Input Range Table (P. 14)**
Specify when ordering

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

Sampling cycle: TI-A, C: 0.5 seconds
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: TI-A, C: ±0.3 % of span ±1 digit
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:
TI-B: Within ±0.5 °C (Range of 0 to 50 °C)
Thermocouple J, T type: Within ±1.0 °C
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 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 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 CIO Module

8.4.1 Cascade control module (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: See **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 (Only for 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
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
	Specify when ordering	
Voltage pulse output:	Rating:	0/12 V DC
	Allowable load resistance:	600 Ω or more
	Cycle :	1 to 100 seconds variable
	Specify when ordering	
Current output:	Output current:	0 to 20 mA DC and 4 to 20 mA DC
	Resolution:	11 bits or more
	Allowable load resistance:	500 Ω or less
	Output impedance:	5 MΩ or more
	Specify when ordering	
	(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
	Resolution:	11 bits or more
	Allowable load resistance:	1 kΩ or more
	Output impedance:	0.1 Ω or less
	Specify when ordering	
	(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	
	Specify when ordering	

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)
Specify when ordering

■ Temperature alarm function

Number of alarms: 2 points

Alarm types:

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)
Process high alarm
Process low alarm
Process high alarm (with alarm hold)
Process 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)

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

Setting resolution: Same as input resolution

Alarm output: This module outputs alarm status to the 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 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 (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
See **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: See 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
Specify when ordering

Voltage pulse output:
Rating: 0/12 V DC
Allowable load resistance: 600 Ω or more
Cycle : 1 to 100 seconds variable
Specify when ordering

Current output:
Output current: 0 to 20 mA DC and 4 to 20 mA DC
Resolution: 11 bits or more
Allowable load resistance: 500 Ω or less
Output impedance: 5 MΩ or more
Specify when ordering
(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
Resolution: 11 bits or more
Allowable load resistance: 1 kΩ or more
Output impedance: 0.1 Ω or less
Specify when ordering
(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
Specify when ordering

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)
Specify when ordering

■ Temperature alarm function

Number of alarms: 2 points

Alarm types:

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)
Process high alarm
Process low alarm
Process high alarm (with alarm hold)
Process 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)

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

Setting resolution: Same as input resolution

Alarm output: This module outputs alarm status to the 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 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 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 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 DI Module

8.6.1 Digital input module (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

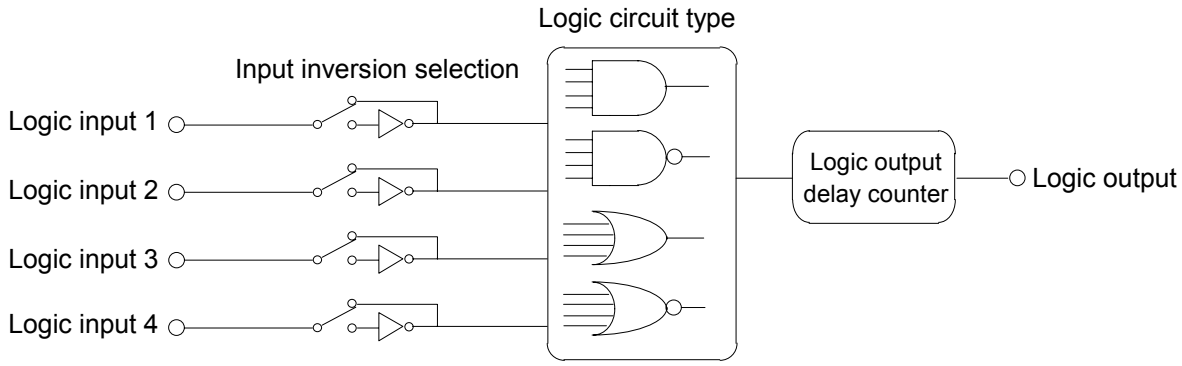
8.6.2 Event digital input module (DI-B)

■ 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 first alarm:	1 to 18 CH
Temperature second alarm:	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 first alarm:	1 to 36 CH
AI second alarm:	1 to 36 CH
TI first alarm:	1 to 36 CH
TI second alarm:	1 to 36 CH
TI burnout status:	1 to 36 CH
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 DO Module

8.7.1 Digital output module (DO-A, B)

■ Output

Output type: DO-A: Relay contact output or open collector output (Sink load)
DO-B: Relay contact output

Number of outputs: DO-A: 8 points
DO-B: 4 points

Number of common points: Relay contact output:
2 points (4 points/common): DO-A type
All channel independent common output: 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 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 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: DO-A: 140 g
DO-B: 130 g

8.7.2 Digital output module (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:	0.1 A/point
		0.8 A/common
Setting method:	Set by 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 (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 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 PCP module.
Channel numbers of 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 TIO modules, etc. can be selected.
-With interlock function

Comparison output functions:

Temperature process value comparison:
- Comparison between PV and PV of TIO module

Temperature set value comparison:
- Comparison between SV and SV of TIO module

AI process value comparison:
- Comparison between PV and PV of AI module

TI process value comparison:
- Comparison between PV and PV of TI module

-Unit common setting for both Alarm delay timer and Alarm differential gap.
-Channel numbers of 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 AI Module

■ Input

Number of inputs: AI-A: 4 points
(Isolated between input and CPU. Not isolated between each channel.)
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: AI-A: 0.2 seconds
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: See 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 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 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: AI-A: 120 g
AI-B: 140 g

8.9 AO Module

■ Output

Number of inputs: AO-A: 4 points
(Isolated between output and CPU. Not isolated between each channel.)
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 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
AI module input value
TI module input value
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: 100 to 120 V AC (50/60 Hz)
200 to 240 V AC (50/60 Hz)
24 V DC
Specify when ordering

Power supply voltage range: 100 to 120 V AC: 90 to 132 V AC
200 to 240 V AC: 180 to 264 V AC
24 V DC: 21.6 to 26.4 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 (Non condensing)

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

MEMO

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