Module Type Controller

SRZ

Instruction Manual

RKC INSTRUMENT INC.

IMS01T04-E1

Thank you for purchasing this 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.
- Be sure to provide an appropriate surge control circuit respectively for the following:
  - If input/output or signal lines within the building are longer than 30 meters.
  - If input/output or signal lines leave the building, regardless the length.
- This instrument is designed for installation in an enclosed instrumentation panel. All high-voltage connections such as power supply terminals must be enclosed in the instrumentation panel to avoid electric shock by operating personnel.
- All precautions described in this manual should be taken to avoid damage to the instrument or equipment.
- All wiring must be in accordance with local codes and regulations.
- All wiring must be completed before power is turned on to prevent electric shock, instrument failure, or incorrect action.
  The power must be turned off before repairing work for input break and output failure including replacement of sensor, contactor or SSR, and all wiring must be completed before power is turned on again.
- To prevent instrument damage 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.
- Do not connect modular connectors to telephone line.

NOTICE

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

MEMO

OUTLINE

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1.1 Features

This chapter describes features, package contents and model code, etc. The module type controller has the following features:

Module type controller SRZ interfaces with the host computer via Modbus or RKC communication protocols. The SRZ sets all of the data items via communication (The communication interface used for both protocols is RS-485.). Therefore before operation, it is necessary to set value of each data item via communication.

■ Common to both Z-TIO and Z-DIO module

- A user can select RKC communication or Modbus.
- When each module is connected, the power and communication lines are connected internally within the modules, and thus it is only necessary to wire one module to the power terminal and communication terminal; there is no need to individually wire each module to the terminals. This reduces the amount of wiring needed.
- Compact size
  Terminal type: depth 85 mm, Connector type: depth 79 mm

■ Z-TIO module

- The Z-TIO module is a temperature control module equipped with either two or four control channels.
- The measurement input is a universal input that supports thermocouple input, resistance temperature sensor input, voltage input, current input, and feedback resistance input.
- The input type can be specified separately for each channel, and different input types can be combined.
- Output types are relay contact output, voltage pulse output, voltage output, current output, open collector output, and triac output. Output types are specified when the order is placed, and a different output type can be specified for each channel.
- 4CH Z-TIO module can have 4 CT (current transformer) inputs.
- Up to 16 Z-TIO modules can be connected.
  [The maximum number of SRZ modules (including other function modules) on the same communication line is 31.]

■ Z-DIO module

- The Z-DIO module is an event input/output module equipped with digital inputs and outputs (DI8 points / DO8 points).
- DI signal assignment enables switching of various mode states and memory areas of the Z-TIO module.
- DO signal assignment enables output of the event result of the Z-TIO module to the event output (DO), and output of the DO manual output state of the Z-DIO module.
- Up to 16 Z-DIO modules can be connected.
  [The maximum number of SRZ modules (including other function modules) on the same communication line is 31.]

For reference purposes, the Modbus protocol identifies the host computer as master, each module of SRZ as slave.

1.2 Checking the Product

Before using this product, check each of the following:

- Model code
- Check that there are no scratch or breakage in external appearance (case, front panel, or terminal, etc.)
- Check that all of the items delivered are complete. (See below)

If any of the products are missing, damaged, or if your manual is incomplete, please contact RKC sales office or the agent.

1.2.1 Z-TIO module

Name	Q'TY	Remarks
☐ Z-TIO module	1	————
☐ Z-TIO Instruction Manual (IMS01T01-E☐)	1	Enclosed with instrument
☐ Z-TIO Host Communication Quick Instruction Manual (IMS01T02-E☐)	1	Enclosed with instrument
☐ Joint connector cover KSRZ-517A	2	Enclosed with instrument
☐ Power terminal cover KSRZ-518A	1	Enclosed with instrument
☐ SRZ Instruction Manual (IMS01T04-E☐)	1	This manual (sold separately) * * This manual can be downloaded from our website: URL: http://www.rkcinst.com/english/manual_load.htm

1.2.2 Z-DIO module

Name	Q'TY	Remarks
☐ Z-DIO module	1	————
☐ Z-DIO module Instruction Manual (IMS01T03-E☐)	1	Enclosed with instrument
☐ Joint connector cover KSRZ-517A	2	Enclosed with instrument
☐ Power terminal cover KSRZ-518A	1	Enclosed with instrument
☐ SRZ Instruction Manual (IMS01T04-E☐)	1	This manual (sold separately) * * This manual can be downloaded from our website: URL: http://www.rkcinst.com/english/manual_load.htm

1.2.3 Accessories (sold separately)

Name	Q'TY	Remarks
☐ End plate DEP-01	2	
☐ Connector SRZP-01 (front screw type)	2	For the connector type module
☐ Connector SRZP-02 (side screw type)	2	For the connector type module
☐ CT cable W-BW-03-1000	1	For CT input connector (cable length: 1 m)
☐ CT cable W-BW-03-2000	1	For CT input connector (cable length: 2 m)
☐ CT cable W-BW-03-3000	1	For CT input connector (cable length: 3 m)
☐ Current transformer CTL-6-P-N	1	0.0 to 30.0 A
☐ Current transformer CTL-12-S56-10L-N	1	0.0 to 100.0 A
☐ Terminal cover KSRZ-510A	1	For the terminal type module

1.3 Model Code

Check whether the delivered product is as specified by referring to the following model code list. If the product is not identical to the specifications, please contact RKC sales office or the agent.

1.3.1 Z-TIO module

■ Suffix code

4-channel type: **Z-TIO-A** – □ – □ □ □ □ / □ □ – □ □□□/Y
(1) (2) (3) (4) (5) (6) (7) (8) (9) (10)

2-channel type: **Z-TIO-B** – □ – □ □ / □ N □ – □ □□□/Y
(1) (2) (3) (6) (7) (8) (9) (10)

Specifications		Suffix code									
		Hardware coding only							Quick start code1		
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Wiring type	Terminal type	T									
	Connector type	C									
Output1 (OUT1)	Relay contact output		M								
	Voltage pulse output		V								
	Voltage output, Current output (See Output Code Table)		□								
	Triac output		T								
	Open collector output		D								
Output2 (OUT2)	Relay contact output			M							
	Voltage pulse output			V							
	Voltage output, Current output (See Output Code Table)			□							
	Triac output			T							
	Open collector output			D							
Output3 (OUT3) [Z-TIO-A type only]	Relay contact output				M						
	Voltage pulse output				V						
	Voltage output, Current output (See Output Code Table)				□						
	Triac output				T						
	Open collector output				D						
Output4 (OUT4) [Z-TIO-A type only]	Relay contact output					M					
	Voltage pulse output					V					
	Voltage output, Current output (See Output Code Table)					□					
	Triac output					T					
	Open collector output					D					
Current transformer (CT) input	None						N				
	CT (4 points) [4-channel type], CT (2 points) [2-channel type]						A				
Quick start code	No quick start code (Configured as factory default)							N			
	Specify quick start code 1							1			
	Specify quick start code 1 and 2							2			
Control Method (all channel common) [Quick start code 1]	No specify quick start code								No code		
	PID action with AT (Reverse action)								F		
	PID action with AT (Direct action)								D		
	Heat/cool PID action with AT [1]								G		
	Heat/cool PID action with AT (for Extruder [air cooling]) [1]								A		
	Heat/cool PID action with AT (for Extruder [water cooling]) [1]								W		
	Position proportioning PID action without FBR [2]								Z		
Measured input and Range (all channel common) [Quick start code 1]	No specify quick start code									No code	
	See range code table.									□□□	
Instrument specification	Version symbol										/Y

[1] Z-TIO-A type: CH2 and CH4 are unused Z-TIO-B type: CH2 is unused
[2] Z-TIO-A type: CH2 and CH4 are feedback resistance input (for monitor) Z-TIO-B type: CH2 is feedback resistance input (for monitor)

● Output Code Table

Output type	Code
Voltage output (0 to 1 V DC)	3
Voltage output (0 to 5 V DC)	4
Voltage output (0 to 10 V DC)	5

Output type	Code
Voltage output (1 to 5 V DC)	6
Current output (0 to 20 mA DC)	7
Current output (4 to 20 mA DC)	8

● Range Code Table

[Thermocouple (TC) input, RTD input]

Type	Code	Range (Input span)	Code	Range (Input span)
K	K35	−200.0 to +400.0 °C	KA1	0 to 800 °F
	K40	−200.0 to +800.0 °C	KA2	0 to 1600 °F
	K42	−200.0 to +1372.0 °C	KC7	−328 to +2501 °F
	K09	0.0 to 400.0 °C	KA4	0.0 to 800.0 °F
	K10	0.0 to 800.0 °C		
J	J27	−200.0 to +400.0 °C	JA1	0 to 800 °F
	J32	−200.0 to +800.0 °C	JA2	0 to 1600 °F
	J29	−200.0 to +1200.0 °C	JB9	−328 to +2192 °F
	J08	0.0 to 400.0 °C	JB6	0.0 to 800.0 °F
	J09	0.0 to 800.0 °C		
T	T19	−200.0 to +400.0 °C	TC5	−328 to +752 °F
			TC6	0.0 to 752.0 °F
E	E20	−200.0 to +1000.0 °C	EB2	0.0 to 800.0 °F
			EB1	−328 to +1832 °F
S	S06	−50 to +1768 °C	SA7	−58 to +3214 °F
R	R07	−50 to +1768 °C	RA7	−58 to +3214 °F
B	B03	0 to 1800 °C	BB1	32 to +3272 °F
N	N07	−200 to +1372 °C	NA8	−328 to +2502 °F
PLII	A02	0 to 1390 °C	AA2	0 to 2534 °F
W5Re/W26Re	W03	0 to 2300 °C	WB1	32 to 4208 °F
Pt100	D21	−200.0 to +200.0 °C	DC6	−328.0 to +752.0 °F
	D35	−200.0 to +850.0 °C	DD2	328 to +1562 °F
JPt100	P31	−200.0 to +649.0 °C	PC6	−328.0 to +752.0 °F
			PD2	328 to +1200 °F

[Voltage input, Current input]

Type	Code	Range (Input span)
0 to 10 mV DC	101	Programmable range −19999 to +19999 [The decimal point position is selectable] (Factory set value: 0.0 to 100.0 %)
0 to 100 mV DC	201	
0 to 1 V DC	301	
0 to 5 V DC	401	
0 to 10 V DC	501	
1 to 5 V DC	601	
0 to 20 mA DC	701	
4 to 20 mA DC	801	

■ Quick start code 2 (Initial setting code)

Quick start code 2 tells the factory to ship with each parameter preset to the values detailed as specified by the customer. Quick start code is not necessarily specified when ordering, unless the preset is requested. These parameters are software selectable items and can be re-programmed in the field via the manual.

□ □ □ □ − □ □
(1) (2) (3) (4) (5) (6)

Specifications		Quick start code 2 (Initial setting code)					
		(1)	(2)	(3)	(4)	(5)	(6)
Event function 1 (EV1) [1]	None	N					
	Event function 1 (See Event type code table)	□					
Event function 2 (EV2) [1]	None		N				
	Event function 2 (See Event type code table)		□				
Event function 3 (EV3) [1]	None			N			
	Event function 3 (See Event type code table)			□			
	Temperature rise completion			6			
Event function 4 (EV4) [1]	None				N		
	Event function 4 (See Event type code table)				□		
	Control loop break alarm (LBA)				5		
CT type [2]	None					N	
	CTL-6-P-N					P	
	CTL-12-S56-10L-N					S	
Communication protocol	RKC communication (ANSI X3.28)						1
	Modbus						2

[1] If it is desired to specify the deviation action between channels or the deviation using local SV, the settings must be configured by the customer. (Engineering setting data)
[2] The CT assignment and heater break alarm (HBA) type must be configured by the customer. (Engineering setting data)

● Event type code table

Code	Type	Code	Type	Code	Type
A	Deviation high	H	Process high	V	SV high
B	Deviation low	J	Process low	W	SV low
C	Deviation high/low	K	Process high with hold action	1	MV high [heat-side]
D	Band	L	Process low with hold action	2	MV low [heat-side]
E	Deviation high with hold action	Q	Deviation high with re-hold action	3	MV high [cool-side]
F	Deviation low with hold action	R	Deviation low with re-hold action	4	MV low [cool-side]
G	Deviation high/low with hold action	T	Deviation high/low with re-hold action		

1.3.2 Z-DIO module

Z-DIO-A – □ – □ □ / □ – □□□□
(1) (2) (3) (4) (5) (6) (7) (8)

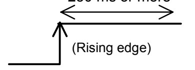
Specifications		Suffix code							
		Hardware coding only				Quick start code1			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Wiring type	Terminal type	T							
	Connector type	C							
Digital input (DI)	None		N						
	8 points		A						
Digital output (DO)	None			N					
	Relay contact output (8 points)			M					
	Open collector output (8 points)			D					
Quick start code (DI/DO assignments)	No quick start code (Configured as factory default)				N				
	Specify quick start code 1				1				
DI signal assignments (DI1 to DI8) [Quick start code 1]	No specify quick start code					No code			
	None					N			
	See DI assignment code table.					□			
DO signal assignments (DO1 to DO4) [Quick start code 1]	No specify quick start code						No code		
	None						N		
	See DO assignment code table.						□		
DO signal assignments (DO5 to DO8) [Quick start code 1]	No specify quick start code							No code	
	None							N	
	See DO assignment code table.							□	
Communication protocol	RKC communication (ANSI X3.28)								1
	Modbus								2

● DI assignment code table

Code	DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8
00	No assignment							
01								AUTO/MAN
02								REM/LOC
03							Interlock release	EDS start signal 1
04								Soak stop
05								RUN/STOP
06								REM/LOC
07							AUTO/MAN	EDS start signal 1
08					Operation mode [3]			Soak stop
09								RUN/STOP
10								EDS start signal 1
11							REM/LOC	Soak stop
12								RUN/STOP
13	Memory area transfer (1 to 8) [1]			Area set [2]			EDS start signal 1	Soak stop
14								RUN/STOP
15							Soak stop	
16								EDS start signal 1
17							REM/LOC	Soak stop
18					Interlock release	AUTO/MAN		RUN/STOP
19							EDS start signal 1	Soak stop
20								RUN/STOP
21							Soak stop	
22								Soak stop
23					AUTO/MAN	REM/LOC	EDS start signal 1	
24							Soak stop	RUN/STOP
25					REM/LOC	EDS start signal 1		
26	Memory area transfer (1, 2) [1]	Area set [2]	Interlock release	RUN/STOP	AUTO/MAN	REM/LOC	Operation mode [3]	
27	Memory area transfer (1 to 8) [1]			Area set [2]	Operation mode [3]			
28	Memory area transfer (1, 2) [1]	Area set [2]	Interlock release	RUN/STOP	AUTO/MAN	REM/LOC	EDS start signal 1	EDS start signal 2
29	EDS start signal 1	EDS start signal 2					Operation mode [3]	

RUN/STOP: RUN/STOP transfer (Contact closed: RUN)
AUTO/MAN: Auto/Manual transfer (Contact closed: Manual mode)
REM/LOC: Remote/Local transfer (Contact closed: Remote mode)
Interlock release (Contact closed: Interlock release)
EDS start signal 1 (Contact closed: EDS start signal ON [for disturbance 1])
EDS start signal 2 (Contact closed: EDS start signal ON [for disturbance 2])
Soak stop (Contact closed: Soak stop)

DI signal will become valid at rising edge after the closed contact is held for 250ms.



[1] Memory area transfer (×:Contact open –: Contact closed)

	Memory area number							
	1	2	3	4	5	6	7	8
DI1	×	–	×	–	×	–	×	–
DI2	×	×	–	–	×	×	–	–
DI3	×	×	×	×	–	–	–	–

[2] Area set becomes invalid prior to factory shipment.

[3] Operation mode transfer (×:Contact open –: Contact closed)

	Operation mode			
	Unused	Monitor	Monitor + Event function	Control
DI5 (DI7)	×	–	×	–
DI6 (DI8)	×	×	–	–

Continued on the next page.

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- DO assignment code table

[DO1 to DO4]

Code	DO1	DO2	DO3	DO4
00	No assignment			
01	DO1 manual output	DO2 manual output	DO3 manual output	DO4 manual output
02	Event 1 comprehensive output [1]	Event 2 comprehensive output [2]	Event 3 comprehensive output [3]	Event 4 comprehensive output [4]
03	Event 1 (CH1)	Event 2 (CH1)	Event 3 (CH1)	Event 4 (CH1)
04	Event 1 (CH2)	Event 2 (CH2)	Event 3 (CH2)	Event 4 (CH2)
05	Event 1 (CH3)	Event 2 (CH3)	Event 3 (CH3)	Event 4 (CH3)
06	Event 1 (CH4)	Event 2 (CH4)	Event 3 (CH4)	Event 4 (CH4)
07	Event 1 (CH1)	Event 1 (CH2)	Event 1 (CH3)	Event 1 (CH4)
08	Event 2 (CH1)	Event 2 (CH2)	Event 2 (CH3)	Event 2 (CH4)
09	Event 3 (CH1)	Event 3 (CH2)	Event 3 (CH3)	Event 3 (CH4)
10	Event 4 (CH1)	Event 4 (CH2)	Event 4 (CH3)	Event 4 (CH4)
11	HBA (CH1)	HBA (CH2)	HBA (CH3)	HBA (CH4)
12	Burnout status (CH1)	Burnout status (CH2)	Burnout status (CH3)	Burnout status (CH4)
13	Temperature rise completion [5]	HBA comprehensive output [6]	Burnout state comprehensive output [7]	DO4 manual output

[1] Logical *OR* of Event 1 (ch1 to ch4)
[2] Logical *OR* of Event 2 (ch1 to ch4)
[3] Logical *OR* of Event 3 (ch1 to ch4)
[4] Logical *OR* of Event 4 (ch1 to ch4)
[5] Temperature rise completion status (ON when temperature rise completion occurs for all channels for which event 3 is set to temperature rise completion.)
[6] Logical *OR* of HBA (ch1 to ch4)
[7] Logical *OR* of burnout state (ch1 to ch4)

[DO5 to DO8]

Code	DO5	DO6	DO7	DO8
00	No assignment			
01	DO5 manual output	DO6 manual output	DO7 manual output	DO8 manual output
02	Event 1 comprehensive output [1]	Event 2 comprehensive output [2]	Event 3 comprehensive output [3]	Event 4 comprehensive output [4]
03	Event 1 (CH1)	Event 2 (CH1)	Event 3 (CH1)	Event 4 (CH1)
04	Event 1 (CH2)	Event 2 (CH2)	Event 3 (CH2)	Event 4 (CH2)
05	Event 1 (CH3)	Event 2 (CH3)	Event 3 (CH3)	Event 4 (CH3)
06	Event 1 (CH4)	Event 2 (CH4)	Event 3 (CH4)	Event 4 (CH4)
07	Event 1 (CH1)	Event 1 (CH2)	Event 1 (CH3)	Event 1 (CH4)
08	Event 2 (CH1)	Event 2 (CH2)	Event 2 (CH3)	Event 2 (CH4)
09	Event 3 (CH1)	Event 3 (CH2)	Event 3 (CH3)	Event 3 (CH4)
10	Event 4 (CH1)	Event 4 (CH2)	Event 4 (CH3)	Event 4 (CH4)
11	HBA (CH1)	HBA (CH2)	HBA (CH3)	HBA (CH4)
12	Burnout status (CH1)	Burnout status (CH2)	Burnout status (CH3)	Burnout status (CH4)
13	Temperature rise completion [5]	HBA comprehensive output [6]	Burnout state comprehensive output [7]	DO8 manual output

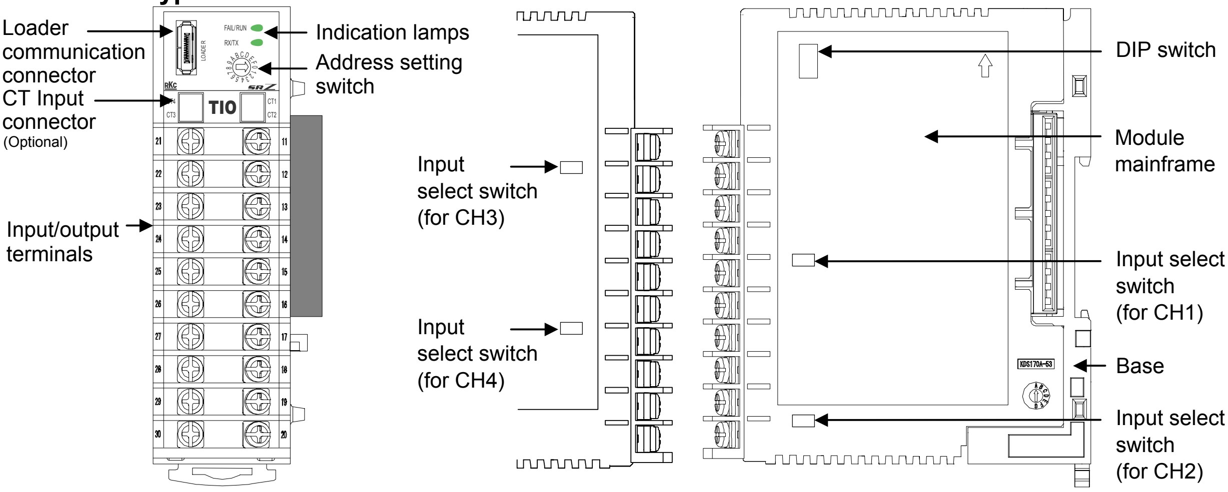
[1] Logical *OR* of Event 1 (ch1 to ch4)
[2] Logical *OR* of Event 2 (ch1 to ch4)
[3] Logical *OR* of Event 3 (ch1 to ch4)
[4] Logical *OR* of Event 4 (ch1 to ch4)
[5] Temperature rise completion status (ON when temperature rise completion occurs for all channels for which event 3 is set to temperature rise completion.)
[6] Logical *OR* of HBA (ch1 to ch4)
[7] Logical *OR* of burnout state (ch1 to ch4)

1.4 Parts Description

1.4.1 Z-TIO module

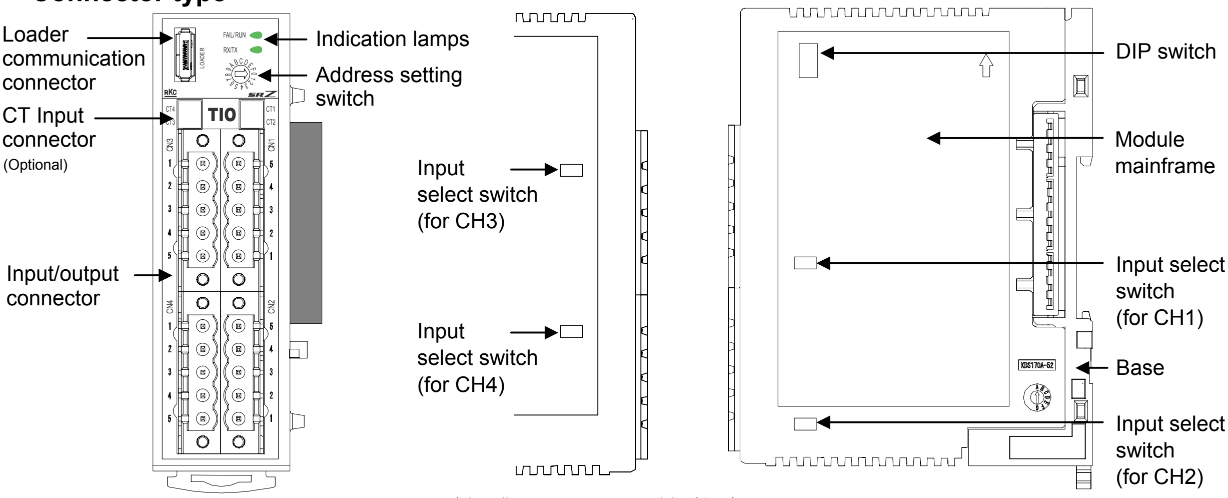
■ Module mainframe

<Terminal type>



(These diagrams represent any module of SRZ.)

<Connector type>



(These diagrams represent any module of SRZ.)

● Indication lamps

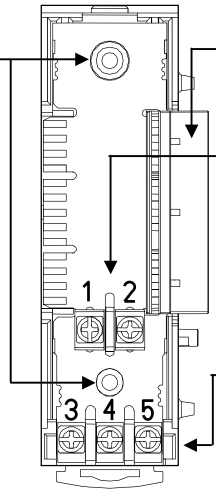
FAIL/RUN [Green or Red]	When normal (RUN):	A green lamp is on
	Self-diagnostic error (FAIL):	A green lamp flashes
	Instrument abnormality (FAIL):	A red lamp is on
RX/TX [Green]	During data send and receive:	A green lamp turns on

● Switches

Address setting switch	Sets the Z-TIO module address. (See P. 5-2.)
DIP switch	Sets the communication speed, data bit configuration, and communication protocol. (See P. 5-3.)
Input select switch	Selector switch for the measurement input type. (See P. 8-70.)

■ Base

Mounting holes (M3 screw)
Holes for screws to fix the base to a panel, etc.
Customer must provide the M3 screws.

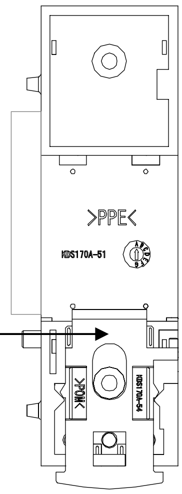


Joint connector
Used to mechanically and electrically connect each module.

Power supply terminals
Supply power to only one of the joined modules, and all of the joined modules will receive power.
(See **4.1 Wiring Cautions**)

Communication terminals (RS-485)
Connect communication wires to only one of the joined modules, and all of the joined modules will communicate.

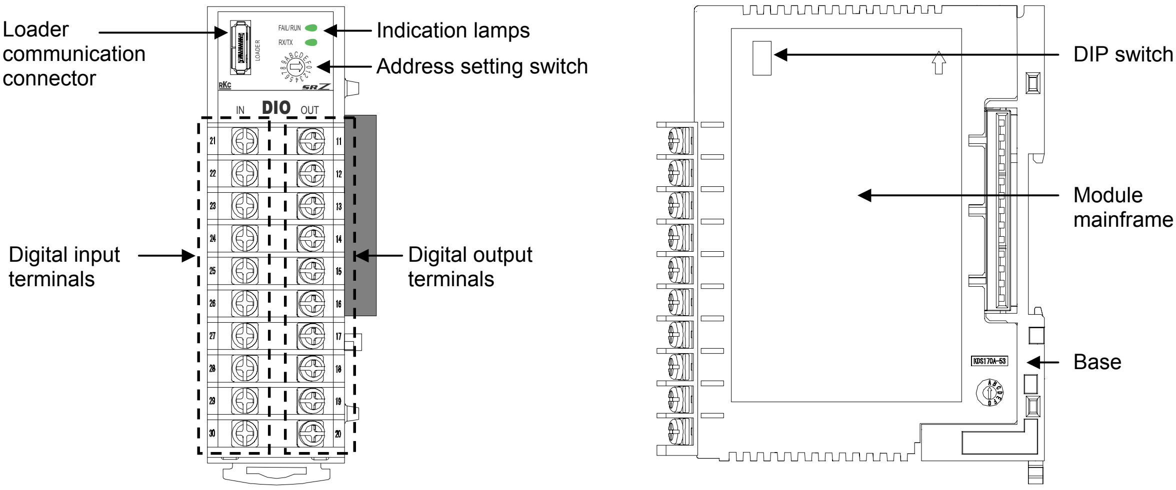
Mounting bracket
Used to fix the module on DIN rails and also to fix each module joined together.



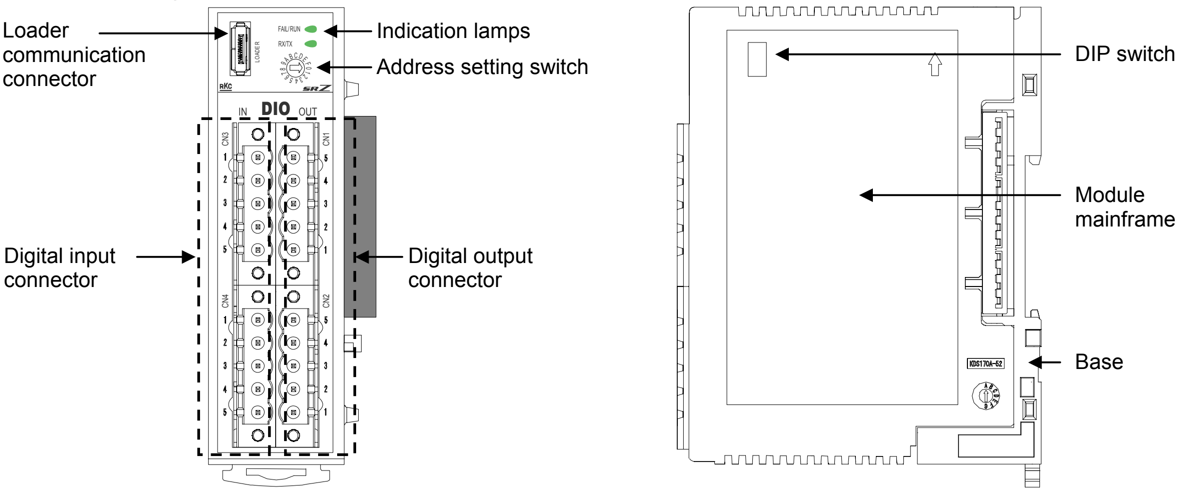
1.4.2 Z-DIO module

■ Module mainframe

<Terminal type>



<Connector type>



● Indication lamps

FAIL/RUN	[Green or Red]	When normal (RUN):	A green lamp is on
		Self-diagnostic error (FAIL):	A green lamp flashes
		Instrument abnormality (FAIL):	A red lamp is on
RX/TX	[Green]	During data send and receive:	A green lamp turns on

● Switches

Address setting switch	Sets the Z-DIO module address. (See P. 5-2.)
DIP switch	Sets the communication speed, data bit configuration, and communication protocol. (See P. 5-3.)

Terminal configurations of the base are the same as the base of Z-TIO module. (See P. 1-10)

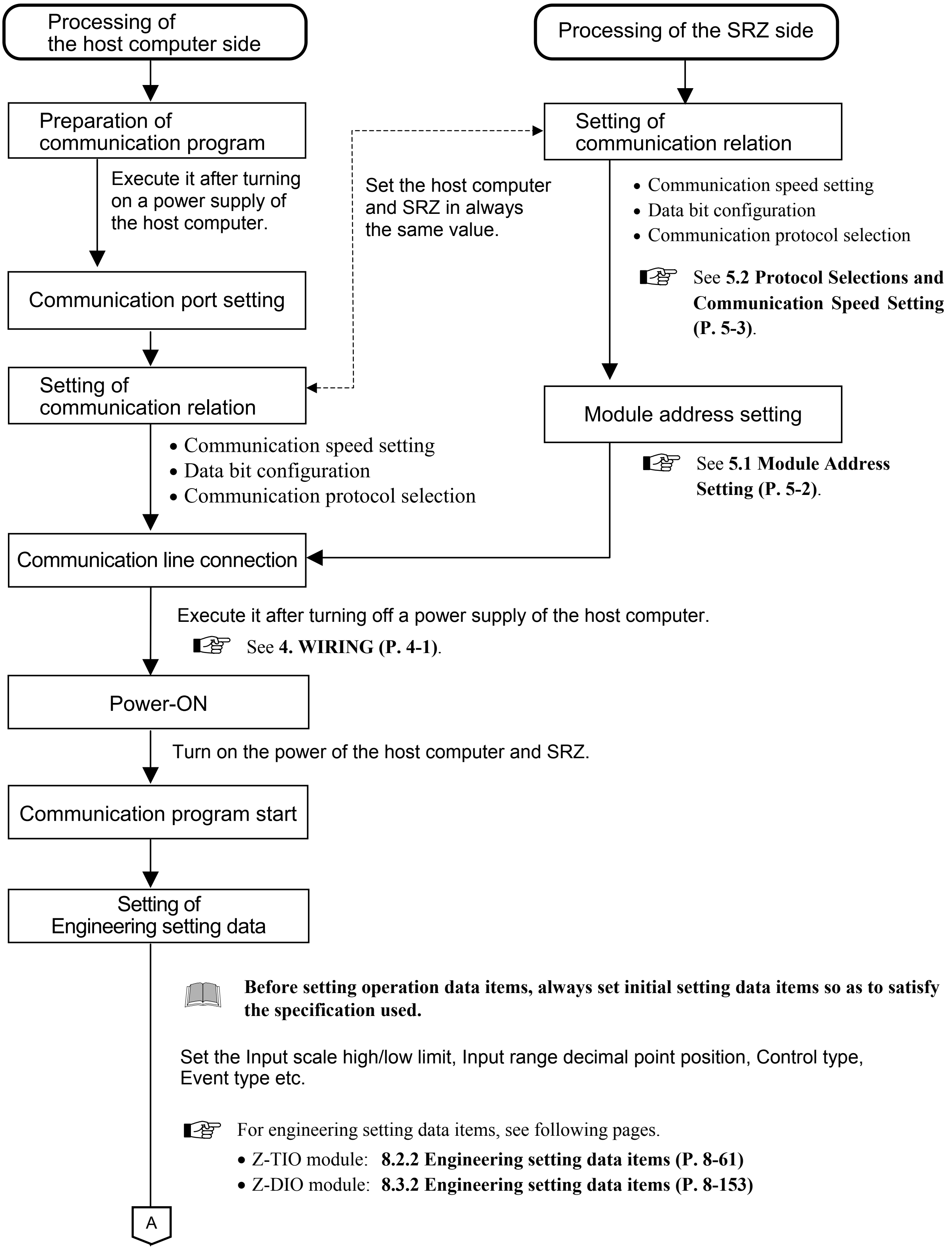
MEMO

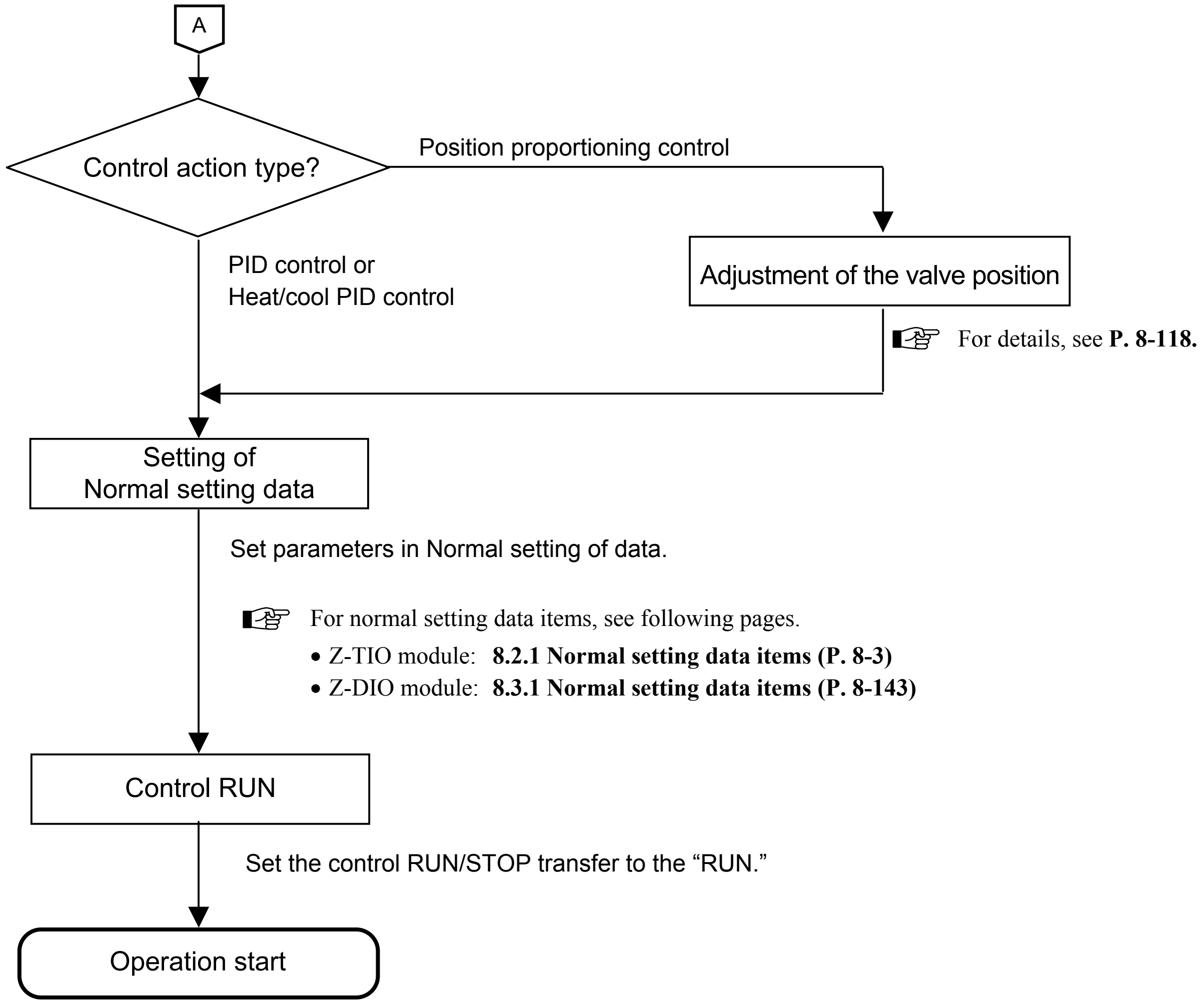
HANDLING PROCEDURE TO OPERATION

2

2. Handling Procedure to Operation

Conduct necessary setting before operation according to the procedure described below.




A
Control action type?
Position proportioning control
Adjustment of the valve position
For details, see **P. 8-118.**
PID control or
Heat/cool PID control
Setting of
Normal setting data
Set parameters in Normal setting of data.
For normal setting data items, see following pages.
• Z-TIO module: **8.2.1 Normal setting data items (P. 8-3)**
• Z-DIO module: **8.3.1 Normal setting data items (P. 8-143)**
Control RUN
Set the control RUN/STOP transfer to the “RUN.”
Operation start

MEMO

MOUNTING 3

3.1 Mounting Cautions

This chapter describes installation environment, mounting cautions, dimensions and mounting procedures.

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

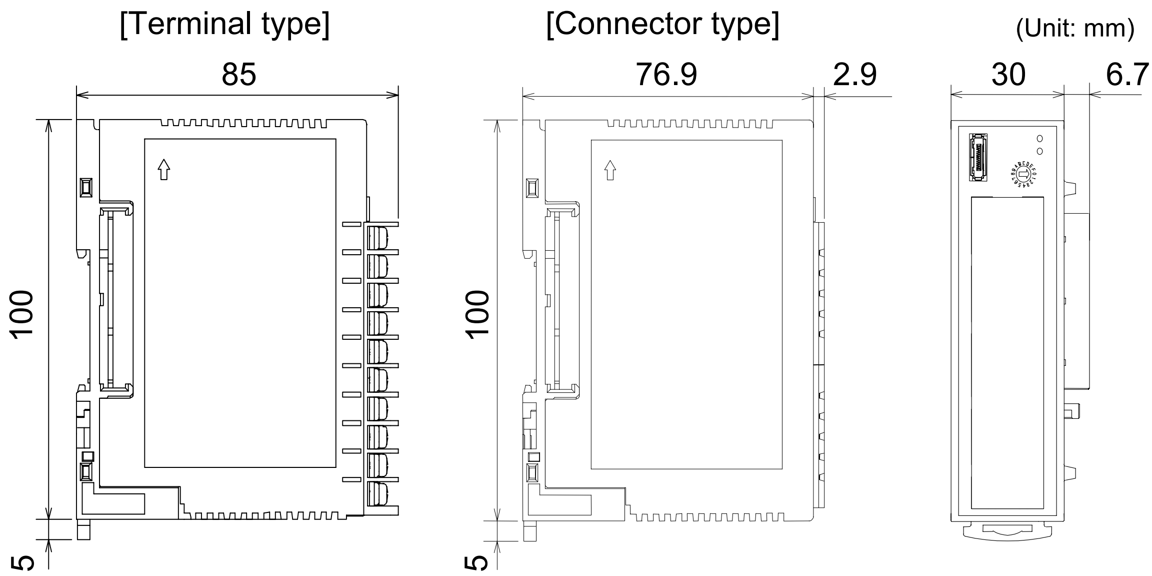
(1) This instrument is intended to be used under the following environmental conditions.
(IEC61010-1) [OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2]

(2) Use this instrument within the following environment conditions.
- Allowable ambient temperature: −10 to +50 °C
- Allowable ambient humidity: 5 to 95 % RH
  (Absolute humidity: MAX.W.C 29 g/m^3 dry air at 101.3 kPa)
- Installation environment conditions: Indoor use
  Altitude up to 2000 m

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

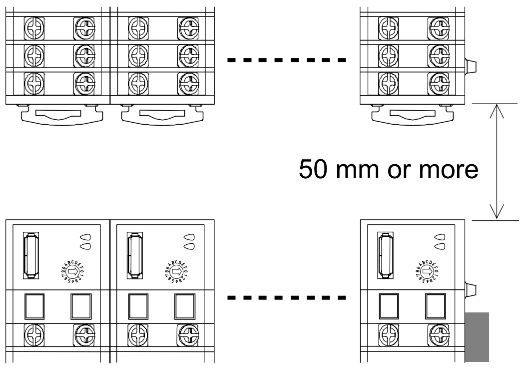
(4) Take the following points into consideration when mounting this instrument in the panel.
- Provide adequate ventilation space so that heat does not build up.
- Do not mount this instrument directly above equipment that generates large amount of heat (heaters, transformers, semi-conductor functional devices, large-wattage resistors).
- If the ambient temperature rises above 50 °C, cool this instrument with a forced air fan, cooler, or the like. However, do not allow cooled air to blow this instrument directly.
- In order to improve safety and the immunity to withstand noise, mount this instrument as far away as possible from high voltage equipment, power lines, and rotating machinery.
  - High voltage equipment: Do not mount within the same panel.
  - Power lines: Separate at least 200 mm
  - Rotating machinery: Separate as far as possible

3.2 Dimensions



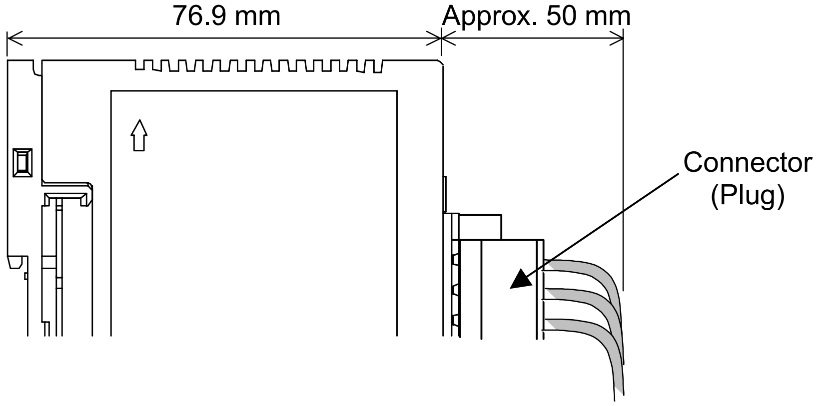
■ Space required between each module vertically

When the module is mounted on the panel, allow a minimum of 50 mm at the top and bottom of the module to attach the module to the mainframe.



■ Depth for connector mount type module (Connector type)

Space for connectors and cables must be considered when installing.

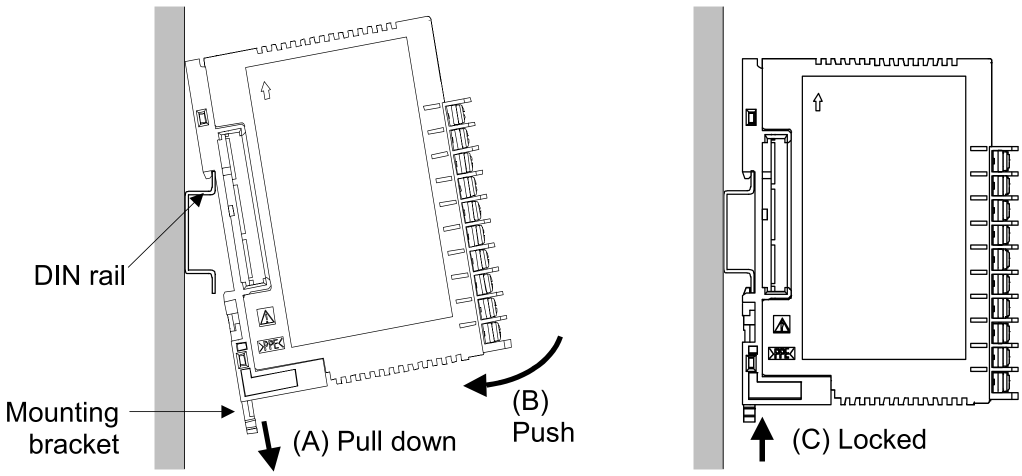


3.3 DIN Rail Mounting

■ Mounting procedures

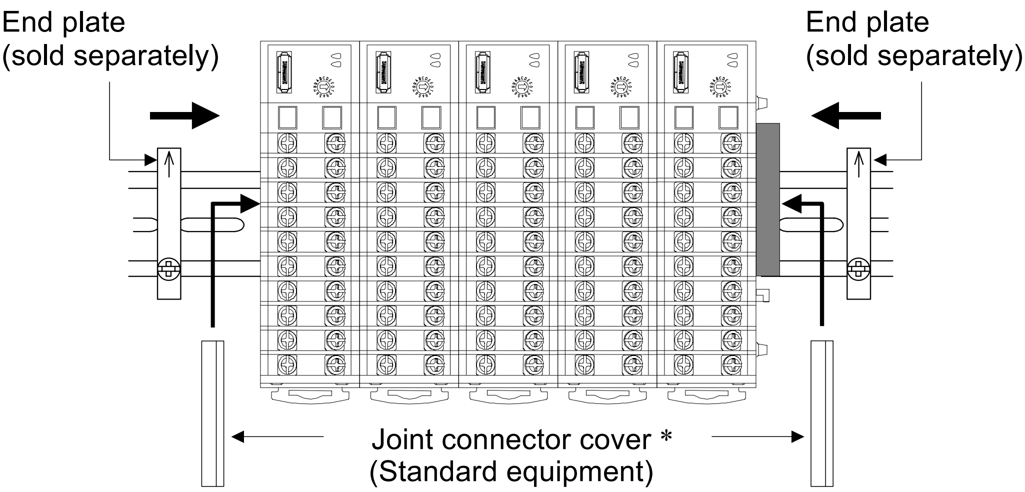
1. Pull down the mounting bracket at the bottom of the module (A). Attach the hooks on the top of the module to the DIN rail and push the lower section into place on the DIN rail (B).

2. Slide the mounting bracket up to secure the module to the DIN rail (C).



■ Mounting End Plates

To firmly fix the modules, use end plates on both sides of the mounted modules.

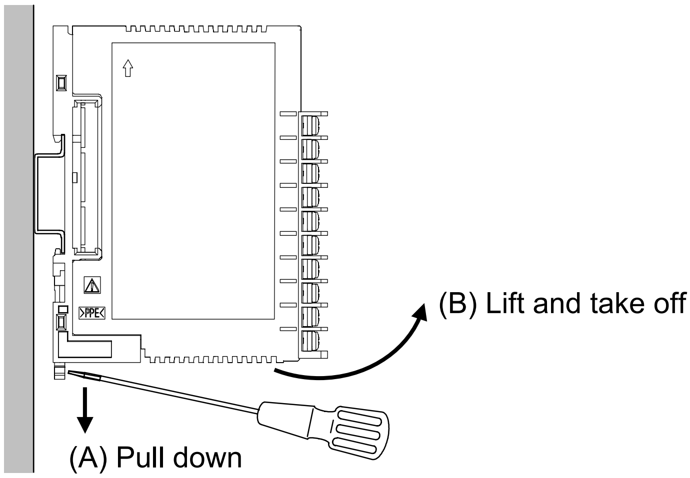


* It is recommended to use a plastic cover on the connector on both sides of the mounted modules for protection of connectors.

	Parts code	Ordering code	Q'ty
End plate	DEP-01	00434944	2
Joint connector cover	KSRZ-517A	00433384	2

■ Removing procedures

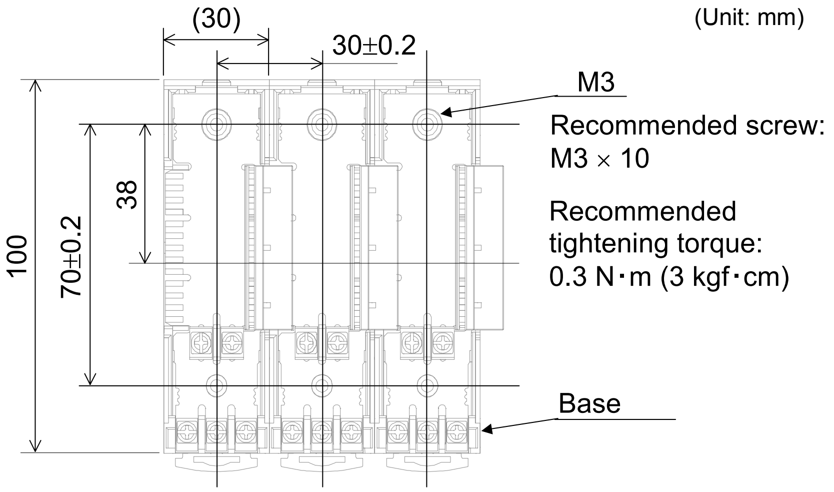
1. Pull down a mounting bracket with a blade screwdriver (A).
2. Lift the module from bottom, and take it off (B).



3.4 Panel Mounting

■ Mounting procedures

1. Refer to the mounting dimensions below when selecting the location.



Mounting dimensions

2. Remove the base from the module (B) while the lock is pressed (A). (Fig.1)

3. Join bases. Then, lock them by pushing in the mounting brackets.

☞ See the **3.5 Joining Each Module (P.3-7).**

4. Fix the base to its mounting position using M3 screws. Customer must provide the screws.

5. Mount the module on the base. (Fig.2)

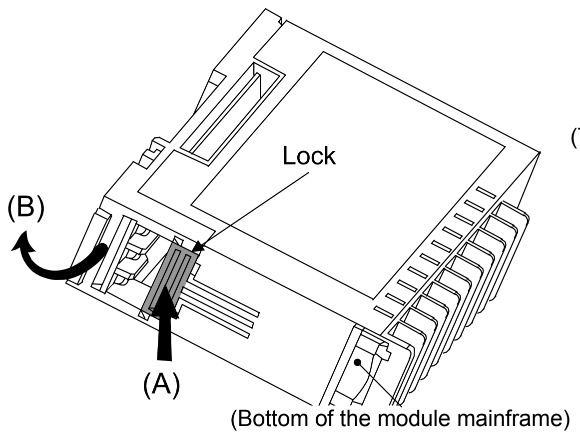


Fig.1: Removing the base

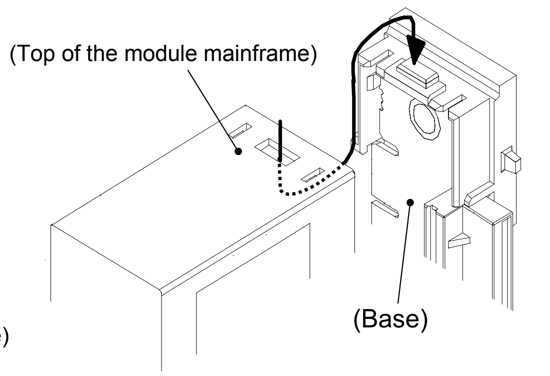


Fig 2: Mounting the module mainframe

3.5 Joining Each Module

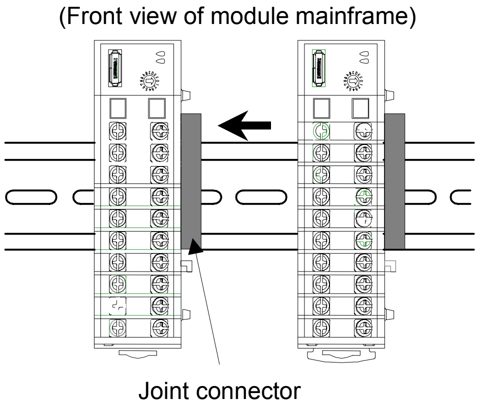
■ Joining procedures

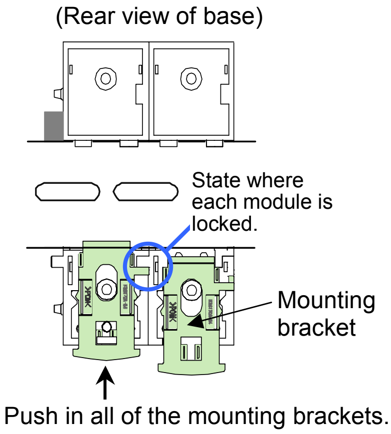
1. Mount the modules on the DIN rail.

2. Slide the modules until the modules are closely joined together and the joint connectors are securely connected.

3. Push in the mounting brackets to lock the modules together and fix to the DIN rail.

For panel mounting, mount the module mainframes after the bases are joined and mounted.



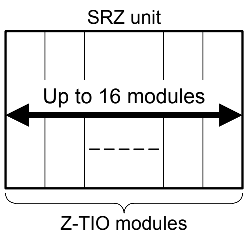


■ Number of connected modules

The number of function modules (Z-TIO, Z-DIO) that can be connected at a time is indicated below.

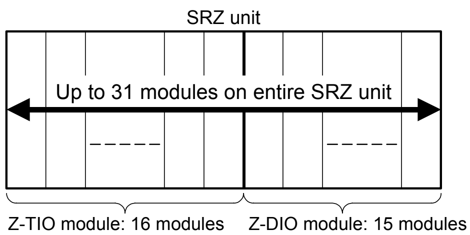
- When connecting only function modules of the same type: 16 modules maximum

[Example] When connecting only Z-TIO modules



- When connecting two or more different types of function modules: Up to 31 modules on entire SRZ unit (However, the number of connected function modules of the same type must not exceed the maximum)

[Example] When connecting Z-TIO modules and Z-DIO modules



MEMO

WIRING 4

4.1 Wiring Cautions

This chapter describes wiring cautions, wiring layout and wiring of terminals.

⚠ WARNING

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

- 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 (3-wire system).
- To avoid noise induction, keep input/output signal wires away from instrument power line, load lines and power lines of other electric equipment.
- 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.
- About eight seconds are required as preparation time for contact output every time the instrument is turned on. Use a delay relay when the output line is used for an external interlock circuit.
- Power supply wiring must be twisted and have a low voltage drop.
- For an instrument with 24 V power supply, supply power from a SELV circuit.
- A suitable power supply should be considered in the end-use equipment. The power supply must be in compliance with a limited-energy circuits (maximum available current of 8 A).
- Supply the power to only one of the joined modules. When power is supplied to any one of the joined modules, all of the joined modules will receive power.
- Select the power capacity which is appropriate for the total power consumption of all joined modules and the initial current surge when the power is turned on.

Power consumption (at maximum load):	140 mA max. (at 24 V DC)	[Z-TIO module (4CH type)]
	80 mA max. (at 24 V DC)	[Z-TIO module (2CH type)]
	70 mA max. (at 24 V DC)	[Z-DIO module]
	Rush current:	10 A or less

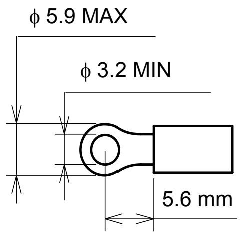
For the terminal type module, use the solderless terminal appropriate to the screw size (M3).

Screw Size: M3 × 7 (with 5.8 × 5.8 square washer)

Recommended tightening torque:
0.4 N・m (4 kgf・cm)

Applicable wire: Solid/twisted wire of 2 mm^2

Recommended solderless terminals:
Manufactured by J.S.T MFG CO., LTD.
Circular terminal with isolation V1.25–MS3
(M3 screw, width 5.5 mm, hole diameter 3.2 mm)



For the connector type module, use the following our connector (plug) [sold separately].

Connector type: SRZP-01 (Front-screw type)
SRZP-02 (Side-screw type)

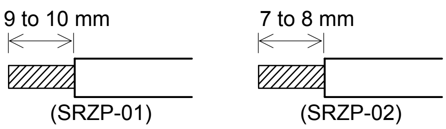
Screw size: M2.5

Recommended tightening torque:
0.43 to 0.50 N・m (4.3 to 5.0 kgf・cm)

Used cable specifications:

Lead wire type:
Solid (AWG 28 [cross-section: 0.081 mm^2] to 12 [cross-section: 3.309 mm^2]) or
Twisted wire (AWG 30 [cross-section: 0.051 mm^2] to 12 [cross-section: 3.309 mm^2])

Stripping length: 9 to 10 mm (SRZP-01), 7 to 8 mm (SRZP-02)



4.2 Connecting Precautions

⚠ **WARNING**

To prevent electric shock or instrument failure, turn off the power before connecting or disconnecting the instrument and peripheral equipment.

- Connect connectors correctly in the right position. If it is forcibly pushed in with pins in the wrong positions, the pins may be bent resulting in instrument failure.
- When connecting or disconnecting the connectors, do not force it too far to right and left or up and down, but move it on the straight. Otherwise, the connector pins may be bent, causing instrument failure.
- When disconnecting a connector, hold it by the connector itself. Disconnecting connectors by yanking on their cables can cause breakdowns.
- To prevent malfunction, never touch the contact section of a connector with bare hands or with hands soiled with oil or the like.
- To prevent damage to cables, do not bend cables over with excessive force.

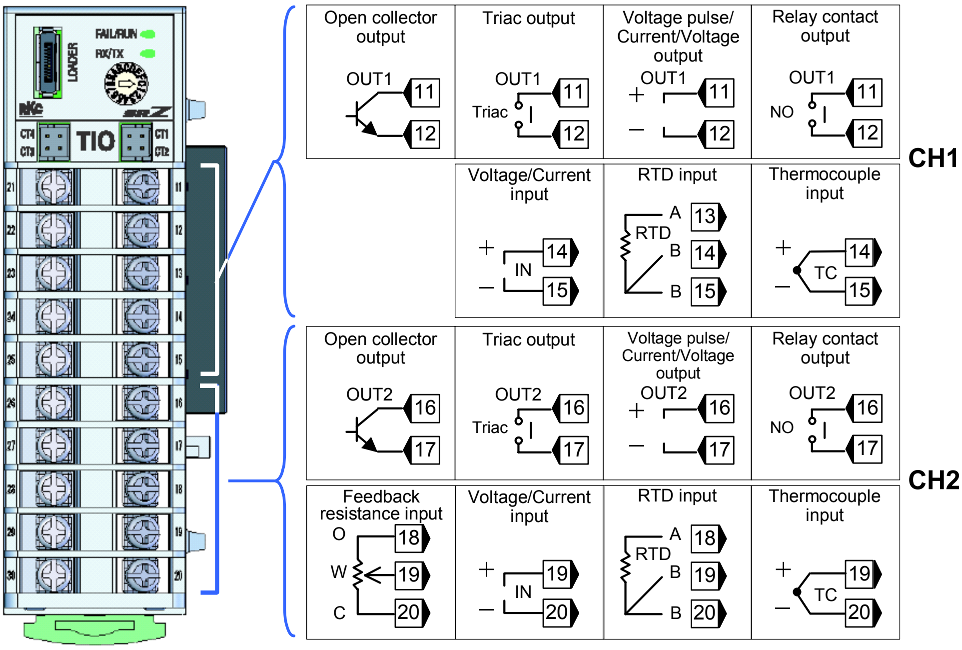
4.3 Terminal Configuration

4.3.1 Z-TIO module

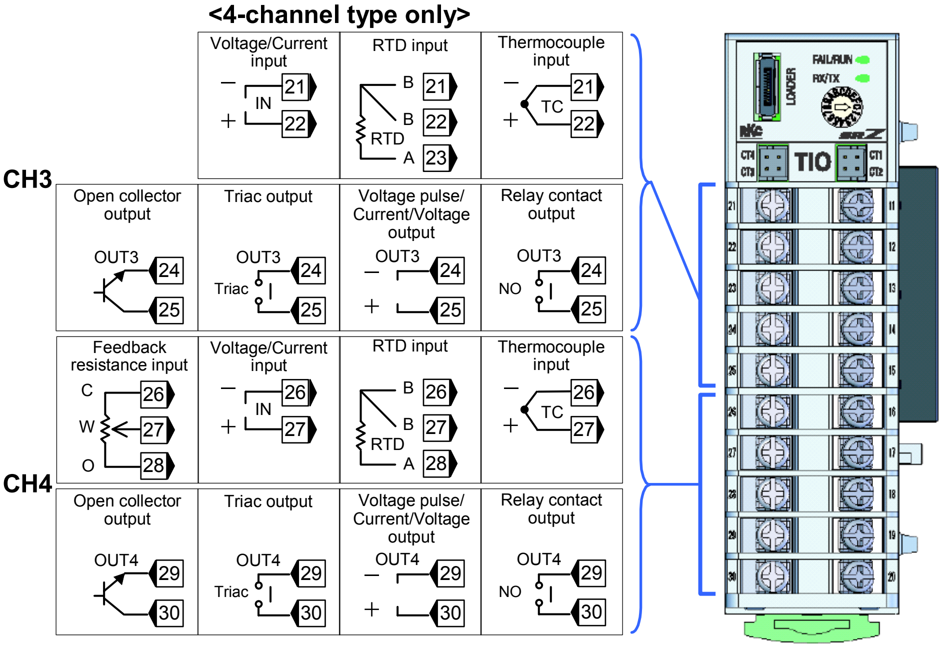
■ Input/output terminals

<Terminal type module>

<Common to both 2CH/4CH types>



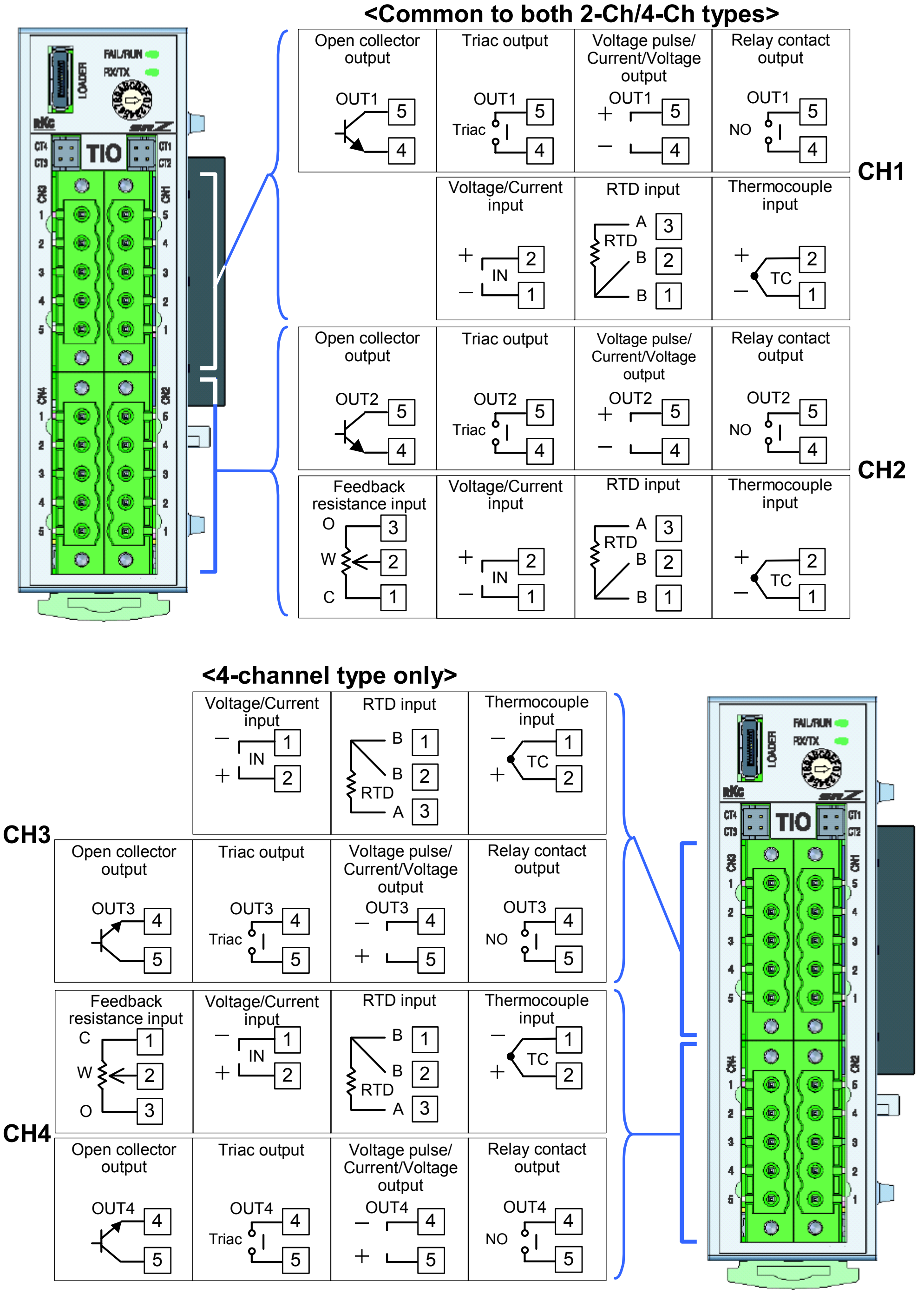
<4-channel type only>



Isolated between each input channel

Voltage pulse output, Current output and Voltage output: Not isolated between output and power supply

<Connecter type module>



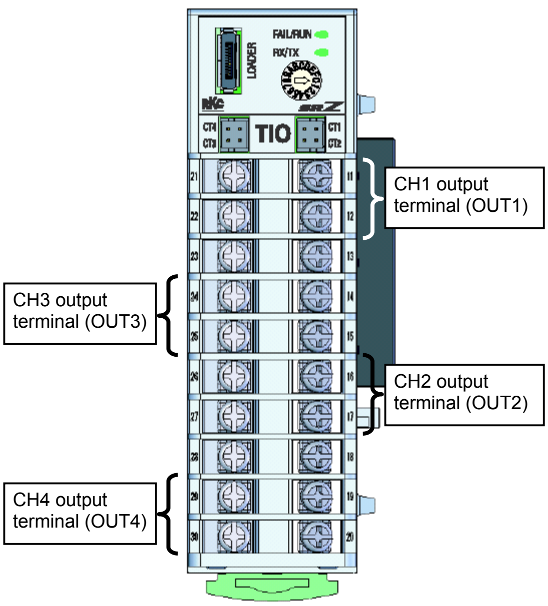
Isolated between each input channel

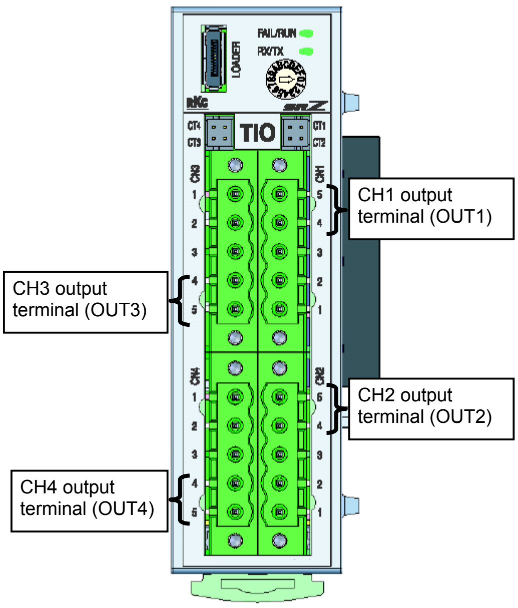
Voltage pulse output, Current output and Voltage output: Not isolated between output and power supply

Input/output configurations by control specifications

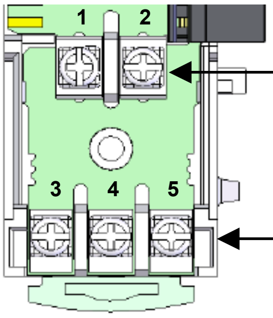
	Control type	CH1 output terminal (OUT1)	CH2 output terminal (OUT2)	CH3 output terminal (OUT3)	CH4 output terminal (OUT4)
2-channel type module	PID control	Control output (CH1)	Control output (CH2)	—	—
	Heat/Cool control	Heat-side output (CH1)	Cool-side output (CH1)	—	—
	Position proportioning control	Open-side output (CH1)	Close-side output (CH1)	—	—
4-channel type module	PID control	Control output (CH1)	Control output (CH2)	Control output (CH3)	Control output (CH4)
	Heat/Cool control	Heat-side output (CH1)	Cool-side output (CH1)	Heat-side output (CH3)	Cool-side output (CH3)
	Position proportioning control	Open-side output (CH1)	Close-side output (CH1)	Open-side output (CH3)	Close-side output (CH3)
	PID control ＋ Heat/Cool control	Control output (CH1)	Control output (CH2)	Heat-side output (CH3)	Cool-side output (CH3)
	PID control ＋ Position proportioning control	Control output (CH1)	Control output (CH2)	Open-side output (CH3)	Close-side output (CH3)
	Heat/Cool control ＋ PID control	Heat-side output (CH1)	Cool-side output (CH1)	Control output (CH3)	Control output (CH4)
	Heat/Cool control ＋ Position proportioning control	Heat-side output (CH1)	Cool-side output (CH1)	Open-side output (CH3)	Close-side output (CH3)
	Position proportioning control ＋ PID control	Open-side output (CH1)	Close-side output (CH1)	Control output (CH3)	Control output (CH4)
	Position proportioning control ＋ Heat/Cool control	Open-side output (CH1)	Close-side output (CH1)	Heat-side output (CH3)	Cool-side output (CH3)

"CH" numbers in parentheses indicate the control channel number of the module.





■ Power supply terminals, Communication terminals (Common to both terminal and connector type module)



Power supply terminals

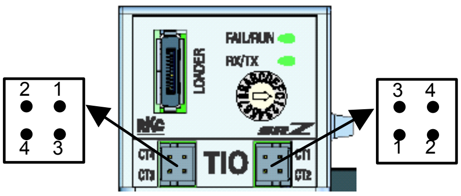
Terminal No.	Description
1	24 V DC (+)
2	24 V DC (–)

Communication terminals (RS-485)

Terminal No.	Description
3	T/R (A)
4	T/R (B)
5	SG

■ CT input connector (Optional)

Pin No.	Description
1	CT4 (CH4)
2	
3	CT3 (CH3)
4	



Pin No.	Description
1	CT2 (CH2)
2	
3	CT1 (CH1)
4	

For the CT input, use the following our CT cable (with socket) and current transformer (CT). [sold separately]

Cable type: W-BW-03-□□□□ (□□□□: Standard cable length [unit: mm])
1000: 1m, 2000: 2 m, 3000: 3 m
[Sleeve color]
White: CT2 (Pin No. 1, 2), CT4 (Pin No. 1, 2)
Blue: CT1 (Pin No. 3, 4), CT3 (Pin No. 3, 4)

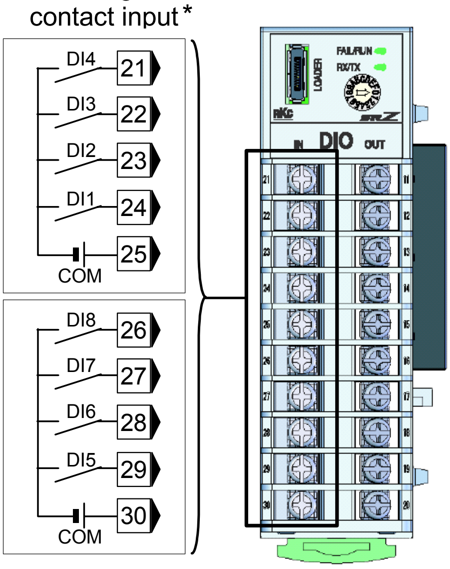
Current transformer (CT): CTL-6-P-N (0.0 to 30.0 A) or CTL-12-S56-10L-N (0.0 to 100.0 A)

4.3.2 Z-DIO module

■ Digital input (DI1 to DI8)

<Terminal type module>

Voltage contact input*



<Connecter type module>

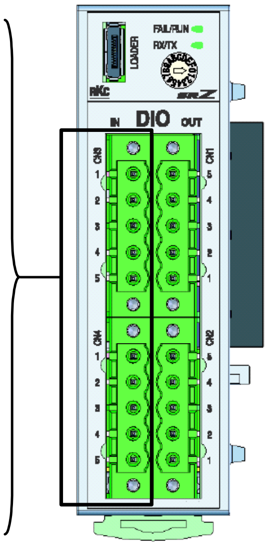
Voltage contact input*

CN3

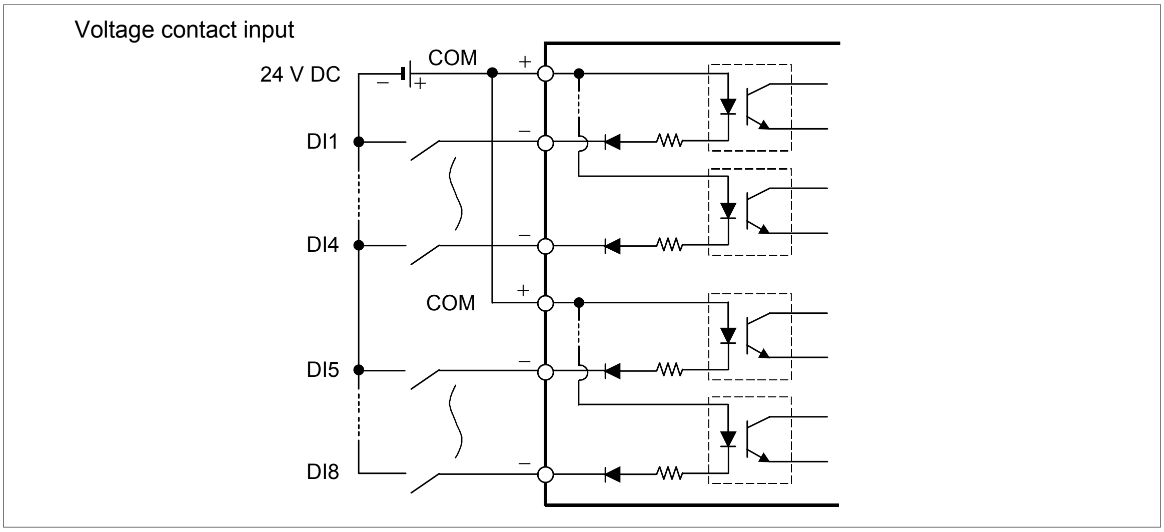
Pin No.	Description
1	DI4
2	DI3
3	DI2
4	DI1
5	COM

CN4

Pin No.	Description
1	DI8
2	DI7
3	DI6
4	DI5
5	COM



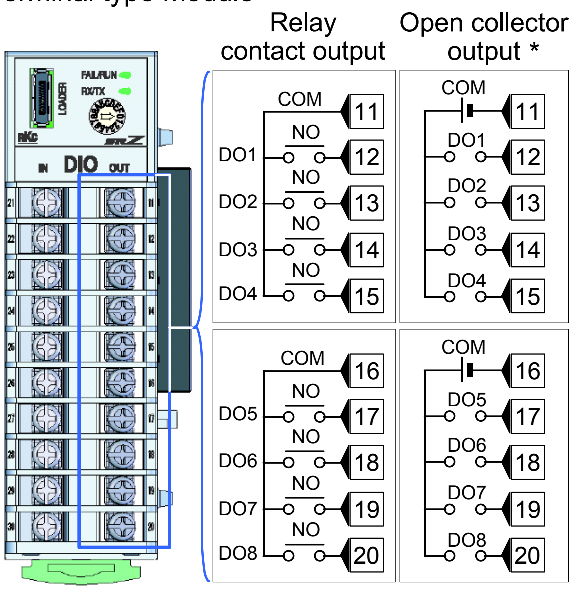
* An external power supply of 24 V DC is required for the voltage contact input.



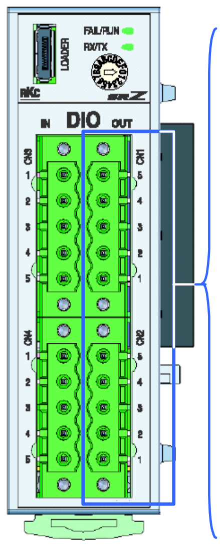
Circuit configuration of digital input

■ Digital output (DO1 to DO8)

<Terminal type module>



<Connecter type module>



Relay contact output/
Open collector output *

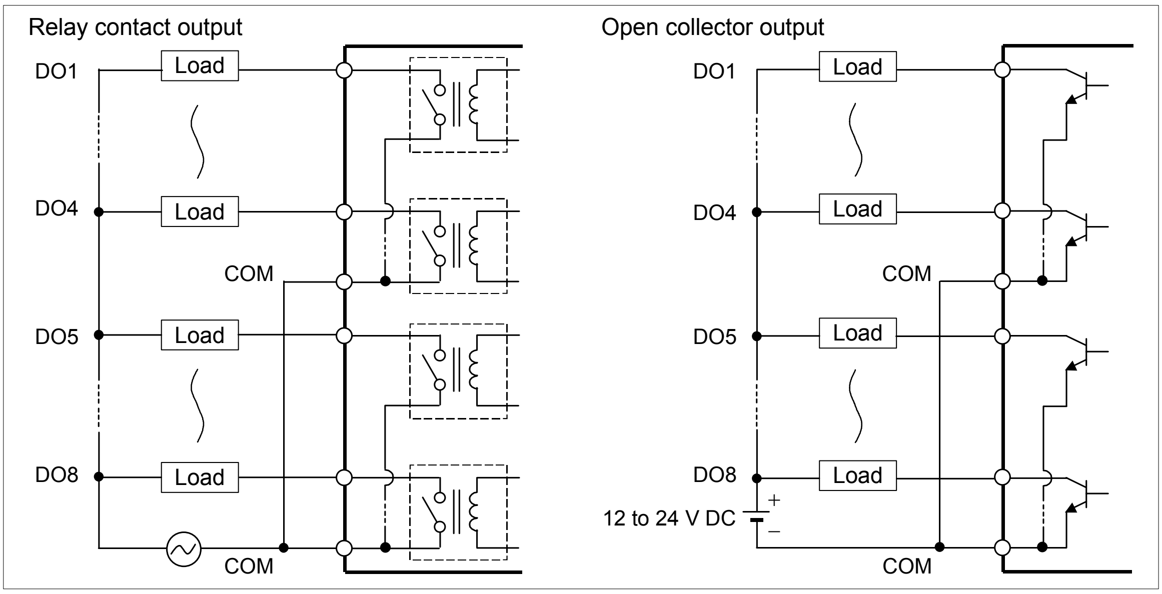
CN1

Pin No.	Description
5	COM
4	DO1
3	DO2
2	DO3
1	DO4

CN2

Pin No.	Description
5	COM
4	DO5
3	DO6
2	DO7
1	DO8

* An external power supply of 12 to 24 V DC is required for the open collector output.



Circuit configuration of digital output

■ Power supply terminals, Communication terminals (Common to both terminal and connector type module)

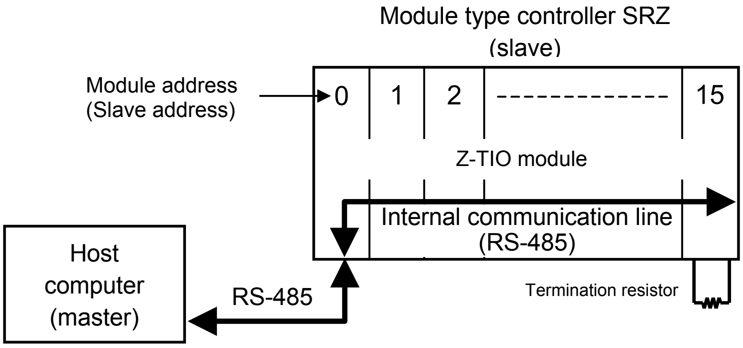
Terminal configurations of the base are the same as the base of Z-TIO module. (See P.4-8)

4.4 Wiring Configuration

⚠ WARNING

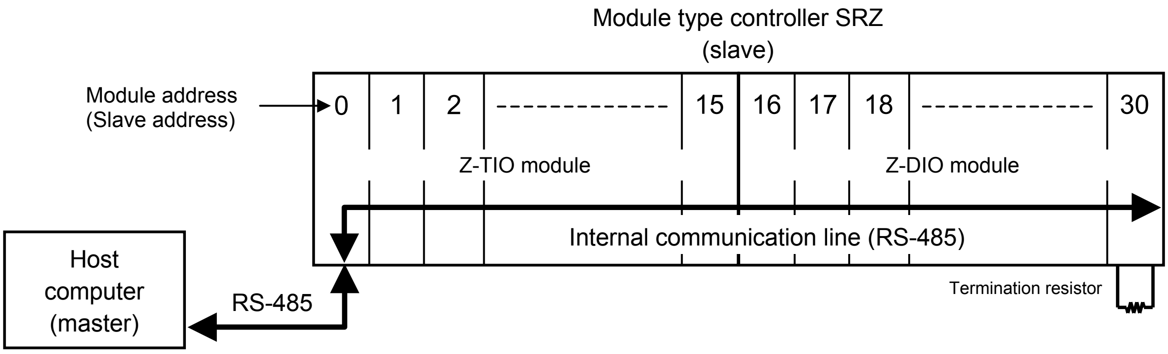
To prevent electric shock or instrument failure, turn off the power before connecting or disconnecting the instrument and peripheral equipment.

■ When two or more Z-TIO module are connected



Up to 16 Z-TIO modules can be connected.

■ When two or more Z-DIO module are connected to Z-TIO modules



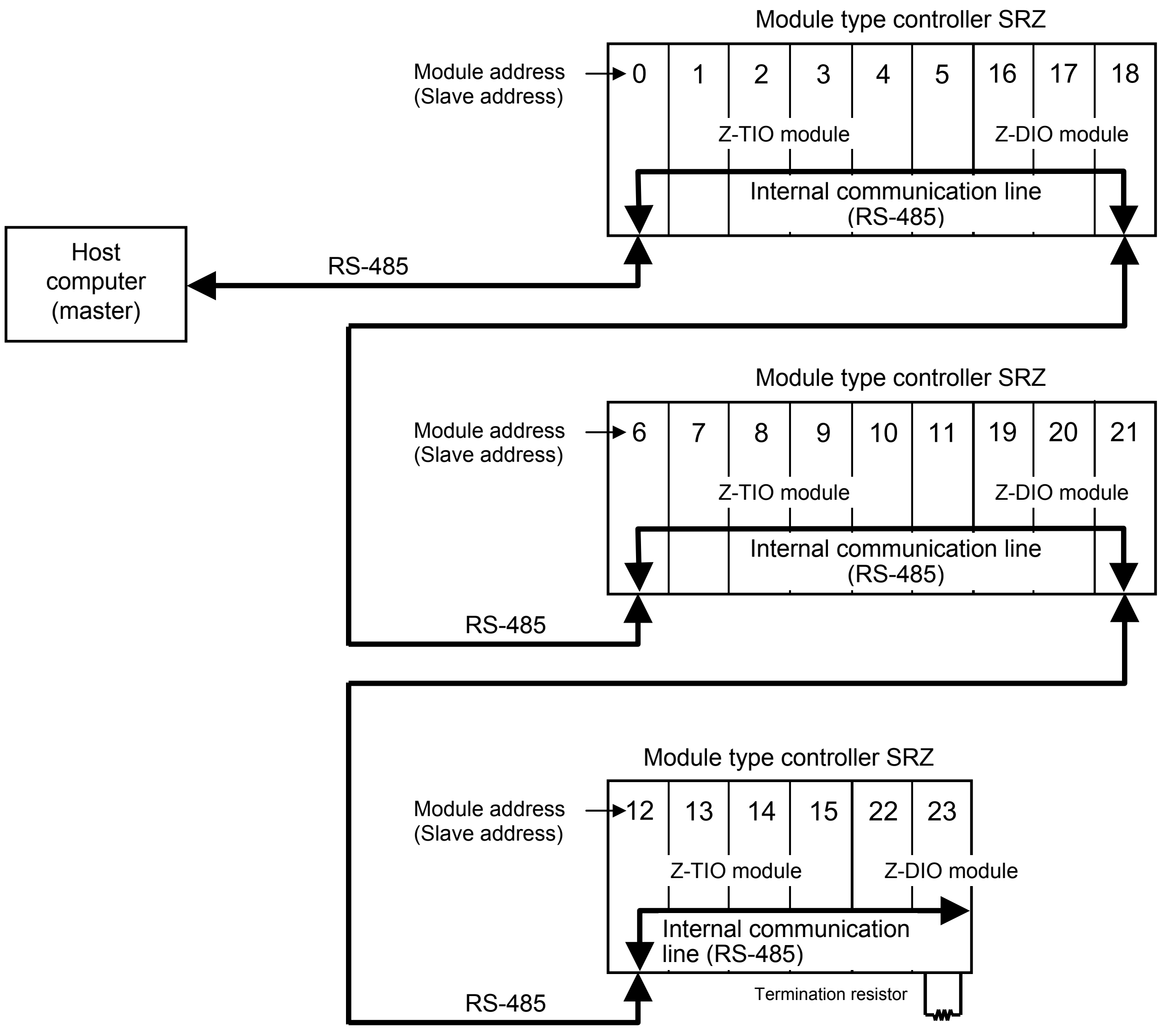
Up to 16 Z-DIO modules can be connected.
The maximum number of SRZ modules (including other function modules) on the same communication line is 31.

Function modules (Z-TIO, Z-DIO) connected inside the same unit can be placed in any position.

For the procedure for connecting modules, see **3.5 Joining Each Module (P. 3-7).**

For the module address settings, see **5. Settings Before Operation (P. 5-1).**

■ When two or more SRZ units are connected



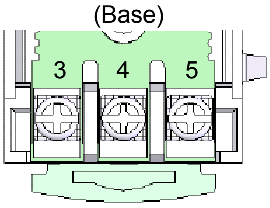
"SRZ unit" refers to a unit consisting of only Z-TIO modules, or a unit in which Z-TIO modules are connected to several other function modules (Z-DIO).

Regardless of the number of units, a maximum of 16 SRZ Z-TIO modules and a maximum of 16 SRZ Z-DIO modules can be connected respectively. However, the maximum number of SRZ modules that can be connected overall, including other function modules (Z-DIO), is 31.

Function modules (Z-TIO, Z-DIO) connected inside the same unit can be placed in any position.

4.5 Connection to Host Computer

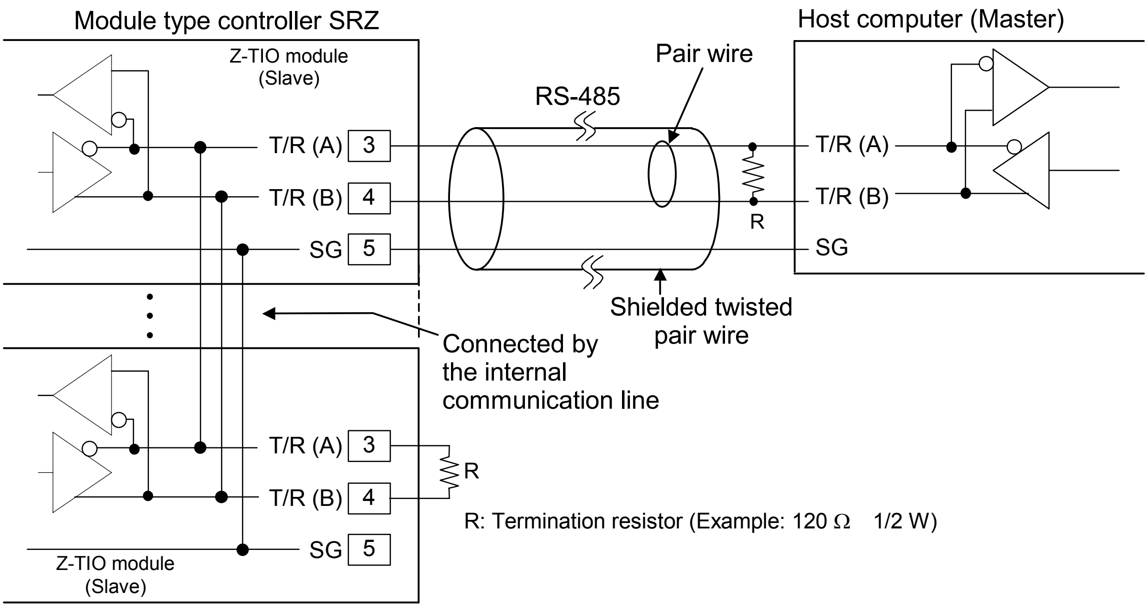
■ Terminal number and signal details



Terminal No.	Signal name	Symbol
3	Send data/Receive data	T/R (B)
4	Send data/Receive data	T/R (A)
5	Signal ground	SG

■ Wiring figure

- **Connection to the RS-485 port of the host computer (master)**



Up to 16 Z-TIO modules can be connected.
The maximum number of SRZ modules (including other function modules) on the same communication line is 31.

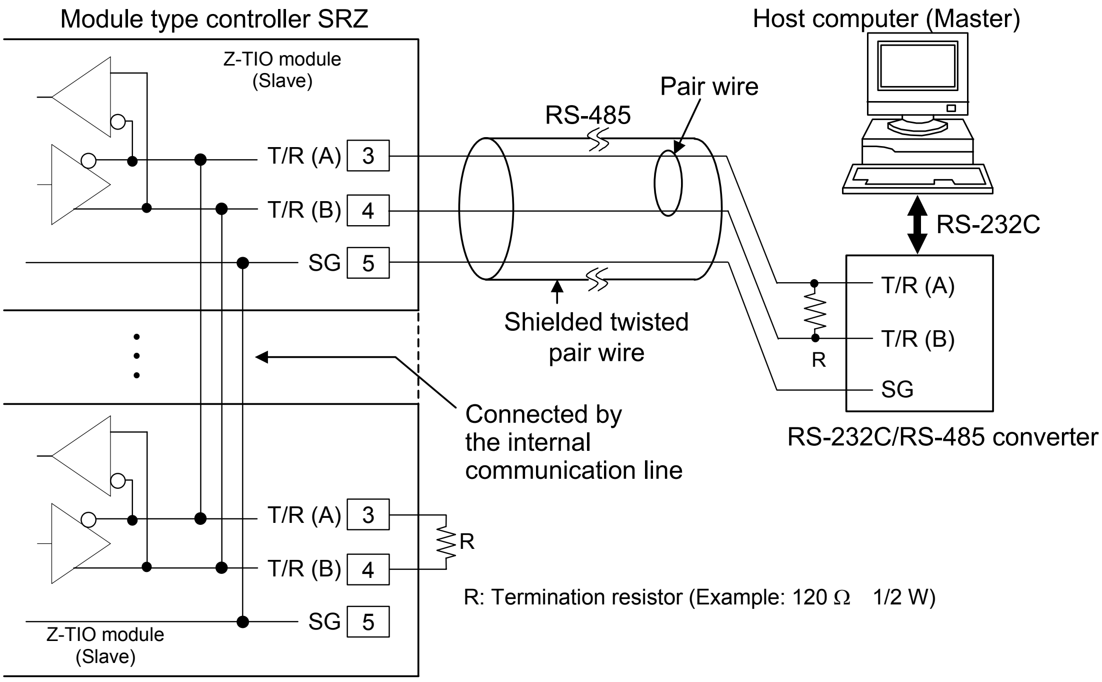
The cable must be provided by the customer.

The above figure shows an example of connecting of Z-TIO modules. However, this figure is also used even when the Z-DIO module is connected instead of the Z-TIO module.

For installation method of termination resistor of the SRZ side, see **4.6 Installation of Termination Resistor (P. 4-16).**

- **Connection to the RS-232C port of the host computer (master)**

A RS-232C/RS-485 converter is required.



Up to 16 Z-TIO modules can be connected.
The maximum number of SRZ modules (including other function modules) on the same communication line is 31.

When the host computer (master) uses Windows95/98/Me/NT/2000/XP, use a RS-232C/RS-485 converter with an automatic send/receive transfer function.
Recommended RS-232C/RS-485 converter:
CD485, CD485/Vmanufactured by Data Link, Inc. or equivalent

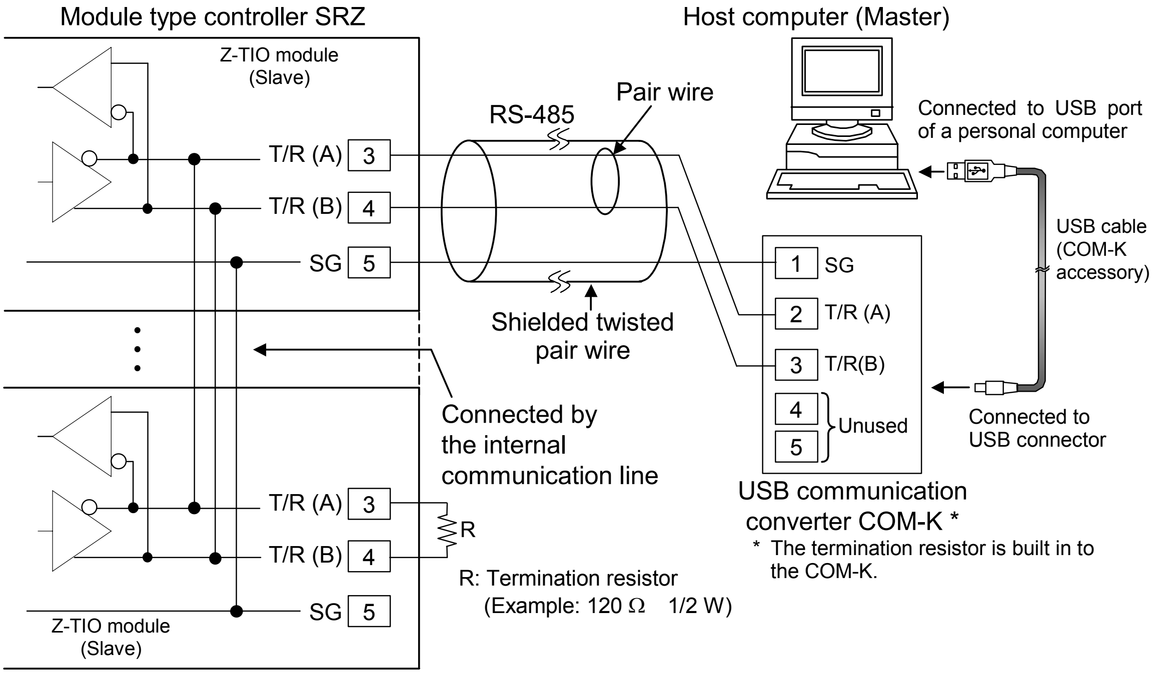
The cable must be provided by the customer.

The above figure shows an example of connecting of Z-TIO modules. However, this figure is also used even when the Z-DIO module is connected instead of the Z-TIO module.

For installation method of termination resistor of the SRZ side, see **4.6 Installation of Termination Resistor (P. 4-16)**.

● Connection to the USB of the host computer (master)

When the host computer (OS: Windows 98SE/2000/XP) is corresponding to the USB connector, our communication converter COM-K (sold separately) can be used.



Up to 16 Z-TIO modules can be connected.
The maximum number of SRZ modules (including other function modules) on the same communication line is 31.

For the COM-K, see **COM-K Instruction Manual (IMR01Z01-E□)**.

The cable must be provided by the customer.

The above figure shows an example of connecting of Z-TIO modules. However, this figure is also used even when the Z-DIO module is connected instead of the Z-TIO module.

☞ For installation method of termination resistor of the SRZ side, see **4.6 Installation of Termination Resistor (P. 4-16)**.

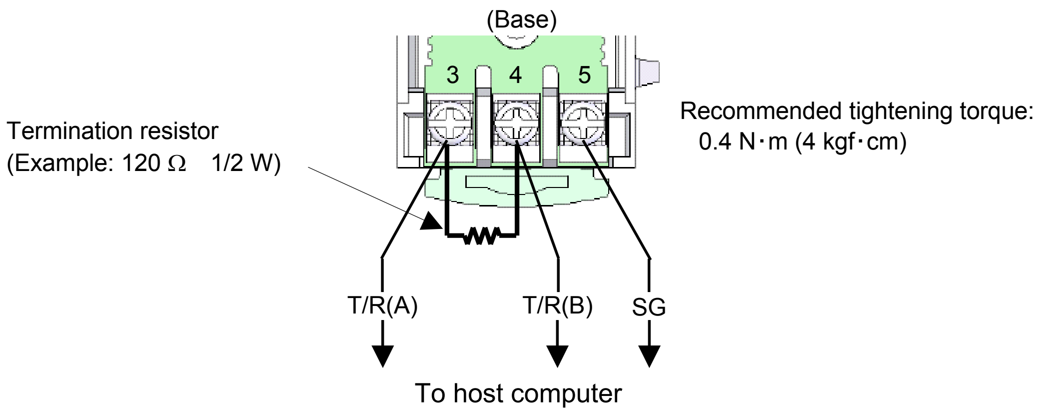
4.6 Installation of Termination Resistor

When connecting termination resistors to each end of the RS-485 communication line, follow the procedure below to connect the resistor to the SRZ end.

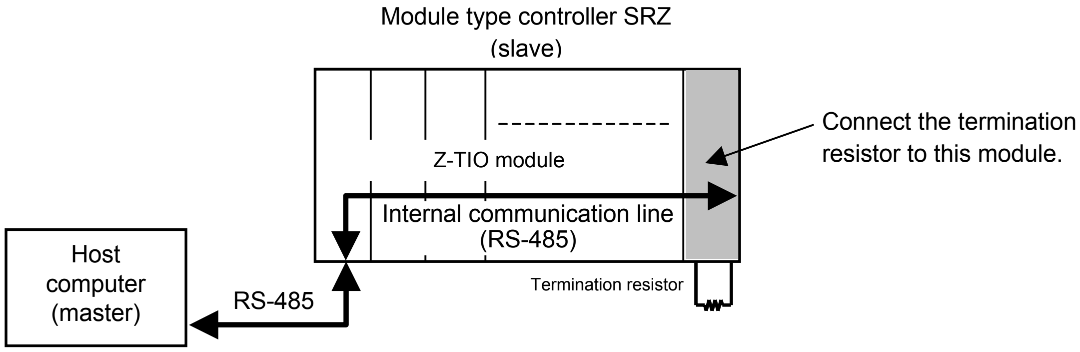
For the termination resistor on the host computer side, connect it so as to satisfy the host computer used.

■ Mounting position

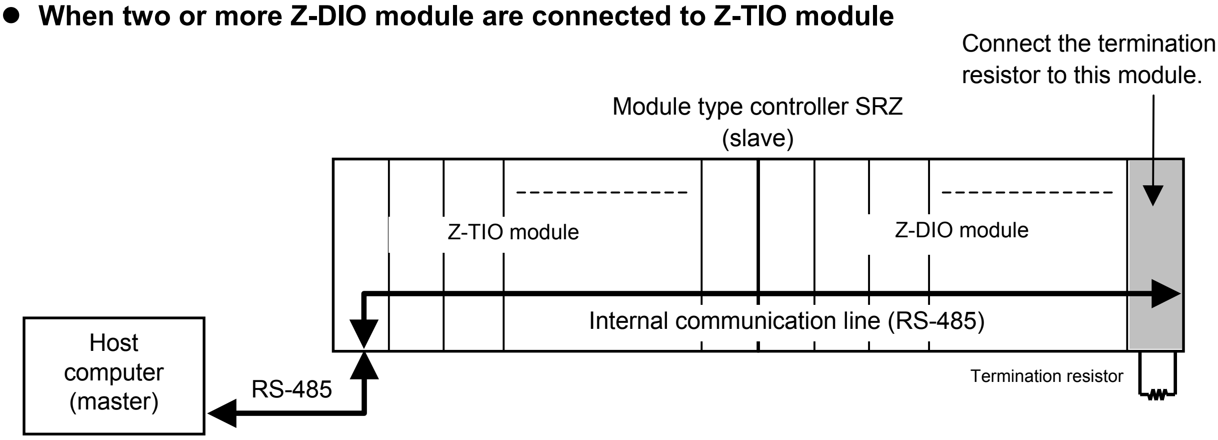
Connect a termination resistor between the communication terminals (No.3 and 4) of the module at the end of the communication line from the host computer.



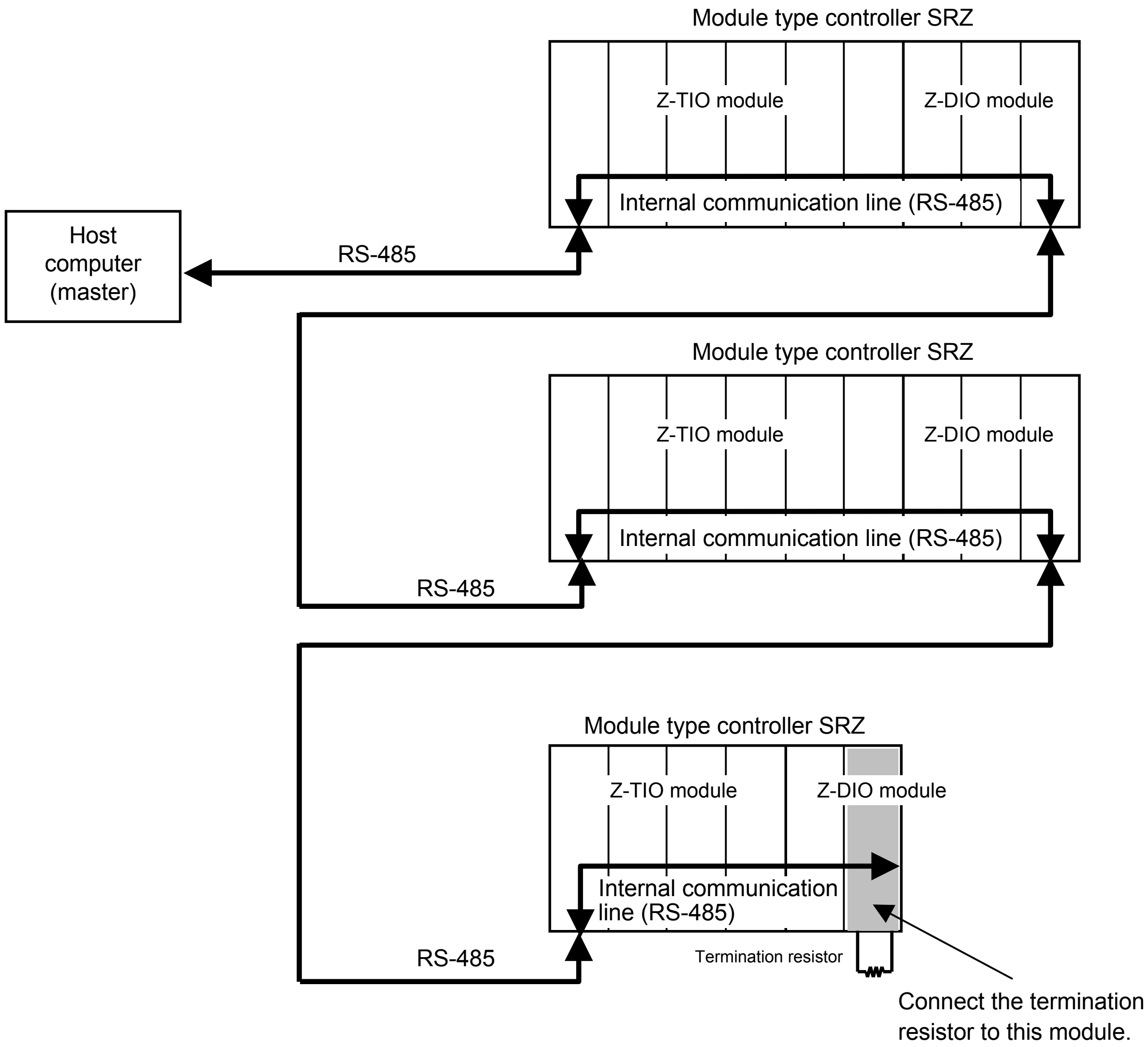
● When two or more Z-TIO module are connected



● When two or more Z-DIO module are connected to Z-TIO module



- **When two or more SRZ units are connected**



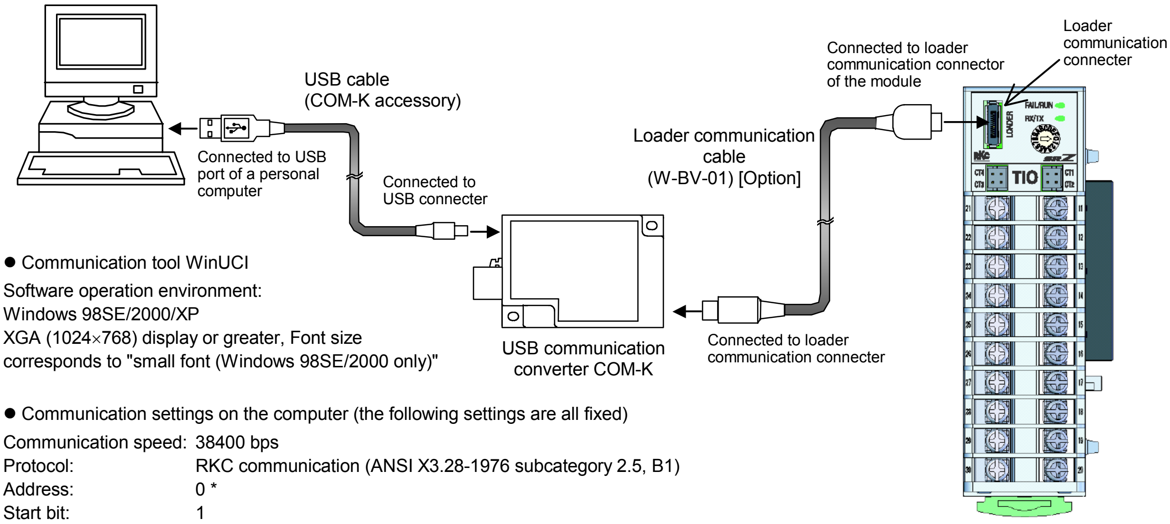
4.7 Connections for Loader Communication

Each function module (Z-TIO, Z-DIO) is equipped standard with a loader communication connector.

The module loader communication connector, our COM-K USB communication converter (sold separately) [1], and a personal computer can be connected with the appropriate cables, and our WinUCI [2] communication tool can be installed on the computer, to enable data management monitoring and settings from the computer.

[1] A loader communication cable (option) is required for the connection to the loader communication connector on the module. USB communication converter COM-K-1 (with Loader communication cable [cable length: 1 m])

[2] Only available as a download from our web site.



● Communication tool WinUCI

Software operation environment:
Windows 98SE/2000/XP
XGA (1024×768) display or greater, Font size corresponds to "small font (Windows 98SE/2000 only)"

● Communication settings on the computer (the following settings are all fixed)

Communication speed:	38400 bps
Protocol:	RKC communication (ANSI X3.28-1976 subcategory 2.5, B1)
Address:	0 *
Start bit:	1
Data bit:	8
Parity bit:	Without
Stop bit:	1

* Not related to the address setting of the address setting switch on the module.

The Loader port is only for parameter setup.

For the COM-K, see the **COM-K Instruction Manual (IMR01Z01-E□).**

SETTINGS BEFORE OPERATION

5

5.1 Module Address Setting

Set communication setting before mounting and wiring of the Z-TIO.

⚠ WARNING

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

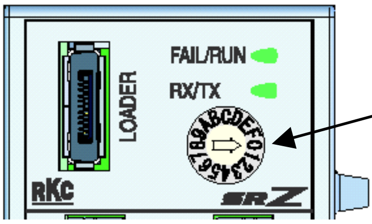
CAUTION

Do not separate the module mainframe from the base with the power turned on. If so, instrument failure may result.

■ Address setting switches

Set an address for the module using a small blade screwdriver.
When using two or more modules, set the desired address to each module.

To avoid problems or malfunction, do not duplicate an address on the same communication line.



Address setting switch
Setting range: 0 to F [0 to 15: Decimal]
Factory set value: 0

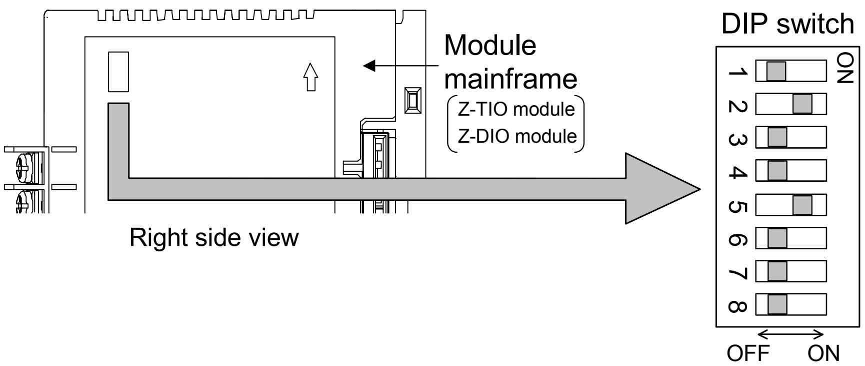
Module address number of each module:

	RKC communication	Modbus
Z-TIO module	0 to 15: Decimal	1 to 16: Decimal The value obtained by adding “1” to the set address corresponds to the address used for the actual program.
Z-DIO module	16 to 31: Decimal The value obtained by adding “16” to the set address corresponds to the address used for the actual program.	17 to 32: Decimal The value obtained by adding “17” to the set address corresponds to the address used for the actual program.

5.2 Protocol Selections and Communication Speed Setting

Use the DIP switch on the right side of module to select communication speed, data bit, configuration and protocol. The data changes become valid when the power is turned on again or when changed to RUN/STOP.

When two or more modules (Z-TIO, Z-DIO) are connected on the same communication line, the DIP switch settings (switch 1 to 8) of all modules must be the same. Otherwise the module may fail or malfunction.



(The above figure is for the terminal type. However, the switch positions are the same for the connector type.)

1	2	Communication speed
OFF	OFF	4800 bps
ON	OFF	9600 bps
OFF	ON	19200 bps
ON	ON	38400 bps

Factory set value: 19200 bps

3	4	5	Data bit configuration
OFF	OFF	OFF	Data 7-bit, without parity, Stop 1-bit *
OFF	ON	OFF	Data 7-bit, Even parity, Stop 1-bit *
ON	ON	OFF	Data 7-bit, Odd parity, Stop 1-bit *
OFF	OFF	ON	Data 8-bit, without parity, Stop 1-bit
OFF	ON	ON	Data 8-bit, Even parity, Stop 1-bit
ON	ON	ON	Data 8-bit, Odd parity, Stop 1-bit

Setting range of Modbus

Setting range of RKC communication

* When the Modbus communication protocol is selected, this setting becomes invalid.
Factory set value: Data 8-bit, without parity

6	Protocol
OFF	RKC communication
ON	Modbus

Factory set value: RKC communication

Switch No. 7 and 8 must be always OFF. Do not set to ON.

5.3 Operating Precautions

Check the following items before starting operation, then turn on the power.

■ Power ON

When first powered on, the unit starts with the operation mode set to "Control" and the RUN/STOP switch set to STOP (control is stopped) (FAIL/RUN display lamp: lights green).
When the RUN/STOP switch is switched from STOP to RUN, operation begins. [Factory set value: STOP]

■ Action at input error

If the input signal wiring is disconnected or short-circuited (RTD input and Feedback resistance input only), the instrument determines that burnout has occurred.

● Burnout direction

Upscale: Thermocouple [1], RTD input (at input break), Feedback resistance input (at input break), Voltage (low) input [1]

Downscale: Thermocouple [1], RTD input (at short-circuited), Feedback resistance input (at short-circuited), Voltage (low) input, Voltage (high) input [2], Current input [2]

[1] For the thermocouple input or the voltage (low) input, upscale or downscale can be selected by Engineering mode. (Factory set value: Upscale)

[2] For the voltage (high) input or the current input, the display becomes indefinite (display of about zero value).

● Output at input error

Control output: According to the contents set by “Action (high/low) at input error”

Event output: According to the contents set by “Event action at input error”

■ Checking the each parameter

The settings for the SV and all parameters should be appropriate for the controlled system.

There are parameters in Engineering setting which can not be changed when the controller is in RUN mode. Change the RUN/STOP mode from RUN to STOP when a change for the parameters in Engineering setting is necessary.

☞ For details of the each parameter, see **8. COMMUNICATION DATA DESCRIPTION (P. 8-1).**

■ Operation when power failure

A power failure of 4 ms or less will not affect the control action. When a power failure of more than 4 ms occurs the instrument assumes that the power has been turned off. When the power returns, the operation of instrument will be re-starts in accordance with the content selected by Hot/Cold start.

☞ For details of Hot/Cold start, see **Hot/Cold start (P. 8-92).**

■ Event hold action

- The event action is activated when the power is turned on or when transferred from STOP mode to RUN mode.
- The event re-hold action is activated when not only the SV is changed, but also the power is turned on or when transferred from STOP mode to RUN mode.

5.4 Communication Requirements

■ Processing times during data send/receive

When the host computer is using either the polling or selecting procedure for communication, the following processing times are required for controller to send data:
- Response wait time after controller sends BCC in polling procedure
- Response wait time after controller sends ACK or NAK in selecting procedure

RKC communication (Polling procedure)

Procedure details	Time
Response send time after controller receives ENQ	50 ms max.
Response send time after controller receives ACK	50 ms max.
Response send time after controller receives NAK	50 ms max.
Response send time after controller sends BCC	2 ms max.

RKC communication (Selecting procedure)

Procedure details	Time
Response send time after controller receives BCC	50 ms max.
Response wait time after controller sends ACK	2 ms max.
Response wait time after controller sends NAK	2 ms max.

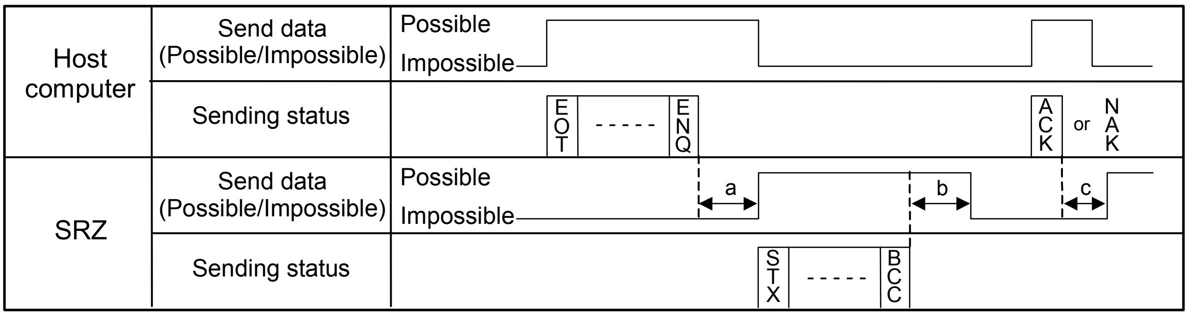
Modbus

Procedure details	Time
Read holding registers [03H] Response send time after the slave receives the query message	50 ms max.
Preset single register [06H] Response send time after the slave receives the query message	30 ms max.
Diagnostics (loopback test) [08H] Response send time after the slave receives the query message	30 ms max.
Preset multiple registers [10H] Response send time after the slave receives the query message	100 ms max.

■ RS-485 (2-wire system) send/receive timing

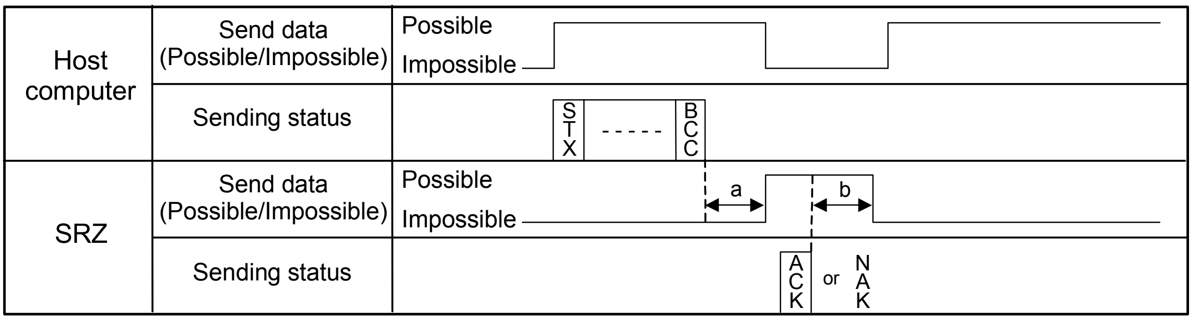
RS-485 communication is conducted through two wires, therefore the transmission and reception of data requires precise timing.

● Polling procedure



a: Response send time after the controller receives [ENQ] + Interval time
b: Response send time after the controller sends BCC
c: Response send time after the controller receives [ACK] + Interval time or
Response send time after the controller receives [NAK] + Interval time

● Selecting procedure



a: Response send time after the controller receives BCC + Interval time
b: Response wait time after the controller sends ACK or Response wait time after the controller sends NAK

To switch the host computer from transmission to reception, send data must be on line.

The following processing times are requires for the controller to process data.
- In Polling procedure, Response wait time after the controller sends BCC
- In Selecting procedure, Response wait time after the controller sends ACK or NAK

■ Fail-safe

A transmission error may occur with the transmission line disconnected, shorted or set to the high-impedance state. In order to prevent the above error, it is recommended that the fail-safe function be provided on the receiver side of the host computer. The fail-safe function can prevent a framing error from its occurrence by making the receiver output stable to the MARK (1) when the transmission line is in the high-impedance state.

RKC COMMUNICATION

6

6.1 Polling

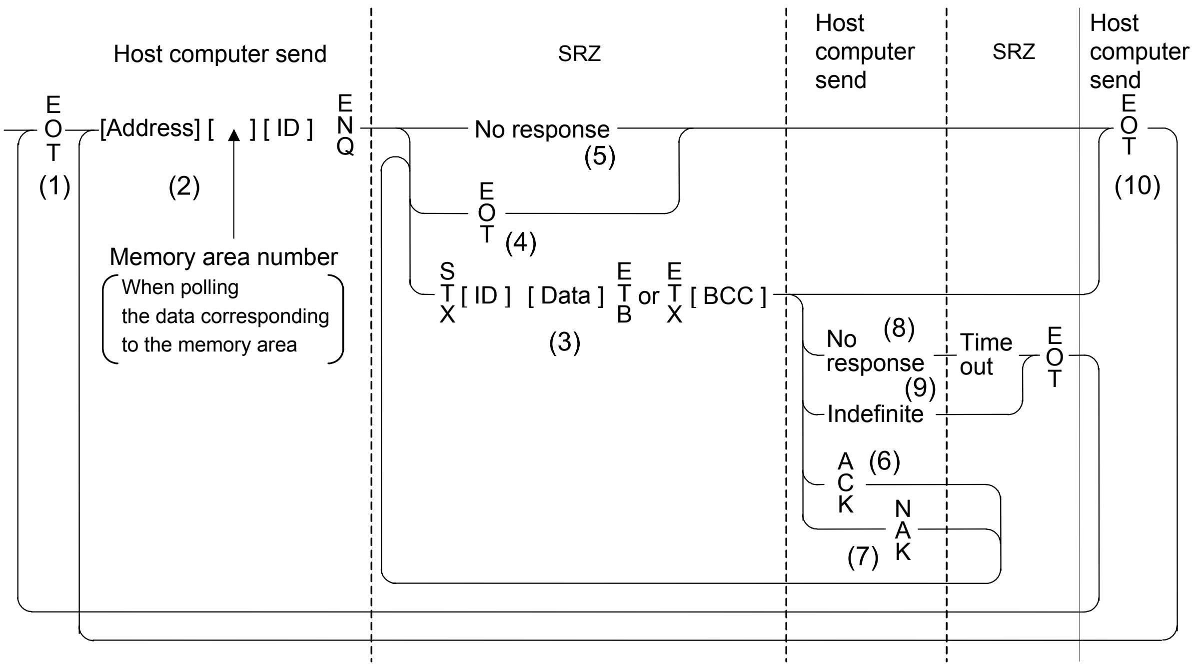
RKC communication uses the polling/selecting method to establish a data link. The basic procedure is followed ANSI X3.28 subcategory 2.5, B1 basic mode data transmission control procedure (Fast selecting is the selecting method used in SRZ).

- The polling/selecting procedures are a centralized control method where the host computer controls the entire process. The host computer initiates all communication so the controller responds according to queries and commands from the host.

- The code use in communication is 7-bit ASCII code including transmission control characters.
  Transmission control characters used in SRZ:
  EOT (04H), ENQ (05H), ACK (06H), NAK (15H), STX (02H), ETB (17H), ETX (03H)
  (   ): Hexadecimal

6.1.1 Polling procedures

Polling is the action where the host computer requests one of the connected SRZ to transmit data.
An example of the polling procedure is shown below:



ID: Identifier

(1) Data link initialization

Host computer sends EOT to the controllers to initiate data link before polling sequence.

(2) Data sent from host computer - Polling sequence

The host computer sends the polling sequence in the following two types of formats:

- Format in which no memory area number is specified, and
- Format in which the memory area number is specified.

- **When no memory area number is specified**

  To be sent in this format for any identifier not corresponding to the memory area.

1.		*3.*		*4.*
				ENQ
Address		Identifier		

Example:

0	1	M	1	ENQ

- **When the memory area number is specified**

  To be sent in this format for any identifier corresponding to the memory area.

1.		*2.*		*3.*		*4.*
		K				ENQ
Address		Memory area number		Identifier		

Example:

0	1	K	1	S	1	ENQ

1. Address (2 digits)

This data is a module address of the SRZ for polled and must be the same as the module address set value in item **5.1 Module Address Setting (P. 5-2).**

The polling address which transmitted a message once becomes effective so long as data link is not initialized by transmit and receive of EOT.

2. Memory area number (2 digits)

This is the identifier to specify the memory area number. It is expressed by “K1” to “K8” to each memory area number (from 1 to 8). If the memory area number is assigned with “K0,” this represents that control area is specified.

The memory area now used for control is called “Control area.”

If the memory area number is not specified when polling the identifier corresponding to the memory area, this represents that the control area is specified.

If any identifier not corresponding to the memory area is assigned with a memory area number, this memory area number is ignored.

3. Identifier (2 digits)
The identifier specifies the type of data that is requested from the SRZ. Always attach the ENQ code to the end of the identifier.

☞ See **6.4 Communication Data List (P. 6-13)**.

4. ENQ
The ENQ is the transmission control character that indicates the end of the polling sequence. The host computer then must wait for a response from the SRZ.

(3) Data sent from the SRZ

If the polling sequence is received correctly, the SRZ sends data in the following format:

1.	***2.***	***3.***	***4.***	***6.***
STX	Identifier	Data	ETB	BCC

or

1.	***2.***	***3.***	***5.***	***6.***
STX	Identifier	Data	ETX	BCC

If the length of send data (from STX to BCC) exceeds 128 bytes, it is divided into blocks by ETB. In this case, the succeeding divided data is sent after STX.

1. STX
STX is the transmission control character which indicates the start of the text transmission (identifier and data).

2. Identifier (2 digits)
The identifier indicates the type of data (measured value, status and set value) sent to the host computer.

☞ See **6.4 Communication Data List (P. 6-13)**.

3. Data
Data which is indicated by an identifier of this instrument, consisting of channel numbers, data, etc. Each channel number and data are delimited by a space (20H). The data and the next channel number are delimited by a comma.

- Channel number: 2-digit ASCII code, not zero-suppressed. Channels without channel numbers may exist depending on the type of identifier.
- Data: ASCII code, zero-suppressed with spaces (20H). The number of digits varies depending on the type of identifier.

Memory area soak time monitor and area soak time become the following data:

- When data range is 0 hour 00 minute to 99 hours 59 minutes:
  Data range is 0:00 to 99:59, punctuation of time unit is expressed in colon ": (3AH)."
- When data range is 0 minute 00 second to 199 minutes 59 seconds:
  Data range is 0:00 to 199:59, punctuation of time unit is expressed in colon ": (3AH)."

4. ETB
Transmission control character indicating the end of the block.

5. ETX
Transmission control character indicating the end of the text.

6. BCC
BCC (Block Check Character) detects error using horizontal parity and is calculated by horizontal parity (even number).

Calculation method of BCC: *Exclusive OR* all data and characters from STX through ETB or ETX, not including STX.

Example:

STX	M	1	0	1			1	5	0	.	0	ETX	BCC
	4DH	31H	30H	31H	20H	20H	31H	35H	30H	2EH	30H	03H	

Hexadecimal numbers

BCC = 4DH ⊕ 31H ⊕ 30H ⊕ 31H ⊕ 20H ⊕ 20H ⊕ 31H ⊕ 35H ⊕ 30H ⊕ 2EH ⊕ 30H ⊕ 03H = 54H
(⊕: *Exclusive OR*)
Value of BCC becomes 54H

(4) EOT send (Ending data transmission from the SRZ)

In the following cases, the SRZ sends EOT to terminate the data link:

- When the specified identifier is invalid
- When there is an error in the data format
- When all the data has been sent

(5) No response from the SRZ

The SRZ will not respond if the polling address is not received correctly. It may be necessary for the host computer to take corrective action such as a time-out.

(6) ACK (Acknowledgment)

An acknowledgment ACK is sent by the host computer when data received is correct. When the SRZ receives ACK from the host computer, the SRZ will send any remaining data of the next identifier without additional action from the host computer.

- When ACK was sent in succession for Z-TIO module, identifier data item down to "Communication switch for logic" in the communication identifier list are sent.
- When ACK was sent in succession for Z-DIO module, identifier data item down to "DO minimum ON/OFF time of proportioning cycle" in the communication identifier list are sent.

When host computer determines to terminate the data link, EOT is sent from the host computer.

(7) NAK (Negative acknowledge)

If the host computer does not receive correct data from the SRZ, it sends a negative acknowledgment NAK to the SRZ. The SRZ will re-send the same data when NAK is received. This cycle will go on continuously until either recovery is achieved or the data link is corrected at the host computer.

(8) No response from host computer

When the host computer does not respond within approximately three seconds after the SRZ sends data, the SRZ sends EOT to terminate the data link (time-out time: about 3 seconds).

(9) Indefinite response from host computer

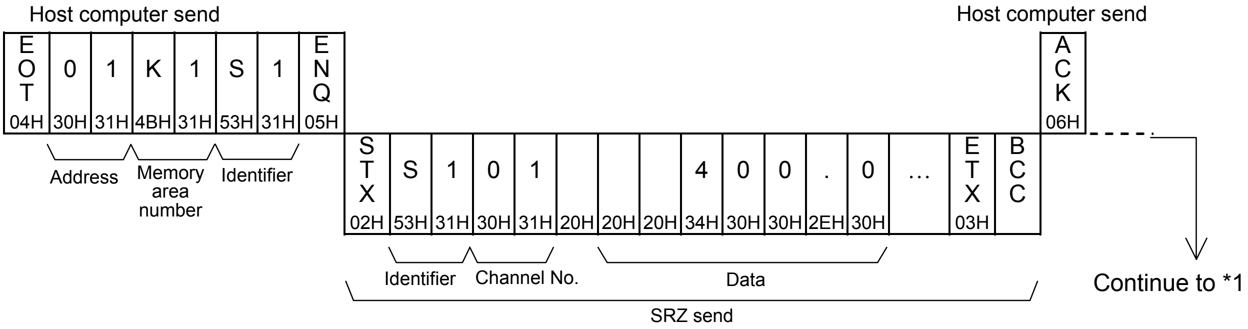
The SRZ sends EOT to terminate the data link when the host computer response is indefinite.

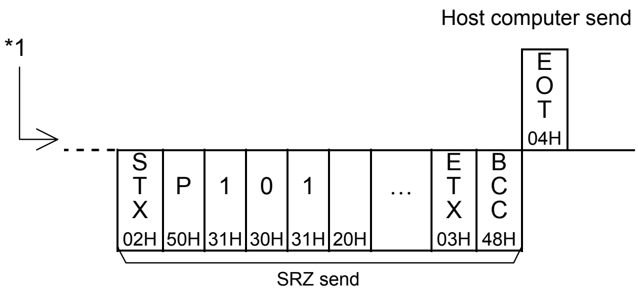
(10) EOT (Data link termination)

The host computer sends EOT message when it is necessary to suspend communication with the SRZ or to terminate the data link due lack of response from the SRZ.

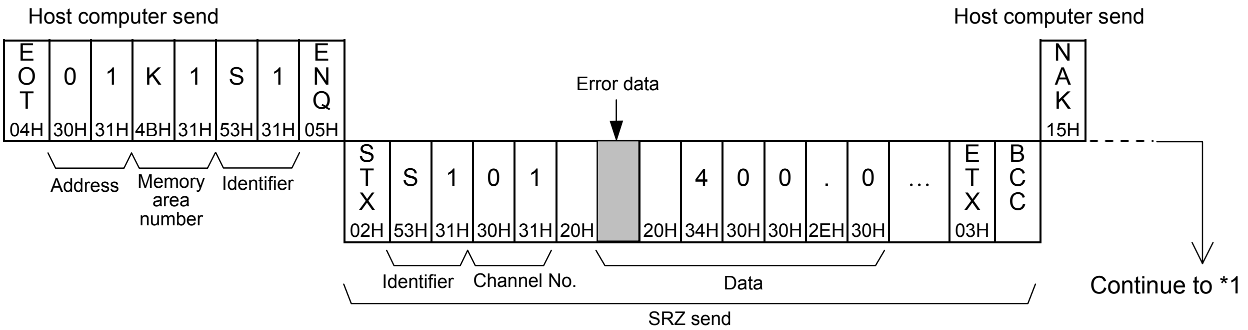
6.1.2 Polling procedure example (When the host computer requests data)

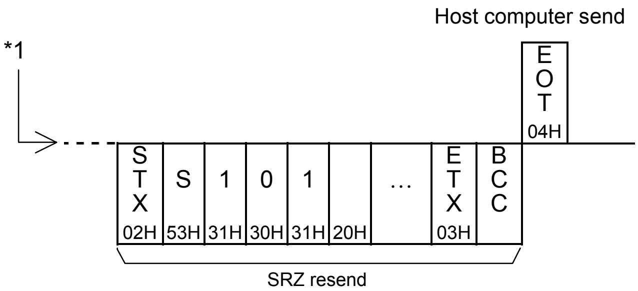
■ Normal transmission





■ Error transmission

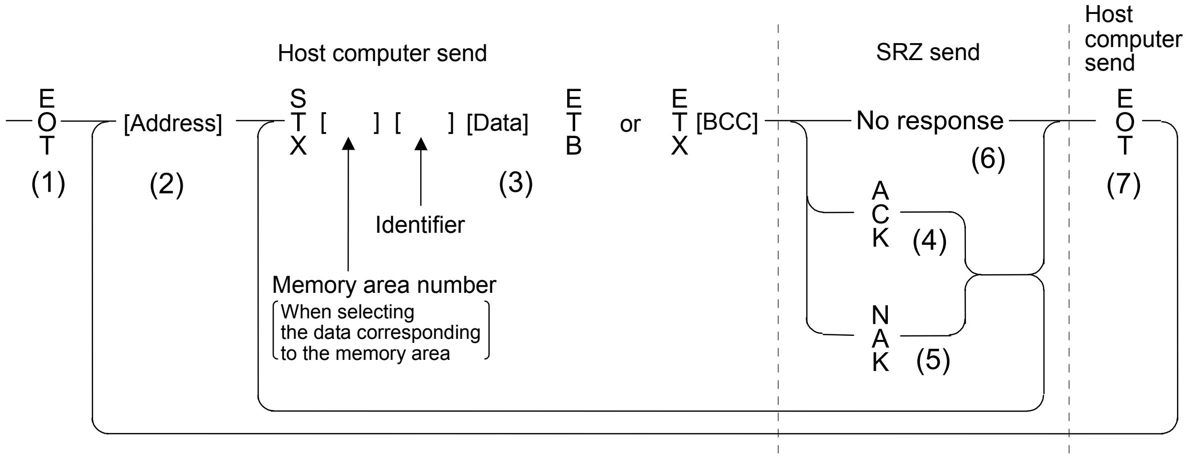




6.2 Selecting

6.2.1 Selecting procedures

Selecting is the action where the host computer requests one of the connected SRZ to receive data. An example of the selecting procedure is shown below:



(1) Data link initialization

Host computer sends EOT to the SRZ to initiate data link before selecting sequence.

(2) Sending selecting address from the host computer

Host computer sends selecting address for the selecting sequence.

Address (2 digits):
This data is a module address of the SRZ to be selected and must be the same as the module address set value in item **5.1 Module Address Setting (P. 5-2)**.

As long as the data link is not initialized by sending or receiving EOT, the selecting address once sent becomes valid.

(3) Data sent from the host computer

The host computer sends data for the selecting sequence with the following format:

- When no memory area number is specified

STX	Identifier	Data	ETB	BCC

or

STX	Identifier	Data	ETX	BCC

• When the memory area number is specified

STX	Memory area number	Identifier	Data	ETB	BCC

or

STX	Memory area number	Identifier	Data	ETX	BCC

☞ For the STX, Memory area number Identifier, Data, ETB, ETX and BCC, see **6.1 Polling (P. 6-2)**.

If the length of send data (from STX to BCC) exceeds 128 bytes, it is divided into blocks by ETB. In this case, the succeeding divided data is sent after STX.

Area soak time set data as the following:

• When data range is 0 hour 00 minute to 99 hours 59 minutes:
Data range is 0:00 to 99:59, punctuation of time unit is expressed in colon ": (3AH)."

• When data range is 0 minute 00 second to 199 minutes 59 seconds:
Data range is 0:00 to 199.59, punctuation of time unit is expressed in colon ": (3AH)."

In addition to above, when minute and second data are set in more than 60, become as the following:

Example: 1:65 (1 hour 65 minutes) → 2:05 (2 hours 05 minutes)
0:65 (0 minute 65 seconds) → 1:05 (1 minute 05 seconds)

About numerical data:

The data that receipt of letter is possible

• Data with numbers below the decimal point omitted or zero-suppressed data can be received.
(Number of digits: Within 7 digits)
<Example> When data send with –001.5, –01.5, –1.5, –1.50, –1.500 at the time of –1.5, SRZ can receive a data.

• When the host computer sends data with decimal point to item of without decimal point, the SRZ receives a message with the value that cut off below the decimal point.
<Example> When setting range is 0 to 200, the SRZ receives as a following.

Send data	0.5	100.5
Receive data	0	100

• The SRZ receives value in accordance with decided place after the decimal point. The value below the decided place after the decimal point is cut off.
<Example> When setting range is –10.00 to +10.00, the controller receives as a following.

Send data	–.5	–.058	.05	–0
Receive data	–0.50	–0.05	0.05	0.00

The data that receipt of letter is impossible

The SRZ sends NAK when received a following data.

+	Plus sign and the data that gained plus sing
−	Only minus sign (there is no figure)
−.	Only minus sign and decimal point (period)

(4) ACK (Acknowledgment)

An acknowledgment ACK is sent by the SRZ when data received is correct. When the host computer receives ACK from the SRZ, the host computer will send any remaining data. If there is no more data to be sent to the SRZ, the host computer sends EOT to terminate the data link.

(5) NAK (Negative acknowledge)

If the SRZ does not receive correct data from the host computer, it sends a negative acknowledgment NAK to the host computer. Corrections, such as re-send, must be made at the host computer. The SRZ will send NAK in the following cases:

- When an error occurs on communication the line (parity, framing error, etc.)
- When a BCC check error occurs
- When the specified identifier is invalid
- When receive data exceeds the setting range
- When receive data is the identifier of RO (read only)

(6) No response from SRZ

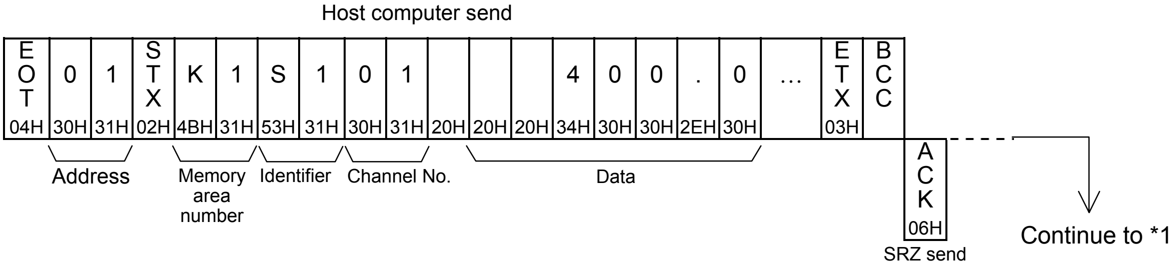
The SRZ does not respond when it can not receive the selecting address, STX, ETB, ETX or BCC.

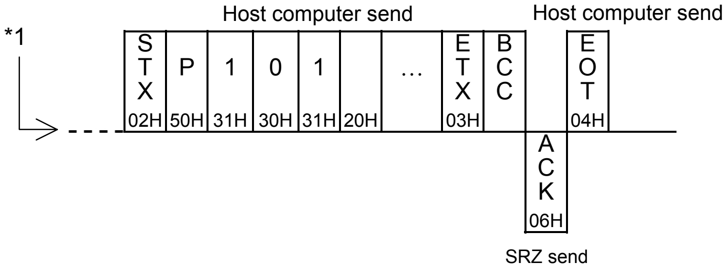
(7) EOT (Data link termination)

The host computer sends EOT when there is no more data to be sent from the host computer or there is no response from the SRZ.

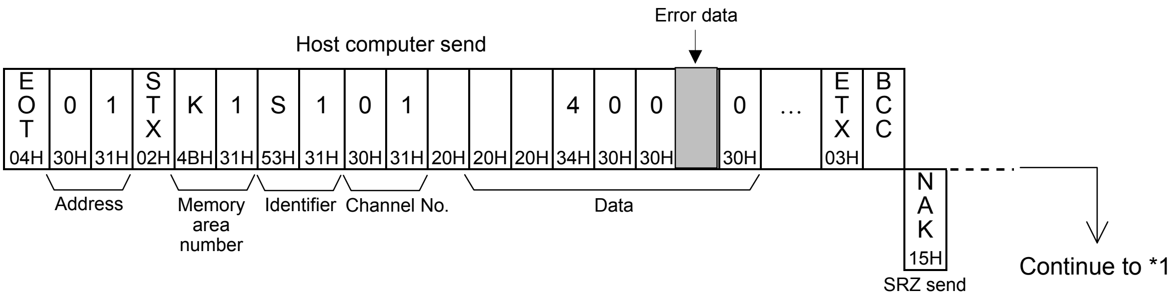
6.2.2 Selecting procedure example (when the host computer sends data)

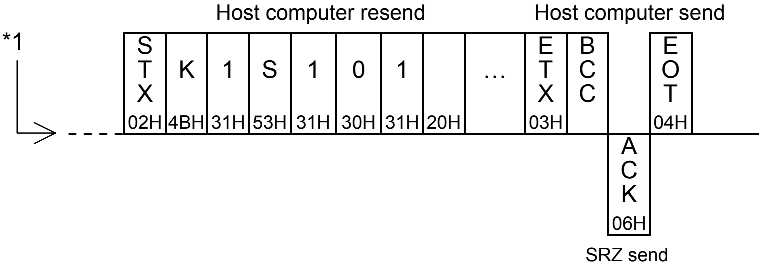
■ Normal transmission





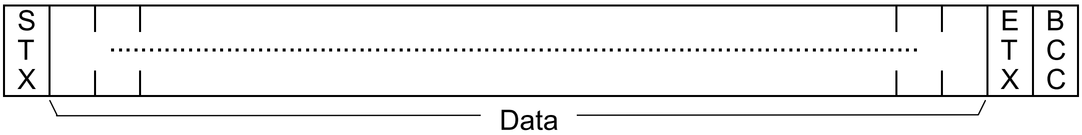
■ Error transmission





6.3 Communication Data Structure

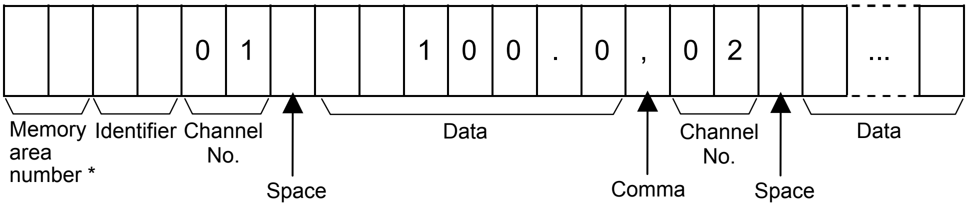
■ Data description (Transmission/receive data structure)



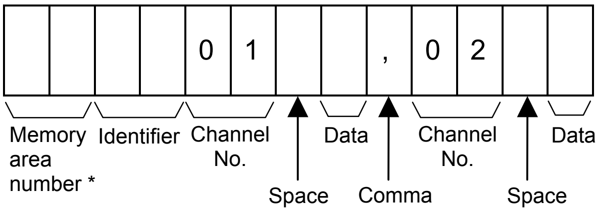
Part of the data above is shown below.

● Data for each channel

Data length 7 digits



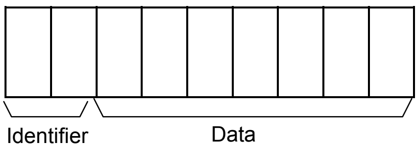
Data length 1 digit



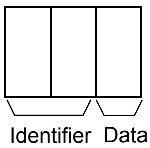
* To select data corresponding to a memory area, specify the number of the appropriate memory area.
If a memory area number is specified for data that does not correspond to a memory area, the specification will be invalid.

● Data for each module address (Without channel)

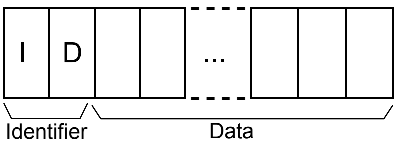
Data length 7 digits



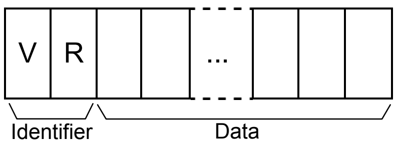
Data length 1 digit



Data length 32 digits (Model code)



Data length 8 digits (ROM version)



6.4 Communication Data List

6.4.1 Reference to communication data list

No.	Name (1)	Iden tifier (2)	Digits (3)	Attri-bute (4)	Struc-ture (5)	Data range (6)	Factory set value (7)
1	Model code	ID	32	RO	M	Model code (character)	—
2	ROM version	VR	8	RO	M	ROM version	—
3	Measured value (PV)	M1	7	RO	C	Input scale low to Input scale high	—

(1) Name: Communication data name

(2) Identifier: Communication identifier of RKC communication

(3) Digits: The number of communication data digits in RKC communication

(4) Attribute: A method of how communication data items are read or written when viewed from the host computer is described

RO: Read only data.

Data direction

Host computer ← SRZ

R/W: Read and Write data

Data direction

Host computer ↔ SRZ

(5) Structure: C: Data for each channel [1, 2] M: Data for each module

[1] On a two-channel type module, there is no communication data for the 3rd and 4th channels.

[2] When heat/cool control or position proportioning control is performed, there will be communication data (indicated by ♣ in the name column) for which the 2nd channel and 4th channel will be invalid. [Read is possible (0 is shown), but the result of Write is disregarded.]

☞ For the data structure, see **6.3 Communication Data Structure (P. 6-12).**

(6) Data range: Read or Write range of communication data

ASCII code data (Example: 7 digits) □□□□□□□

Most significant digit ············Least significant digit

(7) Factory set value: Factory set value of communication data

Communication includes both "Normal setting data" and "Engineering setting data". During RUN (control), the attribute of engineering setting data is RO. To configure engineering setting data, the RUN/STOP switch must be set to STOP (control stopped).

Z-TIO module: Normal setting data No. 1 to 85,
Engineering setting data No. 86 to 208

Z-DIO module: Normal setting data No. 1 to 17,
Engineering setting data No. 18 to 31

> The Engineering setting data should be set according to the application before setting any parameter related to operation. Once the Engineering setting data are set correctly, those datas are not necessary to be changed for the same application under normal conditions. If they are changed unnecessarily, it may result in malfunction or failure of the instrument. RKC will not bear any responsibility for malfunction or failure as a result of improper changes in the Engineering setting.

6.4.2 Communication data of Z-TIO module

No.	Name	Iden tifier	Digits	Attri- bute	Struc- ture	Data range	Factory set value
1	Model code	ID	32	RO	M	Model code (character)	—
2	ROM version	VR	8	RO	M	ROM version	—
3	Measured value (PV)	M1	7	RO	C	Input scale low to Input scale high	—
4	Comprehensive event state	AJ	7	RO	C	Least significant digit: Event 1 state 2nd digit: Event 2 state 3rd digit: Event 3 state 4th digit: Event 4 state 5th digit: Heater break alarm state 6th digit: Temperature rise completion Most significant digit: Burnout Data 0: OFF 1: ON	—
5	Operation mode state monitor	L0	7	RO	C	Least significant digit: Control STOP 2nd digit: Control RUN 3rd digit: Manual mode * 4th digit: Remote mode * 5th digit to Most significant digit: Unused Data 0: OFF 1: ON * During operation in manual mode, the manual mode of the operation mode state monitor is set to the “1: ON” state and the remote mode of the same monitor is se to the “0: OFF” state even if the parameter, “Remote/Local transfer” is set to “1: Remote mode.”	—
6	Error code	ER	7	RO	M	1: Adjustment data error 2: Data back-up error 4: A/D conversion error 32: Logic output data error If two or more errors occur simultaneously, the total summation of these error codes is displayed.	—
7	Manipulated output value (MV) monitor [heat-side] ♣	O1	7	RO	C	PID control or heat/cool PID control: −5.0 to +105.0 % Position proportioning control with feedback resistance (FBR) input: FBR input value is displayed. 0.0 to 100.0 %	—
8	Manipulated output value (MV) monitor [cool-side] ♣	O2	7	RO	C	−5.0 to +105.0 %	—
9	Current transformer (CT) input value monitor	M3	7	RO	C	CTL-6-P-N: 0.0 to 30.0 A CTL-12-S56-10L-N: 0.0 to 100.0 A	—
10	Set value (SV) monitor	MS	7	RO	C	Setting limiter (low) to Setting limiter (high)	—
11	Remote setting (RS) input value monitor	S2	7	RO	C	Setting limiter (low) to Setting limiter (high)	—
12	Burnout state monitor	B1	1	RO	C	0: OFF 1: ON	—
13	Event 1 state monitor	AA	1	RO	C	0: OFF 1: ON	—
14	Event 2 state monitor	AB	1	RO	C		—
15	Event 3 state monitor	AC	1	RO	C		—
16	Event 4 state monitor	AD	1	RO	C		—
17	Heater break alarm (HBA) state monitor	AE	1	RO	C	0: OFF 1: ON	—
18	Output state monitor	Q1	7	RO	M	Least significant digit: OUT1 2nd digit: OUT2 3rd digit: OUT3 4th digit: OUT4 5th digit to Most significant digit: Unused Data 0: OFF 1: ON When control output is specified, this function is available only for a proportioning control.	—

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No.	Name	Iden tifier	Digits	Attri-bute	Struc-ture	Data range	Factory set value
19	Memory area soak time monitor	TR	7	RO	C	0 minutes 00 seconds to 199 minutes 59 seconds: 0:00 to 199:59 (min:sec) 0 hours 00 minutes to 99 hours 59 minutes: 0:00 to 99:59 (hrs:min) Data range of Area soak time can be selected on the Soak time unit.	—
20	Integrated operating time monitor	UT	7	RO	M	0 to 19999 hours	—
21	Holding peak value ambient temperature monitor	Hp	7	RO	C	−10.0 to +100.0 °C (14.0 to 212.0 °F)	—
22	Backup memory state monitor	EM	1	RO	M	0: The content of the backup memory does not coincide with that of the RAM. 1: The content of the backup memory coincides with that of the RAM.	—
23	Logic output monitor 1	ED	7	RO	M	Least significant digit: Logic output 1 2nt digit: Logic output 2 3rd digit: Logic output 3 4th digit: Logic output 4 5th digit to Most significant digit: Unused Data 0: OFF 1: ON	—
24	Logic output monitor 2	EE	7	RO	M	Least significant digit: Logic output 5 2nt digit: Logic output 6 3rd digit: Logic output 7 4th digit: Logic output 8 5th digit to Most significant digit: Unused Data 0: OFF 1: ON	—
25	PID/AT transfer	G1	1	R/W	M	0: PID control 1: Autotuning (AT)	0
26	Auto/Manual transfer	J1	1	R/W	M	0: Auto mode 1: Manual mode	0
27	Remote/Local transfer	C1	1	R/W	M	0: Local mode 1: Remote mode When performing remote control by remote setting input and also performing cascade control and ratio setting, transfer to the Remote mode.	0
28	RUN/STOP transfer	SR	1	R/W	M	0: STOP (Control stop) 1: RUN (Control start)	0
29	Memory area transfer	ZA	7	R/W	C	1 to 8	1
30	Interlock release	AR	1	R/W	C	0: Normal state 1: Interlock release execution	0
31	Event 1 set value (EV1) ★	A1	7	R/W	C	Deviation action, Deviation action between channels, Temperature rise completion range: −Input span to +Input span Process action, SV action: Input scale low to Input scale high MV action: −5.0 to +105.0 % If the Event type corresponds to “0: None,” set to RO (Only reading data is possible). When temperature rise completion is selected at Event3 action type. If Event 4 corresponds to “9: Control loop break alarm (LBA),” the Event 4 set value becomes RO (Only reading data is possible).	50
32	Event 2 set value (EV2) ★	A2	7	R/W	C		50
33	Event 3 set value (EV3) ★	A3	7	R/W	C		50
34	Event 4 set value (EV4) ★	A4	7	R/W	C		50
35	Control loop break alarm (LBA) time ★	A5	7	R/W	C	0 to 7200 seconds (0: Unused) If Event 4 is other than “9: Control loop break alarm (LBA),” set to RO (Only reading data is possible).	480
36	LBA deadband ★	N1	7	R/W	C	0 (0.0) to Input span If Event 4 is other than “9: Control loop break alarm (LBA),” set to RO (Only reading data is possible).	0 (0.0)

★: Parameters which can be used in multi-memory area function

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No.	Name	Iden tifier	Digits	Attri-bute	Struc-ture	Data range	Factory set value
37	Set value (SV) ★	S1	7	R/W	C	Setting limiter (low) to Setting limiter (high)	TC/RTD: 0 °C [°F] V/I: 0.0 %
38	Proportional band [heat-side] ★ ♣	P1	7	R/W	C	TC/RTD inputs: 0 (0.0) to Input span (Unit: °C [°F]) Varies with the setting of the decimal point position selection. Voltage (V)/current (I) inputs: 0.0 to 1000.0 % of Input span 0 (0.0): ON/OFF action (ON/OFF action for both heat and cool actions in case of a heat/cool control type.)	TC/RTD: 30 V/I: 30.0
39	Integral time [heat-side] ★ ♣	I1	7	R/W	C	PID control or heat/cool PID control: 0 to 3600 seconds or 0.0 to 1999.9 seconds (0, 0.0: PD action) Position proportioning control: 1 to 3600 seconds or 0.1 to 1999.9 seconds Varies with the setting of the integral/derivative time decimal point position selection.	240
40	Derivative time [heat-side] ★ ♣	D1	7	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds (0, 0.0: PI action) Varies with the setting of the integral/derivative time decimal point position selection.	60
41	Control response parameter ★ ♣	CA	1	R/W	C	0: Slow 1: Medium 2: Fast P or PD action: 2 (Fast) fixed	PID control, Position proportioning control: 0 Heat/cool PID control: 2
42	Proportional band [cool-side] ★ ♣	P2	7	R/W	C	TC/RTD inputs: 1 (0.1) to Input span (Unit: °C [°F]) Varies with the setting of the decimal point position selection. Voltage (V)/current (I) inputs: 0.1 to 1000.0 % of Input span If control is other than heat/cool PID control, set to RO (Only reading data is possible).	TC/RTD: 30 V/I: 30.0
43	Integral time [cool-side] ★ ♣	I2	7	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds (0, 0.0: PD action) Varies with the setting of the integral/derivative time decimal point position selection. If control is other than heat/cool PID control, set to RO (Only reading data is possible).	240
44	Derivative time [cool-side] ★ ♣	D2	7	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds (0, 0.0: PI action) Varies with the setting of the integral/derivative time decimal point position selection. If control is other than heat/cool PID control, set to RO (Only reading data is possible).	60
45	Overlap/Deadband ★ ♣	V1	7	R/W	C	TC/RTD inputs: −Input span to +Input span (Unit:°C [°F]) Voltage (V)/current (I) inputs: −100.0 to +100.0 % of Input span Minus (−) setting results in overlap. However, the overlapping range is within the proportional range. If control is other than heat/cool PID control, set to RO (Only reading data is possible).	0

★: Parameters which can be used in multi-memory area function

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No.	Name	Iden tifier	Digits	Attri-bute	Struc-ture	Data range	Factory set value
46	Manual reset ★ ♣	MR	7	R/W	C	−100.0 to +100.0 % If the integral function is valid, set to RO (Only reading data is possible). When integral action (heating or cooling side) is zero, manual reset value is added to the control output.	0.0
47	Setting change rate limiter (up) ★	HH	7	R/W	C	0 (0.0) to Input span/unit time * 0 (0.0): Unused	0 (0.0)
48	Setting change rate limiter (down) ★	HL	7	R/W	C	* Unit time: 60 seconds (factory set value)	0 (0.0)
49	Area soak time ★	TM	7	R/W	C	0 minutes 00 seconds to 199 minutes 59 seconds: 0:00 to 199:59 (min:sec) 0 hours 00 minutes to 99 hours 59 minutes: 0:00 to 99:59 (hrs:min) Data range of Area soak time can be selected on the Soak time unit.	0:00
50	Link area number ★	LP	7	R/W	C	0 to 8 (0: No link)	0
51	Heater break alarm (HBA) set value	A7	7	R/W	C	When CT is CTL-6-P-N: 0.0 to 30.0 A (0.0: Not used) When CT is CTL-12-S56-10L-N: 0.0 to 100.0 A (0.0: Not used) If there is no current transformer (CT) or CT is assigned to “0: None,” set to RO (Only reading data is possible).	0.0
52	Heater break determination point	NE	7	R/W	C	0.0 to 100.0 % of HBA set value (0.0: Heater break determination is invalid) If there is no current transformer (CT) or CT is assigned to “0: None,” set to RO (Only reading data is possible). If Heater break alarm (HBA) corresponds to “0: Type A,” set to RO (Only reading data is possible).	30.0
53	Heater melting determination point	NF	7	R/W	C	0.0 to 100.0 % of HBA set value (0.0: Heater melting determination is invalid) If there is no current transformer (CT) or CT is assigned to “0: None,” set to RO (Only reading data is possible). If Heater break alarm (HBA) corresponds to “0: Type A,” set to RO (Only reading data is possible).	30.0
54	PV bias	PB	7	R/W	C	−Input span to +Input span	0
55	PV digital filter	F1	7	R/W	C	0.0 to 100.0 seconds (0.0: Unused)	0.0
56	PV ratio	PR	7	R/W	C	0.500 to 1.500	1.000
57	PV low input cut-off	DP	7	R/W	C	0.00 to 25.00 % of input span If the Square root extraction corresponds to “0: Unused,” set to RO (Only reading data is possible).	0.00
58	RS bias *	RB	7	R/W	C	−Input span to +Input span	0
59	RS digital filter *	F2	7	R/W	C	0.0 to 100.0 seconds (0.0: Unused)	0.0
60	RS ratio *	RR	7	R/W	C	0.001 to 9.999	1.000
61	Output distribution selection	DV	1	R/W	C	0: Control output 1: Distribution output	0
62	Output distribution bias	DW	7	R/W	C	−100.0 to +100.0 %	0.0
63	Output distribution ratio	DQ	7	R/W	C	−9.999 to +9.999	1.000

* Data on RS bias, RS ratio and RS digital filter is that in cascade control or ratio setting.

★: Parameters which can be used in multi-memory area function

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No.	Name	Iden tifier	Digits	Attri-bute	Struc-ture	Data range	Factory set value
64	Proportional cycle time	T0	7	R/W	C	0.1 to 100.0 seconds This item becomes RO (Only reading data is possible) for the voltage/current output specification. This parameter is valid when "0: control output" has been selected at No.95 "Output assignment".	Relay contact output: 20.0 seconds Voltage pulse output, triac output and open collector output: 2.0 seconds
65	Minimum ON/OFF time of proportioning cycle	VI	7	R/W	C	0 to 1000 ms This item becomes RO (Only reading data is possible) for the voltage/current output specification.	0
66	Manual manipulated output value ♣	ON	7	R/W	C	PID control: Output limiter (low) to Output limiter (high) Heat/cool PID control: −Cool-side output limiter (high) to +Heat-side output limiter (high) Position proportioning control: When there is feedback resistance (FBR) input and it does not break: Output limiter (low) to Output limiter (high) When there is no feedback resistance (FBR) input or the feedback resistance (FBR) input is disconnected: 0: Close-side output OFF, Open-side output OFF 1: Close-side output ON, Open-side output OFF 2: Close-side output OFF, Open-side output ON	0.0
67	Area soak time stop function	RV	1	R/W	C	0: No function 1: Event 1 2: Event 2 3: Event 3 4: Event 4	0
68	EDS mode (for disturbance 1)	NG	1	R/W	C	0: No function 1: EDS function mode 2: Learning mode 3: Tuning mode EDS function: External disturbance suppression function	0
69	EDS mode 2 (for disturbance 2)	NX	1	R/W	C		0
70	EDS value 1 (for disturbance 1)	NI	7	R/W	C	−100.0 to +100.0 %	0.0
71	EDS value 1 (for disturbance 2)	NJ	7	R/W	C		0.0
72	EDS value 2 (for disturbance 1)	NK	7	R/W	C	−100.0 to +100.0 %	0.0
73	EDS value 2 (for disturbance 2)	NM	7	R/W	C		0.0
74	EDS transfer time (for disturbance 1)	NN	7	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds	0
75	EDS transfer time (for disturbance 2)	NO	7	R/W	C		0
76	EDS action time (for disturbance 1)	NQ	7	R/W	C	1 to 3600 seconds	600
77	EDS action time (for disturbance 2)	NL	7	R/W	C		600
78	EDS action wait time (for disturbance 1)	NR	7	R/W	C	0.0 to 600.0 seconds	0.0
79	EDS action wait time (for disturbance 2)	NY	7	R/W	C		0.0
80	EDS value learning times	NT	7	R/W	C	0 to 10 times (0: No learning mode)	1

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No.	Name	Iden tifier	Digits	Attri- bute	Struc- ture	Data range	Factory set value
81	EDS start signal	NU	1	R/W	C	0: EDS start signal OFF 1: EDS start signal ON (for disturbance 1) 2: EDS start signal ON (for disturbance 2)	0
82	Operation mode	EI	1	R/W	C	0: Unused 1: Monitor 2: Monitor + Event function 3: Control	3
83	Startup tuning (ST)	ST	1	R/W	C	0: ST unused 1: Execute once 2: Execute always The startup tuning (ST) function is activated according to the ST start condition selected. If control is position proportioning control, set to RO (Only reading data is possible).	0
84	Automatic temperature rise learning	Y8	1	R/W	C	0: Unused 1: Learning If the Automatic temperature rise group corresponds to "0: Automatic temperature rise function OFF," set to RO (Only reading data is possible).	0
85	Communication switch for logic	EF	7	R/W	M	Least significant digit: Communication switch 1 2nd digit: Communication switch 2 3rd digit: Communication switch 3 4th digit: Communication switch 4 5th digit to Most significant digit: Unused Data 0: OFF 1: ON	0
Set data No. 86 or later are for engineering setting [Writable in the STOP mode]							
86	Input type	XI	7	R/W	C	0: TC input K 1: TC input J 2: TC input R 3: TC input S 4: TC input B 5: TC input E 6: TC input N 7: TC input T 8: TC input W5Re/W26Re 9: TC input PLII 12: RTD input Pt100 13: RTD input JPt100 14: Current input 0 to 20 mA DC 15: Current input 4 to 20 mA DC 16: Voltage (high) input 0 to 10 V DC 17: Voltage (high) input 0 to 5 V DC 18: Voltage (high) input 1 to 5 V DC 19: Voltage (low) input 0 to 1 V DC 20: Voltage (low) input 0 to 100 mV DC 21: Voltage (low) input 0 to 10 mV DC 22: Feedback resistance input 100 to 150 Ω 23: Feedback resistance input 151 Ω to 6 kΩ If changed to voltage (high) input from TC/RTD/current/voltage (low)/feedback resistance input, select the hardware by the input selector switch at the side of the module. (See P. 8-70)	Depends on model code When not specifying: 0

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No.	Name	Iden tifier	Digits	Attri-bute	Struc-ture	Data range	Factory set value
87	Display unit	PU	7	R/W	C	0: °C 1: °F The engineering unit for voltage/current input is expressed as %.	0
88	Decimal point position	XU	7	R/W	C	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places TC input: • K, J, T, E Only 0 or 1 can be set. • R, S, B, N, PLII, W5Re/W26Re Only 0 can be set. RTD input: Only 0 or 1 can be set. V/I inputs: From 0 to 4 can be set.	Depends on model code When not specifying: TC/RTD: 1 V/I: 1
89	Input scale high	XV	7	R/W	C	TC/RTD inputs: Input scale low to Maximum value of the selected input range Voltage (V)/current (I) inputs: −19999 to +99999 Varies with the setting of the decimal point position	TC/RTD: Maximum value of the selected input range V/I: 100.0
90	Input scale low	XW	7	R/W	C	TC/RTD inputs: Minimum value of the selected input range to Input scale high Voltage (V)/current (I) inputs: −19999 to +99999 Varies with the setting of the decimal point position	TC/RTD: Minimum value of the selected input range V/I: 0.0
91	Input error determination point (high)	AV	7	R/W	C	Input error determination point (low limit) to (Input range high + 5 % of Input span)	Input range high + (5 % of Input span)
92	Input error determination point (low)	AW	7	R/W	C	(Input range low − 5 % of Input span) to Input error determination point (high limit)	Input range low − (5 % of Input span)
93	Burnout direction	BS	1	R/W	C	0: Upscale 1: Downscale Valid only when the TC input and voltage (low) input are selected.	0
94	Square root extraction	XH	1	R/W	C	0: Unused 1: Used	0
95	Output assignment (Logic output selection function)	E0	1	R/W	C	0: Control output 1: Logic output result 2: FAIL output	0
96	Energized/De-energized (Logic output selection function)	NA	1	R/W	C	0: Energized 1: De-energized	0

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No.	Name	Identifier	Digits	Attribute	Structure	Data range	Factory set value
97	Event 1 type	XA	7	R/W	C	0: None 1: Deviation high (Using SV monitor value) [1] 2: Deviation low (Using SV monitor value) [1] 3: Deviation high/low (Using SV monitor value) [1] 4: Band (Using SV monitor value) [1] 5: Process high [1] 6: Process low [1] 7: SV high 8: SV low 9: Unused 10: MV high [heat-side] [1, 2] 11: MV low [heat-side] [1, 2] 12: MV high [cool-side] [1] 13: MV low [cool-side] [1] 14: Deviation high (Using local SV) [1] 15: Deviation low (Using local SV) [1] 16: Deviation high/low (Using local SV) [1] 17: Deviation (Using local SV) [1] 18: Deviation between channels high [1] 19: Deviation between channels low [1] 20: Deviation between channels high/low [1] 21: Deviation between channels band [1] [1] Event hold action is available. [2] If there is feedback resistance (FBR) input in position proportioning control, set to the feedback resistance (FBR) input value.	Depends on model code When not specifying: 0
98	Event 1 channel setting	FA	1	R/W	C	1: Channel 1 2: Channel 2 3: Channel 3 4: Channel 4 This function is valid when "deviation between channels" is selected	1
99	Event 1 hold action	WA	1	R/W	C	0: OFF 1: Hold action ON (When power turned on) 2: Re-hold action ON (When power turned on and SV changed) This function is valid when input value, deviation or manipulated value action has been selected. In case of a deviation action, this function is not available while in remote mode and while setting changing rate limiter is working.	Depends on model code When not specifying: 0
100	Event 1 interlock	LF	1	R/W	C	0: Unused 1: Used	0
101	Event 1 differential gap	HA	7	R/W	C	① Deviation, process, set value, or Deviation action between channels: 0 to Input span (Unit: °C [°F]) ② MV: 0.0 to 110.0 %	①: TC/RTD: 1 °C [°F] V/I: 0.1 % ②: 0.1 %
102	Event 1 delay timer	TD	7	R/W	C	0 to 18000 seconds	0
103	Force ON of Event 1 action	OA	7	R/W	C	Least significant digit: Event output turned on at input error occurrence 2nd digit: Event output turned on in manual mode 3rd digit: Event output turned on during the autotuning (AT) function is being executed 4th digit: Event output turned on during the setting change rate limiter is being operated 5th digit to Most significant digit: Unused Data 0: Invalid 1: Valid	0

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No.	Name	Identifier	Digits	Attribute	Structure	Data range	Factory set value
104	Event 2 type	XB	7	R/W	C	0: None 1: Deviation high (SV monitor value used) [1] 2: Deviation low (SV monitor value used) [1] 3: Deviation high/low (SV monitor value used) [1] 4: Band (SV monitor value used) [1] 5: Process high [1] 6: Process low [1] 7: SV high 8: SV low 9: Unused 10: MV high [heat-side] [1, 2] 11: MV low [heat-side] [1, 2] 12: MV high [cool-side] [1] 13: MV low [cool-side] [1] 14: Deviation high (Local SV value used) [1] 15: Deviation low (Local SV value used) [1] 16: Deviation high/low (Local SV value used) [1] 17: Deviation (Local SV value used) [1] 18: Deviation between channels high [1] 19: Deviation between channels low [1] 20: Deviation between channels high/low [1] 21: Deviation between channels band [1] [1] Event hold action is available. [2] If there is feedback resistance (FBR) input in position proportioning control, set to the feedback resistance (FBR) input value.	Depends on model code When not specifying: 0
105	Event 2 channel setting	FB	1	R/W	C	1: Channel 1 2: Channel 2 3: Channel 3 4: Channel 4 This function is valid when "deviation between channels" is selected	1
106	Event 2 hold action	WB	1	R/W	C	0: OFF 1: Hold action ON (When power turned on) 2: Re-hold action ON (When power turned on and SV changed) This function is valid when input value, deviation or manipulated value action has been selected. In case of a deviation action, this function is not available while in remote mode and while setting changing rate limiter is working.	Depends on model code When not specifying: 0
107	Event 2 interlock	LG	1	R/W	C	0: Unused 1: Used	0
108	Event 2 differential gap	HB	7	R/W	C	① Deviation, process, set value, or Deviation action between channels: 0 to Input span (Unit: °C [°F]) ② MV: 0.0 to 110.0 %	①: TC/RTD: 1 °C [°F] V/I: 0.1 % ②: 0.1 %
109	Event 2 delay timer	TG	7	R/W	C	0 to 18000 seconds	0
110	Force ON of Event 2 action	OB	7	R/W	C	Least significant digit: Event output turned on at input error occurrence 2nd digit: Event output turned on in manual mode 3rd digit: Event output turned on during the autotuning (AT) function is being executed 4th digit: Event output turned on during the setting change rate limiter is being operated 5th digit to Most significant digit: Unused Data 0: Invalid 1: Valid	0

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No.	Name	Identifier	Digits	Attribute	Structure	Data range	Factory set value
111	Event 3 type	XC	7	R/W	C	0: None 1: Deviation high (SV monitor value used) [1] 2: Deviation low (SV monitor value used) [1] 3: Deviation high/low (SV monitor value used) [1] 4: Band (SV monitor value used) [1] 5: Process high [1] 6: Process low [1] 7: SV high 8: SV low 9: Temperature rise completion 10: MV high [heat-side] [1, 2] 11: MV low [heat-side] [1, 2] 12: MV high [cool-side] [1] 13: MV low [cool-side] [1] 14: Deviation high (Local SV value used) [1] 15: Deviation low (Local SV value used) [1] 16: Deviation high/low (Local SV value used) [1] 17: Deviation (Local SV value used) [1] 18: Deviation between channels high [1] 19: Deviation between channels low [1] 20: Deviation between channels high/low [1] 21: Deviation between channels band [1] [1] Event hold action is available. [2] If there is feedback resistance (FBR) input in position proportioning control, set to the feedback resistance (FBR) input value.	Depends on model code When not specifying: 0
112	Event 3 channel setting	FC	1	R/W	C	1: Channel 1 2: Channel 2 3: Channel 3 4: Channel 4 This function is valid when "deviation between channels" is selected	1
113	Event 3 hold action	WC	1	R/W	C	0: OFF 1: Hold action ON (When power turned on) 2: Re-hold action ON (When power turned on and SV changed) This function is valid when input value, deviation or manipulated value action has been selected. In case of a deviation action, this function is not available while in remote mode and while setting changing rate limiter is working.	Depends on model code When not specifying: 0
114	Event 3 interlock	LH	1	R/W	C	0: Unused 1: Used	0
115	Event 3 differential gap	HC	7	R/W	C	① Deviation, process, set value, Deviation action between channels or Temperature rise completion: 0 to Input span (Unit: °C [°F]) ② MV: 0.0 to 110.0 %	①: TC/RTD: 1 °C [°F] V/I: 0.1 % ②: 0.1 %
116	Event 3 delay timer	TE	7	R/W	C	0 to 18000 seconds If Event 3 corresponds to "9: Temperature rise completion," the Event 3 delay timer becomes the temperature rise completion soak time.	0
117	Force ON of Event 3 action	OC	7	R/W	C	Least significant digit: Event output turned on at input error occurrence 2nd digit: Event output turned on in manual mode 3rd digit: Event output turned on during the autotuning (AT) function is being executed 4th digit: Event output turned on during the setting change rate limiter is being operated 5th digit to Most significant digit: Unused Data 0: Invalid 1: Valid	0

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No.	Name	Iden tifier	Digits	Attri- bute	Struc- ture	Data range	Factory set value
118	Event 4 type	XD	7	R/W	C	0: None 1: Deviation high (SV monitor value used) [1] 2: Deviation low (SV monitor value used) [1] 3: Deviation high/low (SV monitor value used) [1] 4: Band (SV monitor value used) [1] 5: Process high [1] 6: Process low [1] 7: SV high 8: SV low 9: Control loop break alarm (LBA) 10: MV high [heat-side] [1, 2] 11: MV low [heat-side] [1, 2] 12: MV high [cool-side] [1] 13: MV low [cool-side] [1] 14: Deviation high (Local SV value used) [1] 15: Deviation low (Local SV value used) [1] 16: Deviation high/low (Local SV value used) [1] 17: Deviation (Local SV value used) [1] 18: Deviation between channels high [1] 19: Deviation between channels low [1] 20: Deviation between channels high/low [1] 21: Deviation between channels band [1] [1] Event hold action is available. [2] If there is feedback resistance (FBR) input in position proportioning control, set to the feedback resistance (FBR) input value.	Depends on model code When not specifying: 0
119	Event 4 channel setting	FD	1	R/W	C	1: Channel 1 2: Channel 2 3: Channel 3 4: Channel 4 This function is valid when "deviation between channels" is selected	1
120	Event 4 hold action	WD	1	R/W	C	0: OFF 1: Hold action ON (When power turned on) 2: Re-hold action ON (When power turned on and SV changed) This function is valid when input value, deviation or manipulated value action has been selected. In case of a deviation action, this function is not available while in remote mode and while setting changing rate limiter is working.	Depends on model code When not specifying: 0
121	Event 4 interlock	LI	1	R/W	C	0: Unused 1: Used	0
122	Event 4 differential gap	HD	7	R/W	C	① Deviation, process, set value, or Deviation action between channels: 0 to Input span (Unit: °C [°F]) ② MV: 0.0 to 110.0 % Becomes invalid when the Event 4 type corresponds to “9: Control loop break alarm (LBA).”	①: TC/RTD: 1 °C [°F] V/I: 0.1 % ②: 0.1 %
123	Event 4 delay timer	TF	7	R/W	C	0 to 18000 seconds	0
124	Force ON of Event 4 action	OD	7	R/W	C	Least significant digit: Event output turned on at input error occurrence 2nd digit: Event output turned on in manual mode 3rd digit: Event output turned on during the autotuning (AT) function is being executed 4th digit: Event output turned on during the setting change rate limiter is being operated 5th digit to Most significant digit: Unused Data 0: Invalid 1: Valid	0

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No.	Name	Iden tifier	Digits	Attri-bute	Struc-ture	Data range	Factory set value
125	CT ratio	XS	7	R/W	C	0 to 9999	CTL-6-P-N: 800 CTL-12-S56-10L-N: 1000
126	CT assignment	ZF	1	R/W	C	0: None 1: OUT1 2: OUT2 3: OUT3 4: OUT4	1
127	Heater break alarm (HBA) type	ND	1	R/W	C	0: Heater break alarm (HBA) type A (Time-proportional control output) 1: Heater break alarm (HBA) type B (Continuous control output and time-proportional control output)	1
128	Number of heater break alarm (HBA) delay times	DH	7	R/W	C	0 to 255 times	5
129	Hot/Cold start	XN	1	R/W	C	0: Hot start 1 1: Hot start 2 2: Cold start	0
130	Start determination point	SX	7	R/W	C	0 to Input span (The unit is the same as input value.) (0: Action depending on the Hot/Cold start selection)	Depends on specification
131	SV tracking	XL	1	R/W	C	0: Unused 1: Used	1
132	MV transfer function [Action taken when changed to Manual mode from Auto mode]	OT	1	R/W	C	0: MV in Auto mode is used. [Balanceless-bumpless function] 1: MV in previous Manual mode is used.	0
133	Control action	XE	1	R/W	C	0: Brilliant II PID control (Direct action) 1: Brilliant II PID control (Reverse action) 2: Brilliant II Heat/Cool PID control [Water cooling type] 3: Brilliant II Heat/Cool PID control [Air cooling type] 4: Brilliant II Heat/Cool PID control [Cooling gain linear type] 5: Position proportioning control	Depends on model code When not specifying: 1
134	Integral/derivative time decimal point position ♣	PK	1	R/W	C	0: 1 second setting (No decimal place) 1: 0.1 seconds setting (One decimal place)	0
135	Derivative action ♣	KA	1	R/W	C	0: Measured value derivative 1: Deviation derivative	0
136	Undershoot suppression factor ♣	KB	7	R/W	C	0.000 to 1.000	Water cooling: 0.100 Air cooling: 0.250 Cooling gain linear type: 1.000
137	Derivative gain ♣	DG	7	R/W	C	0.1 to 10.0	6.0
138	ON/OFF action differential gap (upper) ♣	IV	7	R/W	C	TC/RTD inputs: 0 to Input span (Unit: °C [°F]) Voltage (V)/current (I) inputs: 0.0 to 100.0 % of input span	TC/RTD: 1 °C [°F] V/I: 0.1 %
139	ON/OFF action differential gap (lower) ♣	IW	7	R/W	C		TC/RTD: 1 °C [°F] V/I: 0.1 %

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No.	Name	Iden tifier	Digits	Attri-bute	Struc-ture	Data range	Factory set value
140	Action (high) at input error ♣	WH	1	R/W	C	0: Normal control 1: Manipulated output value at input error	0
141	Action (low) at input error ♣	WL	1	R/W	C		0
142	Manipulated output value at input error ♣	OE	7	R/W	C	−105.0 to +105.0 % Actual output values become those restricted by the output limiter. Position proportioning control: If there is no feedback resistance (FBR) input or the feedback resistance (FBR) input is disconnected, an action taken when abnormal is in accordance with the value action setting during STOP.	0.0
143	Manipulated output value at STOP mode [heat-side] ♣	OF	7	R/W	C	−5.0 to +105.0 % Position proportioning control: Only when there is feedback resistance (FBR) input and it does not break, the manipulated output value [heat-side] at STOP is output.	−5.0
144	Manipulated output value at STOP mode [cool-side] ♣	OG	7	R/W	C		−5.0
145	Output change rate limiter (up) [heat-side] ♣	PH	7	R/W	C	0.0 to 100.0 %/seconds (0.0: OFF) Becomes invalid when in position proportioning control.	0.0
146	Output change rate limiter (down) [heat-side] ♣	PL	7	R/W	C		0.0
147	Output limiter (high) [heat-side] ♣	OH	7	R/W	C	Output limiter (low) to 105.0 % Position proportioning control: Becomes valid only when there is feedback resistance (FBR) input and it does not break.	105.0
148	Output limiter (low) [heat-side] ♣	OL	7	R/W	C	−5.0 % to Output limiter (high) Position proportioning control: Becomes valid only when there is feedback resistance (FBR) input and it does not break.	−5.0
149	Output change rate limiter (up) [cool-side] ♣	PX	7	R/W	C	0.0 to 100.0 %/seconds (0.0: OFF) Becomes invalid when in position proportioning control.	0.0
150	Output change rate limiter (down) [cool-side] ♣	PY	7	R/W	C		0.0
151	Output limiter (high) [cool-side] ♣	OX	7	R/W	C	Output limiter (low) [cool-side] to 105.0 %	105.0
152	Output limiter (low) [cool-side] ♣	OY	7	R/W	C	−5.0 % to Output limiter (high) [cool-side]	−5.0
153	AT bias ♣	GB	7	R/W	C	−Input span to +Input span	0
154	AT cycles ♣	G3	1	R/W	C	0: 1.5 cycles 1: 2.0 cycles 2: 2.5 cycles 3: 3.0 cycles	1
155	Output value with AT turned on ♣	OP	7	R/W	C	Output value with AT turned off to 105.0 % Actual output values become those restricted by the output limiter. Position proportioning control: Becomes valid only when there is feedback resistance (FBR) input and it does not break (high limit of feedback resistance input at AT).	105.0
156	Output value with AT turned off ♣	OQ	7	R/W	C	−105.0 % to Output value with AT turned on Actual output values become those restricted by the output limiter. Position proportioning control: Becomes valid only when there is feedback resistance (FBR) input and it does not break (low limit of feedback resistance input at AT).	−105.0

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No.	Name	Iden tifier	Digits	Attri-bute	Struc-ture	Data range	Factory set value
157	AT differential gap time ♣	GH	7	R/W	C	0.0 to 50.0 seconds	10.0
158	Proportional band adjusting factor [heat-side] ♣	KC	7	R/W	C	0.01 to 10.00 times	1.00
159	Integral time adjusting factor [heat-side] ♣	KD	7	R/W	C	0.01 to 10.00 times	1.00
160	Derivative time adjusting factor [heat-side] ♣	KE	7	R/W	C	0.01 to 10.00 times	1.00
161	Proportional band adjusting factor [cool-side] ♣	KF	7	R/W	C	0.01 to 10.00 times	1.00
162	Integral time adjusting factor [cool-side] ♣	KG	7	R/W	C	0.01 to 10.00 times	1.00
163	Derivative time adjusting factor [cool-side] ♣	KH	7	R/W	C	0.01 to 10.00 times	1.00
164	Proportional band limiter (high) [heat-side] ♣	P6	7	R/W	C	TC/RTD inputs: 0 (0.0) to Input span (Unit: °C [°F]) Varies with the setting of the decimal point position selection. Voltage (V)/current (I) inputs: 0.0 to 1000.0 % of input span 0 (0.0): ON/OFF action (ON/OFF action for both heat and cool actions in case of a heat/cool control type.)	TC/RTD: Input span V/I: 1000.0 %
165	Proportional band limiter (low) [heat-side] ♣	P7	7	R/W	C		TC/RTD: 0 V/I: 0.0 %
166	Integral time limiter (high) [heat-side] ♣	I6	7	R/W	C	PID control or heat/cool PID control: 0 to 3600 seconds or 0.0 to 1999.9 seconds Position proportioning control: 1 to 3600 seconds or 0.1 to 1999.9 seconds Varies with the setting of the integral/derivative time decimal point position selection.	3600
167	Integral time limiter (low) [heat-side] ♣	I7	7	R/W	C		PID control, Heat/cool PID control: 0 Position proportioning control: 1
168	Derivative time limiter (high) [heat-side] ♣	D6	7	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds Varies with the setting of the integral/derivative time decimal point position selection.	3600
169	Derivative time limiter (low) [heat-side] ♣	D7	7	R/W	C		0
170	Proportional band limiter (high) [cool-side] ♣	P8	7	R/W	C	TC/RTD inputs: 1 to input span or 0.1 to input span (Unit: °C [°F]) Varies with the setting of the decimal point position selection. Voltage (V)/current (I) inputs: 0.1 to 1000.0 % of input span	TC/RTD: Input span V/I: 1000.0 %
171	Proportional band limiter (low) [cool-side] ♣	P9	7	R/W	C		TC/RTD: 1 (0.1) V/I: 0.1 %
172	Integral time limiter (high) [cool-side] ♣	I8	7	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds Varies with the setting of the integral/derivative time decimal point position selection. If control is other than heat/cool PID control, set to RO (Only reading data is possible).	3600
173	Integral time limiter (low) [cool-side] ♣	I9	7	R/W	C		0
174	Derivative time limiter (high) [cool-side] ♣	D8	7	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds Varies with the setting of the integral/derivative time decimal point position selection. If control is other than heat/cool PID control, set to RO (Only reading data is possible).	3600
175	Derivative time limiter (low) [cool-side] ♣	D9	7	R/W	C		0
176	Open/Close output neutral zone ♣	V2	7	R/W	C	0.1 to 10.0 %	2.0

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No.	Name	Identifier	Digits	Attribute	Structure	Data range	Factory set value
177	Action at feedback resistance (FBR) input error ♣	SY	1	R/W	C	0: Action depending on the valve action at STOP 1: Control action continued	0
178	Feedback adjustment ♣	FV	1	R/W	C	0: Adjustment end 1: Open-side adjustment start 2: Close-side adjustment start	—
179	Control motor time ♣	TN	7	R/W	C	5 to 1000 seconds	10
180	Integrated output limiter ♣	OI	7	R/W	C	0.0 to 200.0 % of control motor time (0.0: OFF) Becomes invalid when there is feedback resistance (FBR) input.	150.0
181	Valve action at STOP ♣	VS	1	R/W	C	0: Close-side output OFF, Open-side output OFF 1: Close-side output ON, Open-side output OFF 2: Close-side output OFF, Open-side output ON Becomes valid when there is no feedback resistance (FBR) input or the feedback resistance (FBR) input is disconnected.	0
182	ST proportional band adjusting factor ♣	KI	7	R/W	C	0.01 to 10.00 times	1.00
183	ST integral time adjusting factor ♣	KJ	7	R/W	C	0.01 to 10.00 times	1.00
184	ST derivative time adjusting factor ♣	KK	7	R/W	C	0.01 to 10.00 times	1.00
185	ST start condition ♣	SU	1	R/W	C	0: Activate the startup tuning (ST) function when the power is turned on; when transferred from STOP to RUN; or when the set value (SV) is changed. 1: Activate the startup tuning (ST) function when the power is turned on; or when transferred from STOP to RUN. 2: Activate the startup tuning (ST) function when the set value (SV) is changed.	0
186	Automatic temperature rise group ♣	Y7	7	R/W	C	0 to 16 (0: Automatic temperature rise function OFF)	0
187	Automatic temperature rise dead time ♣	RT	7	R/W	C	0.1 to 1999.9 seconds	10.0
188	Automatic temperature rise gradient data ♣	R2	7	R/W	C	0.1 to Input span/minutes	1.0
189	EDS transfer time decimal point position ♣	NS	1	R/W	C	0: 1 second setting (No decimal place) 1: 0.1 seconds setting (One decimal place)	0
190	Output average processing time for EDS ♣	NV	7	R/W	C	0.1 to 200.0 seconds	1.0
191	Responsive action trigger point for EDS ♣	NW	7	R/W	C	0 to Input span (Unit: °C [°F], %)	1
192	Setting change rate limiter unit time	HU	7	R/W	C	1 to 3600 seconds	60
193	Soak time unit	RU	1	R/W	C	0: 0:00 to 99:59 (hrs:min) [0 hours 00 minutes to 99 hours 59 minutes] 1: 0:00 to 199:59 (min:sec) [0 minutes 00 seconds to 199 minutes 59 seconds] Set the data range of Memory area soak time monitor and Area soak time.	1
194	Setting limiter (high)	SH	7	R/W	C	Setting limiter (low) to Input scale high	Input scale high
195	Setting limiter (low)	SL	7	R/W	C	Input scale low to Setting limiter (high)	Input scale low
196	PV transfer function ♣	TS	1	R/W	C	0: Unused 1: Used	0

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No.	Name	Identifier	Digits	Attribute	Structure	Data range	Factory set value
197	Operation mode assignment 1 (Logic output selection function) Logic output 1 to 4	EA	7	R/W	C	0: No assignment 1: Operation mode (monitor, control) 2: Operation mode (monitor, event function, control) 3: Auto/Manual 4: Remote/Local 5: Interlock release	0
198	Operation mode assignment 2 (Logic output selection function) Logic output 5 to 8	EB	7	R/W	C	0: No assignment 1: Operation mode (monitor, control) 2: Operation mode (monitor, event function, control) 3: Auto/Manual 4: Remote/Local 5: Interlock release	0
199	SV select function	KM	1	R/W	C	0: Remote SV function 1: Cascade control function 2: Ratio setting function 3: Cascade control 2 function	0
200	Remote SV function master channel module address	MC	7	R/W	C	−1 (Master channel is selected from itself) 0 to 99 (Master channel is selected from other modules)	−1
201	Remote SV function master channel selection	MN	7	R/W	C	1 to 99	1
202	Output distribution master channel module address	DY	7	R/W	C	−1 (Master channel is selected from itself) 0 to 99 (Master channel is selected from other modules)	−1
203	Output distribution master channel selection	DZ	7	R/W	C	1 to 99	1
204	Address of interacting modules	RL	7	R/W	C	−1 (Interact with its own module address) 0 to 99 (Interact with the addresses of other modules)	−1
205	Channel selection of interacting modules	RM	7	R/W	C	1 to 99 Becomes valid when the selected module is "Z-TIO module."	1
206	Selection switch of interacting modules	RN	7	R/W	C	Least significant digit: Memory area number 2nd digit: Operation mode 3rd digit: Auto/Manual 4th digit: Remote/Local 5th digit EDS start signal 6th digit Interlock release Most significant digit: Suspension of area soak time Data 0: No interaction 1: Interact with other channels	0
207	Control RUN/STOP holding setting	X1	1	R/W	M	0: Not holding (STOP start) 1: Holding (RUN/STOP hold)	1
208	Interval time	ZX	7	R/W	M	0 to 250 ms	10

6.4.3 Communication data of Z-DIO module

No.	Name	Iden tifier	Digits	Attri-bute	Struc-ture	Data range	Factory set value
1	Model code	ID	32	RO	M	Model code (character)	—
2	ROM version	VR	8	RO	M	ROM version	—
3	Digital input (DI) state 1	L1	7	RO	M	Least significant digit: DI1 state 2nd digit: DI2 state 3rd digit: DI3 state 4th digit: DI4 state 5th digit to Most significant digit: Unused Data 0: Contact open 1: Contact closed	—
4	Digital input (DI) state 2	L6	7	RO	M	Least significant digit: DI5 state 2nd digit: DI6 state 3rd digit: DI7 state 4th digit: DI8 state 5th digit to Most significant digit: Unused Data 0: Contact open 1: Contact closed	—
5	Digital output (DO) state 1	Q2	7	RO	M	Least significant digit: DO1 state 2nd digit: DO2 state 3rd digit: DO3 state 4th digit: DO4 state 5th digit to Most significant digit: Unused Data 0: OFF 1: ON	—
6	Digital output (DO) state 2	Q3	7	RO	M	Least significant digit: DO5 state 2nd digit: DO6 state 3rd digit: DO7 state 4th digit: DO8 state 5th digit to Most significant digit: Unused Data 0: OFF 1: ON	—
7	Error code	ER	7	RO	M	2: Data back-up error	—
8	Integrated operating time monitor	UT	7	RO	M	0 to 19999 hours	—
9	Backup memory state monitor	EM	1	RO	M	0: The content of the backup memory does not coincide with that of the RAM. 1: The content of the backup memory coincides with that of the RAM.	—
10	RUN/STOP transfer	SR	1	R/W	M	0: STOP (Control stop) 1: RUN (Control start)	0
11	DO manual output 1	Q4	7	R/W	M	Least significant digit: DO1 manual output 2nd digit: DO2 manual output 3rd digit: DO3 manual output 4th digit: DO4 manual output 5th digit to Most significant digit: Unused Data 0: OFF 1: ON	0
12	DO manual output 2	Q5	7	R/W	M	Least significant digit: DO5 manual output 2nd digit: DO6 manual output 3rd digit: DO7 manual output 4th digit: DO8 manual output 5th digit to Most significant digit: Unused Data 0: OFF 1: ON	0
13	DO output distribution selection	DO	1	R/W	C	0: DO output 1: Distribution output	0
14	DO output distribution bias	O8	7	R/W	C	−100.0 to +100.0 %	0.0

Continued on the next page.

Continued from the previous page.

No.	Name	Identifier	Digits	Attribute	Structure	Data range	Factory set value
15	DO output distribution ratio	O9	7	R/W	C	−9.999 to +9.999	1.000
16	DO proportional cycle time	V0	7	R/W	C	0.1 to 100.0 seconds	Depends on specification
17	DO minimum ON/OFF time of proportioning cycle	VJ	7	R/W	C	0 to 1000 ms	0
Set data No. 18 or later are for engineering setting [Writable in the STOP mode]							
18	DI function assignment	H2	7	R/W	M	0 to 29 (See page 8-154)	1
19	Memory area setting signal	E1	1	R/W	M	0: Valid 1: Invalid	1
20	DO signal assignment module address 1	LQ	7	R/W	M	−1, 0 to 99 When "-1" is selected, all of the signals of the same type (except temperature rise completion and DO manual output value) are *OR*-operated and produced as outputs from DO.	−1
21	DO signal assignment module address 2	LR	7	R/W	M	−1, 0 to 99 When "-1" is selected, all of the signals of the same type (except temperature rise completion and DO manual output value) are *OR*-operated and produced as outputs from DO.	−1
22	DO output assignment 1 [DO1 to DO4]	LT	7	R/W	M	0 to 13 (See page 8-158)	1
23	DO output assignment 2 [DO5 to DO8]	LX	7	R/W	M	0 to 13 (See page 8-158)	1
24	DO energized/de-energized	NB	7	R/W	C	0: Energized 1: De-energized	0
25	DO output distribution master channel module address	DD	7	R/W	C	−1 (Master channel is selected from itself) 0 to 99 (Master channel is selected from other modules)	−1
26	DO output distribution master channel selection	DJ	7	R/W	C	1 to 99	1
27	DO manipulated output value (MV) at STOP mode	OJ	7	R/W	C	−5.0 to +105.0 %	−5.0
28	DO output limiter (high)	D3	7	R/W	C	DO output limiter (low) to 105.0 %	105.0
29	DO output limiter (low)	D4	7	R/W	C	−5.0 % to DO output limiter (high)	−5.0
30	Control RUN/STOP holding setting	X1	1	R/W	M	0: Not holding (STOP start) 1: Holding (RUN/STOP hold)	1
31	Interval time	ZX	1	R/W	M	0 to 250 ms	10

MEMO

MODBUS 7

7.1 Communication Protocol

The master controls communication between master and slave. A typical message consists of a request (query message) sent from the master followed by an answer (response message) from the slave. When master begins data transmission, a set of data is sent to the slave in a fixed sequence. When it is received, the slave decodes it, takes the necessary action, and returns data to the master.

7.1.1 Message format

The message consists of four parts: slave address, function code, data, and error check code which are always transmitted in the same sequence.

Slave address
Function code
Data
Error check CRC-16

Message format

■ Slave address

The slave address is a number from 0 to F manually set at the module address setting switch located at the front of the function module (Z-TIO, Z-DIO).

☞ For details, see **5.1 Module Address Setting (P. 5-2).**

Although all connected slave units receive the query message sent from the master, only the slave with the slave address coinciding with the query message will accept the message.

■ Function code

The function codes are the instructions set at the master and sent to the slave describing the action to be executed. The function codes are included when the slave responds to the master.

☞ For details, see **7.1.2 Function code (P. 7-3).**

■ Data

The data to execute the function specified by the function code is sent to the slave and corresponding data returned to the master from the slave.

☞ For details, see **7.2 Message Format (P. 7-8), 7.3 Data Configuration (P. 7-12)** and **7.5 Communication Data List (P. 7-22).**

■ Error check

An error checking code (CRC-16: Cyclic Redundancy Check) is used to detect an error in the signal transmission.

☞ For details, see **7.1.5 Calculating CRC-16 (P. 7-5).**

7.1.2 Function code

- **Function code contents**

Function code (Hexadecimal)	Function	Contents
03H	Read holding registers	Measured value, control output value, current transformer input measured value, Event status, etc.
06H	Preset single register	Set value, PID constants, event set value, etc.
08H	Diagnostics (loopback test)	Loopback test
10H	Preset multiple registers	Set value, PID constants, event set value, etc.

- **Message length of each function (Unit: byte)**

Function code (Hexadecimal)	Function	Query message		Response message	
		Min	Max	Min	Max
03H	Read holding registers	8	8	7	255
06H	Preset single register	8	8	8	8
08H	Diagnostics (loopback test)	8	8	8	8
10H	Preset multiple registers	11	255	8	8

7.1.3 Communication mode

Signal transmission between the master and slaves is conducted in Remote Terminal Unit (RTU) mode.

Items	Contents
Data bit length	8-bit (Binary)
Start mark of message	Unused
End mark of message	Unused
Message length	See **7.1.2 Function code**
Data time interval	Less than 24 bits' time *
Error check	CRC-16 (Cyclic Redundancy Check)

* When sending a command message from the master, set intervals of data configuring one message to time shorter than the 24 bits' time. If time intervals become time longer than the 24 bits' time the relevant slave assumes that message sending from the master is terminated to deform the message format. As a result, the slave does not make a response.

7.1.4 Slave responses

(1) Normal response

- In the response message of the Read Holding Registers, the slave returns the read out data and the number of data items with the same slave address and function code as the query message.
- In the response message of the Preset Single Register, the slave returns the same message as the query message.
- In the response message of the Diagnostics (Loopback test), the slave returns the same message as the query message.
- In the response message of the Preset Multiple Registers, the slave returns the slave address, the function code, starting number, and number of holding registers in the multi-query message.

(2) Defective message response

- If the query message from the master is defective, except for transmission error, the slave returns the error response message without any action.
- If the self-diagnostic function of the slave detects an error, the slave will return an error response message to all query messages.
- The function code of each error response message is obtained by adding 80H to the function code of the query message.

Slave address
Function code
Error code
Error check CRC-16

Error response message

Error code	Contents
1	Function code error (An unsupported function code was specified)
2	When the mismatched address is specified.
3	When the specified number of data items in the query message exceeds the maximum number of data items available
4	Self-diagnostic error response

(3) No response

The slave ignores the query message and does not respond when:

- The slave address in the query message does not coincide with any slave address settings.
- The CRC code of the master does not coincide with that of the slave.
- Transmission error such as overrun, framing, parity and etc., is found in the query message.
- Data time interval in the query message from the master exceeds 24 bit’s time.

7.1.5 Calculating CRC-16

The Cyclic Redundancy Check (CRC) is a 2 byte (16-bit) error check code. After constructing the data message, not including start, stop, or parity bit, the master calculates a CRC code and appends this to the end of the message. The slave will calculate a CRC code from the received message, and compare it with the CRC code from the master. If they do not coincide, a communication error has occurred and the slave does not respond.

The CRC code is formed in the following sequence:

1. Load a 16-bit CRC register with FFFFH.

2. *Exclusive OR* (⊕) the first byte (8 bits) of the message with the CRC register. Return the result to the CRC register.

3. Shift the CRC register 1 bit to the right.

4. If the carry flag is 1, *exclusive OR* the CRC register with A001 hexadecimal and return the result to the CRC register. If the carry flag is 0, repeat step ***3***.

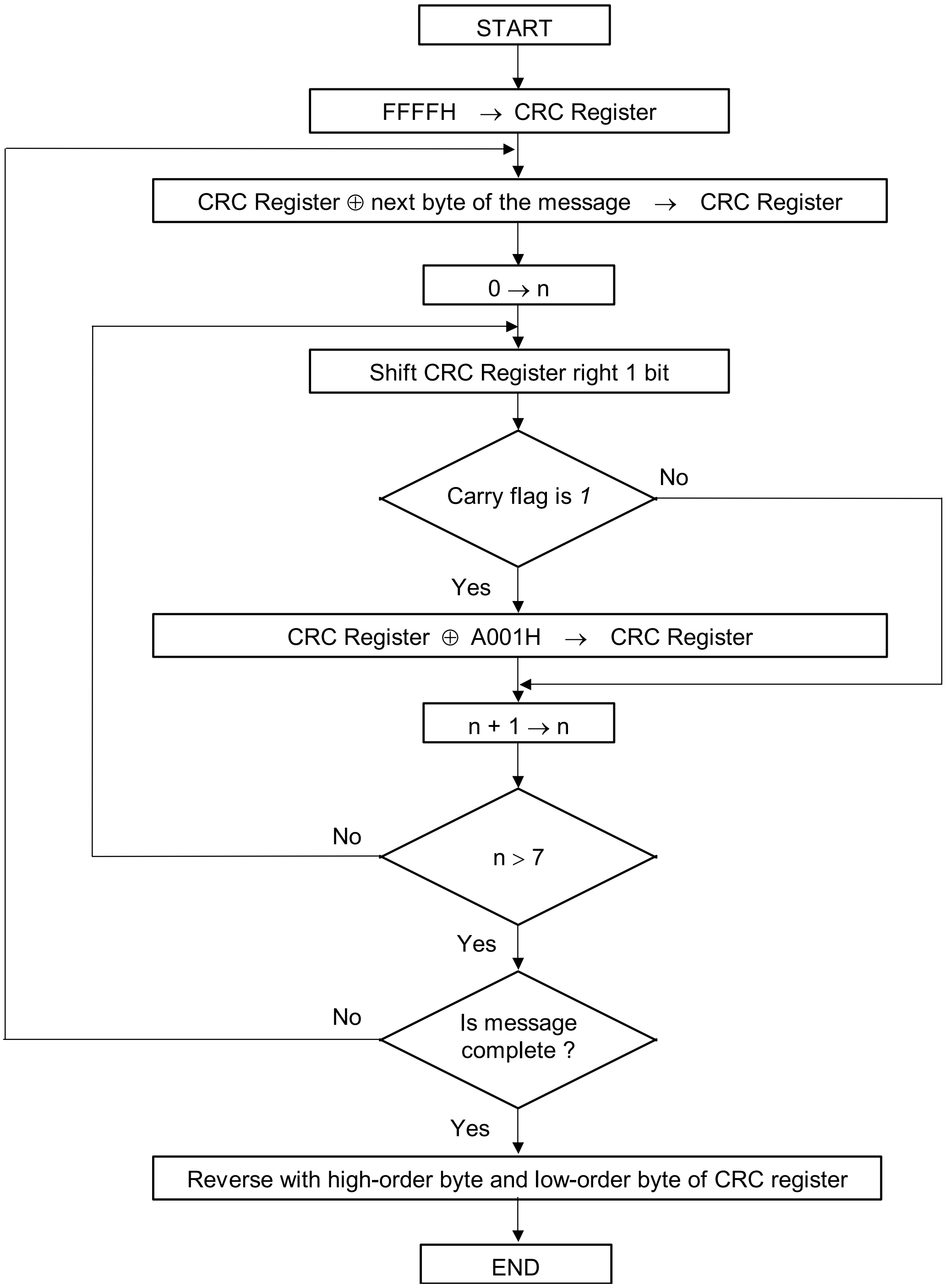
5. Repeat step ***3*** and ***4*** until there have been 8 shifts.

6. *Exclusive OR* the next byte (8 bits) of the message with the CRC register.

7. Repeat step ***3*** through ***6*** for all bytes of the message (except the CRC).

8. The CRC register contains the 2 byte CRC error code. When they are appended to the message, the low-order byte is appended first, followed by the high-order byte.

■ The flow chart of CRC-16



The ⊕ symbol indicates an *exclusive OR* operation. The symbol for the number of data bits is *n*.

■ Example of a CRC calculation in the 'C' language

This routine assumes that the data types 'uint16' and 'uint8' exists. Theses are unsigned 16-bit integer (usually an 'unsigned short int' for most compiler types) and unsigned 8-bit integer (unsigned char). 'z_p' is a pointer to a Modbus message, and 'z_messaage_length' is its length, excluding the CRC. Note that the Modbus message will probably contain NULL characters and so normal C string handling techniques will not work.

```
uint16 calculate_crc (byte *z_p, unit16 z_message_length)

/* CRC runs cyclic Redundancy Check Algorithm on input z_p        */
/* Returns value of 16 bit CRC after completion and               */
/* always adds 2 crc bytes to message                             */
/* returns 0 if incoming message has correct CRC                  */

{
    uint16 CRC= 0xffff;
    uint16 next;
    uint16 carry;
    uint16 n;
    uint8 crch, crcl;

    while (z_messaage_length--) {
        next = (uint16) *z_p;
        CRC ^= next;
        for (n = 0; n < 8; n++) {
            carry = CRC & 1;
            CRC >>= 1;
            if (carry) {
              CRC ^= 0xA001;
            }
        }
        z_p++;
    }
    crch = CRC / 256;
    crcl = CRC % 256
    z_p [z_messaage_length++] = crcl;
    z_p [z_messaage_length] = crch;
    return CRC;
}
```

7.2 Message Format

7.2.1 Read holding registers [03H]

The query message specifies the starting register address and quantity of registers to be read.
The contents of the holding registers are entered in the response message as data, divided into two parts: the high-order 8-bit and the low-order 8-bit, arranged in the order of the register numbers.

Example: The contents of the four holding registers from 0000H to 0003H are the read out from slave address 2.

Query message

Slave address		02H	
Function code		03H	
Starting No.	High	00H	First holding register address
	Low	00H	
Quantity	High	00H	The setting must be between 1 (0001H) and 125 (007DH).
	Low	04H	
CRC-16	High	44H	
	Low	3AH	

Normal response message

Slave address		02H	
Function code		03H	
Number of data		08H	→ Number of holding registers × 2
First holding register contents	High	01H	
	Low	24H	
Next holding register contents	High	01H	
	Low	1BH	
Next holding register contents	High	01H	
	Low	2BH	
Next holding register contents	High	01H	
	Low	22H	
CRC-16	High	AAH	
	Low	F3H	

Error response message

Slave address		02H
80H + Function code		83H
Error code		03H
CRC-16	High	F1H
	Low	31H

7.2.2 Preset single register [06H]

The query message specifies data to be written into the designated holding register. The write data is arranged in the query message with high-order 8-bit first and low-order 8-bit next. Only R/W holding registers can be specified.

Example: Data is written into the holding register 008EH of slave address 1.

Query message

Slave address		01H
Function code		06H
Holding register number	High	00H
	Low	8EH
Write data	High	00H
	Low	64H
CRC-16	High	E8H
	Low	0AH

Any data within the range

Normal response message

Slave address		01H
Function code		06H
Holding register number	High	00H
	Low	8EH
Write data	High	00H
	Low	64H
CRC-16	High	E8H
	Low	0AH

Contents will be the same as query message data.

Error response message

Slave address		01H
80H + Function code		86H
Error code		02H
CRC-16	High	C3H
	Low	A1H

7.2.3 Diagnostics (Loopback test) [08H]

The master's query message will be returned as the response message from the slave.
This function checks the communication system between the master and slave.

Example: Loopback test for slave address 1

Query message

Slave address		01H	
Function code		08H	
Test code	High	00H	Test code must be set to 00.
	Low	00H	
Data	High	1FH	Any pertinent data
	Low	34H	
CRC-16	High	E9H	
	Low	ECH	

Normal response message

Slave address		01H	Contents will be the same as query message data.
Function code		08H	
Test code	High	00H	
	Low	00H	
Data	High	1FH	
	Low	34H	
CRC-16	High	E9H	
	Low	ECH	

Error response message

Slave address		01H
80H + Function code		88H
Error code		03H
CRC-16	High	06H
	Low	01H

7.2.4 Preset multiple registers [10H]

The query message specifies the starting register address and quantity of registers to be written.
The write data is arranged in the query message with high-order 8-bit first and low-order 8-bit next. Only R/W holding registers can be specified.

Example: Data is written into the two holding registers from 008EH to 008FH of slave address 1.

Query message

Slave address		01H	
Function code		10H	
Starting number	High	00H	First holding register address
	Low	8EH	
Quantity	High	00H	The setting must be between 1 (0001H) and 123 (007BH).
	Low	02H	
Number of data		04H	Number of holding registers × 2
Data to first register	High	00H	Any pertinent data
	Low	64H	
Data to next register	High	00H	
	Low	64H	
CRC-16	High	3AH	
	Low	77H	

Normal response message

Slave address		01H
Function code		10H
Starting number	High	00H
	Low	8EH
Quantity	High	00H
	Low	02H
CRC-16	High	21H
	Low	E3H

Error response message

Slave address		01H
80H + Function code		90H
Error code		02H
CRC-16	High	CDH
	Low	C1H

7.3 Data Configuration

The numeric range of data used in Modbus protocol is 0000H to FFFFH. Only the set value within the setting range is effective.

FFFFH represents −1.

7.3.1 Data processing with decimal points

■ Data without decimal points

● Data of Z-TIO module

Comprehensive event state
Operation mode state monitor
Error code
Burnout state monitor
Event 1 state monitor
Event 2 state monitor
Event 3 state monitor
Event 4 state monitor
Heater break alarm (HBA) state monitor
Output state monitor
Memory area soak time monitor
Integrated operating time monitor
Backup memory state monitor
Logic output monitor
PID/AT transfer
Auto/Manual transfer
Remote/Local transfer
RUN/STOP transfer
Memory area transfer
Interlock release
Control loop break alarm (LBA) time
Control response parameter
Area soak time
Link area number
Output distribution selection
Minimum ON/OFF time of proportioning cycle
Area soak time stop function
EDS mode 1 (for disturbance 1)
EDS mode 2 (for disturbance 2)
EDS action time (for disturbance 1)
EDS action time (for disturbance 2)
EDS value learning times
EDS start signal
Operation mode
Startup tuning (ST)
Automatic temperature rise learning
Communication switch for logic
Input type
Display unit
Decimal point position
Burnout direction
Square root extraction
Output assignment selection *
Energized/De-energized *
Event 1 type
Event 1 channel setting
Event 1 hold action
Event 1 interlock
Event 1 delay timer
Force ON of Event 1 action
Event 2 type
Event 2 channel setting
Event 2 hold action
Event 2 interlock
Event 2 delay timer
Force ON of Event 2 action
Event 3 type
Event 3 channel setting
Event 3 hold action
Event 3 interlock
Event 3 delay timer
Force ON of Event 3 action
Event 4 type
Event 4 channel setting
Event 4 hold action
Event 4 interlock
Event 4 delay timer
Force ON of Event 4 action
CT ratio
CT assignment
Heater break alarm (HBA) type
Number of heater break alarm (HBA) delay times
Hot/Cold start
SV tracking
MV transfer function
Control action
Integral/derivative time decimal point position
Undershoot suppression factor
Action (high) at input error
Action (low) at input error
AT cycles
Action at feedback resistance (FBR) input error
Feedback adjustment
Control motor time
Valve action at STOP
ST start condition
Automatic temperature rise group
EDS transfer time decimal point position
Setting change rate limiter unit time
Soak time unit
PV transfer function
Operation mode assignment *
SV select function
Remote SV function master channel module address
Remote SV function master channel selection
Output distribution master channel module address
Output distribution master channel selection
Address of interacting module
Channel selection of interacting modules
Selection switch of interacting modules
Control RUN/STOP holding setting
Interval time

* Logic output selection function

● Data of Z-DIO module

Digital input (DI) state
Digital output (DO) state
Error code
Integrated operating time monitor
Backup memory state monitor
RUN/STOP transfer
DO manual output
DO output distribution selection
DO minimum ON/OFF time of proportioning cycle
DI function assignment
Memory area setting signal
DO signal assignment module address 1
DO signal assignment module address 2
DO output assignment 1 [DO1 to DO4]
DO output assignment 2 [DO5 to DO8]
DO energized/de-energized
DO output distribution master channel module address
DO output distribution master channel selection
Control RUN/STOP holding setting
Interval time

Example: When integrated operating time monitor is 72, 72 = 0048H

Integrated operating time monitor	High	00H
	Low	48H

■ Data with decimal points

The Modbus protocol does not recognize data with decimal points during communication.

● Data with one decimal place (Z-TIO module)

Manipulated output value (MV) monitor [heat-side]
Manipulated output value (MV) monitor [cool-side]
Current transformer (CT) input value monitor
Holding peak value ambient temperature monitor
Manual reset
Heater break alarm (HBA) set value
Heater break determination point
Heater melting determination point
PV digital filter
RS digital filter
Output distribution bias
Proportional cycle time
Manual manipulated output value
EDS value 1 (for disturbance 1)
EDS value 2 (for disturbance 2)
EDS value 2 (for disturbance 1)
EDS value 2 (for disturbance 2)
EDS action time (for disturbance 1)
EDS action time (for disturbance 2)
Derivative gain
Manipulated output value at input error
Manipulated output value at STOP mode [heat-side]
Manipulated output value at STOP mode [cool-side]
Output change rate limiter (up) [heat-side]
Output change rate limiter (down) [heat-side]
Output limiter (high)[heat-side]
Output limiter (low)[heat-side]
Output change rate limiter (up) [cool-side]
Output change rate limiter (down) [cool-side]
Output limiter (high) [cool-side]
Output limiter (low) [cool-side]
Output value with AT turned on
Output value with AT turned off
AT differential gap time
Open/Close output neutral zone
Integrated output limiter
Automatic temperature rise dead time
Automatic temperature rise group
Output average processing time for EDS

● Data with one decimal place (Z-DIO module)

DO output distribution bias
DO proportioning cycle time
DO manipulated output value (MV) at STOP mode
DO output limiter (high)
DO output limiter (low)

Example: When heater break alarm (HBA) set value 1 is 20.0 A, 20.0 is processed as 200, 200 = 00C8H

Heater break alarm (HBA) set value	High	00H
	Low	C8H

- **Data with two decimal places (Z-TIO module)**

PV low input cut-off
Proportional band adjusting factor [heat-side]
Integral time adjusting factor [heat-side]
Derivative time adjusting factor [heat-side]
Proportional band adjusting factor [cool-side]
Integral time adjusting factor [cool-side]
Derivative time adjusting factor [cool-side]
ST proportional band adjusting factor
ST integral time adjusting factor
ST derivative time adjusting factor

Example: When PV low input cut-off is 0.55 second, 0.55 is processed as 55,
55 = 0037H

PV low input cut-off	High	00H
	Low	37H

- **Data with three decimal places (Z-TIO module)**

PV ratio
RS ratio
Output distribution ratio
Undershoot suppression factor

- **Data with three decimal places (Z-DIO module)**

DO output distribution ratio

Example: When PV ratio is 0.555, 0.555 is processed as 555,
555 = 022BH

PV ratio	High	02H
	Low	2BH

- **Data whose decimal point's presence and/or position depends on integral/derivative time decimal point position selection (Z-TIO module)**

The position of the decimal point changes depending on the integral/derivative time decimal point position selection type, because the Modbus protocol does not recognize data with decimal points during communication.

Type of decimal points position: No decimal place, one decimal place

Integral time [heat-side]
Derivative time [heat-side]
Integral time [cool-side]
Derivative time [cool-side]
Integral time limiter (high) [heat-side]
Integral time limiter (low) [heat-side]
Derivative time limiter (high) [heat-side]
Derivative time limiter (low) [heat-side]
Integral time limiter (high) [cool-side]
Integral time limiter (low) [cool-side]
Derivative time limiter (high) [cool-side]
Derivative time limiter (low) [cool-side]

Example: When Integral time [heat-side] is 240.0 seconds, 240.0 is processed as 2400,
2400 = 0960H

Integral time [heat-side]	High	09H
	Low	60H

- **Data whose decimal point's presence and/or position depends on EDS transfer time decimal point position selection**

The position of the decimal point changes depending on the EDS transfer time decimal point position selection type, because the Modbus protocol does not recognize data with decimal points during communication.

Type of decimal points position: No decimal place, one decimal place

EDS transfer time (for disturbance 1)
EDS transfer time (for disturbance 2)

Example: When EDS transfer time (for disturbance 1) is 50.0 seconds, 50.0 is processed as 50, 500 = 01F4H

EDS transfer time (for disturbance 1)	High	01H
	Low	F4H

- **Data whose decimal point's presence and/or position depends on input range and decimal point position selection**

The position of the decimal point changes depending on the input range type and the decimal point position selection type, because the Modbus protocol does not recognize data with decimal points during communication.

Type of decimal points position:
Temperature input: No decimal place, one decimal place
Voltage/current input: No decimal place, one decimal place, two decimal places, three decimal places, four decimal places

Measured value (PV)
Set value (SV) monitor
Remote setting (RS) input value monitor
Event 1 set value (EV1)
Event 2 set value (EV2)
Event 3 set value (EV3)
Event 4 set value (EV4)
LBA deadband
Set value (SV)
Proportional band [heat-side]
Proportional band [cool-side]
Overlap/Deadband
Setting change rate limiter (up)
Setting change rate limiter (down)
PV bias
RS bias
Input scale high
Input scale low
Input error determination point (high)
Input error determination point (low)
Event 1 differential gap
Event 2 differential gap
Event 3 differential gap
Event 4 differential gap
Start determination point
ON/OFF action differential gap (upper)
ON/OFF action differential gap (lower)
AT bias
Proportional band limiter (high) [heat-side]
Proportional band limiter (low) [heat-side]
Proportional band limiter (high) [cool-side]
Proportional band limiter (low) [cool-side]
Responsive action trigger point for EDS
Setting limiter (high)
Setting limiter (low)

Example: When Set value (SV) is −20.0 °C, −20.0 is processed as −200,
−200 = 0000H − 00C8H = FF38H

Set value (SV)	High	FFH
	Low	38H

7.3.2 Caution for handling communication data

- In this communication, the variables that memory area includes handles different address with for control area and for setting area.
- If data (holding register) exceeding the accessible address range is accessed, an error response message is returned.
- Read data of unused item is a default value.
- Any attempt to write to an unused item is not processed as an error. Data can not be written into an unused item.
- If data range or address error occurs during data writing, it is not processed as an error. Except the data that error occurred, normal data is written in data register. Therefore, it is necessary to confirm data after the end of setting data.
- Communication data includes data that becomes RO (read only) depending on the specification. No error occurs even if data is written when set to RO. However in this case, no data is written.

☞ For details, see **7.5 Communication Data List (P. 7-22)**.

- Send the next command message at time intervals of 24 bits after the master receives the response message.

7.3.3 How to use memory area data

Memory area function can store up to 8 individual sets of SVs and parameters. One of the areas is used for control, and the currently selected area is “Control area.”
Memory area data can be used to check and change settings that belong to memory areas other than the control area. Reading and writing of memory area data is performed by channel.

■ Read and write of memory area data

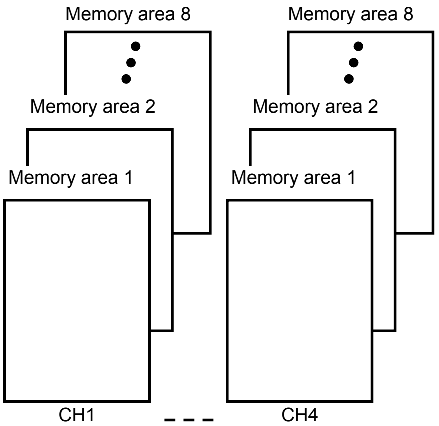
If any memory area number to perform data read and write is specified by the setting memory area number (0500H to 0503H), data corresponding to the specified memory area number is called up to the register addresses from 0501H to 0514H. By using these register addresses from 0504H to 0553H, it becomes possible to read and write data in any memory area.

	Register address			
	CH1	CH2	CH3	CH4
Setting memory area number	0500H	0501H	0502H	0503H
Event 1 set value (EV1)	0504H	0505H	0506H	0507H
Event 2 set value (EV2)	0508H	0509H	050AH	050BH
Event 3 set value (EV3)	050CH	050DH	050EH	050FH
Event 4 set value (EV4)	0510H	0511H	0512H	0513H
Control loop break alarm (LBA) time	0514H	0515H	0516H	0517H
LBA deadband	0518H	0519H	051AH	051BH
Set value (SV)	051CH	051DH	051EH	051FH
Proportional band [heat-side]	0520H	0521H	0522H	0523H
Integral time [heat-side]	0524H	0525H	0526H	0527H
Derivative time [heat-side]	0528H	0529H	052AH	052BH
Control response parameter	052CH	052DH	052EH	052FH
Proportional band [cool-side]	0530H	0531H	0532H	0533H
Integral time [cool-side]	0534H	0535H	0536H	0537H
Derivative time [cool-side]	0538H	0539H	053AH	053BH
Overlap/Deadband	053CH	053DH	053EH	053FH
Manual reset	0540H	0541H	0542H	0543H
Setting change rate limiter (up)	0544H	0545H	0546H	0547H
Setting change rate limiter (down)	0548H	0549H	054AH	054BH
Area soak time	054CH	054DH	054EH	054FH
Link area number	0550H	0551H	0552H	0553H

Register address to specify memory area

Register address of memory area data

☞ For the Memory area data list, see the **7.5.4 Memory area data address (P. 7-46)**.



A memory area number which data is read/written is written to the register address, 0500H (for CH1).

Data corresponding to a specified memory area number is called up to the CH1 register addresses.

Event 1 set value (EV1) (0504H)
Event 2 set value (EV2) (0508H)
Event 3 set value (EV3) (050CH)
Event 4 set value (EV4) (0510H)
Control loop break alarm (LBA) time (0514H)
LBA deadband (0518H)
Set value (SV) (0501C)
Proportional band [heat-side] (0520H)
Integral time [heat-side] (0524H)
Derivative time [heat-side] (0528H)
Control response parameter (052CH)
Proportional band [cool-side] (0530H)
Integral time [cool-side] (0534H)
Derivative time [cool-side] (0538H)
Overlap/Deadband (053CH)
Manual reset (0540H)
Setting change rate limiter (up) (0544H)
Setting change rate limiter (down) (0548H)
Area soak time (054CH)
Link area number (0550H)

[Example 1] When data on the Event 1 set value in Memory area 2 of CH1 is read

1. The memory area number, “2” is written to the CH1 setting memory area number (0500H).
Data in Memory area 2 is called up to the CH1 register addresses.

CH1 register addresses

Setting memory area number	0500H	2	Memory area number “2”
Event 1 set value (EV1)	0504H	50	
Event 2 set value (EV2)	0508H		
Event 3 set value (EV3)	050CH		
Event 4 set value (EV4)	0510H		
Control loop break alarm (LBA) time	0514H		
LBA deadband	0518H		
Set value (SV)	051CH		
Proportional band [heat-side]	0520H		
Integral time [heat-side]	0524H		
Derivative time [heat-side]	0528H		The data of memory area 2 is loaded into these register addresses.
Control response parameter	052CH		
Proportional band [cool-side]	0530H		
Integral time [cool-side]	0534H		
Derivative time [cool-side]	0538H		
Overlap/Deadband	053CH		
Manual reset	0540H		
Setting change rate limiter (up)	0544H		
Setting change rate limiter (down)	0548H		
Area soak time	054CH		
Link area number	0550H		

2. Data “50” on Event 1 set values (0504H) is read.

[Example 2] When the set value (SV) in Memory area 3 of CH1 is changed to 200

1. The memory area number, “3” is written to the CH1 setting memory area number (0500H).
Data in Memory area 3 is called up to the CH1 register addresses.

CH1 register addresses

Setting memory area number	0500H	3	Memory area number “3”
Event 1 set value (EV1)	0504H		
Event 2 set value (EV2)	0508H		
Event 3 set value (EV3)	050CH		
Event 4 set value (EV4)	0510H		
Control loop break alarm (LBA) time	0514H		
LBA deadband	0518H		
Set value (SV)	051CH	150	
Proportional band [heat-side]	0520H		
Integral time [heat-side]	0524H		
Derivative time [heat-side]	0528H		The data of memory area 3 is loaded into these register addresses.
Control response parameter	052CH		
Proportional band [cool-side]	0530H		
Integral time [cool-side]	0534H		
Derivative time [cool-side]	0538H		
Overlap/Deadband	053CH		
Manual reset	0540H		
Setting change rate limiter (up)	0544H		
Setting change rate limiter (down)	0548H		
Area soak time	054CH		
Link area number	0550H		

2. “200” is written to the set value (SV) (051CH).

■ Control area transfer

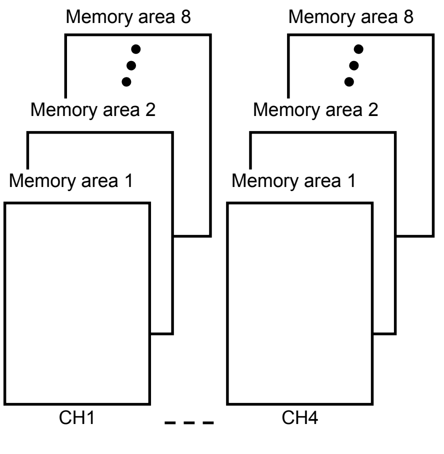
Any memory area used for control is specified by the memory area transfer (006EH to 0071H). The area (0076H to 00C5H) now used for control is called “Control area.”

The memory area number (control area) can be changed at either RUN or STOP.

	Register address			
	CH1	CH2	CH3	CH4
Memory area transfer	006EH	006FH	0070H	0071H
Event 1 set value (EV1)	0076H	0077H	0078H	0079H
Event 2 set value (EV2)	007AH	007BH	007CH	007DH
Event 3 set value (EV3)	007EH	007FH	0080H	0081H
Event 4 set value (EV4)	0082H	0083H	0084H	0085H
Control loop break alarm (LBA) time	0086H	0087H	0088H	0089H
LBA deadband	008AH	008BH	008CH	008DH
Set value (SV)	008EH	008FH	0090H	0091H
Proportional band [heat-side]	0092H	0093H	0094H	0095H
Integral time [heat-side]	0096H	0097H	0098H	0099H
Derivative time [heat-side]	009AH	009BH	009CH	009DH
Control response parameter	009EH	009FH	00A0H	00A1H
Proportional band [cool-side]	00A2H	00A3H	00A4H	00A5H
Integral time [cool-side]	00A6H	00A7H	00A8H	00A9H
Derivative time [cool-side]	00AAH	00ABH	00ACH	00ADH
Overlap/Deadband	00AEH	00AFH	00B0H	00B1H
Manual reset	00B2H	00B3H	00B4H	00B5H
Setting change rate limiter (up)	00B6H	00B7H	00B8H	00B9H
Setting change rate limiter (down)	00BAH	00BBH	00BCH	00BDH
Area soak time	00BEH	00BFH	00C0H	00C1H
Link area number	00C2H	00C3H	00C4H	00C5H

Register address to specify control area

Register address of memory area data



Any memory area number used for control is written to the register address, 006EH (for CH1).

Data corresponding to a specified memory area number is called up to the CH1 register addresses.

－Control area－

Event 1 set value (EV1) (0076H)
Event 2 set value (EV2) (007AH)
Event 3 set value (EV3) (007EH)
Event 4 set value (EV4) (0082H)
Control loop break alarm (LBA) time (0086H)
LBA deadband (008AH)
Set value (SV) (008EH)
Proportional band [heat-side] (0092H)
Integral time [heat-side] (0096H)
Derivative time [heat-side] (0096A)
Control response parameter (009EH)
Proportional band [cool-side] (00A2H)
Integral time [cool-side] (00A6H)
Derivative time [cool-side] (00AAH)
Overlap/Deadband (00AEH)
Manual reset (00B2H)
Setting change rate limiter (up) (00B6H)
Setting change rate limiter (down) (00BAH)
Area soak time (00BEH)
Link area number (00C2H)

[Example] When performing control by calling up data in Memory area 3 of CH1

1. The memory area number, “3” is written to the memory area transfer (006EH).
Data in Memory area 3 is called up to the CH1 register addresses.

CH1 register addresses

Memory area transfer	006EH	3
Event 1 set value (EV1)	0076H	
Event 2 set value (EV2)	007AH	
Event 3 set value (EV3)	007EH	
Event 4 set value (EV4)	0082H	
Control loop break alarm (LBA) time	0086H	
LBA deadband	008AH	
Set value (SV)	008EH	
Proportional band [heat-side]	0092H	
Integral time [heat-side]	0096H	
Derivative time [heat-side]	009AH	
Control response parameter	009EH	
Proportional band [cool-side]	00A2H	
Integral time [cool-side]	00A6H	
Derivative time [cool-side]	00AAH	
Overlap/Deadband	00AEH	
Manual reset	00B2H	
Setting change rate limiter (up)	00B6H	
Setting change rate limiter (down)	00BAH	
Area soak time	00BEH	
Link area number	00C2H	

Memory area number, “3”

The data of memory area 3 is loaded into these register addresses.

2. Control of CH1 is performed by using data in the register addresses.

If the memory area transfer (006EH to 0071H) and the setting memory area number (0500H to 0503H) are set to the same memory area number, the respective data can be synchronized.

- Values in the control areas (0076H to 00C5H) become the same as those in the memory areas (0504H to 0553H).
- If data in the control area is changed, data in the memory area is also changed.
- If data in the memory area is changed, data in the control area is also changed.

7.4 How to Use Data Mapping

When this communication method is used, 16 types of data (mapping data) can be specified as desired for the specified function module (Z-TIO, Z-DIO), and read/write can be performed continuously.

	Z-TIO module	Z-DIO module
Register address to specify mapping data	1000H to 100FH	1000H to 100FH
Register address to actually read/write data	1500H to 150FH	1500H to 150FH
Register address of data which can be mapped	See **7.5.2 Communication data of Z-TIO module (P. 7-23).**	See **7.5.3 Communication data of Z-DIO module (P. 7-43).**

☞ For the data mapping address list, see the **7.5.5 Data mapping address (P. 7-48)**.

[Example]
Mapping the CH1 data "measured value (PV), manipulated output value (MV) monitor [heat-side], event 1 state monitor, event 2 state monitor" of a Z-TIO module to register addresses 1500H to 1503H.

For data mapping		
Name	Register address	
	HEX	DEC
Register address setting 1 Read/write address: 1500H	1000	4096
Register address setting 2 Read/write address: 1501H	1001	4097
Register address setting 3 Read/write address: 1502H	1002	4098
Register address setting 4 Read/write address: 1503H	1003	4099

Mapping data		
Name	Register address (CH1)	
	HEX	DEC
Measured value (PV)	0000	0
Manipulated output value (MV) monitor [heat-side]	000D	13
Event 1 state monitor	0025	37
Event 2 state monitor	0029	41

Write

1. The register address, "0000H" of the "Measured value (PV)" to be mapped is written to register address setting 1 (1000H).
2. The register address, "000DH" of the "Manipulated output value (MV) monitor [heat-side]" to be mapped is written to register address setting 2 (1001H).
3. The register address, "0025H" of the "Event 1 state monitor" to be mapped is written to register address setting 3 (1002H).
4. The register address, "0029H" of the "Event 2 state monitor" to be mapped is written to register address setting 4 (1003H).
5. The assignment of the register addresses from 1500H to 1503H from/to which data is actually read/written becomes as follows.

Register address		Name
HEX	DEC	
1500	5376	Measured value (PV)
1501	5377	Manipulated output value (MV) monitor [heat-side]
1502	5378	Event 1 state monitor
1503	5379	Event 2 state monitor

High-speed communication is performed by reading or writing data in the consecutive register addresses from 1500H to 1503H.

7.5 Communication Data List

7.5.1 Reference to communication data list

No.	Name (1)	Chan-nel (2)	Resister address (3)		Attri-bute (4)	Struc-ture (5)	Data range (6)	Factory set value (7)
			HEX	DEC				
1	Measured value (PV)	CH1 CH2 CH3 CH4	0000 0001 0002 0003	0 1 2 3	RO	C	Input scale low to Input scale high	—
2	Comprehensive event	CH1			RO	C	bit 0: Event 1 state	—

(1) Name: Communication data name

(2) Channel: Channel numbers of each function module (Z-TIO, Z-DIO)

(3) Register address:

Register addresses of each channel (HEX: Hexadecimal DEC: Decimal)

With respect to the following communication data of the Z-TIO module, the register addresses of the indicated channels are non-used areas.

- Two-channel type module: Register addresses of the 3rd and 4th channels
- Heat/cool control and position proportioning control: Register addresses of the 2nd and 4th channels *
- Cool-only communication data of heat/cool control: Register addresses of the 2nd and 4th channels *

* Communication data with a ♣ mark in the name column.

(4) Attribute: A method of how communication data items are read or written when viewed from the host computer is described

RO: Only reading data is possible.

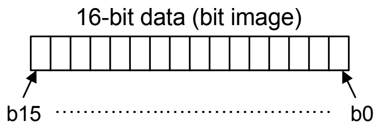
Data direction
Host computer ← SRZ

R/W: Reading and writing data is possible.

Data direction
Host computer ↔ SRZ

(5) Structure: C: Data for each channel M: Data for each module

(6) Data range: Read or write range of communication data



(7) Factory set value: Factory set value of communication data

Communication includes both “Normal setting data” and “Engineering setting data”. During RUN (control), the attribute of engineering setting data is RO. To configure engineering setting data, the RUN/STOP switch must be set to STOP (control stopped).

Z-TIO module: Normal setting data No. 1 to 83,
Engineering setting data No. 85 to 207
Z-DIO module: Normal setting data No. 1 to 13,
Engineering setting data No. 15 to 28

> The Engineering setting data should be set according to the application before setting any parameter related to operation. Once the Engineering setting data are set correctly, those datas are not necessary to be changed for the same application under normal conditions. If they are changed unnecessarily, it may result in malfunction or failure of the instrument. RKC will not bear any responsibility for malfunction or failure as a result of improper changes in the Engineering setting.

7.5.2 Communication data of Z-TIO module

No.	Name	Chan-nel	Register address HEX	Register address DEC	Attri-bute	Struc-ture	Data range	Factory set value
1	Measured value (PV)	CH1 CH2 CH3 CH4	0000 0001 0002 0003	0 1 2 3	RO	C	Input scale low to Input scale high	—
2	Comprehensive event state	CH1 CH2 CH3 CH4	0004 0005 0006 0007	4 5 6 7	RO	C	Bit data b0: Event 1 state b1: Event 2 state b2: Event 3 state b3: Event 4 state b4: Heater break alarm state b5: Temperature rise completion b6: Burnout b7 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 127]	—
3	Operation mode state monitor	CH1 CH2 CH3 CH4	0008 0009 000A 000B	8 9 10 11	RO	C	Bit data b0: Control STOP b1: Control RUN b2: Manual mode * b3: Remote mode * b4 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 15] * During operation in manual mode, the manual mode of the operation mode state monitor is set to the “1: ON” state and the remote mode of the same monitor is se to the “0: OFF” state even if the parameter, “Remote/Local transfer” is set to “1: Remote mode.”	—
4	Error code	—	000C	12	RO	M	Bit data b0: Adjustment data error b1: Data back-up error b2: A/D conversion error b3: Unused b4: Unused b5: Logic output data error b6 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 63] If two or more errors occur simultaneously, the total summation of these error codes is displayed.	—
5	Manipulated output value (MV) monitor [heat-side] ♣	CH1 CH2 CH3 CH4	000D 000E 000F 0010	13 14 15 16	RO	C	PID control or heat/cool PID control: −5.0 to +105.0 % Position proportioning control with feedback resistance (FBR) input: 0.0 to 100.0 %	—
6	Manipulated output value (MV) monitor [cool-side] ♣	CH1 Unused CH3 Unused	0011 Unused 0012 Unused	17 Unused 19 Unused	RO	C	−5.0 to +105.0 %	—
7	Current transformer (CT) input value monitor	CH1 CH2 CH3 CH4	0015 0016 0017 0018	21 22 23 24	RO	C	CTL-6-P-N: 0.0 to 30.0A CTL-12-S56-10L-N: 0.0 to 100.0 A	—
8	Set value (SV) monitor	CH1 CH2 CH3 CH4	0019 001A 001B 001C	25 26 27 28	RO	C	Setting limiter (low) to Setting limiter (high)	—
9	Remote setting (RS) input value monitor	CH1 CH2 CH3 CH4	001D 001E 001F 0020	29 30 31 32	RO	C	Setting limiter (low) to Setting limiter (high)	—

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No.	Name	Chan-nel	Register address HEX	Register address DEC	Attri-bute	Struc-ture	Data range	Factory set value
10	Burnout state monitor	CH1 CH2 CH3 CH4	0021 0022 0023 0024	33 34 35 36	RO	C	0: OFF 1: ON	—
11	Event 1 state monitor	CH1 CH2 CH3 CH4	0025 0026 0027 0028	37 38 39 40	RO	C	0: OFF 1: ON	—
12	Event 2 state monitor	CH1 CH2 CH3 CH4	0029 002A 002B 002C	41 42 43 44	RO	C		—
13	Event 3 state monitor	CH1 CH2 CH3 CH4	002D 002E 002F 0030	45 46 47 48	RO	C		—
14	Event 4 state monitor	CH1 CH2 CH3 CH4	0031 0032 0033 0034	49 50 51 52	RO	C		—
15	Heater break alarm (HBA) state monitor	CH1 CH2 CH3 CH4	0035 0036 0037 0038	53 54 55 56	RO	C	0: OFF 1: ON	—
16	Output state monitor	—	0039	57	RO	M	Bit data b0: OUT1 b1: OUT2 b2: OUT3 b3: OUT4 b4 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 15] When control output is specified, this function is available only for a proportioning control.	—
17	Memory area soak time monitor	CH1 CH2 CH3 CH4	003A 003B 003C 003D	58 59 60 61	RO	C	0 minutes 00 seconds to 199 minutes 59 seconds: 0 to 11999 seconds 0 hours 00 minutes to 99 hours 59 minutes: 0 to 5999 minutes Data range of Area soak time can be selected on the Soak time unit.	—
18	Integrated operating time monitor	—	003E	62	RO	M	0 to 19999 hours	—
19	Holding peak value ambient temperature monitor	CH1 CH2 CH3 CH4	003F 0040 0041 0042	63 64 65 66	RO	C	−10.0 to +100.0 °C (14.0 to 212.0 °F)	—
20	Backup memory state monitor	—	0043	67	RO	M	0: The content of the backup memory does not coincide with that of the RAM. 1: The content of the backup memory coincides with that of the RAM.	—
21	Logic output monitor	—	0044	68	RO	M	Bit data b0: Logic output 1 b1: Logic output 2 b2: Logic output 3 b3: Logic output 4 b4: Logic output 5 b5: Logic output 6 b6: Logic output 7 b7: Logic output 8 b8 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 255]	—

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No.	Name	Chan-nel	Register address HEX	DEC	Attri-bute	Struc-ture	Data range	Factory set value
22	Unused	—	0045 ⋮ 0060	69 ⋮ 96	—	—	—	—
23	PID/AT transfer	CH1 CH2 CH3 CH4	0061 0062 0063 0064	97 98 99 100	R/W	C	0: PID control 1: Autotuning (AT)	0
24	Auto/Manual transfer	CH1 CH2 CH3 CH4	0065 0066 0067 0068	101 102 103 104	R/W	C	0: Auto mode 1: Manual mode	0
25	Remote/Local transfer	CH1 CH2 CH3 CH4	0069 006A 006B 006C	105 106 107 108	R/W	C	0: Local mode 1: Remote mode When performing remote control by remote setting input and also performing cascade control and ratio setting, transfer to the Remote mode.	0
26	RUN/STOP transfer	—	006D	109	R/W	M	0: STOP (Control stop) 1: RUN (Control start)	0
27	Memory area transfer	CH1 CH2 CH3 CH4	006E 006F 0070 0071	110 111 112 113	R/W	C	1 to 8	1
28	Interlock release	CH1 CH2 CH3 CH4	0072 0073 0074 0075	114 115 116 117	R/W	C	0: Normal state 1: Interlock release execution	0
29	Event 1 set value (EV1) ★	CH1 CH2 CH3 CH4	0076 0077 0078 0079	118 119 120 121	R/W	C	Deviation action, Deviation action between channels, Temperature rise completion range: −Input span to +Input span Process action, SV action: Input scale low to Input scale high MV action: −5.0 to +105.0 % If the Event type corresponds to "0: None," set to RO (Only reading data is possible). When temperature rise completion is selected at Event 3 action type. If Event 4 corresponds to "9: Control loop break alarm (LBA)," the Event 4 set value becomes RO (Only reading data is possible).	50
30	Event 2 set value (EV2) ★	CH1 CH2 CH3 CH4	007A 007B 007C 007D	122 123 124 125	R/W	C		50
31	Event 3 set value (EV3) ★	CH1 CH2 CH3 CH4	007E 007F 0080 0081	126 127 128 129	R/W	C		50
32	Event 4 set value (EV4) ★	CH1 CH2 CH3 CH4	0082 0083 0084 0085	130 131 132 133	R/W	C		50
33	Control loop break alarm (LBA) time ★	CH1 CH2 CH3 CH4	0086 0087 0088 0089	134 135 136 137	R/W	C	0 to 7200 seconds (0: Unused) If Event 4 is other than "9: Control loop break alarm (LBA)," set to RO (Only reading data is possible).	480
34	LBA deadband ★	CH1 CH2 CH3 CH4	008A 008B 008C 008D	138 139 140 141	R/W	C	0 (0.0) to Input span If Event 4 is other than "9: Control loop break alarm (LBA)," set to RO (Only reading data is possible).	0 (0.0)
35	Set value (SV) ★	CH1 CH2 CH3 CH4	008E 008F 0090 0091	142 143 144 145	R/W	C	Setting limiter (low) to Setting limiter (high)	TC/RTD: 0 °C [°F] V/I: 0.0 %

★: Parameters which can be used in multi-memory area function

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No.	Name	Chan-nel	Register address HEX	Register address DEC	Attri-bute	Struc-ture	Data range	Factory set value
36	Proportional band [heat-side] ★ ♣	CH1 CH2 CH3 CH4	0092 0093 0094 0095	146 147 148 149	R/W	C	TC/RTD inputs: 0 (0.0) to Input span (Unit: °C [°F]) Varies with the setting of the decimal point position selection. Voltage (V)/current (I) inputs: 0.0 to 1000.0 % of Input span 0 (0.0): ON/OFF action (ON/OFF action for both heat and cool actions in case of a heat/cool control type.)	TC/RTD: 30 V/I: 30.0
37	Integral time [heat-side] ★ ♣	CH1 CH2 CH3 CH4	0096 0097 0098 0099	150 151 152 153	R/W	C	PID control or heat/cool PID control: 0 to 3600 seconds or 0.0 to 1999.9 seconds (0, 0.0: PD action) Position proportioning control: 1 to 3600 seconds or 0.1 to 1999.9 seconds Varies with the setting of the integral/derivative time decimal point position selection.	240
38	Derivative time [heat-side] ★ ♣	CH1 CH2 CH3 CH4	009A 009B 009C 009D	154 155 156 157	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds (0, 0.0: PI action) Varies with the setting of the integral/derivative time decimal point position selection.	60
39	Control response parameter ★ ♣	CH1 CH2 CH3 CH4	009E 009F 00A0 00A1	158 159 160 161	R/W	C	0: Slow 1: Medium 2: Fast P or PD action: 2 (Fast) fixed	PID control, Position proportioning control: 0 Heat/cool PID control: 2
40	Proportional band [cool-side] ★ ♣	CH1 Unused CH3 Unused	00A2 Unused 00A4 Unused	162 Unused 164 Unused	R/W	C	TC/RTD inputs: 1 (0.1) to Input span (Unit: °C [°F]) Varies with the setting of the decimal point position selection. Voltage (V)/current (I) inputs: 0.1 to 1000.0 % of Input span If control is other than heat/cool PID control, set to RO (Only reading data is possible).	TC/RTD: 30 V/I: 30.0
41	Integral time [cool-side] ★ ♣	CH1 Unused CH3 Unused	00A6 Unused 00A8 Unused	166 Unused 168 Unused	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds (0, 0.0: PD action) Varies with the setting of the integral/derivative time decimal point position selection. If control is other than heat/cool PID control, set to RO (Only reading data is possible).	240
42	Derivative time [cool-side] ★ ♣	CH1 Unused CH3 Unused	00AA Unused 00AC Unused	170 Unused 172 Unused	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds (0, 0.0: PI action) Varies with the setting of the integral/derivative time decimal point position selection. If control is other than heat/cool PID control, set to RO (Only reading data is possible).	60
43	Overlap/Deadband ★ ♣	CH1 CH2 CH3 CH4	00AE 00AF 00B0 00B1	174 175 176 177	R/W	C	TC/RTD inputs: −Input span to +Input span (Unit:°C [°F]) Voltage (V)/current (I) inputs: −100.0 to +100.0 % of Input span Minus (−) setting results in overlap. However, the overlapping range is within the proportional range. If control is other than heat/cool PID control, set to RO (Only reading data is possible).	0

★: Parameters which can be used in multi-memory area function

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No.	Name	Channel	Register address HEX	Register address DEC	Attribute	Structure	Data range	Factory set value
44	Manual reset ★	CH1 CH2 CH3 CH4	00B2 00B3 00B4 00B5	178 179 180 181	R/W	C	−100.0 to +100.0 % If the integral function is valid, set to RO (Only reading data is possible). When integral action (heating or cooling side) is zero, manual reset value is added to the control output.	0.0
45	Setting change rate limiter (up) ★	CH1 CH2 CH3 CH4	00B6 00B7 00B8 00B9	182 183 184 185	R/W	C	0 (0.0) to Input span/unit time * 0 (0.0): Unused * Unit time: 60 seconds (factory set value)	0 (0.0)
46	Setting change rate limiter (down) ★	CH1 CH2 CH3 CH4	00BA 00BB 00BC 00BD	186 187 188 189	R/W	C		0 (0.0)
47	Area soak time ★	CH1 CH2 CH3 CH4	00BE 00BF 00C0 00C1	190 191 192 193	R/W	C	0 minutes 00 seconds to 199 minutes 59 seconds: 0 to 11999 seconds 0 hours 00 minutes to 99 hours 59 minutes: 0 to 5999 minuts Data range of Area soak time can be selected on the Soak time unit.	0
48	Link area number ★	CH1 CH2 CH3 CH4	00C2 00C3 00C4 00C5	194 195 196 197	R/W	C	0 to 8 (0: No link)	0
49	Heater break alarm (HBA) set value	CH1 CH2 CH3 CH4	00C6 00C7 00C8 00C9	198 199 200 201	R/W	C	When CT is CTL-6-P-N: 0.0 to 30.0 A (0.0: Not used) When CT is CTL-12-S56-10L-N: 0.0 to 100.0 A (0.0: Not used) If there is no current transformer (CT) or CT is assigned to "0: None," set to RO (Only reading data is possible).	0.0
50	Heater break determination point	CH1 CH2 CH3 CH4	00CA 00CB 00CC 00CD	202 203 204 205	R/W	C	0.0 to 100.0 % of HBA set value (0.0: Heater break determination is invalid) If there is no current transformer (CT) or CT is assigned to "0: None," set to RO (Only reading data is possible). If Heater break alarm (HBA) corresponds to "0: Type A," set to RO (Only reading data is possible).	30.0
51	Heater melting determination point	CH1 CH2 CH3 CH4	00CE 00CF 00D0 00D1	206 207 208 209	R/W	C	0.0 to 100.0 % of HBA set value (0.0: Heater melting determination is invalid) If there is no current transformer (CT) or CT is assigned to "0: None," set to RO (Only reading data is possible). If Heater break alarm (HBA) corresponds to "0: Type A," set to RO (Only reading data is possible).	30.0
52	PV bias	CH1 CH2 CH3 CH4	00D2 00D3 00D4 00D5	210 211 212 213	R/W	C	−Input span to +Input span	0
53	PV digital filter	CH1 CH2 CH3 CH4	00D6 00D7 00D8 00D9	214 215 216 217	R/W	C	0.0 to 100.0 seconds (0.0: Unused)	0.0
54	PV ratio	CH1 CH2 CH3 CH4	00DA 00DB 00DC 00DD	218 219 220 221	R/W	C	0.500 to 1.500	1.000
55	PV low input cut-off	CH1 CH2 CH3 CH4	00DE 00DF 00E0 00E1	222 223 224 225	R/W	C	0.00 to 25.00 % of input span If the Square root extraction corresponds to "0: Unused," set to RO (Only reading data is possible).	0.00

★: Parameters which can be used in multi-memory area function

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No.	Name	Channel	Register address HEX	Register address DEC	Attribute	Structure	Data range	Factory set value
56	RS bias *	CH1 CH2 CH3 CH4	00E2 00E3 00E4 00E5	226 227 228 229	R/W	C	−Input span to +Input span	0
57	RS digital filter *	CH1 CH2 CH3 CH4	00E6 00E7 00E8 00E9	230 231 232 233	R/W	C	0.0 to 100.0 seconds (0.0: Unused)	0.0
58	RS ratio *	CH1 CH2 CH3 CH4	00EA 00EB 00EC 00ED	234 235 236 237	R/W	C	0.001 to 9.999	1.000
59	Output distribution selection	CH1 CH2 CH3 CH4	00EE 00EF 00F0 00F1	238 239 240 241	R/W	C	0: Control output 1: Distribution output	0
60	Output distribution bias	CH1 CH2 CH3 CH4	00F2 00F3 00F4 00F5	242 243 244 245	R/W	C	−100.0 to +100.0 %	0.0
61	Output distribution ratio	CH1 CH2 CH3 CH4	00F6 00F7 00F8 00F9	246 247 248 249	R/W	C	−9.999 to +9.999	1.000
62	Proportional cycle time	CH1 CH2 CH3 CH4	00FA 00FB 00FC 00FD	250 251 252 253	R/W	C	0.1 to 100.0 seconds This item becomes RO (Only reading data is possible) for the voltage/current output specification. This parameter is valid when "0: control output" has been selected at No.94 "Output assignment".	Relay contact output: 20.0 seconds Voltage pulse output, triac output and open collector output: 2.0 seconds
63	Minimum ON/OFF time of proportioning cycle	CH1 CH2 CH3 CH4	00FE 00FF 0100 0101	254 255 256 257	R/W	C	0 to 1000 ms This item becomes RO (Only reading data is possible) for the voltage/current output specification.	0
64	Manual manipulated output value ♣	CH1 CH2 CH3 CH4	0102 0103 0104 0105	258 259 260 261	R/W	C	PID control: Output limiter (low) to Output limiter (high) Heat/cool PID control: −Cool-side output limiter (high) to +Heat-side output limiter (high) Position proportioning control: When there is feedback resistance (FBR) input and it does not break: Output limiter (low) to Output limiter (high) When there is no feedback resistance (FBR) input or the feedback resistance (FBR) input is disconnected: 0: Close-side output OFF, Open-side output OFF 1: Close-side output ON, Open-side output OFF 2: Close-side output OFF, Open-side output ON	0.0
65	Area soak time stop function	CH1 CH2 CH3 CH4	0106 0107 0108 0109	262 263 264 265	R/W	C	0: No function 1: Event 1 2: Event 2 3: Event 3 4: Event 4	0

* Data on RS bias, RS ratio and RS digital filter is that in cascade control or ratio setting.

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No.	Name	Chan-nel	Register address HEX	Register address DEC	Attri-bute	Struc-ture	Data range	Factory set value
66	EDS mode (for disturbance 1)	CH1 CH2 CH3 CH4	011A 011B 011C 011D	266 267 268 269	R/W	C	0: No function 1: EDS function mode 2: Learning mode 3: Tuning mode EDS function: External disturbance suppression function	0
67	EDS mode (for disturbance 2)	CH1 CH2 CH3 CH4	011E 011F 0110 0111	270 271 272 273	R/W	C		0
68	EDS value 1 (for disturbance 1)	CH1 CH2 CH3 CH4	0112 0113 0114 0115	274 275 276 277	R/W	C	−100.0 to +100.0 %	0.0
69	EDS value 1 (for disturbance 2)	CH1 CH2 CH3 CH4	0116 0117 0118 0119	278 279 280 281	R/W	C		0.0
70	EDS value 2 (for disturbance 1)	CH1 CH2 CH3 CH4	011A 011B 011C 011D	282 283 284 285	R/W	C	−100.0 to +100.0 %	0.0
71	EDS value 2 (for disturbance 2)	CH1 CH2 CH3 CH4	011E 011F 0120 0121	286 287 288 289	R/W	C		0.0
72	EDS transfer time (for disturbance 1)	CH1 CH2 CH3 CH4	0122 0123 0124 0125	290 291 292 293	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds	0
73	EDS transfer time (for disturbance 2)	CH1 CH2 CH3 CH4	0126 0127 0128 0129	294 295 296 297	R/W	C		0
74	EDS action time (for disturbance 1)	CH1 CH2 CH3 CH4	012A 012B 012C 012D	298 299 300 301	R/W	C	1 to 3600 seconds	600
75	EDS action time (for disturbance 2)	CH1 CH2 CH3 CH4	012E 012F 0130 0131	302 303 304 305	R/W	C		600
76	EDS action wait time (for disturbance 1)	CH1 CH2 CH3 CH4	0132 0133 0134 0135	306 307 308 309	R/W	C	0.0 to 600.0 seconds	0.0
77	EDS action wait time (for disturbance 2)	CH1 CH2 CH3 CH4	0136 0137 0138 0139	310 311 312 313	R/W	C		0.0
78	EDS value learning times	CH1 CH2 CH3 CH4	013A 013B 013C 013D	314 315 316 317	R/W	C	0 to 10 times (0: No learning mode)	1
79	EDS start signal	CH1 CH2 CH3 CH4	013E 013F 0140 0141	318 319 320 321	R/W	C	0: EDS start signal OFF 1: EDS start signal ON (for disturbance 1) 2: EDS start signal ON (for disturbance 2)	0
80	Operation mode	CH1 CH2 CH3 CH4	0142 0143 0144 0145	322 323 324 325	R/W	C	0: Unused 1: Monitor 2: Monitor + Event function 3: Control	3

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No.	Name	Chan-nel	Register address		Attri-bute	Struc-ture	Data range	Factory set value
			HEX	DEC				
81	Startup tuning (ST)	CH1 CH2 CH3 CH4	0146 0147 0148 0149	326 327 328 329	R/W	C	0: ST unused 1: Execute once 2: Execute always The startup tuning (ST) function is activated according to the ST start condition selected. If control is position proportioning control, set to RO (Only reading data is possible).	0
82	Automatic temperature rise learning	CH1 CH2 CH3 CH4	014A 014B 014C 014D	330 331 332 333	R/W	C	0: Unused 1: Learning If the Automatic temperature rise group corresponds to "0: Automatic temperature rise function OFF," set to RO (Only reading data is possible).	0
83	Communication switch for logic	—	014E	334	R/W	M	Bit data b0: Communication switch 1 b1: Communication switch 2 b2: Communication switch 3 b3: Communication switch 4 b4 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 15]	0
84	Unused	—	014F ⋮ 0175	335 ⋮ 373	—	—	—	—
Set data No. 85 or later are for engineering setting [Writable in the STOP mode]								
85	Input type	CH1 CH2 CH3 CH4	0176 0177 0178 0179	374 375 376 377	R/W	C	0: TC input K 1: TC input J 2: TC input R 3: TC input S 4: TC input B 5: TC input E 6: TC input N 7: TC input T 8: TC input W5Re/W26Re 9: TC input PLII 12: RTD input Pt100 13: RTD input JPt100 14: Current input 0 to 20 mA DC 15: Current input 4 to 20 mA DC 16: Voltage (high) input 0 to 10 V DC 17: Voltage (high) input 0 to 5 V DC 18: Voltage (high) input 1 to 5 V DC 19: Voltage (low) input 0 to 1 V DC 20: Voltage (low) input 0 to 100 mV DC 21: Voltage (low) input 0 to 10 mV DC 22: Feedback resistance input 100 to 150 Ω 23: Feedback resistance input 151 Ω to 6 kΩ If changed to voltage (high) input from TC/RTD/current/voltage (low)/feedback resistance input, select the hardware by the input selector switch at the side of the module. (See P. 8-70)	Depends on model code When not specifying: 0
86	Display unit	CH1 CH2 CH3 CH4	017A 017B 017C 017D	378 379 380 381	R/W	C	0: °C 1: °F The engineering unit for voltage/current input is expressed as %.	0

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No.	Name	Chan-nel	Register address HEX	Register address DEC	Attri-bute	Struc-ture	Data range	Factory set value
87	Decimal point position	CH1 CH2 CH3 CH4	017E 017F 0180 0181	382 383 384 385	R/W	C	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places TC input: • K, J, T, E: Only 0 or 1 can be set. • R, S, B, N, PLII, W5Re/W26Re: Only 0 can be set. RTD input: Only 0 or 1 can be set. V/I inputs: From 0 to 4 can be set.	Depends on model code When not specifying: TC/RTD: 1 V/I: 1
88	Input scale high	CH1 CH2 CH3 CH4	0182 0183 0184 0185	386 387 388 389	R/W	C	TC/RTD inputs: Input scale low to Maximum value of the selected input range Voltage (V)/current (I) inputs: −19999 to +99999 Varies with the setting of the decimal point position	TC/RTD: Maximum value of the selected input range V/I: 100.0
89	Input scale low	CH1 CH2 CH3 CH4	0186 0187 0188 0189	390 391 392 393	R/W	C	TC/RTD inputs: Minimum value of the selected input range to Input scale high Voltage (V)/current (I) inputs: −19999 to +99999 Varies with the setting of the decimal point position	TC/RTD: Minimum value of the selected input range V/I: 0.0
90	Input error determination point (high)	CH1 CH2 CH3 CH4	018A 018B 018C 018D	394 395 396 397	R/W	C	Input error determination point (low limit) to (Input range high + 5 % of Input span)	Input range high + (5 % of Input span)
91	Input error determination point (low)	CH1 CH2 CH3 CH4	018E 018F 0190 0191	398 399 400 401	R/W	C	(Input range low – 5 % of Input span) to Input error determination point (high limit)	Input range low – (5 % of Input span)
92	Burnout direction	CH1 CH2 CH3 CH4	0192 0193 0194 0195	402 403 404 405	R/W	C	0: Upscale 1: Downscale Valid only when the TC input and voltage (low) input are selected.	0
93	Square root extraction	CH1 CH2 CH3 CH4	0196 0197 0198 0199	406 407 408 409	R/W	C	0: Unused 1: Used	0
94	Output assignment (Logic output selection function)	CH1 CH2 CH3 CH4	019A 019B 019C 019D	410 411 412 413	R/W	C	0: Control output 1: Logic output result 2: FAIL output	0
95	Energized/De-energized (Logic output selection function)	CH1 CH2 CH3 CH4	019E 019F 01A0 01A1	414 415 416 417	R/W	C	0: Energized 1: De-energized	0

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No.	Name	Chan-nel	Register address HEX	Register address DEC	Attri-bute	Struc-ture	Data range	Factory set value
96	Event 1 type	CH1 CH2 CH3 CH4	01A2 01A3 01A4 01A5	418 419 420 421	R/W	C	0: None 1: Deviation high (Using SV monitor value) [1] 2: Deviation low (Using SV monitor value) [1] 3: Deviation high/low (Using SV monitor value) [1] 4: Band (Using SV monitor value) [1] 5: Process high [1] 6: Process low [1] 7: SV high 8: SV low 9: Unused 10: MV high [heat-side] [1, 2] 11: MV low [heat-side] [1, 2] 12: MV high [cool-side] [1] 13: MV low [cool-side] [1] 14: Deviation high (Using local SV) [1] 15: Deviation low (Using local SV) [1] 16: Deviation high/low (Using local SV) [1] 17: Deviation (Using local SV) [1] 18: Deviation between channels high [1] 19: Deviation between channels low [1] 20: Deviation between channels high/low [1] 21: Deviation between channels band [1] [1] Event hold action is available. [2] If there is feedback resistance (FBR) input in position proportioning control, set to the feedback resistance (FBR) input value.	Depends on model code When not specifying: 0
97	Event 1 channel setting	CH1 CH2 CH3 CH4	01A6 01A7 01A8 01A9	422 423 424 425	R/W	C	1: Channel 1 2: Channel 2 3: Channel 3 4: Channel 4 This function is valid when "deviation between channels" is selected	1
98	Event 1 hold action	CH1 CH2 CH3 CH4	01AA 01AB 01AC 01AD	426 427 428 429	R/W	C	0: OFF 1: Hold action ON (When power turned on) 2: Re-hold action ON (When power turned on and SV changed) This function is valid when input value, deviation or manipulated value action has been selected. In case of a deviation action, this function is not available while in remote mode and while setting changing rate limiter is working.	Depends on model code When not specifying: 0
99	Event 1 interlock	CH1 CH2 CH3 CH4	01AE 01AF 01B0 01B1	430 431 432 433	R/W	C	0: Unused 1: Used	0
100	Event 1 differential gap	CH1 CH2 CH3 CH4	01B2 01B3 01B4 01B5	434 435 436 437	R/W	C	① Deviation, process, set value, or Deviation action between channels: 0 to Input span (Unit: °C [°F]) ② MV: 0.0 to 110.0 %	①: TC/RTD: 1 °C [°F] V/I: 0.1 % ②: 0.1 %
101	Event 1 delay timer	CH1 CH2 CH3 CH4	01B6 01B7 01B8 01B9	438 439 440 441	R/W	C	0 to 18000 seconds	0
102	Force ON of Event 1 action	CH1 CH2 CH3 CH4	01BA 01BB 01BC 01BD	442 443 444 445	R/W	C	Bit data b0: Event output turned on at input error occurrence b1: Event output turned on in manual mode b2: Event output turned on during the autotuning (AT) function is being executed b3: Event output turned on during the setting change rate limiter is being operated b4 to b15: Unused Data 0: Invalid 1: Valid [Decimal number: 0 to 15]	0

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No.	Name	Chan-nel	Register address HEX	DEC	Attri-bute	Struc-ture	Data range	Factory set value
103	Event 2 type	CH1 CH2 CH3 CH4	01BE 01BF 01C0 01C1	446 447 448 449	R/W	C	0: None 1: Deviation high (SV monitor value used) [1] 2: Deviation low (SV monitor value used) [1] 3: Deviation high/low (SV monitor value used) [1] 4: Band (SV monitor value used) [1] 5: Process high [1] 6: Process low [1] 7: SV high 8: SV low 9: Unused 10: MV high [heat-side] [1, 2] 11: MV low [heat-side] [1, 2] 12: MV high [cool-side] [1] 13: MV low [cool-side] [1] 14: Deviation high (Local SV value used) [1] 15: Deviation low (Local SV value used) [1] 16: Deviation high/low (Local SV value used) [1] 17: Deviation (Local SV value used) [1] 18: Deviation between channels high [1] 19: Deviation between channels low [1] 20: Deviation between channels high/low [1] 21: Deviation between channels band [1] [1] Event hold action is available. [2] If there is feedback resistance (FBR) input in position proportioning control, set to the feedback resistance (FBR) input value.	Depends on model code When not specifying: 0
104	Event 2 channel setting	CH1 CH2 CH3 CH4	01C2 01C3 01C4 01C5	450 451 452 453	R/W	C	1: Channel 1 2: Channel 2 3: Channel 3 4: Channel 4 This function is valid when "deviation between channels" is selected	1
105	Event 2 hold action	CH1 CH2 CH3 CH4	01C6 01C7 01C8 01C9	454 455 456 457	R/W	C	0: OFF 1: Hold action ON (When power turned on) 2: Re-hold action ON (When power turned on and SV changed) This function is valid when input value, deviation or manipulated value action has been selected. In case of a deviation action, this function is not available while in remote mode and while setting changing rate limiter is working.	Depends on model code When not specifying: 0
106	Event 2 interlock	CH1 CH2 CH3 CH4	01CA 01CB 01CC 01CD	458 459 460 461	R/W	C	0: Unused 1: Used	0
107	Event 2 differential gap	CH1 CH2 CH3 CH4	01CE 01CF 01D0 01D1	462 463 464 465	R/W	C	① Deviation, process, set value, or Deviation action between channels: 0 to Input span (Unit: °C [°F]) ② MV: 0.0 to 110.0 %	①: TC/RTD: 1 °C [°F] V/I: 0.1 % ②: 0.1 %
108	Event 2 delay timer	CH1 CH2 CH3 CH4	01D2 01D3 01D4 01D5	466 467 468 469	R/W	C	0 to 18000 seconds	0
109	Force ON of Event 2 action	CH1 CH2 CH3 CH4	01D6 01D7 01D8 01D9	470 471 472 473	R/W	C	Bit data b0: Event output turned on at input error occurrence b1: Event output turned on in manual mode b2: Event output turned on during the autotuning (AT) function is being executed b3: Event output turned on during the setting change rate limiter is being operated b4 to b15: Unused Data 0: Invalid 1: Valid [Decimal number: 0 to 15]	0

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No.	Name	Chan-nel	Register address HEX	Register address DEC	Attri-bute	Struc-ture	Data range	Factory set value
110	Event 3 type	CH1 CH2 CH3 CH4	01DA 01DB 01DC 01DD	474 475 476 477	R/W	C	0: None 1: Deviation high (SV monitor value used) [1] 2: Deviation low (SV monitor value used) [1] 3: Deviation high/low (SV monitor value used) [1] 4: Band (SV monitor value used) [1] 5: Process high [1] 6: Process low [1] 7: SV high 8: SV low 9: Temperature rise completion 10: MV high [heat-side] [1, 2] 11: MV low [heat-side] [1, 2] 12: MV high [cool-side] [1] 13: MV low [cool-side] [1] 14: Deviation high (Local SV value used) [1] 15: Deviation low (Local SV value used) [1] 16: Deviation high/low (Local SV value used) [1] 17: Deviation (Local SV value used) [1] 18: Deviation between channels high [1] 19: Deviation between channels low [1] 20: Deviation between channels high/low [1] 21: Deviation between channels band [1] [1] Event hold action is available. [2] If there is feedback resistance (FBR) input in position proportioning control, set to the feedback resistance (FBR) input value.	Depends on model code When not specifying: 0
111	Event 3 channel setting	CH1 CH2 CH3 CH4	01DE 01DF 01E0 01E1	478 479 480 481	R/W	C	1: Channel 1 2: Channel 2 3: Channel 3 4: Channel 4 This function is valid when "deviation between channels" is selected	1
112	Event 3 hold action	CH1 CH2 CH3 CH4	01E2 01E3 01E4 01E5	482 483 484 485	R/W	C	0: OFF 1: Hold action ON (When power turned on) 2: Re-hold action ON (When power turned on and SV changed) This function is valid when input value, deviation or manipulated value action has been selected. In case of a deviation action, this function is not available while in remote mode and while setting changing rate limiter is working.	Depends on model code When not specifying: 0
113	Event 3 interlock	CH1 CH2 CH3 CH4	01E6 01E7 01E8 01E9	486 487 488 489	R/W	C	0: Unused 1: Used	0
114	Event 3 differential gap	CH1 CH2 CH3 CH4	01EA 01EB 01EC 01ED	490 491 492 493	R/W	C	① Deviation, process, set value, Deviation action between channels, or Temperature rise completion: 0 to Input span (Unit: °C [°F]) ② MV: 0.0 to 110.0 %	①: TC/RTD: 1 °C [°F] V/I: 0.1 % ②: 0.1 %
115	Event 3 delay timer	CH1 CH2 CH3 CH4	01EE 01EF 01F0 01F1	494 495 496 497	R/W	C	0 to 18000 seconds If Event 3 corresponds to “9: Temperature rise completion,” the Event 3 delay timer becomes the temperature rise completion soak time.	0
116	Force ON of Event 3 action	CH1 CH2 CH3 CH4	01F2 01F3 01F4 01F5	498 499 500 501	R/W	C	Bit data b0: Event output turned on at input error occurrence b1: Event output turned on in manual mode b2: Event output turned on during the autotuning (AT) function is being executed b3: Event output turned on during the setting change rate limiter is being operated b4 to b15: Unused Data 0: Invalid 1: Valid [Decimal number: 0 to 15]	0

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No.	Name	Channel	Register address HEX	Register address DEC	Attribute	Structure	Data range	Factory set value
117	Event 4 type	CH1 CH2 CH3 CH4	01F6 01F7 01F8 01F9	502 503 504 505	R/W	C	0: None 1: Deviation high (SV monitor value used) [1] 2: Deviation low (SV monitor value used) [1] 3: Deviation high/low (SV monitor value used) [1] 4: Band (SV monitor value used) [1] 5: Process high [1] 6: Process low [1] 7: SV high 8: SV low 9: Control loop break alarm (LBA) 10: MV high [heat-side] [1, 2] 11: MV low [heat-side] [1, 2] 12: MV high [cool-side] [1] 13: MV low [cool-side] [1] 14: Deviation high (Local SV value used) [1] 15: Deviation low (Local SV value used) [1] 16: Deviation high/low (Local SV value used) [1] 17: Deviation (Local SV value used) [1] 18: Deviation between channels high [1] 19: Deviation between channels low [1] 20: Deviation between channels high/low [1] 21: Deviation between channels band [1] [1] Event hold action is available. [2] If there is feedback resistance (FBR) input in position proportioning control, set to the feedback resistance (FBR) input value.	Depends on model code When not specifying: 0
118	Event 4 channel setting	CH1 CH2 CH3 CH4	01FA 01FB 01FC 01FD	506 507 508 509	R/W	C	1: Channel 1 2: Channel 2 3: Channel 3 4: Channel 4 This function is valid when "deviation between channels" is selected	1
119	Event 4 hold action	CH1 CH2 CH3 CH4	01FE 01FF 0200 0201	510 511 512 513	R/W	C	0: OFF 1: Hold action ON (When power turned on) 2: Re-hold action ON (When power turned on and SV changed) This function is valid when input value, deviation or manipulated value action has been selected. In case of a deviation action, this function is not available while in remote mode and while setting changing rate limiter is working.	Depends on model code When not specifying: 0
120	Event 4 interlock	CH1 CH2 CH3 CH4	0202 0203 0204 0205	514 515 516 517	R/W	C	0: Unused 1: Used	0
121	Event 4 differential gap	CH1 CH2 CH3 CH4	0206 0207 0208 0209	518 519 520 521	R/W	C	① Deviation, process, set value, or Deviation action between channels: 0 to Input span (Unit: °C [°F]) ② MV: 0.0 to 110.0 % Becomes invalid when the Event 4 type corresponds to “9: Control loop break alarm (LBA).”	①: TC/RTD: 1 °C [°F] V/I: 0.1 % ②: 0.1 %
122	Event 4 delay timer	CH1 CH2 CH3 CH4	020A 020B 020C 020D	522 523 524 525	R/W	C	0 to 18000 seconds	0
123	Force ON of Event 4 action	CH1 CH2 CH3 CH4	020E 020F 0210 0211	526 527 528 529	R/W	C	Bit data b0: Event output turned on at input error occurrence b1: Event output turned on in manual mode b2: Event output turned on during the autotuning (AT) function is being executed b3: Event output turned on during the setting change rate limiter is being operated b4 to b15: Unused Data 0: Invalid 1: Valid [Decimal number: 0 to 15]	0

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No.	Name	Chan-nel	Register address HEX	Register address DEC	Attri-bute	Struc-ture	Data range	Factory set value
124	CT ratio	CH1 CH2 CH3 CH4	0212 0213 0214 0215	530 531 532 533	R/W	C	0 to 9999	CTL-6-P-N: 800 CTL-12-S56-10L-N: 1000
125	CT assignment	CH1 CH2 CH3 CH4	0216 0217 0218 0219	534 535 536 537	R/W	C	0: None 1: OUT1 2: OUT2 3: OUT3 4: OUT4	1
126	Heater break alarm (HBA) type	CH1 CH2 CH3 CH4	021A 021B 021C 021D	538 539 540 541	R/W	C	0: Heater break alarm (HBA) type A (Time-proportional control output) 1: Heater break alarm (HBA) type B (Continuous control output and time-proportional control output)	1
127	Number of heater break alarm (HBA) delay times	CH1 CH2 CH3 CH4	021E 021F 0220 0221	542 543 544 545	R/W	C	0 to 255 times	5
128	Hot/Cold start	CH1 CH2 CH3 CH4	0222 0223 0224 0225	546 547 548 549	R/W	C	0: Hot start 1 1: Hot start 2 2: Cold start	0
129	Start determination point	CH1 CH2 CH3 CH4	0226 0227 0228 0229	550 551 552 553	R/W	C	0 to Input span (The unit is the same as input value.) (0: Action depending on the Hot/Cold start selection)	Depends on specification
130	SV tracking	CH1 CH2 CH3 CH4	022A 022B 022C 022D	554 555 556 557	R/W	C	0: Unused 1: Used	1
131	MV transfer function [Action taken when changed to Manual mode from Auto mode]	CH1 CH2 CH3 CH4	022E 022F 0230 0231	558 559 560 561	R/W	C	0: MV in Auto mode is used. [Balanceless-bumpless function] 1: MV in previous Manual mode is used.	0
132	Control action	CH1 CH2 CH3 CH4	0232 0233 0234 0235	562 563 564 565	R/W	C	0: Brilliant II PID control (Direct action) 1: Brilliant II PID control (Reverse action) 2: Brilliant II Heat/Cool PID control [Water cooling type] 3: Brilliant II Heat/Cool PID control [Air cooling type] 4: Brilliant II Heat/Cool PID control [Cooling gain linear type] 5: Position proportioning control	Depends on model code When not specifying: 1
133	Integral/derivative time decimal point position ♣	CH1 CH2 CH3 CH4	0236 0237 0238 0239	566 567 568 569	R/W	C	0: 1 second setting (No decimal place) 1: 0.1 seconds setting (One decimal place)	0
134	Derivative action ♣	CH1 CH2 CH3 CH4	023A 023B 023C 023D	570 571 572 573	R/W	C	0: Measured value derivative 1: Deviation derivative	0
135	Undershoot suppression factor ♣	CH1 Unused CH3 Unused	023E Unused 0240 Unused	574 Unused 576 Unused	R/W	C	0.000 to 1.000	Water cooling: 0.100 Air cooling: 0.250 Cooling gain linear type: 1.000

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No.	Name	Channel	Register address HEX	Register address DEC	Attribute	Structure	Data range	Factory set value
136	Derivative gain ♣	CH1 CH2 CH3 CH4	0242 0243 0244 0245	578 579 580 581	R/W	C	0.1 to 10.0	6.0
137	ON/OFF action differential gap (upper) ♣	CH1 CH2 CH3 CH4	0246 0247 0248 0249	582 583 584 585	R/W	C	TC/RTD inputs: 0 to Input span (Unit: °C [°F]) Voltage (V)/current (I) inputs: 0.0 to 100.0 % of input span	TC/RTD: 1 °C [°F] V/I: 0.1 %
138	ON/OFF action differential gap (lower) ♣	CH1 CH2 CH3 CH4	024A 024B 024C 024D	586 587 588 589	R/W	C		TC/RTD: 1 °C [°F] V/I: 0.1 %
139	Action (high) at input error ♣	CH1 CH2 CH3 CH4	024E 024F 0250 0251	590 591 592 293	R/W	C	0: Normal control 1: Manipulated output value at input error	0
140	Action (low) at input error ♣	CH1 CH2 CH3 CH4	0252 0253 0254 0255	594 595 596 597	R/W	C		0
141	Manipulated output value at input error ♣	CH1 CH2 CH3 CH4	0256 0257 0258 0259	598 599 600 601	R/W	C	−105.0 to +105.0 % Actual output values become those restricted by the output limiter. Position proportioning control: If there is no feedback resistance (FBR) input or the feedback resistance (FBR) input is disconnected, an action taken when abnormal is in accordance with the value action setting during STOP.	0.0
142	Manipulated output value at STOP mode [heat-side] ♣	CH1 CH2 CH3 CH4	025A 025B 025C 025D	602 603 604 605	R/W	C	−5.0 to +105.0 % Position proportioning control: Only when there is feedback resistance (FBR) input and it does not break, the manipulated output value [heat-side] at STOP is output.	−5.0
143	Manipulated output value at STOP mode [cool-side] ♣	CH1 Unused CH3 Unused	025E Unused 0260 Unused	606 Unused 608 Unused	R/W	C		−5.0
144	Output change rate limiter (up) [heat-side] ♣	CH1 CH2 CH3 CH4	0262 0263 0264 0265	610 611 612 613	R/W	C	0.0 to 100.0 %/seconds (0.0: OFF) Becomes invalid when in position proportioning control.	0.0
145	Output change rate limiter (down) [heat-side] ♣	CH1 CH2 CH3 CH4	0266 0267 0268 0269	614 615 616 617	R/W	C		0.0
146	Output limiter (high) [heat-side] ♣	CH1 CH2 CH3 CH4	026A 026B 026C 026D	618 619 620 621	R/W	C	Output limiter (low) to 105.0 % Position proportioning control: Becomes valid only when there is feedback resistance (FBR) input and it does not break.	105.0
147	Output limiter (low) [heat-side] ♣	CH1 CH2 CH3 CH4	026E 026F 0270 0271	622 623 624 625	R/W	C	−5.0 % to Output limiter (high) Position proportioning control: Becomes valid only when there is feedback resistance (FBR) input and it does not break.	−5.0
148	Output change rate limiter (up) [cool-side] ♣	CH1 Unused CH3 Unused	0272 Unused 0274 Unused	626 Unused 628 Unused	R/W	C	0.0 to 100.0 %/seconds (0.0: OFF) Becomes invalid when in position proportioning control.	0.0
149	Output change rate limiter (down) [cool-side] ♣	CH1 Unused CH3 Unused	0276 Unused 0278 Unused	630 Unused 632 Unused	R/W	C		0.0

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No.	Name	Channel	Register address HEX	Register address DEC	Attribute	Structure	Data range	Factory set value
150	Output limiter (high) [cool-side] ♣	CH1 Unused CH3 Unused	027A Unused 027C Unused	634 Unused 636 Unused	R/W	C	Output limiter (low) [cool-side] to 105.0 %	105.0
151	Output limiter (low) [cool-side] ♣	CH1 Unused CH3 Unused	027E Unused 0280 Unused	638 Unused 640 Unused	R/W	C	−5.0 % to Output limiter (high) [cool-side]	−5.0
152	AT bias ♣	CH1 CH2 CH3 CH4	0282 0283 0284 0285	642 643 644 645	R/W	C	−Input span to +Input span	0
153	AT cycles ♣	CH1 CH2 CH3 CH4	0286 0287 0288 0289	646 647 648 649	R/W	C	0: 1.5 cycles 1: 2.0 cycles 2: 2.5 cycles 3: 3.0 cycles	1
154	Output value with AT turned on ♣	CH1 CH2 CH3 CH4	028A 028B 028C 028D	650 651 652 653	R/W	C	Output value with AT turned off to 105.0 % Actual output values become those restricted by the output limiter. Position proportioning control: Becomes valid only when there is feedback resistance (FBR) input and it does not break (high limit of feedback resistance input at AT).	105.0
155	Output value with AT turned off ♣	CH1 CH2 CH3 CH4	028E 028F 0290 0291	654 655 656 657	R/W	C	−105.0 % to Output value with AT turned on Actual output values become those restricted by the output limiter. Position proportioning control: Becomes valid only when there is feedback resistance (FBR) input and it does not break (low limit of feedback resistance input at AT).	−105.0
156	AT differential gap time ♣	CH1 CH2 CH3 CH4	0292 0293 0294 0295	658 659 660 661	R/W	C	0.0 to 50.0 seconds	10.0
157	Proportional band adjusting factor [heat-side] ♣	CH1 CH2 CH3 CH4	0296 0297 0298 0299	662 663 664 665	R/W	C	0.01 to 10.00 times	1.00
158	Integral time adjusting factor [heat-side] ♣	CH1 CH2 CH3 CH4	029A 029B 029C 029D	666 667 668 669	R/W	C	0.01 to 10.00 times	1.00
159	Derivative time adjusting factor [heat-side] ♣	CH1 CH2 CH3 CH4	029E 029F 02A0 02A1	670 671 672 673	R/W	C	0.01 to 10.00 times	1.00
160	Proportional band adjusting factor [cool-side] ♣	CH1 Unused CH3 Unused	02A2 Unused 02A4 Unused	674 Unused 676 Unused	R/W	C	0.01 to 10.00 times	1.00
161	Integral time adjusting factor [cool-side] ♣	CH1 Unused CH3 Unused	02A6 Unused 02A8 Unused	678 Unused 680 Unused	R/W	C	0.01 to 10.00 times	1.00
162	Derivative time adjusting factor [cool-side] ♣	CH1 Unused CH3 Unused	02AA Unused 02AC Unused	682 Unused 684 Unused	R/W	C	0.01 to 10.00 times	1.00

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No.	Name	Chan-nel	Register address		Attri-bute	Struc-ture	Data range	Factory set value
			HEX	DEC				
163	Proportional band limiter (high) [heat-side] ♣	CH1 CH2 CH3 CH4	02AE 02AF 02B0 02B1	686 687 688 689	R/W	C	TC/RTD inputs: 0 (0.0) to Input span (Unit: °C [°F]) Varies with the setting of the decimal point position selection. Voltage (V)/current (I) inputs: 0.0 to 1000.0 % of input span 0 (0.0): ON/OFF action (ON/OFF action for both heat and cool actions in case of a heat/cool control type.)	TC/RTD: Input span V/I: 1000.0 %
164	Proportional band limiter (low) [heat-side] ♣	CH1 CH2 CH3 CH4	02B2 02B3 02B4 02B5	690 691 692 693	R/W	C		TC/RTD: 0 V/I: 0.0 %
165	Integral time limiter (high) [heat-side] ♣	CH1 CH2 CH3 CH4	02B6 02B7 02B8 02B9	694 695 696 697	R/W	C	PID control or heat/cool PID control: 0 to 3600 seconds or 0.0 to 1999.9 seconds Position proportioning control: 1 to 3600 seconds or 0.1 to 1999.9 seconds Varies with the setting of the integral/derivative time decimal point position selection.	3600
166	Integral time limiter (low) [heat-side] ♣	CH1 CH2 CH3 CH4	02BA 02BB 02BC 02BD	698 699 700 701	R/W	C		PID control, Heat/cool PID control: 0 Position proportioning control: 1
167	Derivative time limiter (high) [heat-side] ♣	CH1 CH2 CH3 CH4	02BE 02BF 02C0 02C1	702 703 704 705	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds Varies with the setting of the integral/derivative time decimal point position selection.	3600
168	Derivative time limiter (low) [heat-side] ♣	CH1 CH2 CH3 CH4	02C2 02C3 02C4 02C5	706 707 708 709	R/W	C		0
169	Proportional band limiter (high) [cool-side] ♣	CH1 Unused CH3 Unused	02C6 Unused 02C8 Unused	710 Unused 712 Unused	R/W	C	TC/RTD inputs: 1 to input span or 0.1 to input span (Unit: °C [°F]) Varies with the setting of the decimal point position selection. Voltage (V)/current (I) inputs: 0.1 to 1000.0 % of input span	TC/RTD: Input span V/I: 1000.0 %
170	Proportional band limiter (low) [cool-side] ♣	CH1 Unused CH3 Unused	02CA Unused 02CC Unused	714 Unused 716 Unused	R/W	C		TC/RTD: 1 (0.1) V/I: 0.1 %
171	Integral time limiter (high) [cool-side] ♣	CH1 Unused CH3 Unused	02CE Unused 02D0 Unused	718 Unused 720 Unused	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds Varies with the setting of the integral/derivative time decimal point position selection. If control is other than heat/cool PID control, set to RO (Only reading data is possible).	3600
172	Integral time limiter (low) [cool-side] ♣	CH1 Unused CH3 Unused	02D2 Unused 02D4 Unused	722 Unused 724 Unused	R/W	C		0
173	Derivative time limiter (high) [cool-side] ♣	CH1 Unused CH3 Unused	02D6 Unused 02D8 Unused	726 Unused 728 Unused	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds Varies with the setting of the integral/derivative time decimal point position selection. If control is other than heat/cool PID control, set to RO (Only reading data is possible).	3600
174	Derivative time limiter (low) [cool-side] ♣	CH1 Unused CH3 Unused	02DA Unused 02DC Unused	730 Unused 732 Unused	R/W	C		0
175	Open/Close output neutral zone ♣	CH1 Unused CH3 Unused	02DE Unused 02E0 Unused	734 Unused 736 Unused	R/W	C	0.1 to 10.0 %	2.0
176	Action at feedback resistance (FBR) input error ♣	CH1 Unused CH3 Unused	02E2 Unused 02E4 Unused	738 Unused 740 Unused	R/W	C	0: Action depending on the valve action at STOP 1: Control action continued	0
177	Feedback adjustment ♣	CH1 Unused CH3 Unused	02E6 Unused 02E8 Unused	742 Unused 744 Unused	R/W	C	0: Adjustment end 1: Open-side adjustment start 2: Close-side adjustment start	—

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No.	Name	Chan-nel	Register address HEX	Register address DEC	Attri-bute	Struc-ture	Data range	Factory set value
178	Control motor time ♣	CH1 Unused CH3 Unused	02EA Unused 02EC Unused	746 Unused 748 Unused	R/W	C	5 to 1000 seconds	10
179	Integrated output limiter ♣	CH1 Unused CH3 Unused	02EE Unused 02F0 Unused	750 Unused 752 Unused	R/W	C	0.0 to 200.0 % of control motor time (0.0: OFF) Becomes invalid when there is feedback resistance (FBR) input	150.0
180	Valve action at STOP ♣	CH1 Unused CH3 Unused	02F2 Unused 02F4 Unused	754 Unused 756 Unused	R/W	C	0: Close-side output OFF, Open-side output OFF 1: Close-side output ON, Open-side output OFF 2: Close-side output OFF, Open-side output ON Becomes valid when there is no feedback resistance (FBR) input or the feedback resistance (FBR) input is disconnected.	0
181	ST proportional band adjusting factor ♣	CH1 CH2 CH3 CH4	02F6 02F7 02F8 02F9	758 759 760 761	R/W	C	0.01 to 10.00 times	1.00
182	ST integral time adjusting factor ♣	CH1 CH2 CH3 CH4	02FA 02FB 02FC 02FD	762 763 764 765	R/W	C	0.01 to 10.00 times	1.00
183	ST derivative time adjusting factor ♣	CH1 CH2 CH3 CH4	02FE 02FF 0300 0301	766 767 768 769	R/W	C	0.01 to 10.00 times	1.00
184	ST start condition ♣	CH1 CH2 CH3 CH4	0302 0303 0304 0305	770 771 772 773	R/W	C	0: Activate the startup tuning (ST) function when the power is turned on; when transferred from STOP to RUN; or when the set value (SV) is changed. 1: Activate the startup tuning (ST) function when the power is turned on; or when transferred from STOP to RUN. 2: Activate the startup tuning (ST) function when the set value (SV) is changed.	0
185	Automatic temperature rise group ♣	CH1 CH2 CH3 CH4	0306 0307 0308 0309	774 775 776 777	R/W	C	0 to 16 (0: Automatic temperature rise function OFF)	0
186	Automatic temperature rise dead time ♣	CH1 CH2 CH3 CH4	030A 030B 030C 030D	778 779 780 781	R/W	C	0.1 to 1999.9 seconds	10.0
187	Automatic temperature rise gradient data ♣	CH1 CH2 CH3 CH4	030E 030F 0310 0311	782 783 784 785	R/W	C	0.1 to Input span/minutes	1.0
188	EDS transfer time decimal point position ♣	CH1 CH2 CH3 CH4	0312 0313 0314 0315	786 787 788 789	R/W	C	0: 1 second setting (No decimal place) 1: 0.1 seconds setting (One decimal place)	0
189	Output average processing time for EDS ♣	CH1 CH2 CH3 CH4	0316 0317 0318 0319	790 791 792 793	R/W	C	0.1 to 200.0 seconds	1.0
190	Responsive action trigger point for EDS ♣	CH1 CH2 CH3 CH4	031A 031B 031C 031D	794 795 796 797	R/W	C	0 to Input span (Unit: °C [°F], %)	1

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No.	Name	Chan-nel	Register address HEX	Register address DEC	Attri-bute	Struc-ture	Data range	Factory set value
191	Setting change rate limiter unit time	CH1 CH2 CH3 CH4	031E 031F 0320 0321	798 799 800 801	R/W	C	1 to 3600 seconds	60
192	Soak time unit	CH1 CH2 CH3 CH4	0322 0323 0324 0325	802 803 804 805	R/W	C	0: 0 to 5999 minutes [0 hours 00 minutes to 99 hours 59 minutes] 1: 0 to 11999 seconds [0 minutes 00 seconds to 199 minutes 59 seconds] Set the data range of Memory area soak time monitor and Area soak time.	1
193	Setting limiter (high)	CH1 CH2 CH3 CH4	0326 0327 0328 0329	806 807 808 809	R/W	C	Setting limiter (low) to Input scale high	Input scale high
194	Setting limiter (low)	CH1 CH2 CH3 CH4	032A 032B 032C 032D	810 811 812 813	R/W	C	Input scale low to Setting limiter (high)	Input scale low
195	PV transfer function ♣	CH1 CH2 CH3 CH4	032E 032F 0330 0331	814 815 816 817	R/W	C	0: Unused 1: Used	0
196	Operation mode assignment 1 (Logic output selection function) Logic output 1 to 4	CH1 CH2 CH3 CH4	0332 0333 0334 0335	818 819 820 821	R/W	C	0: No assignment 1: Operation mode (monitor, control) 2: Operation mode (monitor, event function, control) 3: Auto/Manual 4: Remote/Local 5: Interlock release	0
197	Operation mode assignment 2 (Logic output selection function) Logic output 5 to 8	CH1 CH2 CH3 CH4	0336 0337 0338 0339	822 823 824 825	R/W	C	0: No assignment 1: Operation mode (monitor, control) 2: Operation mode (monitor, event function, control) 3: Auto/Manual 4: Remote/Local 5: Interlock release	0
198	SV select function	CH1 CH2 CH3 CH4	033A 033B 033C 033D	826 827 828 829	R/W	C	0: Remote SV function 1: Cascade control function 2: Ratio setting function 3: Cascade control 2 function	0
199	Remote SV function master channel module address	CH1 CH2 CH3 CH4	033E 033F 0340 0341	830 831 832 833	R/W	C	−1 (Master channel is selected from itself) 0 to 99 (Master channel is selected from other modules)	−1
200	Remote SV function master channel selection	CH1 CH2 CH3 CH4	0342 0343 0344 0345	834 835 836 837	R/W	C	1 to 99	1
201	Output distribution master channel module address	CH1 CH2 CH3 CH4	0346 0347 0348 0349	838 839 840 841	R/W	C	−1 (Master channel is selected from itself) 0 to 99 (Master channel is selected from other modules)	−1
202	Output distribution master channel selection	CH1 CH2 CH3 CH4	034A 034B 034C 034D	842 843 844 845	R/W	C	1 to 99	1

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No.	Name	Chan-nel	Register address HEX	Register address DEC	Attri-bute	Struc-ture	Data range	Factory set value
203	Address of interacting modules	CH1 CH2 CH3 CH4	034E 034F 0350 0351	846 847 848 849	R/W	C	−1 (Interact with its own module address) 0 to 99 (Interact with the addresses of other modules)	−1
204	Channel selection of interacting modules	CH1 CH2 CH3 CH4	0352 0353 0354 0355	850 851 852 853	R/W	C	1 to 99 Becomes valid when the selected module is "Z-TIO module".	1
205	Selection switch of interacting modules	CH1 CH2 CH3 CH4	0356 0357 0358 0359	854 855 856 857	R/W	C	Bit data b0: Memory area number b1: Operation mode b2: Auto/Manual b3: Remote/Local b4: EDS start signal b5: Interlock release b6: Suspension of area soak time b7 to b15: Unused Data 0: No interaction 1: Interact with other channels [Decimal number: 0 to 127]	0
206	Control RUN/STOP holding setting	—	035A	858	R/W	C	0: Not holding (STOP start) 1: Holding (RUN/STOP hold)	1
207	Interval time	—	035B	859	R/W	C	0 to 250 ms	10

7.5.3 Communication data of Z-DIO module

No.	Name	Chan-nel	Register address HEX	Register address DEC	Attri-bute	Struc-ture	Data range	Factory set value
1	Digital input (DI) state	—	0000	0	RO	M	Bit data b0: DI1 state b1: DI2 state b2: DI3 state b3: DI4 state b4: DI5 state b5: DI6 state b6: DI7 state b7: DI8 state b8 to b15: Unused Data 0: Contact open 1: Contact closed [Decimal number: 0 to 255]	—
2	Digital output (DO) state	—	0001	1	RO	M	Bit data b0: DO1 state b1: DO2 state b2: DO3 state b3: DO4 state b4: DO5 state b5: DO6 state b6: DO7 state b7: DO8 state b8 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 255]	—
3	Error code	—	0002	2	RO	M	Bit data b1: Data back-up error b0, b2 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 2]	—
4	Integrated operating time monitor	—	0003	3	RO	M	0 to 19999 hours	—
5	Backup memory state monitor	—	0004	4	RO	M	0: The content of the backup memory does not coincide with that of the RAM. 1: The content of the backup memory coincides with that of the RAM.	—
6	Unused	—	0005 ⋮ 0045	5 ⋮ 69	—	—	—	—
7	RUN/STOP transfer	—	0046	70	R/W	M	0: STOP (Control stop) 1: RUN (Control start)	0
8	DO manual output	—	0047	71	R/W	M	Bit data b0: DO1 manual output b1: DO2 manual output b2: DO3 manual output b3: DO4 manual output b4: DO5 manual output b5: DO6 manual output b6: DO7 manual output b7: DO8 manual output b8 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 255]	0

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No.	Name	Chan- nel	Register address		Attri- bute	Struc- ture	Data range	Factory set value
			HEX	DEC				
9	DO output distribution selection	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8	0048 0049 004A 004B 004C 004D 004E 004F	72 73 74 75 76 77 78 79	R/W	C	0: DO output 1: Distribution output	0
10	DO output distribution bias	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8	0050 0051 0052 0053 0054 0055 0056 0057	80 81 82 83 84 85 86 87	R/W	C	−100.0 to +100.0 %	0.0
11	DO output distribution ratio	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8	0058 0059 005A 005B 005C 005D 005E 005F	88 89 90 91 92 93 94 95	R/W	C	−9.999 to +9.999	1.000
12	DO proportional cycle time	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8	0060 0061 0062 0063 0064 0065 0066 0067	96 97 98 99 100 101 102 103	R/W	C	0.1 to 100.0 seconds	Depends on specification
13	DO minimum ON/OFF time of proportioning cycle	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8	0068 0069 006A 006B 006C 006D 006E 006F	104 105 106 107 108 109 110 111	R/W	C	0 to 1000 ms	0
14	Unused	—	0070 ⋮ 00A3	112 ⋮ 163	—	—	—	—
Set data No. 15 or later are for engineering setting [Writable in the STOP mode]								
15	DI function assignment	—	00A4	164	R/W	M	0 to 29 (See page 8-154)	1
16	Memory area setting signal	—	00A5	165	R/W	M	0: Valid 1: Invalid	1
17	DO signal assignment module address 1	—	00A6	166	R/W	M	−1, 0 to 99 When "-1" is selected, all of the signals of the same type (except temperature rise completion and DO manual output value) are *OR*-operated and produced as outputs from DO.	−1
18	DO signal assignment module address 2	—	00A7	167	R/W	M	−1, 0 to 99 When "-1" is selected, all of the signals of the same type (except temperature rise completion and DO manual output value) are *OR*-operated and produced as outputs from DO.	−1
19	DO output assignment 1 [DO1 to DO4]	—	00A8	168	R/W	M	0 to 13 (See page 8-158)	1

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No.	Name	Chan-nel	Register address		Attri-bute	Struc-ture	Data range	Factory set value
			HEX	DEC				
20	DO output assignment 2 [DO5 to DO8]	—	00A9	169	R/W	M	0 to 13 (See page 8-158)	1
21	DO energized/de-energized	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8	00AA 00AB 00AC 00AD 00AE 00AF 00B0 00B1	170 171 172 173 174 175 176 177	R/W	C	0: Energized 1: De-energized	0
22	DO output distribution master channel module address	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8	00B2 00B3 00B4 00B5 00B6 00B7 00B8 00B9	178 179 180 181 182 183 184 185	R/W	C	−1 (Master channel is selected from itself) 0 to 99 (Master channel is selected from other modules)	−1
23	DO output distribution master channel selection	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8	00BA 00BB 00BC 00BD 00BE 00BF 00C0 00C1	186 187 188 189 190 191 192 193	R/W	C	1 to 99	1
24	DO manipulated output value (MV) at STOP mode	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8	00C2 00C3 00C4 00C5 00C6 00C7 00C8 00C9	194 195 196 197 198 199 200 201	R/W	C	−5.0 to +105.0 %	−5.0
25	DO output limiter (high)	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8	00CA 00CB 00CC 00CD 00CE 00CF 00D0 00D1	202 203 204 205 206 207 208 209	R/W	C	DO output limiter (low) to 105.0 %	105.0
26	DO output limiter (low)	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8	00D2 00D3 00D4 00D5 00D6 00D7 00D8 00D9	210 211 212 213 214 215 216 217	R/W	C	−5.0 % to DO output limiter (high)	−5.0
27	Control RUN/STOP holding setting	—	00DA	218	R/W	M	0: Not holding (STOP start) 1: Holding (RUN/STOP hold)	1
28	Interval time	—	00DB	219	R/W	M	0 to 250 ms	10

7.5.4 Memory area data address (Z-TIO)

The register addresses, 0500H to 0553H are used for checking and changing each set value belonging to the memory area.

No.	Name	Chan-nel	Register address HEX	Register address DEC	Attri-bute	Struc-ture	Data range	Factory set value
1	Setting memory area number	CH1 CH2 CH3 CH4	0500 0501 0502 0503	1280 1281 1282 1283	R/W	C	1 to 8	1
2	Event 1 set value (EV1)	CH1 CH2 CH3 CH4	0504 0505 0506 0507	1284 1285 1286 1287	R/W	C	Deviation action, Deviation action between channels, Temperatue rise completion range: –Input span to +Input span Process action, SV action: Input scale low to Input scale high MV action: −5.0 to +105.0 %	50
3	Event 2 set value (EV2)	CH1 CH2 CH3 CH4	0508 0509 050A 050B	1288 1289 1290 1291	R/W	C		50
4	Event 3 set value (EV3)	CH1 CH2 CH3 CH4	050C 050D 050E 050F	1292 1293 1294 1295	R/W	C		50
5	Event 4 set value (EV4)	CH1 CH2 CH3 CH4	0510 0511 0512 0513	1296 1297 1298 1299	R/W	C		50
6	Control loop break alarm (LBA) time	CH1 CH2 CH3 CH4	0514 0515 0516 0517	1300 1301 1302 1303	R/W	C	0 to 7200 seconds (0: Unused)	480
7	LBA deadband	CH1 CH2 CH3 CH4	0518 0519 051A 051B	1304 1305 1306 1307	R/W	C	0 (0.0) to Input span	0 (0.0)
8	Set value (SV)	CH1 CH2 CH3 CH4	051C 051D 051E 051F	1308 1309 1310 1311	R/W	C	Setting limiter (low) to Setting limiter (high)	TC/RTD: 0 °C [°F] V/I: 0.0 %
9	Proportional band [heat-side]	CH1 CH2 CH3 CH4	0520 0521 0522 0523	1312 1313 1314 1315	R/W	C	TC/RTD inputs: 0 (0.0) to Input span (Unit: °C [°F]) Voltage (V)/current (I) inputs: 0.0 to 1000.0 % of Input span 0 (0.0): ON/OFF action (ON/OFF action for both heat and cool actions in case of a heat/cool control type.)	TC/RTD: 30 V/I: 30.0
10	Integral time [heat-side]	CH1 CH2 CH3 CH4	0524 0525 0526 0527	1316 1317 1318 1319	R/W	C	PID control or heat/cool PID control: 0 to 3600 seconds or 0.0 to 1999.9 seconds (0, 0.0: PD action) Position proportioning control: 1 to 3600 seconds or 0.1 to 1999.9 seconds	240
11	Derivative time [heat-side]	CH1 CH2 CH3 CH4	0528 0529 052A 052B	1320 1321 1322 1323	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds (0, 0.0: PI action)	60
12	Control response parameter	CH1 CH2 CH3 CH4	052C 052D 052E 052F	1324 1325 1326 1327	R/W	C	0: Slow 1: Medium 2: Fast	PID control, Position proportioning control: 0 Heat/cool PID control: 2

Continued on the next page.

Continued from the previous page.

No.	Name	Channel	Register address HEX	Register address DEC	Attribute	Structure	Data range	Factory set value
13	Proportional band [cool-side]	CH1 CH2 CH3 CH4	0530 0531 0532 0533	1328 1329 1330 1331	R/W	C	TC/RTD inputs: 1 to Input span or 0.1 to Input span (Unit: °C [°F]) Voltage (V)/current (I) inputs: 0.1 to 1000.0 % of Input span	TC/RTD: 30 V/I: 30.0
14	Integral time [cool-side]	CH1 CH2 CH3 CH4	0534 0535 0536 0357	1332 1333 1334 1335	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds (0, 0.0: PD action)	240
15	Derivative time [cool-side]	CH1 CH2 CH3 CH4	0538 0539 053A 053B	1336 1337 1338 1339	R/W	C	0 to 3600 seconds or 0.0 to 1999.9 seconds (0, 0.0: PI action)	60
16	Overlap/Deadband	CH1 CH2 CH3 CH4	053C 053D 053E 053F	1340 1341 1342 1343	R/W	C	TC/RTD inputs: −Input span to +Input span (Unit:°C [°F]) Voltage (V)/current (I) inputs: −100.0 to +100.0 % of Input span	0
17	Manual reset	CH1 CH2 CH3 CH4	0540 0541 0542 0543	1344 1345 1346 1347	R/W	C	−100.0 to +100.0 %	0.0
18	Setting change rate limiter (up)	CH1 CH2 CH3 CH4	0544 0545 0546 0547	1348 1349 1350 1351	R/W	C	0 (0.0) to Input span/unit time * 0 (0.0): Unused	0 (0.0)
19	Setting change rate limiter (down)	CH1 CH2 CH3 CH4	0548 0549 054A 054B	1352 1353 1354 1355	R/W	C	* Unit time: 60 seconds (factory set value)	0 (0.0)
20	Area soak time	CH1 CH2 CH3 CH4	054C 054D 054E 054F	1356 1357 1358 1359	R/W	C	0 minutes 00 seconds to 199 minutes 59 seconds: 0 to 11999 seconds 0 hours 00 minutes to 99 hours 59 minutes: 0 to 5999 minutes	0
21	Link area number	CH1 CH2 CH3 CH4	0550 0551 0552 0553	1360 1361 1362 1363	R/W	C	0 to 8 (0: No link)	0

7.5.5 Data mapping address (Z-TIO, Z-DIO)

■ Register address for data mapping

No.	Name	Register address HEX	Register address DEC	Number of data items	Attri-bute	Data range	Factory set value
1	Register address setting 1 Read/write address: 1500H	1000	4096	1	R/W	Decimal: −1 to 4095 (−1: No mapping) Hexadecimal: FFFFH to 0FFFH (FFFFH: No mapping) Set the register address of data to be assigned to 1500H to 150FH.	−1
2	Register address setting 2 Read/write address: 1501H	1001	4097	1	R/W		−1
3	Register address setting 3 Read/write address: 1502H	1002	4098	1	R/W		−1
4	Register address setting 4 Read/write address: 1503H	1003	4099	1	R/W		−1
5	Register address setting 5 Read/write address: 1504H	1004	4100	1	R/W		−1
6	Register address setting 6 Read/write address: 1505H	1005	4101	1	R/W		−1
7	Register address setting 7 Read/write address: 1506H	1006	4102	1	R/W		−1
8	Register address setting 8 Read/write address: 1507H	1007	4103	1	R/W		−1
9	Register address setting 9 Read/write address: 1508H	1008	4104	1	R/W		−1
10	Register address setting 10 Read/write address: 1509H	1009	4105	1	R/W		−1
11	Register address setting 11 Read/write address: 150AH	100A	4106	1	R/W		−1
12	Register address setting 12 Read/write address: 150BH	100B	4107	1	R/W		−1
13	Register address setting 13 Read/write address: 150CH	100C	4108	1	R/W		−1
14	Register address setting 14 Read/write address: 150DH	100D	4109	1	R/W		−1
15	Register address setting 15 Read/write address: 150EH	100E	4110	1	R/W		−1
16	Register address setting 16 Read/write address: 150FH	100F	4111	1	R/W		−1

■ Register address for data read/writes

No.	Name	Register address HEX	Register address DEC	Number of data items	Attri-bute	Data range	Factory set value
1	Data specified by register address setting 1 (1000H)	1500	5376	1		Differs depending on data specified.	
2	Data specified by register address setting 2 (1001H)	1501	5377	1			
3	Data specified by register address setting 3 (1002H)	1502	5378	1			
4	Data specified by register address setting 4 (1003H)	1503	5379	1			
5	Data specified by register address setting 5 (1004H)	1504	5380	1			
6	Data specified by register address setting 6 (1005H)	1505	5381	1			
7	Data specified by register address setting 7 (1006H)	1506	5382	1			
8	Data specified by register address setting 8 (1007H)	1507	5383	1			
9	Data specified by register address setting 9 (1008H)	1508	5384	1			
10	Data specified by register address setting 10 (1009H)	1509	5385	1			
11	Data specified by register address setting 11 (100AH)	150A	5386	1			
12	Data specified by register address setting 12 (100BH)	150B	5387	1			
13	Data specified by register address setting 13 (100CH)	150C	5388	1			
14	Data specified by register address setting 14 (100DH)	150D	5389	1			
15	Data specified by register address setting 15 (100EH)	150E	5390	1			
16	Data specified by register address setting 16 (100FH)	150F	5391	1			

MEMO

COMMUNICATION DATA DESCRIPTION

8

8.1 Reference to Communication Data Contents

(1) (2) (3)

Set value (SV)	RKC communication identifier	S1
	Modbus register address	ch1: 008EH (142) ch3: 0090H (144) ch2: 008FH (143) ch4: 0091H (145)

(4) Set value (SV) is desired value of the control.

(5) Attribute: R/W

(6) Digits: 7 digits

(7) Number of data: 4 (Data of each channel)

(8) Data range: Setting limiter (low) to Setting limiter (high)

(9) Factory set value: TC/RTD inputs: 0 °C (°F)
Voltage (V) /current (I) inputs: 0.0 %

(10) Related parameters: Input type (P. 8-69), Input scale high/low (P. 8-71)

(1) Name: Communication data name

(2) RKC communication identifier:
Communication identifier of RKC communication

(3) Modbus register address:
Modbus communication data register addresses of each channel
These register addresses are written using both of hexadecimal and decimal (in parentheses) numbers.

(4) Description: A short description of the communication data item

(5) Attribute: A method of how communication data items are read or written when viewed from the host computer is described.

RO: Read only data

Data direction
Host computer ← SRZ

R/W: Read and Write data

Data direction
Host computer ↔ SRZ

(6) Digits: The number of communication data digits in RKC communication

(7) Number of data: The number of communication data in Modbus
Number of each channel data: 4 (Z-TIO), 8 (Z-DIO)
Number of each module data: 1 (Common to both Z-TIO and Z-DIO module)

(8) Data range: Read or Write range of communication data

(9) Factory set value: Factory set value of communication data

(10) Related parameters: A name and a page of relational items

There is item including the functional description.

8.2 Communication Data of Z-TIO Module

8.2.1 Normal setting data items

Model code	RKC communication identifier	ID
	Modbus register address	—

This value is the type identifier code of the Z-TIO module.

Attribute: RO
Digits: 32 digits
Number of data: —
Data range: —
Factory set value: —

ROM version	RKC communication identifier	VR
	Modbus register address	—

This value is a version of the ROM loaded on the Z-TIO module.

Attribute: RO
Digits: 8 digits
Number of data: —
Data range: The version of loading software
Factory set value: —

Measured value (PV)	RKC communication identifier	M1
	Modbus register address	ch1: 0000H (0) ch3: 0002H (2) ch2: 0001H (1) ch4: 0003H (3)

Measured value (PV) is an input value of the Z-TIO module.
There are thermocouple input (TC), resistance temperature detector input (RTD), voltage input (V), current input (I) and feedback resistance input.

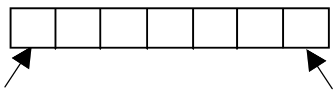
Attribute: RO
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: Input scale low to Input scale high
Factory set value: —

Comprehensive event state	RKC communication identifier	AJ	
	Modbus register address	ch1: 0004H (4) ch2: 0005H (5)	ch3: 0006H (6) ch4: 0007H (7)

Each event state such as Event 1 to Event 4, heater break alarm, temperature rise completion or burnout is expressed in bit data items.

Attribute: RO
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: **RKC communication:** ASCII code data
The event state is assigned as a digit image in ASCII code data of 7 digits.

ASCII code data of 7 digits:



Most significant digit ·············· Least significant digit

Data: 0: OFF 1: ON

Least significant digit: Event 1 state
2nd digit: Event 2 state
3rd digit: Event 3 state
4th digit: Event 4 state
5th digit: Heater break alarm state
6th digit: Temperature rise completion
Most significant digit: Burnout

Modbus: 0 to 127 (bit data)
The event state is assigned as a bit image in binary numbers.

Bit image: 0000000000000000

bit 15 ··························· bit 0

Bit data: 0: OFF 1: ON

bit 0: Event 1 state
bit 1: Event 2 state
bit 2: Event 3 state
bit 3: Event 4 state
bit 4: Heater break alarm state
bit 5: Temperature rise completion
bit 6: Burnout
bit 7 to bit 15: Unused

Factory set value: —
Related parameters: Event set value (EV) (P. 8-20), Heater break alarm (HBA) set value (P. 8-32),
Heater break determination point (P. 8-34),
Heater melting determination point (P. 8-34),
Burnout direction (P. 8-74), Event type (P. 8-77),
Event hold action (P. 8-81), Event interlock (P. 8-83),
Event differential gap (P. 8-84), Event delay timer (P. 8-85),
CT ratio (P. 8-89), CT assignment (P. 8-89),
Heater break alarm (HBA) type (P. 8-90),
Number of heater break alarm (HBA) delay times (P. 8-91)

Operation mode state monitor	RKC communication identifier	L0
	Modbus register address	ch1: 0008H (8) ch3: 000AH (10) ch2: 0009H (9) ch4: 000BH (11)

Each operation mode state of the Z-TIO module is expressed in bit data items.

Attribute: RO
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: **RKC communication:** ASCII code data
The operation mode state is assigned as a digit image in ASCII code data of 7 digits.

ASCII code data of 7 digits:

Most significant digit ··············· Least significant digit

Data: 0: OFF 1: ON

Least significant digit: Control STOP
2nd digit: Control RUN
3rd digit: Manual mode (Including Remote mode)
4th digit: Remote mode
5th digit to Most significant digit: Unused

Modbus: 0 to 15 (bit data)
The operation mode state is assigned as a bit image in binary numbers.

Bit image: 0000000000000000
bit 15 ··························· bit 0

Bit data: 0: OFF 1: ON

bit 0: Control STOP
bit 1: Control RUN
bit 2: Manual mode (Including Remote mode)
bit 3: Remote mode
bit 4 to bit 15: Unused

Factory set value: —
Related parameters: Auto/Manual transfer (P. 8-16), Remote/Local transfer (P. 8-17), RUN/STOP transfer (P. 8-17)

Error code	RKC communication identifier	ER
	Modbus register address	000CH (12)

Each error state of the Z-TIO module is expressed in bit data items.

Attribute: RO
Digits: 7 digits
Number of data: 1 (Data of each module)
Data range: 0 to 63 (bit data)
The error state is assigned as a bit image in binary numbers.
However, send data from the SRZ be changed to decimal ASCII code from the bit image in binary numbers for RKC communication.

Bit image: 0000000000000000
bit 15 ·························· bit 0

Bit data: 0: OFF 1: ON

bit 0: Adjustment data error
bit 1: Data back-up error
bit 2: A/D conversion error
bit 3: Unused
bit 4: Unused
bit 5: Logic output data error
bit 6 to bit 15: Unused

Factory set value: —

Manipulated output value (MV) monitor [heat-side]	RKC communication identifier	O1	
	Modbus register address	ch1: 000DH (13) ch2: 000EH (14)	ch3: 000FH (15) ch4: 0010H (16)

Heat-side output value for PID control or heat/cool PID control.
When feedback resistance (FBR) input is used in position proportioning control, the feedback resistance (FBR) input value is monitored.

Attribute: RO
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: PID control or Heat/Cool PID control: −5.0 to +105.0 %
When feedback resistance (FBR) input is used in position proportioning control:
0.0 to 100.0 %
Factory set value: —

When there is feedback resistance (FBR) input and the feedback resistance (FBR) is not connected, overscale will occur and cause a burnout state.

Manipulated output value (MV) monitor [cool-side]	RKC communication identifier	O2	
	Modbus register address	ch1: 0011H (17) ch2: Unused	ch3: 0013H (19) ch4: Unused

Cool-side output value of heat/cool PID control.

Attribute: RO
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: −5.0 to +105.0 %
Factory set value: —
Related parameters: Manual manipulated output value (P. 8-42), Output limiter (high/low) (P. 8-107)

The manipulated output value on the cool-side is valid only during Heat/Cool PID control.

Current transformer (CT) input value monitor	RKC communication identifier	M3	
	Modbus register address	ch1: 0015H (21) ch2: 0016H (22)	ch3: 0017H (23) ch4: 0018H (24)

This item is current transformer input value to use by a heater break alarm (HBA) function.

Attribute: RO
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: CTL-6-P-N: 0.0 to 30.0A
CTL-12-S56-10L-N: 0.0 to 100.0 A
Factory set value: —
Related parameters: Heater break alarm (HBA) state monitor (P. 8-9),
Heater break alarm (HBA) set value (P. 8-32),
CT ratio (P. 8-89), CT assignment (P. 8-89),
Number of heater break alarm (HBA) delay times (P. 8-91)

The CT input cannot measure less than 0.4 A.

Set value (SV) monitor	RKC communication identifier	MS	
	Modbus register address	ch1: 0019H (25) ch2: 001AH (26)	ch3: 001BH (27) ch4: 001CH (28)

This value is a monitor of the set value (SV) that is a desired value for control.

Attribute: RO
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: Setting limiter (low) to Setting limiter (high)
Factory set value: —
Related parameters: Input type (P. 8-69), Decimal point position (P. 8-71)

Remote setting (RS) input value monitor	RKC communication identifier	S2	
	Modbus register address	ch1: 001DH (29) ch2: 001EH (30)	ch3: 001FH (31) ch4: 0020H (32)

Input value used in remote mode. Monitors the SV selected by the remote SV selection function.

Attribute: RO
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: Setting limiter (low) to Setting limiter (high)
Factory set value: —
Related parameters: RS bias (P. 8-36), RS ratio (P. 8-37), RS digital filter (P. 8-37),
SV select function (P. 8-127),
Remote SV function master channel module address (P. 8-133),
Remote SV function master channel selection (P. 8-134)

Burnout state monitor	RKC communication identifier	B1	
	Modbus register address	ch1: 0021H (33) ch2: 0022H (34)	ch3: 0023H (35) ch4: 0024H (36)

Monitor a state in input break.

Attribute: RO
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range: 0: OFF
1: ON
Factory set value: —
Related parameters: Burnout direction (P. 8-74)

Event 1 state monitor	RKC communication identifier	AA
	Modbus register address	ch1: 0025H (37) ch3: 0027H (39) ch2: 0026H (38) ch4: 0028H (40)
Event 2 state monitor	RKC communication identifier	AB
	Modbus register address	ch1: 0029H (41) ch3: 002BH (43) ch2: 002AH (42) ch4: 002CH (44)
Event 3 state monitor	RKC communication identifier	AC
	Modbus register address	ch1: 002DH (45) ch3: 002FH (47) ch2: 002EH (46) ch4: 0030H (48)
Event 4 state monitor	RKC communication identifier	AD
	Modbus register address	ch1: 0031H (49) ch3: 0033H (51) ch2: 0032H (50) ch4: 0034H (52)

Monitor an ON/OFF state of the event.

Attribute: RO
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range: 0: OFF
1: ON
Factory set value: —
Related parameters: Event set value (P. 8-20), Event type (P. 8-77), Event channel setting (P. 8-80), Event hold action (P. 8-81), Event interlock (P. 8-83), Event differential gap (P. 8-84), Event delay timer (P. 8-85)

Heater break alarm (HBA) state monitor	RKC communication identifier	AE
	Modbus register address	ch1: 0035H (53) ch3: 0037H (55) ch2: 0036H (54) ch4: 0038H (56)

Monitor a state of heater break alarm.

Attribute: RO
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range: 0: OFF
1: ON
Factory set value: —
Related parameters: Current transformer (CT) input value monitor (P. 8-7), Heater break alarm (HBA) set value (P. 8-32), CT ratio (P. 8-89), CT assignment (P. 8-89), Number of heater break alarm (HBA) delay times (P. 8-91)

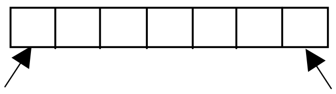
Heater break alarm function cannot be used when control output is voltage/current output.

Output state monitor	RKC communication identifier	Q1
	Modbus register address	0039H (57)

ON/OFF state of output (OUT1 to OUT4) is expressed as a bit image in decimal number.

Attribute: RO
Digits: 7 digits
Number of data: 1 (Data of each module)
Data range: **RKC communication:** ASCII code data
The output state is assigned as a digit image in ASCII code data of 7 digits.

ASCII code data of 7 digits:



Most significant digit ··············· Least significant digit

Data: 0: OFF 1: ON

Least significant digit: OUT1
2nd digit: OUT2
3rd digit: OUT3
4th digit: OUT4
5th digit to Most significant digit: Unused

Modbus: 0 to 15 (bit data)
The output state is assigned as a bit image in binary numbers.

Bit image: 0000000000000000
bit 15 ······························ bit 0

Bit data: 0: OFF 1: ON

bit 0: OUT1
bit 1: OUT2
bit 2: OUT3
bit 3: OUT4
bit 4 to bit 15: Unused

Factory set value: —
Related parameters: Output assignment (P. 8-75)

When the output type is control output, this is only effective when time proportional output is used.

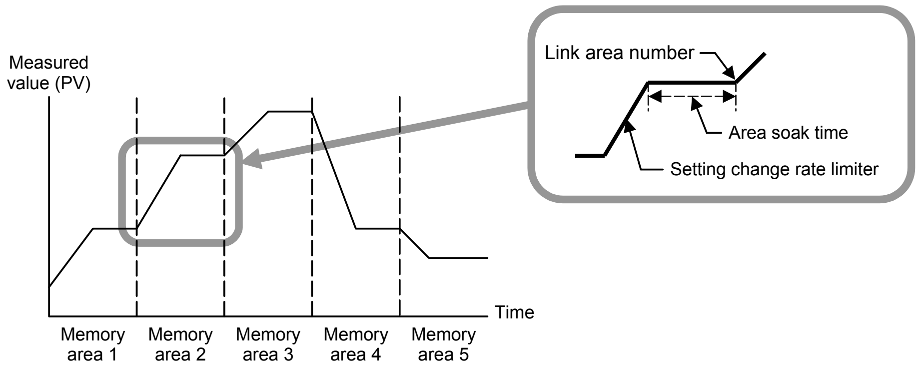
Memory area soak time monitor	RKC communication identifier	TR
	Modbus register address	ch1: 003AH (58) ch3: 003CH (60) ch2: 003BH (59) ch4: 003DH (61)

Monitors the time elapsed for memory area operation (soak time) when ramp/soak control by using Multi-memory Area is performed.

Attribute: RO
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0 minutes 00 seconds to 199 minutes 59 seconds or
0 hours 00 minutes to 99 hours 59 minutes
[RKC communication]
0 minutes 00 seconds to 199 minutes 59 seconds: 0:00 to 199:59 (min:sec)
0 hours 00 minutes to 99 hours 59 minutes: 0:00 to 99:59 (hrs:min)
[Modbus]
0 minutes 00 seconds to 199 minutes 59 seconds: 0 to 11999 seconds
0 hours 00 minutes to 99 hours 59 minutes: 0 to 5999 minutes
Factory set value: —
Related parameters: Area soak time (P. 8-30), Link area number (P. 8-31), Soak time unit (P. 8-124)

As the area soak time for the memory area linked last becomes invalid, no area soak time is monitored.

Example of the simple ramp/soak control:



Integrated operating time monitor	RKC communication identifier	UT
	Modbus register address	003EH (62)

This value is an integrated operating time of the Z-TIO module.

Attribute: RO
Digits: 7 digits
Number of data: 1 (Data of each module)
Data range: 0 to 19999 hours
Factory set value: —

Holding peak value ambient temperature monitor	RKC communication identifier	Hp
	Modbus register address	ch1: 003FH (63) ch3: 0041H (65) ch2: 0040H (64) ch4: 0042H (66)

This value is a maximum ambient temperature on the terminal board of the module.

Attribute: RO
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: −10.0 to +100.0 °C (14.0 to 212.0 °F)
Factory set value: —

Backup memory state monitor	RKC communication identifier	EM
	Modbus register address	0043H (67)

The contents of the RAM and those of the FRAM can be checked.

Attribute: RO
Digits: 1 digit
Number of data: 1 (Data of each module)
Data range: 0: The content of the backup memory does not coincide with that of the RAM.
1: The content of the backup memory coincides with that of the RAM.
Factory set value: —

Logic output monitor 1	RKC communication identifier	ED
Logic output monitor 2	RKC communication identifier	EE
Logic output monitor	Modbus register address	0044H (68)

Each logic output state of the Z-TIO module is expressed in bit data items.

Attribute: RO
Digits: 7 digits
Number of data: 1 (Data of each module)
Data range: **RKC communication:** ASCII code data
The logic output state is assigned as a digit image in ASCII code data of 7 digits.

ASCII code data of 7 digits:

Most significant digit ·············· Least significant digit

Data: 0: OFF 1: ON

[Logic output monitor 1]
Least significant digit: Logic output 1
2nd digit: Logic output 2
3rd digit: Logic output 3
4th digit: Logic output 4
5th digit to Most significant digit: Unused

[Logic output monitor 2]
Least significant digit: Logic output 5
2nd digit: Logic output 6
3rd digit: Logic output 7
4th digit: Logic output 8
5th digit to Most significant digit: Unused

Modbus: 0 to 255 (bit data)
The logic output state is assigned as a bit image in binary numbers.

Bit image: 0000000000000000
bit 15 ··························· bit 0

Bit data: 0: OFF 1: ON

bit 0: Logic output 1
bit 1: Logic output 2
bit 2: Logic output 3
bit 3: Logic output 4
bit 4: Logic output 5
bit 5: Logic output 6
bit 6: Logic output 7
bit 7: Logic output 8
bit 8 to bit 15: Unused

Factory set value: —
Related parameters: Communication switch for logic (P. 8-60), Output assignment (P. 8-75), Operation mode assignment (P. 8-126)

PID/AT transfer	RKC communication identifier	G1
	Modbus register address	ch1: 0061H (97) ch3: 0063H (99) ch2: 0062H (98) ch4: 0064H (100)

Activation or deactivation of the Autotuning (AT) function is selected.

Attribute: R/W
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range: 0: PID control
1: Autotuning (AT)
Factory set value: 0 (PID control)
Related parameters: AT bias (P. 8-108), AT cycles (P. 8-109), Output value with AT turned on (P. 8-110), Output value with AT turned off (P. 8-110), AT differential gap time (P. 8-111), Proportional band limiter (high/low) [heat-side/cool-side] (P. 8-112), Integral time limiter (high/low) [heat-side/cool-side] (P. 8-112), Derivative time limiter (high/low) [heat-side/cool-side] (P. 8-113), Proportional band adjusting factor [heat-side/cool-side] (P. 8-113, P. 8-115), Integral time adjusting factor [heat-side/cool-side] (P. 8-114, P. 8-116), Derivative time adjusting factor [heat-side/cool-side] (P. 8-115, P. 8-116)

Autotuning (AT):
The autotuning (AT) function automatically measures, computes and sets the optimum PID values. The autotuning (AT) can be used for PID control (Direct action/Reverse action), Heat/cool PID control, and Position proportioning control.

● Caution for using the autotuning (AT)

- When a temperature change (UP and/or Down) is 1 °C or less per minute during autotuning (AT), autotuning (AT) may be cancelled before calculating PID values. In that case, adjust the PID values manually. It is possible to happen when the set value is around the ambient temperature or is close to the maximum temperature achieved by the load.
- If the manipulated output may be limited by the output limiter setting, the optimum PID values may not be calculated by autotuning (AT).
- If the output change rate limiter is set, the optimum PID values may not be calculated by autotuning (AT).
- When the cascade control is activated, the AT function cannot be turned on.

● Requirements for autotuning (AT) start

Start the autotuning (AT) when all following conditions are satisfied:
The autotuning (AT) function can start from any state after power on, during arise in temperature or in stable control.

Operation mode state	RUN/STOP transfer	RUN
	PID/AT transfer	PID control
	Auto/Manual transfer	Auto mode
	Remote/Local transfer	Local mode
Parameter setting		Output limiter (high) ≥ 0.1 %, Output limiter (low) ≤ 99.9 %
Input value state		The measured value (PV) is not underscale or overscale.
		Input error determination point (high) ≥ Measured value (PV) ≥ Input error determination point (low)
Operation mode (Identifier: EI)		Control

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● **Requirements for autotuning (AT) cancellation**

If the autotuning (AT) is canceled according to any of the following conditions, the controller immediately changes to PID control. The PID values will be the same as before autotuning (AT) was activated.

When the Operation mode is transferred	When the RUN/STOP mode is changed to the STOP mode.
	When the PID/AT transfer is changed to the PID control.
	When the Auto/Manual mode is changed to the Manual mode.
	When the Remote/Local mode is changed to the Remote mode.
Operation mode (Identifier: EI)	When changed to unused, monitor, or the monitor + event function.
When the parameter is changed	When the temperature set value (SV) is changed.
	When the PV bias, the PV digital filter, or the PV ratio is changed.
	When the AT bias is changed.
	When the control area is changed.
When the input value becomes abnormal	When the measured value (PV) goes to underscale or overscale.
	When the measured value (PV) goes to input error range. (Measured value (PV) ≥ Input error determination point (high) or Input error determination point (low) ≥ Measured value (PV))
When the AT exceeded the execution time	When the AT does not end in two hours after AT started
Power failure	When the power failure of more than 4 ms occurs.
Instrument error	When the instrument is in the FAIL state.

Parameters for autotuning (AT) are provided to compute the PID values suitable for various controlled systems and control actions. Set them, as required.

Example 1: When you want to find each constant suited for P control, PI control, or PD control by autotuning.

For P control:
Set “0” to Integral time limiter (high) [heat-side] and Derivative time limiter (high) [heat-side].

For PI control:
Set “0” to Derivative time limiter (high) [heat-side].

For PD control:
Set “0” to Integral time limiter (high) [heat-side].

When autotuning (AT) is executed by making the settings above, the control constants suited for P, PI, or PD control are found.

Also corresponds to heat/cool PID control cool-side and position proportioning control.

Example 2: When you want to limit on/off output only at autotuning (AT)
Autotuning (AT) that limits the ON/OFF output values only at autotuning (AT) can be executed by setting the output value with AT turned on and the output value with AT turned off.

Only when the feedback resistance (FBR) input is connected in the position proportioning control, the “Output value with AT turned on” and “Output value with AT turned off” setting becomes valid.

Auto/Manual transfer	RKC communication identifier	J1
	Modbus register address	ch1: 0065H (101) ch3: 0067H (103) ch2: 0066H (102) ch4: 0068H (104)

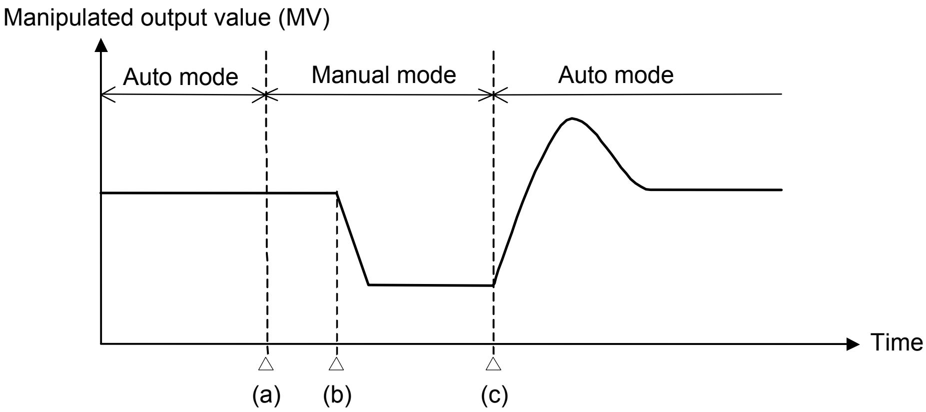
Use to transfer the Auto mode or Manual mode.

Auto mode: Automatic control is performed.
Manual mode: The manipulated output value can be manually changed.

Attribute: R/W
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range: 0: Auto mode
1: Manual mode
Factory set value: 0 (Auto mode)
Related parameters: Operation mode state monitor (P. 8-5), MV transfer function (P. 8-95)
PV transfer function (P. 8-125)
Function: The manipulated output value when changed to the Manual mode from the Auto mode differs depending on the MV transfer function (P. 8-95) setting. The MV transfer function enables the selection of whether a balanceless and bumpless transfer is made or a previous manipulated output value is used.

● Balanceless-bumpless function

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.



(a) Transfer from Auto mode to Manual mode.
However, when the mode is transferred to Manual mode, the manipulated output value used in Auto mode will be used as the manual output value in Manual mode.

(b) The manipulated output value is changed (Manual mode function)

(c) Transfer from Manual mode to Auto mode.
When the mode is transferred to Auto mode, the controller starts PID control based on the MV used in Manual mode.

Remote/Local transfer	RKC communication identifier	C1
	Modbus register address	ch1: 0069H (105) ch3: 006BH (107) ch2: 006AH (106) ch4: 006CH (108)

Use to transfer the Remote mode or Local mode.

Local mode: Control is performed at the local set value (SV).
Remote mode: Control is performed with a remote setting (RS) input value.

Attribute: R/W
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range: 0: Local mode
1: Remote mode
Factory set value: 0 (Local mode)
Related parameters: Operation mode state monitor (P. 8-5), SV tracking (P. 8-94)

When the ratio setting is selected with the SV selection function or cascade control is performed, the adjustment gauge on the slave must be switched to Remote mode.

RUN/STOP transfer	RKC communication identifier	SR
	Modbus register address	006DH (109)

Use to transfer the RUN (control RUN) or STOP (control STOP).

Attribute: R/W
Digits: 1 digit
Number of data: 1 (Data of each module)
Data range: 0: Control STOP
1: Control RUN
Factory set value: 0 (STOP)
Related parameters: Operation mode state monitor (P. 8-5), Operation mode (P. 8-52), Control RUN/STOP holding setting (P. 8-141)

When used together with RKC panel mounted controllers (HA400/900, FB400/900, etc.), be careful that the numbers of indicating “RUN/STOP” of this instrument are opposite from those of the above controllers (0: Control RUN, 1: Control STOP).

Memory area transfer	RKC communication identifier	ZA
	Modbus register address	ch1: 006EH (110) ch3: 0070H (112) ch2: 006FH (111) ch4: 0071H (113)

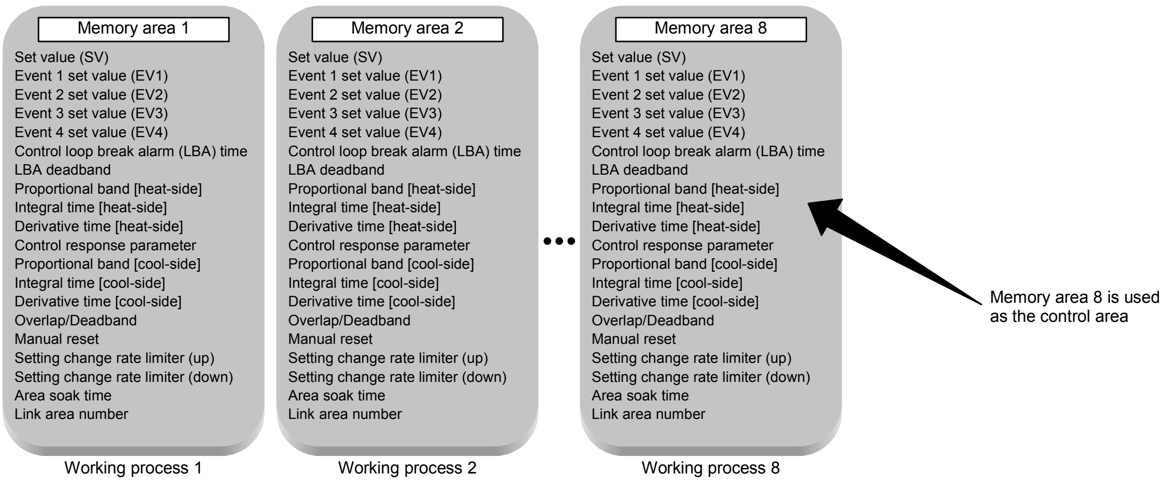
This item selects the memory area (control area) to use for control.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 1 to 8
Factory set value: 1

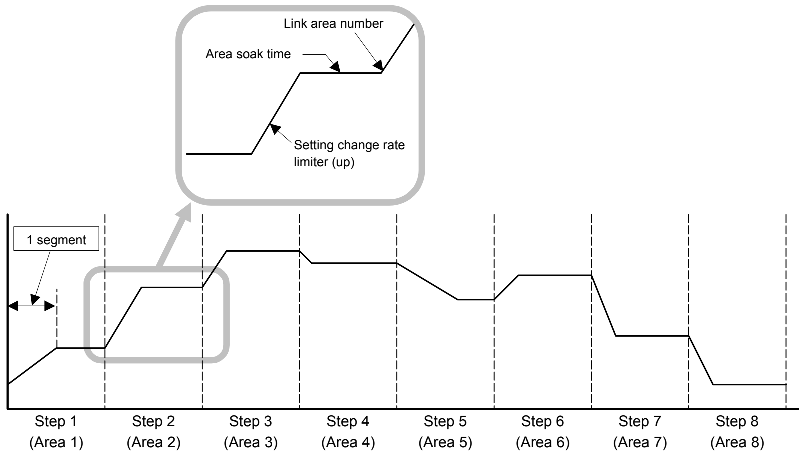
● Multi-memory area function

Multi-Memory Area function can store up to 8 individual sets of SVs and parameters in Parameter setting mode.* One of the Areas is used for control, and the currently selected area is "Control area".
If the set values are stored in divided memory areas for each work process, it is possible to collectively call up all of these set values necessary for the process simply by changing the corresponding memory area numbers.

* On the SRZ, up to eight areas can be stored per channel.



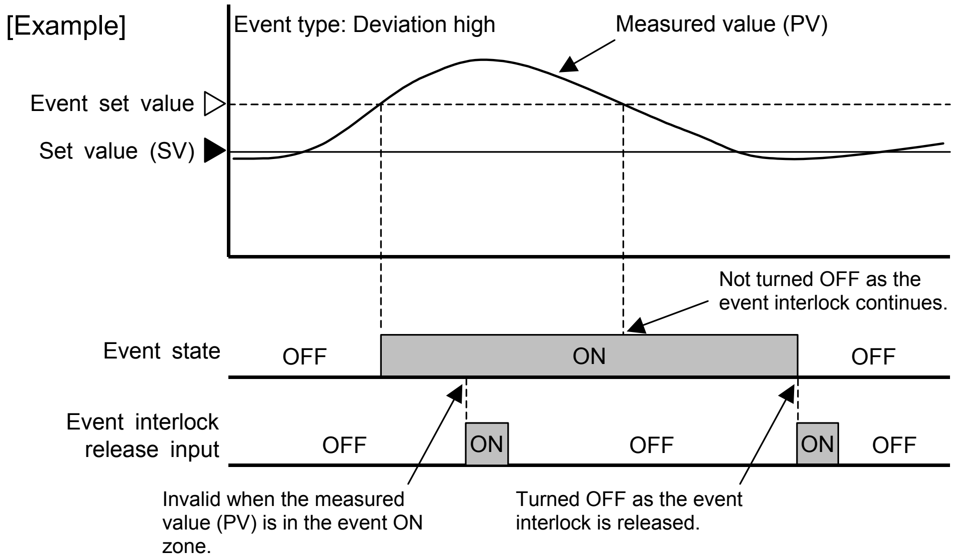
In addition, it is possible to perform Ramp/Soak control by linking each memory area. It is possible to perform Ramp/Soak control of up to sixteen segments (eight steps) per channel.



Interlock release	RKC communication identifier	AR
	Modbus register address	0042H (66)

The event state is turned OFF when the event ON state is continued by the event interlock function.

Attribute: R/W
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range: 0: Normal state
1: Interlock release execution
Related parameters: Event interlock (P. 8-83)
Factory set value: 0 (Normal state)
Function: The following example shows how the event interlock is released.



To enable the interlock function, the interlock item of Event 1 to Event 4 must be set to “1: Used”.

Event 1 set value (EV1)	RKC communication identifier	A1
	Modbus register address	ch1: 0076H (118) ch3: 0078H (120) ch2: 0077H (119) ch4: 0079H (121)
Event 2 set value (EV2)	RKC communication identifier	A2
	Modbus register address	ch1: 007AH (122) ch3: 007CH (124) ch2: 007BH (123) ch4: 007DH (125)
Event 3 set value (EV3)	RKC communication identifier	A3
	Modbus register address	ch1: 007EH (126) ch3: 0080H (128) ch2: 007FH (127) ch4: 0081H (129)
Event 4 set value (EV4)	RKC communication identifier	A4
	Modbus register address	ch1: 0082H (130) ch3: 0084H (132) ch2: 0083H (131) ch4: 0085H (133)

Use to set setting value of an event action.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range:
Deviation action [1]: –Input span to +Input span
Deviation action between channels [1]: –Input span to +Input span
Process action [2]: Input scale low to Input scale high
SV action [2]: Input scale low to Input scale high
MV action (heat-side, cool-side)[2]: –5.0 to +105.0 %
Temperature rise completion range (Event 3 only)[3]:
–Input span to +Input span

[1] Deviation high, Deviation low, Deviation high/low, Band
[2] high, low
[3] When temperature rise completion is selected for the Event 3 type.

Factory set value: 50
Related parameters: Event type (P. 8-77), Event hold action (P. 8-81), Event differential gap (P. 8-84), Event delay timer (P. 8-85), Force ON of Event action (P. 8-87)

When "9: Temperature rise completion" is selected for the Event 3 type, the Event 3 setting will be the range for determining temperature rise completion.
For information on the temperature rise completion function, see **Event Type (P. 8-77).**

When "9: Control loop break alarm (LBA)" is selected for the Event 4 type, the Event 4 setting will be RO.

Control loop break alarm (LBA) time	RKC communication identifier	A5
	Modbus register address	ch1: 0086H (134) ch3: 0088H (136) ch2: 0087H (135) ch4: 0089H (137)

The LBA time sets the time required for the LBA function to determine there is a loop failure. When the LBA is output (under alarm status), the LBA function still monitors the measured value (PV) variation at an interval of the LBA time.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0 to 7200 seconds (0: Unused)
Related parameters: LBA deadband (P. 8-22), Event 4 type (P. 8-77)
Factory set value: 480 seconds
Function: The control loop break alarm (LBA) function is used to detect a load (heater) break or a failure in the external actuator (power controller, magnet relay, etc.), or a failure in the control loop caused by an input (sensor) break.
The LBA function is activated when control output reaches 0 % (low limit with output limit function) or 100 % (high limit with output limit function). LBA monitors variation of the measured value (PV) for the length of LBA time, and when the LBA time has passed and the PV is still within the alarm determination range, the LBA will be output.

[Alarm action]

LBA determination range: Temperature input: 2 °C [2 °F] fixed
Voltage/current input: 0.2% fixed

- **Heat control**

	When the output reaches 0 % (low limit with output limit function)	**When the output exceeds 100 % (high limit with output limit function)**
For reverse action	When the LBA time has passed and the PV has not fallen below the alarm determination range, the alarm will be turned on.	When the LBA time has passed and the PV has not risen beyond the alarm determination range, the alarm will be turned on.
For direct action	When the LBA time has passed and the PV has not risen beyond the alarm determination range, the alarm will be turned on.	When the LBA time has passed and the PV has not risen beyond the alarm determination range, the alarm will be turned on.

- **Heat/cool control**

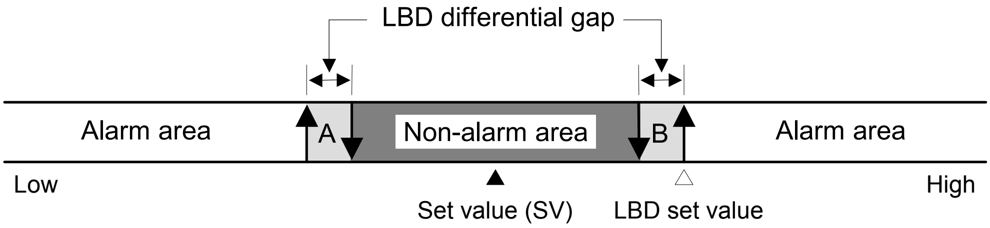
When the heat-side output exceeds 100 % (high limit with heat-side output limit function) and the cool-side output reaches 0 %	**When the heat-side output reaches 0 % and the cool-side output exceeds 100 % (high limit with cool-side output limit function)**
When the LBA time has passed and the PV has not risen beyond the alarm determination range, the alarm will be turned on.	When the LBA time has passed and the PV has not fallen below the alarm determination range, the alarm will be turned on.

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

LBA deadband	RKC communication identifier	N1
	Modbus register address	ch1: 008AH (138) ch3: 008CH (140) ch2: 008BH (139) ch4: 008DH (141)

Control loop break alarm (LBA) deadband gives a neutral zone to prevent the control loop break alarm (LBA) from malfunctioning caused by disturbance.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0 (0.0) to Input span
Related parameters: Control loop break alarm (LBA) time (P. 8-21), Event 4 type (P. 8-77)
Factory set value: 0 (0.0)
Function: The LBA may malfunction due to external disturbance from outside even when the control does not have any problem. To prevent malfunctioning due to external disturbance, LBA deadband (LBD) sets a neutral zone in which LBA is not activated.
When the measured value (PV) is within the LBD area, LBA will not be activated.
If the LBD setting is not correct, the LBA will not work correctly.



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

LBD differential gap: TC/RTD input: 0.8 °C (0.8 °F)
Voltage/current input: 0.8 % of span

If the LBA function detects an error occurring in the control loop, but cannot specify the location, a check of the control loop in order. The LBA function does not detect a location which causes alarm status. If LBA alarm is ON, check each device or wiring of the control loop.

When AT function is activated or the controller is in STOP mode, the LBA function is not activated.

If the LBA setting time match the controlled object requirements, the LBA setting time should be adjusted. If setting time is not correct, the LBA will malfunction by turning on or off at inappropriate time or not turning on at all.

While the LBA is ON (under alarm status), the following conditions cancel the alarm status and LBA will be OFF.
- The measured value (PV) rises beyond (or falls below) the LBA determination range within the LBA time.
- The measured value (PV) enters within the LBA deadband.

Set value (SV) [Local set value (SV)]	RKC communication identifier	S1
	Modbus register address	ch1: 008EH (142) ch3: 0090H (144) ch2: 008FH (143) ch4: 0091H (145)

Set value (SV) is desired value of the control.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: Setting limiter (low) to Setting limiter (high)
Factory set value: TC/RTD input: 0 °C [°F]
Voltage/current input: 0.0 %
Related parameters: Input type (P. 8-69), Setting limiter (high/low) (P. 8-125)

Proportional band [heat-side]	RKC communication identifier	P1
	Modbus register address	ch1: 0092H (146) ch3: 0094H (148) ch2: 0093H (147) ch4: 0095H (149)
Proportional band [cool-side]	RKC communication identifier	P2
	Modbus register address	ch1: 00A2H (162) ch3: 00A4H (164) ch2: Unused ch4: Unused

Use to set the proportional band of the P, PI, PD and PID control.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: Proportional band [heat-side]:
TC/RTD input: 0 (0.0) to Input span (Unit: °C [°F])
Voltage/current input: 0.0 to 1000.0 % of input span
0 (0.0): ON/OFF action
(Heat/Cool PID control: heat-side and cool-side are both ON/OFF action)
Proportional band [cool-side]:
TC/RTD input: 1 (0.1) to Input span (Unit: °C [°F])
Voltage/current input: 0.1 to 1000.0 % of input span
Factory set value: Proportional band [heat-side]:
TC/RTD input: 30 °C [°F]
Voltage/current input: 30.0 %
Proportional band [cool-side]:
TC/RTD input: 30 °C [°F]
Voltage/current input: 30.0 %
Related parameters: Overlap/Deadband (P. 8-27), Decimal point position (P. 8-71),
Control action (P. 8-95), ON/OFF action differential gap (upper/lower) (P. 8-102)

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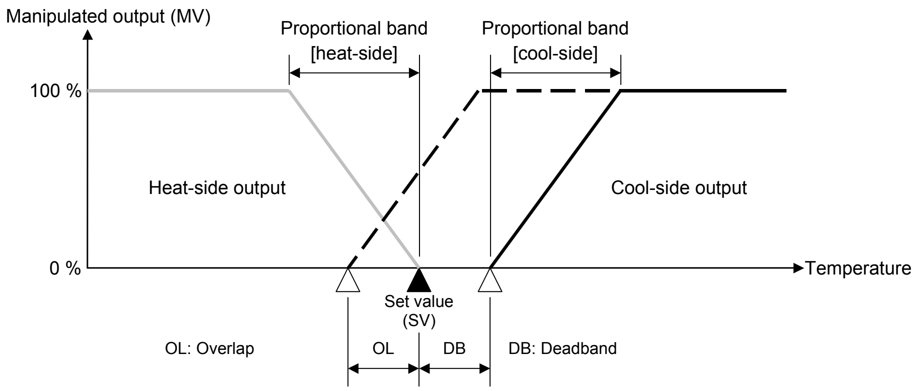
Function: In heat/cool control, only one module enables heat and cool control. For example, this is effective when cool control is required in extruder cylinder temperature control.



The proportional band [cool-side] is valid only during heat/cool PID control.

Integral time [heat-side]	RKC communication identifier	I1
	Modbus register address	ch1: 0096H (150) ch3: 0098H (152) ch2: 0097H (151) ch4: 0099H (153)
Integral time [cool-side]	RKC communication identifier	I2
	Modbus register address	ch1: 00A6H (166) ch3: 00A8H (168) ch2: Unused ch4: Unused

Integral action is to eliminate offset between set value (SV) and measured value (PV) by proportional action. The degree of Integral action is set by time in seconds.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: Integral time [heat-side]
PID control or Heat/Cool PID control: 0 to 3600 seconds or 0.0 to 1999.9 seconds
0 (0.0): Integral time OFF (PD action)
Position proportioning control: 1 to 3600 seconds or 0.1 to 1999.9 seconds
Integral time [cool-side] 0 to 3600 seconds or 0.0 to 1999.9 seconds
0 (0.0): Integral time OFF (PD action)
Factory set value: Integral time [heat-side] 240 seconds
Integral time [cool-side] 240 seconds
Related parameters: Control action (P. 8-95), Integral/derivative time decimal point position (P. 8-100)

The integral time [cool-side] is valid only during heat/cool PID control.

When the heat-side or cool-side integral time is set to zero for heat/cool PID control, PD action will take place for both heat-side and cool-side.

Derivative time [heat-side]	RKC communication identifier	D1
	Modbus register address	ch1: 009AH (154) ch3: 009CH (156) ch2: 009BH (155) ch4: 009DH (157)
Derivative time [cool-side]	RKC communication identifier	D2
	Modbus register address	ch1: 00AAH (170) ch3: 00ACH (172) ch2: Unused ch4: Unused

Derivative action is to prevent rippling and make control stable by monitoring output change. The degree of Derivative action is set by time in seconds.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: Derivative time [heat-side]: 0 to 3600 seconds or 0.0 to 1999.9 seconds
0 (0.0): Derivative time OFF (PI action)
Derivative time [cool-side]: 0 to 3600 seconds or 0.0 to 1999.9 seconds
Derivative time [cool-side]: 0 (0.0): Derivative time OFF (PI action)
Factory set value: Derivative time [heat-side]: 60 seconds
Derivative time [cool-side]: 60 seconds
Related parameters: Control action (P. 8-95), Integral/derivative time decimal point position (P. 8-100), Derivative gain (P. 8-101)

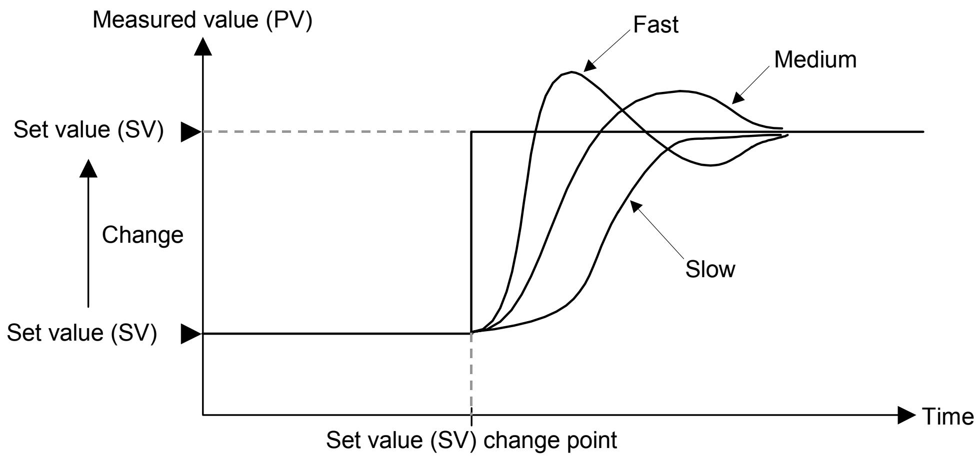
The derivative time [cool-side] is valid only during heat/cool PID control.

Control response parameter	RKC communication identifier	CA
	Modbus register address	ch1: 009EH (158) ch3: 00A0H (160) ch2: 009FH (159) ch4: 00A1H (161)

The control response for the set value (SV) change can be selected among Slow, Medium, and Fast.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0: Slow
1: Medium
2: Fast
Factory set value: PID control, Position proportioning control: 0 (Slow)
Heat/Cool PID control: 2 (Fast)
Related parameters: Control action (P. 8-95)
Function: The control response for the set value (SV) change can be selected among Slow, Medium, and Fast. If a fast response is required, Fast is chosen. Fast may cause overshoot. If overshoot is critical, Slow is chosen.

Fast	Selected when rise time needs to be shortened (operation needs to started fast). However in this case, slight overshooting may not be avoided.
Medium	Middle between "Fast" and "Slow". Overshooting when set to "Medium" becomes less than that when set to "Fast".
Slow	Selected when no overshooting is allowed. Used when material may be deteriorated if the temperature becomes higher that the set value.



For P control and PD control, the control response is fixed at 2 (Fast).

Overlap/Deadband	RKC communication identifier	V1
	Modbus register address	ch1: 00AEH (174) ch3: 00B0H (176) ch2: 00AFH (175) ch4: 00B1H (177)

This is the overlapped range of proportional bands (on the heat and cool sides) or the deadband range when Heat/Cool PID control is performed.

Attribute: R/W

Digits: 7 digits

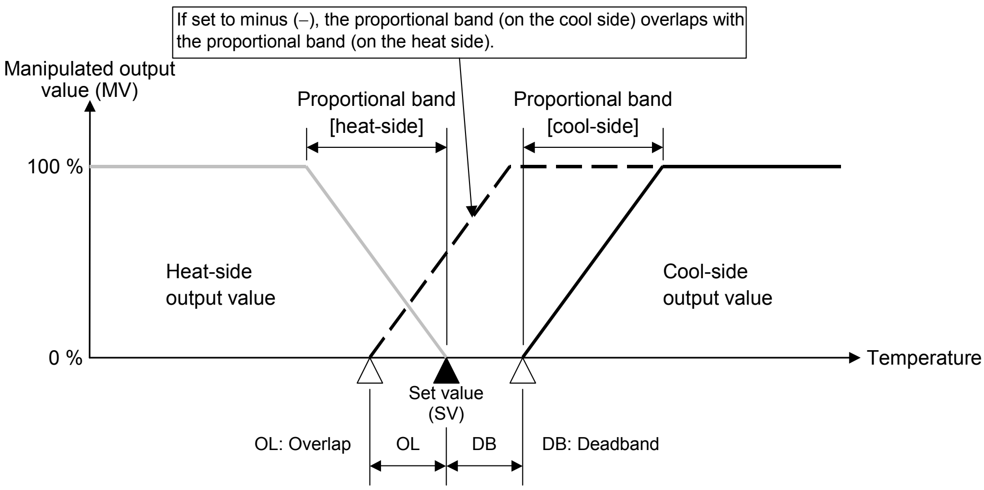
Number of data: 4 (Data of each channel)

Data range: TC/RTD input: −Input span to +Input span (Unit: °C [°F])
Voltage (V)/Current (I) input: −100.0 to +100.0 % of Input span

Factory set value: TC/RTD input: 0 °C [°F]
Voltage (V)/Current (I) input: 0.0 %

Related parameters: Proportional band [heat-side/cool-side] (P. 8-23), Control action (P. 8-95)

Function: Overlap (OL):
Range in which the proportional band [heat-side] and the proportional band [cool-side] are overlapped. If a measured value (PV) is within the overlapped range, manipulated output values (heat-side and cool-side) may be simultaneously output.
Deadband (DB):
This is a control dead zone existing between the proportional band [heat-side] and the proportional band [cool-side]. If a measured value (PV) is within the deadband range, neither the manipulated output value (heat-side) nor the manipulated output value (cool-side) is output.



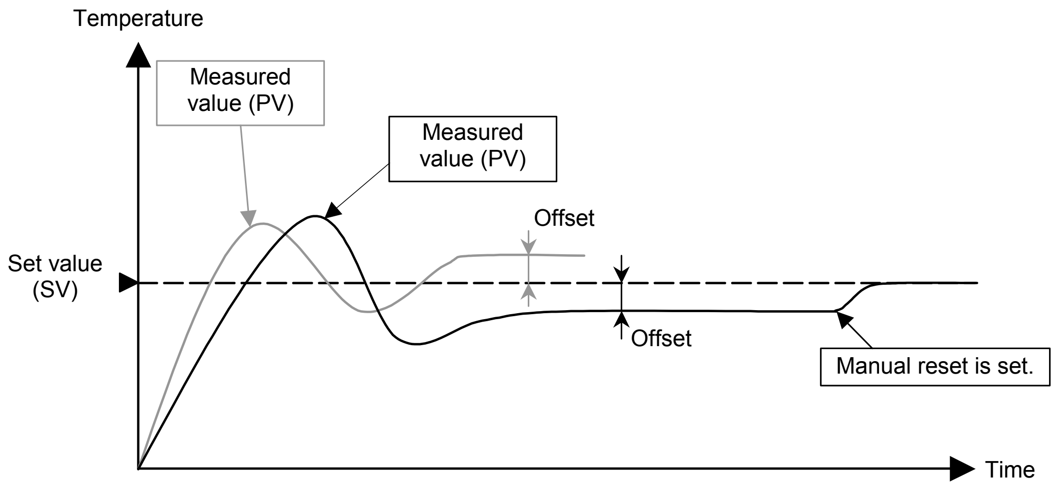
Minus (−) setting results is overlap. However, the overlapping range is limited to the proportional band [heat-side] set range or the proportional band [cool-side] set range, whichever is smaller.

Manual reset	RKC communication identifier	MR
	Modbus register address	ch1: 00B2H (178) ch3: 00B4H (180) ch2: 00B3H (179) ch4: 00B5H (181)

In order to eliminate the offset occurring in proportional (P) control, the manipulated output value is manually corrected.

When the Manual reset is set to the plus (+) side:
The manipulated output value under the stable condition increases by the manual reset value.
When the Manual reset is set to the minus (–) side:
The manipulated output value under the stable condition decreases by the manual reset value.

Attribute: R/W
When the integral function is enabled, the manual reset is RO.
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: –100.0 to +100.0 %
Factory set value: 0.0 %
Related parameters: Integral time [heat-side/cool-side] (P. 8-24)
Function: This is the function used to manually correct the offset when in proportional (P) control or PD control.
Offset means the deviation of the actual when the manipulated output value becomes stabilized (stable state). If the manual reset value varies, the manipulated output value also changes.



To enable the manual reset function, either integral time [heat-side] or integral time [cool-side] must be set to zero.

Setting change rate limiter (up)	RKC communication identifier	HH
	Modbus register address	ch1: 00B6H (182) ch3: 00B8H (184) ch2: 00B7H (183) ch4: 00B9H (185)
Setting change rate limiter (down)	RKC communication identifier	HL
	Modbus register address	ch1: 00BAH (186) ch3: 00BCH (188) ch2: 00BBH (187) ch4: 00BDH (189)

This function is to allow the set value (SV) to be automatically changed at specific rates when a new set value (SV).

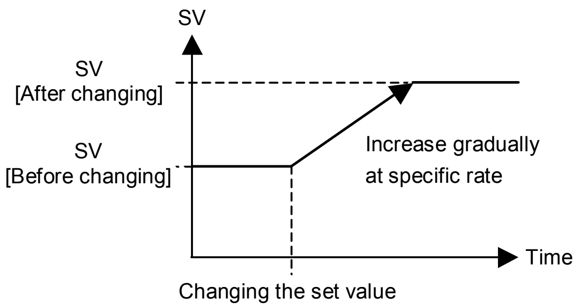
Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0 (0.0) to Input span/unit time *
0 (0.0): Unused
* Unit time: 60 seconds (Factory set value)
Factory set value: Setting change rate limiter (up): 0
Setting change rate limiter (down): 0
Related parameters: Setting change rate limiter unit time (P. 8-124)

● Setting change rate limiter

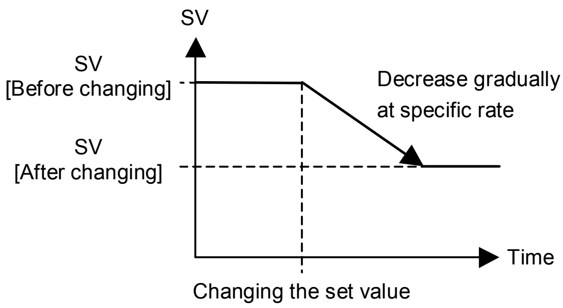
This function is to allow the set value (SV) to be automatically changed at specific rates when a new set value (SV). Setting change rate limiter (up) is used when the SV is changed to a higher SV. Setting change rate limiter (down) is used when the SV is changed to a lower SV.

[Application examples of setting change rate limiter]

• Increasing the SV to a higher value



• Decreasing the SV to a lower value



When the setting change rate limiter is used, the SV will also ramp up or ramp down by the function at power-on and operation mode change from STOP to RUN.

If the autotuning (AT) function is activated while the SV is ramping up or ramping down by the setting change rate limiter, AT will starts after the SV finishes ramp-up or ramp-down by the limiter, and the controller is in PID control mode until AT starts.

When the value of setting change rate limiter is changed during normal operation, the ramp-up or ramp-down rate will be changed unless the SV already has finished ramp-up or ramp-down by the function.

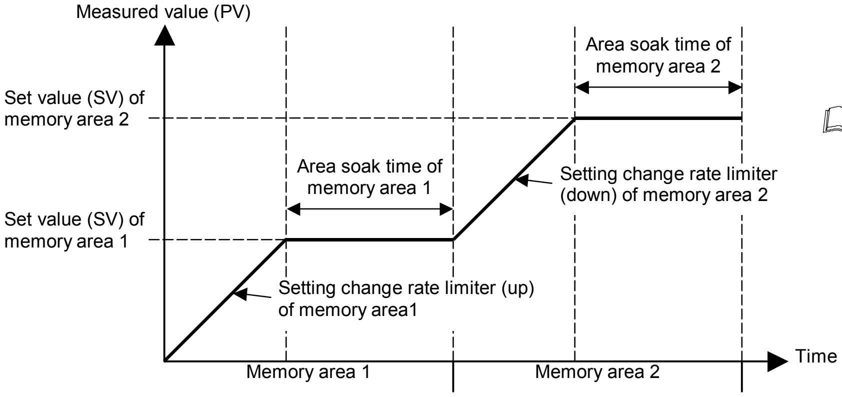
If the rate of setting change limiter is set to any value other than "0: Unused", the event re-hold action to be taken by a set value (SV) change becomes invalid.

Area soak time	RKC communication identifier	TM
	Modbus register address	ch1: 00BEH (190) ch3: 00C0H (192) ch2: 00BFH (191) ch4: 00C1H (193)

This is the time required until transferred to the Link area number when performing Ramp/Soak control.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: RKC communication:
0 minutes 00 seconds to 199 minutes 59 seconds: 0:00 to 199:59 (min:sec)
0 hours 00 minutes to 99 hours 59 minutes: 0:00 to 99:59 (hrs:min)
Modbus:
0 minutes 00 seconds to 199 minutes 59 seconds: 0 to 11999 seconds
0 hours 00 minutes to 99 hours 59 minutes: 0 to 5999 minutes
Factory set value: RKC communication: 0:00
Modbus: 0
Related parameters: Soak time unit (P. 8-124)
Function: Area Soak Time is used for ramp/soak control function in conjunction with Link Area Number and Setting Change Rate Limiter (up/down).

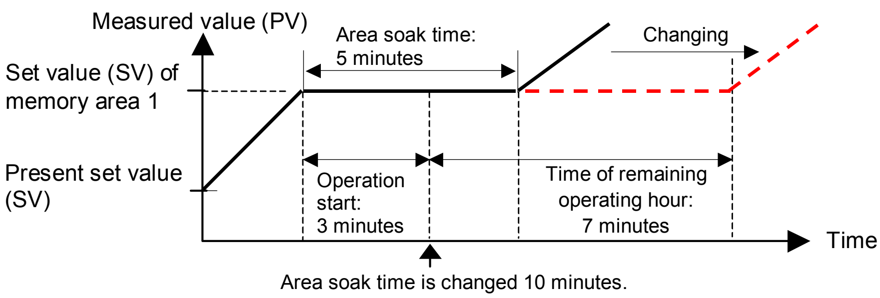
[Application examples of area soak time]



The area soak time for the memory area linked last becomes invalid to continue the state of the set value (SV) reached.

Time required while the setting change rate limiter is being operated is not included in the area soak time.

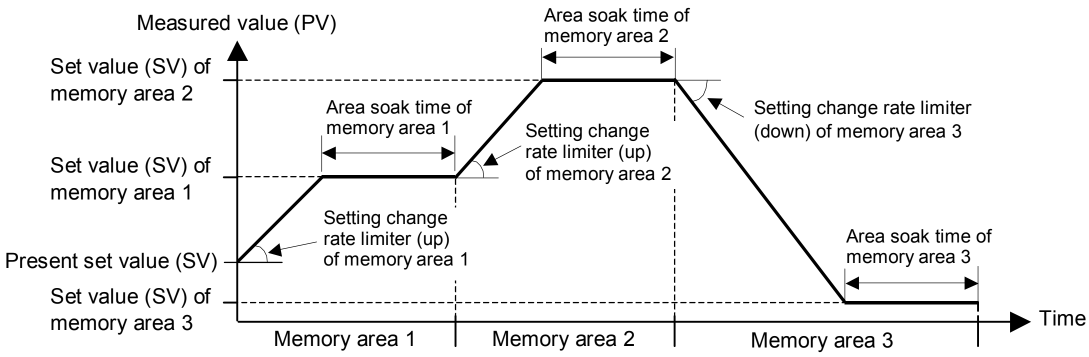
The Area Soak Time can be changed during normal operation with ramp/soak control function, but Read the following example carefully how the time change affects ramp/soak control time.
For example, the Memory area which has 5-minute soak time is executed.
When 3 minutes passed, the Area Soak Time is changed from 5 minutes to 10 minutes.
The remaining time of the currently executed Memory Area is calculated as follows.
(The new soak time 10 minutes) – (lapsed time 3 minutes) = (remaining time 7 minutes)
The old soak time does not have any effect on remaining time.



Link area number	RKC communication identifie	LP
	Modbus register address	ch1: 00C2H (194) ch3: 00C4H (196) ch2: 00C3H (195) ch4: 00C5H (197)

Memory area numbers for linking the corresponding memory areas are set when Ramp/Soak control is performed.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0 to 8
(0: No link)
Factory set value: 0
Function: Link Area Number is used for ramp/soak control function in conjunction with Area Soak Time and Setting Change Rate Limiter (up/down).



The area soak time for the memory area linked last becomes invalid to continue the state of the set value (SV) reached.

Heater break alarm (HBA) set value	RKC communication identifier	A7
	Modbus register address	ch1: 00C6H (198) ch3: 00C8H (200) ch2: 00C7H (199) ch4: 00C9H (201)

HBA is to set the set values for the heater break alarm (HBA) function. The HBA function detects a fault in the heating circuit by monitoring the current flowing through the load by a dedicated current transformer (CT).

For type "A" HBA,
- Set the set value to approximately 85 % of the maximum reading of the CT input.
- Set the set value to a slightly smaller value to prevent a false alarm if the power supply may become unstable.
- When more than one heater is connected in parallel, it may be necessary to increase the HBA set value to detect a single heater failure.

For type "B" HBA,
Set the set value to the maximum CT input value. This will be the current when the control is at 100 % control output. The set value is used to calculate the width of a non-alarm range.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: When the CT type is CTL-6-P-N: 0.0 to 30.0 A (0.0: Not used)
When the CT type is CTL-12-S56-10L-N: 0.0 to 100.0 A (0.0: Not used)
Factory set value: 0.0 A
Related parameters: Comprehensive event state (P. 8-4),
Current transformer (CT) input value monitor (P. 8-7),
Heater break alarm (HBA) state monitor (P. 8-9),
Heater break determination point (P. 8-34),
Heater melting determination point (P. 8-34),
CT ratio (P. 8-89), CT assignment (P. 8-89),
Heater break alarm (HBA) type (P. 8-90),
Number of heater break alarm (HBA) delay times (P. 8-91)

Function:

< Heater break alarm (HBA) type A >

Heater Break Alarm (HBA) type A can only be used with time-proportional control output (relay, voltage pulse, or triac output). The HBA function monitors the current flowing through the load by a dedicated current transformer (CT), compares the measured value with the HBA set values, and detects a fault in the heating circuit.

Low or No current flow (Heater break, malfunction of the control device, etc.):

When the control output is ON and the CT input value is equal to or less than the heater break determination point for the preset number of consecutive sampling cycles, an alarm is activated. However, heater break alarm does not action when control output ON time is 0.1 second or less.

Over current or short-circuit:

When the control output is OFF and the CT input value is equal to or greater than the heater break determination point for the preset number of consecutive sampling cycles, an alarm is activated. However, heater break alarm does not action when control output ON time is 0.1 second or less.

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< Heater break alarm (HBA) type B >

Heater Break Alarm (HBA) type B can be used with both continuous control output (current/voltage continuous output) and time-proportional control output (relay, voltage pulse output, or triac). The HBA function assumes that the heater current value is proportional* to the control output value of the controller, otherwise viewed as the manipulated variable (MV), and compare it with the CT input value to detect a fault in the heating or cooling circuit.

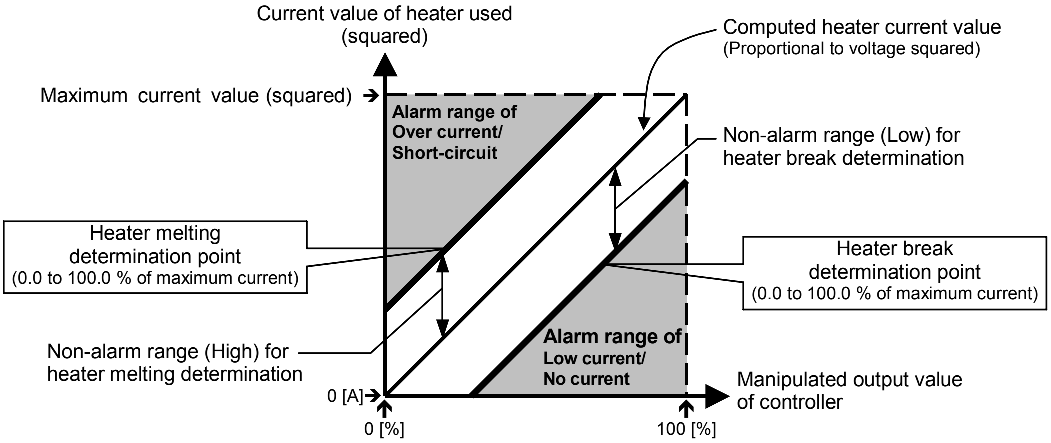
* It is assumed that the current value flowing through the load is at maximum when the control output from the controller is 100 %, and the minimum current value flowing through the load is zero (0) when the control output from the controller is 0 %.

Low or No current flow (Heater break, malfunction of the control device, etc.)

The alarm determination point (Low) is calculated as follows:
(Non-alarm range (Low) width) = (Heater break determination point) × (HBA set value)
(Alarm determination point (Low)) = ((HBA set value) × (MV)) – (Non-alarm range (Low) width)
When the CT input value is equal to or less than the heater break determination point for the preset number of consecutive sampling cycles, an alarm status is produced.

Over current or short-circuit

The alarm determination point (High) is calculated as follows:
(Non-alarm range (High) width) = (Heater melting determination point) × (HBA set value)
(Alarm determination point (High)) = ((HBA set value) × (MV)) + (Non-alarm range (High) width)
When the CT input value is equal to or greater than the heater melting determination point for the preset number of consecutive sampling cycles, an alarm status is produced.



The current factory set values of the heater break determination point and the heater melting determination point are set to 30.0 %. If any of the following conditions exists, set them to a slightly larger value to prevent a false alarm.

- **Heater current values is not proportional to the control output in Phase control.**
- **There is difference on control output accuracy between the controller and the operating unit (SCR Power Controller).**
- **There is a delay on control output between the controller and the operating unit (SCR Power Controller).**

The factory set value of the HBA type is heater break alarm (HBA) type B.

Heater break determination point	RKC communication identifier	NE
	Modbus register address	ch1: 00CAH (202) ch3: 00CCH (204) ch2: 00CBH (203) ch4: 00CDH (205)

Set the heater break determination point for the heater break alarm (HBA) type B.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.0 to 100.0 % of HBA set value
(0.0: Heater break determination is invalid)
Factory set value: 30.0 %
Related parameters: Comprehensive event state (P. 8-4),
Heater break alarm (HBA) state monitor (P. 8-9),
Heater break alarm (HBA) set value (P. 8-32),
Heater melting determination point (P. 8-34),
CT assignment (P. 8-89), Heater break alarm (HBA) type (P. 8-90),
Number of heater break alarm (HBA) delay times (P. 8-91)
Function: See **Heater break alarm (HBA) set value (P. 8-32).**

Heater melting determination point	RKC communication identifier	NF
	Modbus register address	ch1: 00CEH (206) ch3: 00D0H (208) ch2: 00CFH (207) ch4: 00D1H (209)

Set the heater melting determination point for the heater break alarm (HBA) type B.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.0 to 100.0 % of HBA set value
(0.0: Heater melting determination is invalid)
Factory set value: 30.0 %
Related parameters: Comprehensive event state (P. 8-4),
Heater break alarm (HBA) state monitor (P. 8-9),
Heater break alarm (HBA) set value (P. 8-32),
Heater break determination point (P. 8-34),
CT assignment (P. 8-89), Heater break alarm (HBA) type (P. 8-90),
Number of heater break alarm (HBA) delay times (P. 8-91)
Function: See **Heater break alarm (HBA) set value (P. 8-32)**

PV bias	RKC communication identifier	PB
	Modbus register address	ch1: 00D2H (210) ch3: 00D4H (212) ch2: 00D3H (211) ch4: 00D5H (213)

PV bias adds bias to the measured value (PV). The PV bias is used to compensate the individual variations of the sensors or correct the difference between the measured value (PV) of other instruments.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: −Input span to +Input span
Factory set value: 0

PV digital filter	RKC communication identifier	F1
	Modbus register address	ch1: 00D6H (214) ch3: 00D8H (216) ch2: 00D7H (215) ch4: 00D9H (217)

This item is the time of the first-order lag filter eliminate noise against the measured input.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.0 to 100.0 seconds
(0.0: Unused)
Factory set value: 0.0 seconds

PV ratio	RKC communication identifier	PR
	Modbus register address	ch1: 00DAH (218) ch3: 00DCH (220) ch2: 00DBH (219) ch4: 00DDH (221)

PV ratio is a multiplier to be applied to the measured value (PV). The PV ratio is used to compensate the individual variations of the sensors or correct the difference between the measured value (PV) of other instruments.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.500 to 1.500
Factory set value: 1.000

PV low input cut-off	RKC communication identifier	DP
	Modbus register address	ch1: 00DEH (222) ch3: 00E0H (224) ch2: 00DFH (223) ch4: 00E1H (225)

PV low input cut-off is used with Square Root Extraction function. The measured value less than the PV low input cut-off is ignored to prevent control disturbance caused by input variation at low measured value range.

Attribute: R/W
When square root extraction is "0: Unused", the PV low input cut-off will be RO (Only reading data is possible).

Digits: 7 digits

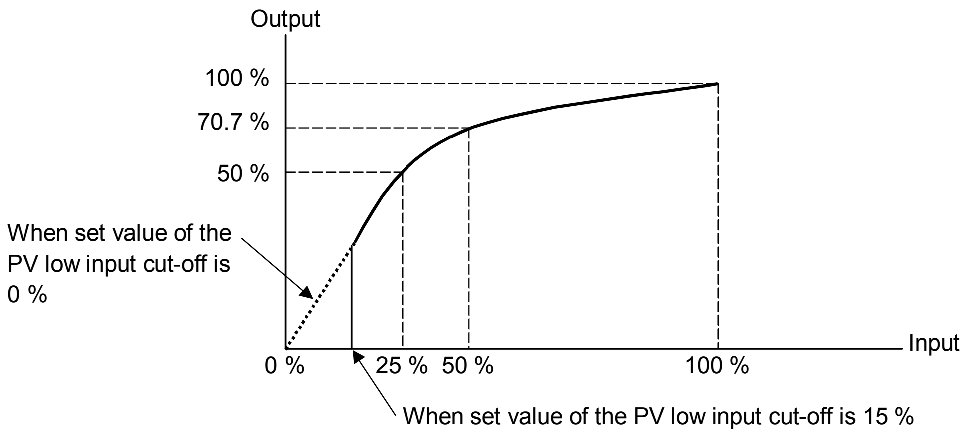
Number of data: 4 (Data of each channel)

Data range: 0.00 to 25.00 % of input span

Factory set value: 0.00 %

Related parameters: Square root extraction (P. 8-74)

Function: When input signal square root extraction is used for in flow control, etc., the square root extraction result varies widely at the low measured value range. The measured value less than the PV low input cut-off is ignored to calculate control output in order to prevent control disturbance caused by input variation at low measured value range.



RS bias	RKC communication identifier	RB
	Modbus register address	ch1: 00E2H (226) ch3: 00E4H (228) ch2: 00E3H (227) ch4: 00E5H (229)

RS bias adds bias to the remote setting (RS) input value.

Attribute: R/W

Digits: 7 digits

Number of data: 4 (Data of each channel)

Data range: –Input span to +Input span

Factory set value: 0

Related parameters: Remote/Local transfer (P. 8-17), SV select function (P. 8-127),
Remote SV function master channel module address (P. 8-133),
Remote SV function master channel selection (P. 8-134)

When the cascade control is selected, this is used as the cascade bias.
When the ratio setting is selected, this is used as the ratio setting bias.

RS digital filter	RKC communication identifier	F2
	Modbus register address	ch1: 00E6H (230) ch3: 00E8H (232) ch2: 00E7H (231) ch4: 00E9H (233)

This item is the time of the first-order lag filter eliminate noise against the remote setting input.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.0 to 100.0 seconds
(0.0: Unused)
Factory set value: 0.0 seconds
Related parameters: Remote/Local transfer (P. 8-17), SV select function (P. 8-127), Remote SV function master channel module address (P. 8-133), Remote SV function master channel selection (P. 8-134)

When the cascade control is selected, this is used as the cascade digital filter.
When the ratio setting is selected, this is used as the ratio setting digital filter.

RS ratio	RKC communication identifier	RR
	Modbus register address	ch1: 00EAH (234) ch3: 00ECH (236) ch2: 00EBH (235) ch4: 00EDH (237)

RS ratio is a multiplier to be applied to the remote setting (RS) input value.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.001 to 9.999
Factory set value: 1.000
Related parameters: Remote/Local transfer (P. 8-17), SV select function (P. 8-127), Remote SV function master channel module address (P. 8-133), Remote SV function master channel selection (P. 8-134)

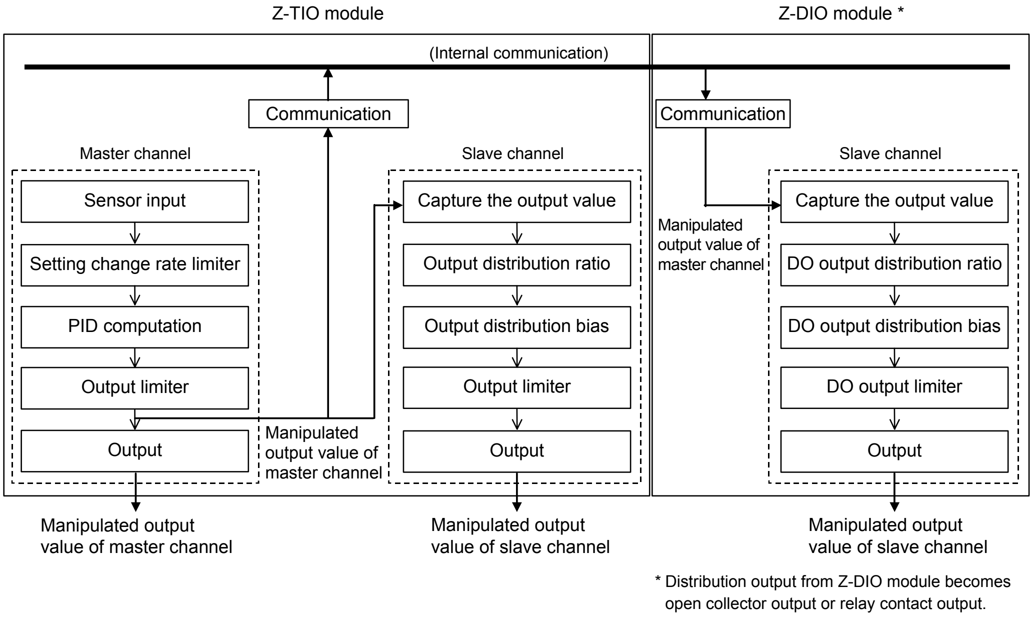
When the cascade control is selected, this is used as the cascade ratio.
When the ratio setting is selected, this is used as the ratio setting ratio.

Output distribution selection	RKC communication identifier	DV
	Modbus register address	ch1: 00EEH (238) ch3: 00F0H (240) ch2: 00EFH (239) ch4: 00F1H (241)

Select whether or not the manipulated output value of the specified master channel is output from slave channels.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0: Control output (master channel)
1: Distribution output (slave channel)
Factory set value: 0 (Control output)
Related parameters: Output distribution bias (P. 8-40), Output distribution ratio (P. 8-40), Output distribution master channel module address (P. 8-133), Output distribution master channel selection (P. 8-136)
Function: The output distribution function outputs the manipulated output value calculated for the master channel as a manipulated output value from slave channels. Bias and ratio calculations can also be applied to the manipulated output value calculated for the master channel before it is output from the slave channels.

Number of output distribution channels: 187 channels maximum
(excluding the master channel)
[When Z-DIO module: 16 modules, Z-TIO module 4CH type: 15 modules]



The manipulated output values of the master channel and slave channels are each output within the limit of the output limiter.

The output distribution function only functions within modules that are connected together (SRZ unit).

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● Operation flow

1. Set the Output distribution master channel module address

In the slave channel, set the module address of the module that includes the channel to be specified as the master channel.

Output distribution master channel module address:
−1 (Master channel is selected from itself)
0 to 99 (Master channel is selected from other modules)

2. Select the Output distribution master channel

In the slave channel, select the channel number of the channel that will be the master channel in the master channel module. This setting is not required in the master channel.

Output distribution master channel selection: 1 to 99

3. Output distribution selection

Set "0: Control output" in the master channel.
Set "1: Distribution output" in the slave channel.

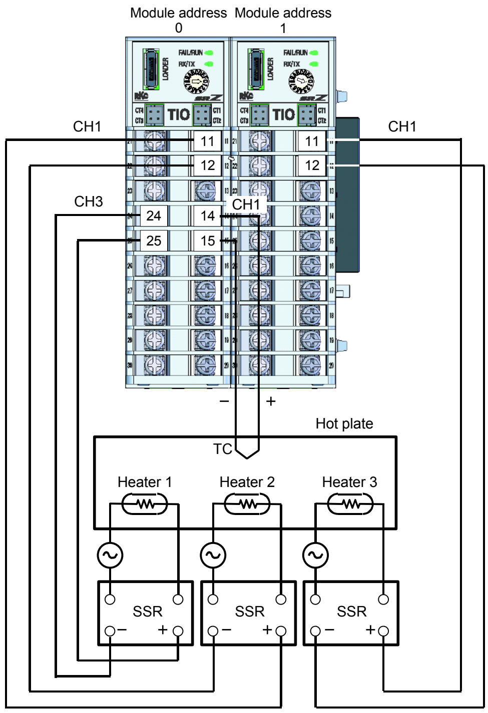
4. Control start

5. Ajust the Output distribution bias

6. Ajust the Output distribution ratio

In each slave, set the bias and ratio for the manipulated output value from the master. Select these settings as needed based on the actual operation state.

Example: Using two Z-TIO modules (4CH type)



Master/Slave:

Master/Slave	Module address	CH	Input	Output
Master channel (Heater 2)	Module address 0	CH1	Sensor input	Control output
Slave channel (Heater 1)	Module address 0	CH3		Distribution output
Slave channel (Heater 3)	Module address 1	CH1		Distribution output

Setting:

Setting items	Module address 0		Module address 1
	CH1 (Master)	CH3 (Slave)	CH1 (Slave)
Output distribution master channel module address		−1 or 0	0 (Set module address 0)
Output distribution master channel selection		1 (Set CH1)	1 (Set CH1)
Output distribution selection	**0 (Contro output)**	**1 (Distribution output)**	**1 (Distribution output)**
Output distribution bias		Set as needed	
Output distribution ratio		Set as needed	

Output distribution bias	RKC communication identifier	DW
	Modbus register address	ch1: 00F2H (242) ch3: 00F4H (244) ch2: 00F3H (243) ch4: 00F5H (245)

The bias which is added to the manipulated output value of the master channel that is distributed to slave channels and output.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: −100.0 to +100.0 %
Factory set value: 0.0 %
Related parameters: Output distribution selection (P. 8-38), Output distribution ratio (P. 8-40), Output distribution master channel module address (P. 8-135), Output distribution master channel selection (P. 8-136)

Output distribution ratio	RKC communication identifier	DQ
	Modbus register address	ch1: 00F6H (246) ch3: 00F8H (248) ch2: 00F7H (247) ch4: 00F9H (249)

The ratio (magnification) which is applied to the manipulated output value of the master channel that is distributed to slave channels and output.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: −9.999 to +9.999
Factory set value: 1.000
Related parameters: Output distribution selection (P. 8-38), Output distribution bias (P. 8-40), Output distribution master channel module address (P. 8-135), Output distribution master channel selection (P. 8-136)

Proportional cycle time	RKC communication identifier	T0
	Modbus register address	ch1: 00FAH (250) ch3: 00FCH (252) ch2: 00FBH (251) ch4: 00FDH (253)

Proportional Cycle Time is to set control cycle time for time based control output such as voltage pulse for SSR, triac, relay and open-collector output.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.1 to 100.0 seconds
Factory set value: Relay contact output: 20.0 seconds
Voltage pulse output (V), Triac output (T) and Open-collector output (D): 2.0 seconds
Related parameters: Output assignment (P. 8-75)

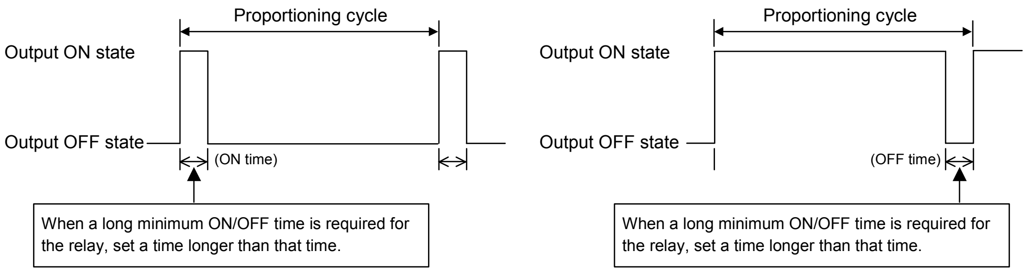
To set the proportioning cycle, “0: Control output” must be set in the output assignment item.

The proportional cycle time becomes invalid when the voltage/current output is selected.

Minimum ON/OFF time of proportioning cycle	RKC communication identifier	VI
	Modbus register address	ch1: 00FEH (254) ch3: 0100H (256) ch2: 00FFH (255) ch4: 0101H (257)

This is the minimum ON/OFF time of the time proportioning cycle.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0 to 1000 ms
Factory set value: 0 ms
Related parameters: Proportional cycle time (P. 8-40), Output assignment (P. 8-75)
Function: The minimum ON/OFF time of the proportioning cycle is used to prevent output ON or OFF when the output is greater than 0 % or less than 100 %. This is useful when you wish to establish a minimum ON/OFF time to prolong the life of the relay.



The minimum ON/OFF time of the proportioning cycle becomes invalid when the voltage/current output is selected.

Operation will not take place if "Proportional cycle time ≤ Minimum ON/OFF time of proportioning cycle".

Manual manipulated output value	RKC communication identifier	ON
	Modbus register address	ch1: 0102H (258) ch3: 0104H (260) ch2: 0103H (259) ch4: 0105H (261)

Use to set the output value in the manual control.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: PID control: Output limiter (low) to Output limiter (high)
Heat/cool PID control: −Cool-side output limiter (high) to +Heat-side output limiter (high)
Position proportioning control:
When there is feedback resistance (FBR) input and no feedback resistance (FBR) input is disconnected: Output limiter (low) to Output limiter (high)
When there is no feedback resistance (FBR) input or the feedback resistance (FBR) input is disconnected:
0: Close-side output OFF, Open-side output OFF
1: Close-side output ON, Open-side output OFF
2: Close-side output OFF, Open-side output ON

Factory set value: 0.0
Related parameters: Output limiter (high/low) (P. 8-107)

If position proportional control is changed from “Feedback resistance (FBR) input” to “No FBR input”, both open-side output and close-side output will turn OFF.

If an input disconnection occurs when “Feedback resistance (FBR) input” is used, the manual manipulated output value will start from the state “0 (close-side output OFF, open-side output OFF)”.

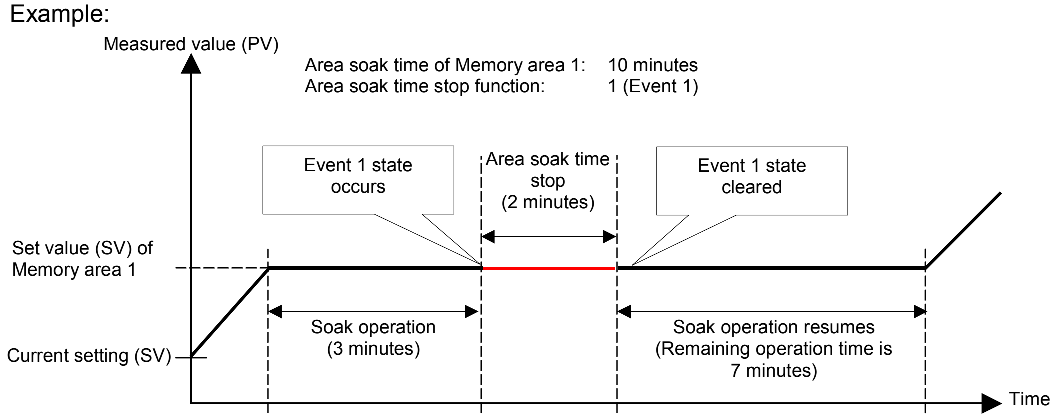
Following recovery from an input disconnection when “Feedback resistance (FBR) input” is used, the manual manipulated output value will be bumped to the current feedback resistance value.

Area soak time stop function	RKC communication identifier	RV
	Modbus register address	ch1: 0106H (262) ch3: 0108H (264) ch2: 0107H (263) ch4: 0109H (265)

Select the event for which the area soak time is to be stopped when an event state occurs.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0: No function
1: Event 1
2: Event 2
3: Event 3
4: Event 4
Factory set value: 0 (No function)
Related parameters: Area soak time (P. 8-30)
Function: The area soak time stop function stops the area soak time count when an event state occurs at the specified event output during soak operation. When the event state is cleared, the area soak time count stop is canceled and soak operation resumes from the state immediately prior to the stop.

Example:



EDS mode (for disturbance 1)	RKC communication identifier	NG
	Modbus register address	ch1: 010AH (266) ch3: 010CH (268) ch2: 010BH (267) ch4: 010DH (269)
EDS mode (for disturbance 2)	RKC communication identifier	NX
	Modbus register address	ch1: 010EH (270) ch3: 0110H (272) ch2: 010FH (271) ch4: 0111H (273)

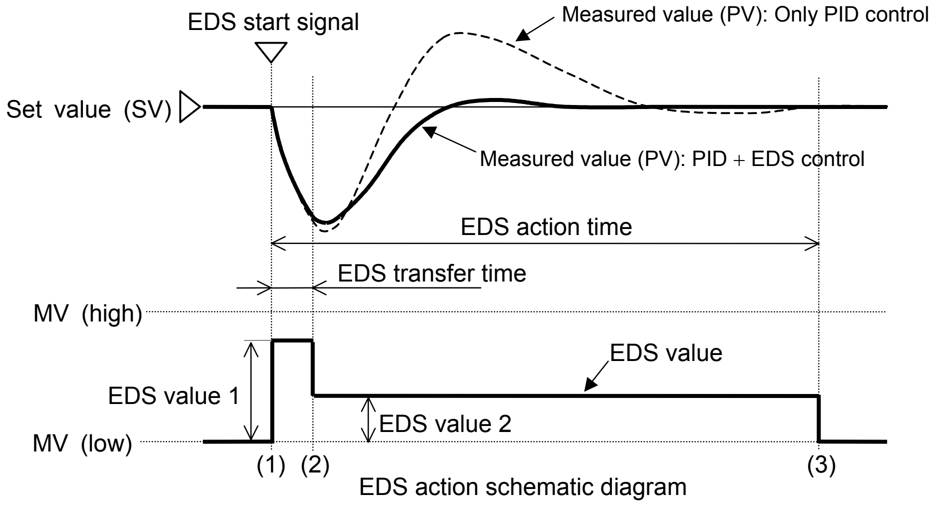
Select the mode of the EDS function (External disturbance suppression function).

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range:
0: No function
1: EDS function mode
2: Learning mode
3: Tuning mode

Factory set value: EDS mode (for disturbance 1): 0 (No function)
EDS mode (for disturbance 2): 0 (No function)

Related parameters: EDS value 1 (P. 8-48), EDS value 2 (P. 8-48), EDS transfer time (P. 8-49), EDS action time (P. 8-49), EDS action wait time (P. 8-50), EDS value learning times (P. 8-50), EDS start signal (P. 8-51)

Function: When an external disturbance that affects control occurs, the EDS function corrects and minimizes the effect of the disturbance before the effect (such as disturbance of the temperature) appears. The EDS function has three modes (tuning, learning, and EDS function). After tuning and learning are performed, control by the EDS function (EDS control) can be performed.
If EDS control is performed in cases where the disturbance generation timing is known in a temperature control sequence generating inevitable disturbances, temperature control after disturbance generation becomes more stable.



EDS action schematic diagram

(1) First, the EDS start signal is received and then the signal obtained by adding the EDS value 1 to the manipulated output (MV) is output.
(2) The signal obtained by adding the EDS value 2 to the manipulated output (MV) is output when the EDS transfer time elapses after EDS start.
(3) The EDS output value added is reset when the EDS action time elapses after EDS start or a new EDS start signal is generated to make processing so that no output may vary.

Two parameters (for disturbance 1, for disturbance 2) are available to enable responses to two different types of disturbances.

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As EDS action time, inexact time required until a single disturbance response converges is set. This time will be automatically calculated when tuning is performed, and will be the action time of the EDS control. In addition, EDS action wait time is set as wait time until the action is actually taken after the EDS start signal is received.

There is two types of EDS start signal: input via communication and input by digital input (DI). For DI, the Z-DIO module is required.

● Tuning mode/Learning mode/EDS function mode

If EDS control is performed for the first time or the set value (SV) or PID constants are changed even when EDS control is already performed, execute tuning and learning.

Avoid generating the next disturbance until disturbances generated when the EDS start signal is input converge and then stabilize (until the EDS action time elapses) while tuning and learning are being executed.

Tuning mode:

If the tuning is executed, the EDS transfer time, the EDS value 1, the EDS value 2, and EDS action time are automatically calculated and then set.

Learning mode:

If the learning is executed, the EDS transfer time, the EDS value 1, and the EDS value 2 calculated by the above tuning are revised to more appropriate values.

Set the number of learning times beforehand.

EDS function mode:

When the EDS function is executed, EDS control is performed using the EDS transfer time, EDS value 1, and EDS value 2, which were calculated and set by executing tuning and learning.

● Requirements for performing

- Control action should be set to PID or PI control.
- Input should not be abnormal (not exceed the input error determination point).
- The set value (SV) must not have changed
  (even if a setting change rate limiter is set, the SV must not have changed in accordance with the change rate)
- The settings of EDS value 1 and EDS value 2 must be other than “0.0”.
- The EDS mode selection must not be “0: No function”.

The output change rate limiter should be set. The desired result of disturbance rejection may not be obtained.

The EDS function does not support heat/cool control or position proportioning control.

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● Requirements for normal end and suspending

[Normal end]

- When the EDS action time elapses after EDS control starts following EDS start signal input
- When a new EDS start signal is input (in this case, EDS control is re-started within the same sampling period or after a lapse of the EDS action wait time.)

[Requirements for suspending]

- When "EDS mode selection," "EDS value 1," "EDS value 2," "EDS transfer time" or "EDS action wait time" is changed
- When "set value (SV)," "proportional band," "integral time" or "derivative time" is changed
- When the requirements for taking action are not satisfied any more

No control is suspended even if the "EDS action time" is changed during EDS control. The changed EDS action time becomes valid when the next EDS start signal is input.

● Operating Procedure for EDS function

The procedure for performing EDS control is described in the following on the assumption that the disturbance generation timing is known. If tuning and learning have already been executed, you may start from item ***5***.

1. Setting of set value (SV) and PID constants

Set the set value (SV) and PID constants before performing EDS control.
When calculating the PID constants, the Autotuning (AT) function may be activated.

2. Setting of EDS control related parameters

Set the EDS action time, EDS action wait time and number of learning times.

3. Tuning execution

- If the EDS start signal is input at the disturbance generation timing after the "tuning mode" is selected in EDS mode selection, the tuning action starts being taken.
- The EDS action time is automatically calculated and set.
- The tuning ends when the calculated EDS action time elapses and thus the EDS transfer time, EDS value 1, and EDS value 2 are automatically calculated and then set. In addition, EDS mode selection is automatically turned to the "2: Learning mode" to start of preparing the learning.

4. Learning execution

- If the EDS start signal is input at the disturbance generation timing after the tuning ends (EDS mode selection: learning mode), the first learning starts using the EDS transfer time, the EDS value 1 and the EDS value 2 calculated by that tuning.
- After a lapse of the EDS action time, the learning ends. In addition, if the number of learning times preset reaches, EDS mode selection is automatically turned to the "EDS control mode" to start preparing EDS control. The EDS transfer time, the EDS value 1 and the EDS value 2 are revised when the next EDS start signal is input.

5. EDS control execution

If the EDS start signal is input at the disturbance generation timing after the learning ends (EDS mode: EDS function mode) or the "EDS function mode" is set by EDS mode selection, EDS control reflecting the last learning result starts.

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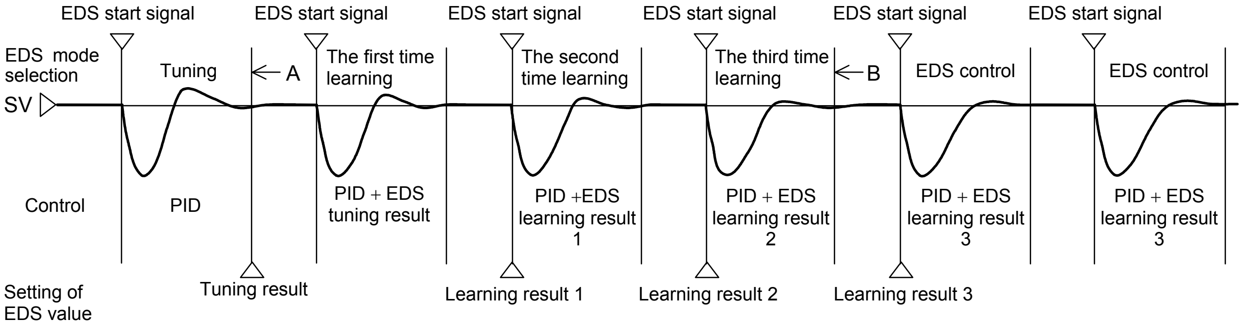
Example: EDS action selection when the number of learning times is set at 3
(When there is one disturbance pattern)



A: EDS mode selection automatically turns from "3: Tuning mode" to the "2: Learning mode".
B: EDS mode selection automatically turns from "2: Learning mode" to the "1: EDS function mode".

If it is impossible to satisfy a control response to the last learning result, the learning can be continued. In this case, if the EDS start signal is input at the disturbance generation timing with EDS mode selection turned to the "2: Learning mode" again, the learning re-starts. Also change the number of learning times before the EDS start signal is input, if necessary.

If it needs to end the learning before arriving at the number of learning times, turn EDS mode selection to the "1: EDS function mode" before inputting the next EDS start signal. In this case, the learning result calculated before being turned to the "1: EDS function mode" becomes valid.

If the EDS output value is not automatically calculated only once after the instrument power is turned on, the instrument is set to the "3: Tuning mode" by the first EDS start signal even with EDS mode selection turned to the "2: Learning mode" to start executing the tuning.

EDS value 1 (for disturbance 1)	RKC communication identifier	NI
	Modbus register address	ch1: 0112H (274) ch3: 0114H (276) ch2: 0113H (275) ch4: 0115H (277)
EDS value 1 (for disturbance 2)	RKC communication identifier	NJ
	Modbus register address	ch1: 0116H (278) ch3: 0118H (280) ch2: 0117H (279) ch4: 0119H (281)

This setting is used to suppress temperature changes in the measured value (PV) due to external disturbances.

Attribute: R/W

Digits: 7 digits

Number of data: 4 (Data of each channel)

Data range: −100.0 to +100.0 %

Factory set value: EDS value 1 (for disturbance 1): 0.0 %
EDS value 1 (for disturbance 2): 0.0 %

Related parameters: EDS mode (P. 8-44), EDS value 2 (P. 8-48), EDS transfer time (P. 8-49), EDS action time (P. 8-49), EDS action wait time (P. 8-50), EDS value learning times (P. 8-50), EDS start signal (P. 8-51)

Function: For the EDS function, see **EDS mode (P. 8-44).**

EDS value 2 (for disturbance 1)	RKC communication identifier	NK
	Modbus register address	ch1: 011AH (282) ch3: 011CH (284) ch2: 011BH (283) ch4: 011DH (285)
EDS value 2 (for disturbance 2)	RKC communication identifier	NM
	Modbus register address	ch1: 011EH (286) ch3: 0120H (288) ch2: 011FH (287) ch4: 0121H (289)

This setting is used to suppress overshooting and undershooting of the measured value (PV) due to rebounding.

Attribute: R/W

Digits: 7 digits

Number of data: 4 (Data of each channel)

Factory set value: EDS value 2 (for disturbance 1): 0.0 %
EDS value 2 (for disturbance 2): 0.0 %

Related parameters: EDS mode (P. 8-44), EDS value 1 (P. 8-48), EDS transfer time (P. 8-49), EDS action time (P. 8-49), EDS action wait time (P. 8-50), EDS value learning times (P. 8-50), EDS start signal (P. 8-51)

Function: For the EDS function, see **EDS mode (P. 8-44).**

EDS transfer time (for disturbance 1)	RKC communication identifier	NN
	Modbus register address	ch1: 0122H (290) ch3: 0124H (292) ch2: 0123H (291) ch4: 0125H (293)
EDS transfer time (for disturbance 2)	RKC communication identifier	NO
	Modbus register address	ch1: 0126H (294) ch3: 0128H (296) ch2: 0127H (295) ch4: 0129H (297)

This sets the time for transfer between EDS value 1 and EDS value 2. This time is used to attain a balance between suppressing temperature changes due to external disturbances and suppressing rebounding.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0 to 3600 seconds or 0.0 to 1999.9 seconds
Factory set value: EDS transfer time (for disturbance 1): 0 seconds
EDS transfer time (for disturbance 2): 0 seconds
Related parameters: EDS mode (P. 8-44), EDS value 1 (P. 8-48), EDS value 2 (P. 8-48), EDS action time (P. 8-49), EDS action wait time (P. 8-50), EDS value learning times (P. 8-50), EDS start signal (P. 8-51)
Function: For the EDS function, see **EDS mode (P. 8-44).**

EDS action time (for disturbance 1)	RKC communication identifier	NQ
	Modbus register address	ch1: 012AH (298) ch3: 012CH (300) ch2: 012BH (299) ch4: 012DH (301)
EDS action time (for disturbance 2)	RKC communication identifier	NL
	Modbus register address	ch1: 012EH (302) ch3: 0130H (304) ch2: 012FH (303) ch4: 0131H (305)

For the EDS action time, set the approximate time for a single disturbance response to converge. This time will be automatically calculated when tuning is performed, and will be the action time of the EDS control.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 1 to 3600 seconds
Factory set value: EDS action time (for disturbance 1): 600 seconds
EDS action time (for disturbance 2): 600 seconds
Related parameters: EDS mode (P. 8-44), EDS value 1 (P. 8-48), EDS value 2 (P. 8-48), EDS transfer time (P. 8-49), EDS action wait time (P. 8-50), EDS value learning times (P. 8-50), EDS start signal (P. 8-51)
Function: For the EDS function, see **EDS mode (P. 8-44).**

EDS action wait time (for disturbance 1)	RKC communication identifier	NR
	Modbus register address	ch1: 0132H (306) ch3: 0134H (308) ch2: 0133H (307) ch4: 0135H (309)
EDS action wait time (for disturbance 2)	RKC communication identifier	NY
	Modbus register address	ch1: 0136H (310) ch3: 0138H (312) ch2: 0137H (311) ch4: 0139H (313)

Set the wait time until action is actually started following the reception of an EDS start signal.

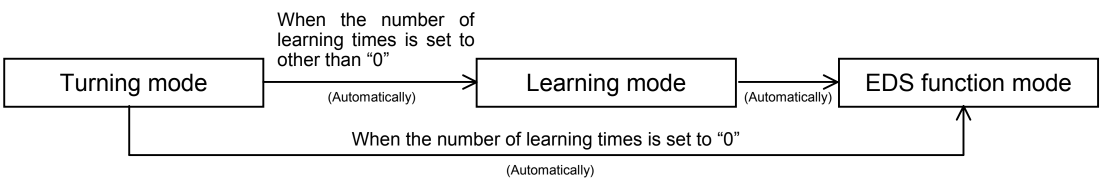
Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.0 to 600.0 seconds
Factory set value: EDS action wait time (for disturbance 1): 0.0 seconds
EDS action wait time (for disturbance 2): 0.0 seconds
Related parameters: EDS mode (P. 8-44), EDS value 1 (P. 8-48), EDS value 2 (P. 8-48), EDS transfer time (P. 8-49), EDS action wait time (P. 8-49), EDS value learning times (P. 8-50), EDS start signal (P. 8-51)
Function: For the EDS function, see **EDS mode (P. 8-44).**

EDS value learning times	RKC communication identifier	NT
	Modbus register address	ch1: 013AH (314) ch3: 013CH (316) ch2: 013BH (315) ch4: 013DH (317)

Set the number of learning times when “Learning mode” is selected in ESD mode selection.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0 to 10 times (0: No learning mode)
Factory set value: 1 time
Related parameters: EDS mode (P. 8-44), EDS value 1 (P. 8-48), EDS value 2 (P. 8-48), EDS transfer time (P. 8-49), EDS action time (P. 8-49), EDS action wait time (P. 8-50), EDS start signal (P. 8-51)
Function: For the EDS function, see **EDS mode (P. 8-44).**

If the number of learning times is set to “0”, the mode will automatically change to EDS function mode when tuning mode ends.



EDS start signal	RKC communication identifier	NU
	Modbus register address	ch1: 013EH (318) ch3: 0140H (320) ch2: 013FH (319) ch4: 0141H (321)

This is the input signal to start or end the mode (tuning, learning, and EDS function) of EDS mode selection.

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

Data range:
0: EDS start signal OFF
1: EDS start signal ON (for disturbance 1)
2: EDS start signal ON (for disturbance 2)

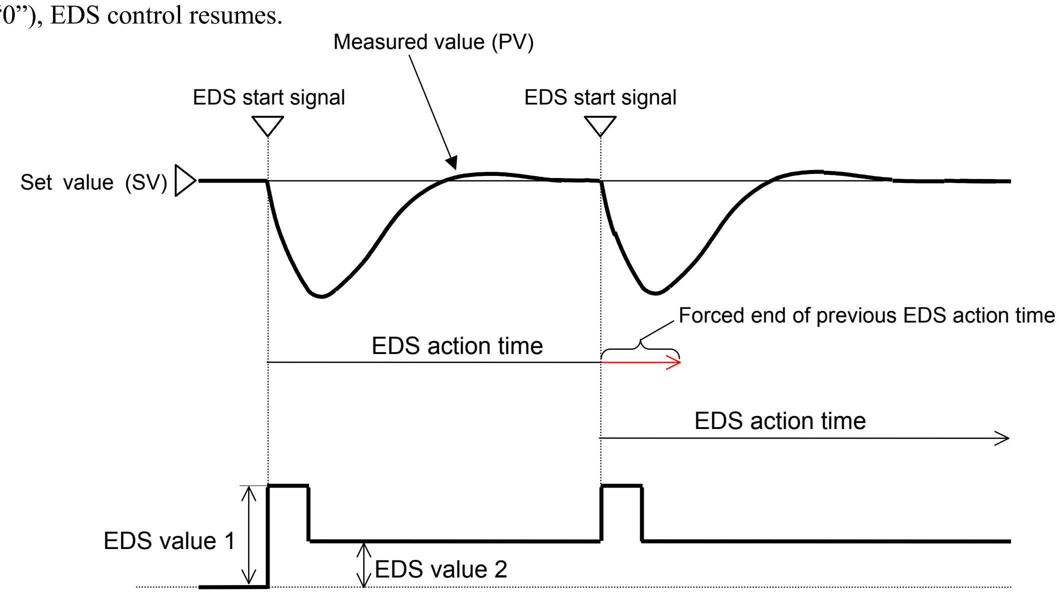
Factory set value: 0 (EDS start signal OFF)

Related parameters: EDS mode (P. 8-44), EDS value 1 (P. 8-48), EDS value 2 (P. 8-48), EDS transfer time (P. 8-49), EDS action time (P. 8-49), EDS action wait time (P. 8-50), EDS value learning times (P. 8-50)

Function: For the EDS function, see **EDS mode (P. 8-44).**

Automatically returns to "0: EDS start signal OFF" after the EDS start signal is turned ON.

When the EDS start signal is input a second time during EDS control (when the EDS start signal is "0"), EDS control resumes.



If you wish to execute EDS start signal input using a digital input (DI) signal, a Z-DIO module is necessary (P. 8-154).

When EDS start signal input is executed using the DI signal of a Z-DIO module, EDS start signal ON (for disturbance 1) and EDS start signal ON (for disturbance 2) can be input simultaneously. However, in this case, EDS control for disturbance 1 is given priority.

Operation mode	RKC communication identifier	EI
	Modbus register address	ch1: 0142H (322) ch3: 0144H (324) ch2: 0143H (323) ch4: 0145H (325)

This mode is used to select “unused”, “monitor”, “monitor + event function”, or “control” for each channel.

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

Data range:
0: Unused (Neither monitor nor control is performed)
1: Monitor (Only data monitor is performed)
2: Monitor + Event function
(Data monitor and event action [temperature rise completion, including LBA] are performed)
3: Control (Control is performed)

Factory set value: 3 (Control)

Related parameters: Operation mode state monitor (P. 8-5), RUN/STOP transfer (P. 8-17), Control RUN/STOP holding setting (P. 8-141)

Instrument action states in each operation mode from the RUN/STOP state:

		Operation Mode			
		Unused	Monitor	Monitor + Event function	Control
RUN state	Monitor (measured value)	“0” is displayed	Measured value		
	Event action	Event function disabled [1]		Event function enabled	
	Output terminal (when control output is selected) [2]	Output of −5 %	Manipulated output value at STOP mode		Control output value
	Output terminal (when logic output is selected) [3]	Depends on logic output result			
	Output terminal (when FAIL output is selected) [4]	Depends on FAIL result			
STOP state	Monitor (measured value)	“0” is displayed	Measured value		
	Event action	Event function disabled [1]			
	Output terminal (when control output is selected) [2]	Output of −5 %			
	Output terminal (when logic output is selected) [3]	Logic output result: OFF			
	Output terminal (when FAIL output is selected) [4]	Depends on FAIL result			

[1] If this instrument action state occurs when event interlock is ON, the interlock will be canceled.
[2] When the output type is relay contact output, voltage pulse output, triac output, or open collector output, the output is limited to the range 0 to 100 %.
[3] When the output type is voltage output or current output, logic output is disabled.
[4] When the output type is voltage output or current output, FAIL output is disabled.

Instrument action states depending on the operation mode and RUN/STOP switching:

Operation Mode	RUN/STOP	State	
“Monitor + Event function” state	STOP ↓ RUN	Event function*	Action according to the selection in “Event Hold Action” (P. 8-81).
“Control” state		Event function*	Action according to the selection in “Event Hold Action” (P. 8-81).
		Control	Action according to the settings in “Control RUN/STOP Hold Setting” (P. 8-141), “Hot/Cold Start” (P. 8-92), and “Start Determination Point” (P. 8-93).
“Unused” or “Monitor” ↓ “Monitor + Event function”	RUN state	Event function*	Action according to the selection in “Event Hold Action” (P. 8-81).
“Unused” or “Monitor” ↓ “Control”		Event function*	Action according to the selection in “Event Hold Action” (P. 8-81).
		Control	Same action as when power is turned on.
“Monitor + Event function” ↓ “Control”		Control	Same action as when power is turned on.

* Excluding the SV high, SV low, and control loop break alarm (LBA).

Startup tuning (ST)	RKC communication identifier	ST
	Modbus register address	ch1: 0146H (326) ch3: 0148H (328) ch2: 0147H (327) ch4: 0149H (329)

Use to set the number of execution times of Startup tuning (ST).

Attribute: R/W

Digits: 7 digits

Number of data: 1 (Data of each channel)

Data range:
0: ST unused
1: Execute once
2: Execute always

Factory set value: 0 (ST unused)

Related parameters: ST proportional band adjusting factor (P. 8-120), ST derivative time adjusting factor (P. 8-120), ST integral time adjusting factor (P. 8-120), ST start condition (P. 8-120), Proportional band limiter (high/low) [heat-side] (P. 8-113), Integral time limiter (high/low) [heat-side] (P. 8-114), Derivative time limiter (high/low) [heat-side] (P. 8-115)

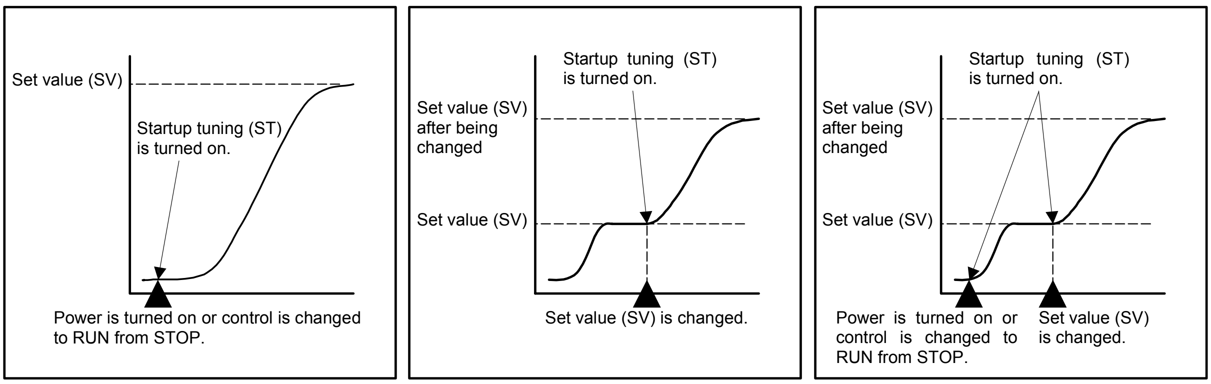
Function: Startup tuning (ST) is a function which automatically computes and sets the PID values from the response characteristics of the controlled system at power ON, transfer from STOP to RUN, and set value (SV) change.

- As simple autotuning, the PID values can be found in a short time without disturbing controllability for controlled systems with slow response at power ON.
- For controlled systems which require different PID values for each temperature setting, the PID values can be found for each set value (SV) change.
- Timing of activating the startup tuning (ST) can be selected from among the following three types.
  - Activate the startup tuning (ST) function when the power is turned on; when transferred from STOP to RUN; or when the set value (SV) is changed.
  - Activate the startup tuning (ST) function when the power is turned on; or when transferred from STOP to RUN.
  - Activate the startup tuning (ST) function when the set value (SV) is changed.

Activate the startup tuning (ST) function when the power is turned on; or when transferred from STOP to RUN.

Activate the startup tuning (ST) function when the set value (SV) is changed.

Activate the startup tuning (ST) function when the power is turned on; when transferred from STOP to RUN; or when the set value (SV) is changed.



Startup tuning (ST) function does not correspond to the heat/cool PID control (only in the temperature fall direction) and the position proportioning control.

If startup tuning ends normally, the LBA time is automatically set twice as large as the integral time.

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- **Caution for using the startup tuning (ST)**

- For startup tuning (ST) at power ON or transfer from STOP to RUN, always set the power to ON simultaneously with the start of tuning or before the start of tuning.
- Start startup tuning (ST) in the state in which the temperature differential of the measured value (PV) and set value (SV) at the start of startup tuning (ST) is twice the proportional band, or greater.
- If in Heat/Cool PID control, start activating the startup tuning (ST) function under the condition of "Set value (SV) > Measured value (PV)." Only the PID values on the heat-side are automatically calculated but no PID values on the cool-side are changed. Execute the autotuning (AT) function to the PID valued on the cool-side.
- When the manipulated output may be limited by the output limiter setting, the optimum PID values may not be calculated by startup tuning (ST).
- When setting the output change rate limiter, the optimum PID values may not be calculated by startup tuning (ST).
- When setting the setting change rate limiter, the optimum PID values are not obtained even when startup tuning (ST) is executed at set value (SV) change.

- **Requirements for startup tuning (ST) start**

Start the autotuning (AT) when all following conditions are satisfied:

Operation mode state	RUN/STOP transfer	RUN
	PID/AT transfer	PID control
	Auto/Manual transfer	Auto mode
	Remote/Local transfer	Local mode
Parameter setting		Startup tuning (ST) is set to ON. (Executed onece, Execute always)
		Output limiter (high) ≥ 0.1 %, Output limiter (low) ≤ 99.9 %
Input value state		The measured value (PV) is not underscale or overscale.
		Input error determination point (high) ≥ Measured value (PV) ≥ Input error determination point (low)
		At startup tuning (ST) at setting change, the measured value (PV) shall be stabilized.
		Set value (SV) > Measured value (PV) (Heat/Cool PID control)
Output value state		At startup, output is changed and saturated at the output limiter value (high) or the output limiter value (low).

- **Requirements for startup tuning (ST) cancellation**

If the startup tuning (ST) is canceled according to any of the following conditions, the controller immediately changes to PID control. The PID values will be the same as before ST was activated.

When the parameter is changed	When startup tuning (ST) is set to OFF
	When the PV bias, the PV digital filter, or the PV ratio is changed.
When the Operation mode is transferred	When the RUN/STOP mode is changed to the STOP mode.
	When the autotuning (AT) is activated.
	When the Auto/Manual mode is changed to the Manual mode.
	When the Remote/Local mode is changed to the Remote mode.
When the input value becomes abnormal	When the measured value (PV) goes to underscale or overscale.
	When the measured value (PV) goes to input error range. (Measured value (PV) ≥ Input error determination point (high) or Input error determination point (low) ≥ Measured value (PV))
When the ST exceeded the execution time	When the ST does not end in hundred minutes after ST started
Power failure	When the power failure of more than 4 ms occurs.
Instrument error	When the instrument is in the FAIL state.

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● Procedure for using the startup tuning (ST)

The setting procedure when executing startup tuning (ST) only one time at power ON is shown below as a setting example.

1. Set the start condition

In "ST start condition" in the engineering setting data, set "At power ON (either 0 or 1)" as the startup tuning (ST) start condition.

ST start condition:
0: Activate the startup tuning (ST) function when the power is turned on; when transferred from STOP to RUN; or when the set value (SV) is changed.
1: Activate the startup tuning (ST) function when the power is turned on; or when transferred from STOP to RUN.
2: Activate the startup tuning (ST) function when the set value (SV) is changed.

2. Set the execution method

In "Startup tuning (ST)" in the normal setting data, set "1: Execute once".

3. Start the Startup tuning (ST)

Turn off the power once and turn it on again. The startup tuning (ST) will automatically start.

When startup tuning (ST) is executed with power ON or control is switched from STOP to RUN as the start condition, the starting action will be "Hot start 2" regardless of the setting of **Hot/Cold Start (P. 8-92)**.

When startup tuning (ST) was interrupted, the setting does not change to "0: ST unused." Startup tuning (ST) starts when the restart conditions are satisfied.

As the parameters for startup tuning (ST) function, there are "ST proportional band adjusting factor", "ST integral time adjusting factor", and "ST derivative time adjusting factor" in Engineering setting data. However, use the same setting as the factory set values (1.00 times).

Example: When set the proportional band adjusting factor
Proportional band (P) =
Calculated proportional band × Proportional band adjusting factor (0.01 to 10.00 times)

Automatic temperature rise learning	RKC communication identifier	Y8
	Modbus register address	ch1: 014AH (330) ch3: 014CH (332) ch2: 014BH (331) ch4: 014DH (333)

Use to select Use/Unuse of the Automatic temperature rise learning function.

Attribute: R/W
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range: 0: Unused
1: Learning
Factory set value: 0 (Unused)
Related parameters: Automatic temperature rise group (P. 8-121), Automatic temperature rise dead time (P. 8-121), Automatic temperature rise gradient data (P. 8-122)
Function: Automatic temperature rise learning is used to obtain the “Automatic temperature rise dead time” and “Automatic temperature rise gradient data” that are required to perform automatic temperature rise. When “1: Learning” is set and control is switched from STOP to RUN, learning starts. When “Automatic temperature rise dead time” and “Automatic temperature rise gradient data” are obtained, automatic temperature rise learning ends.

When in Heat/Cool PID control, automatic temperature rise learning is only in the temperature rise direction.

Automatic temperature rise learning can be executed even when the automatic temperature rise group (P. 8-121) is set to “0: Automatic temperature rise function OFF”. However, temperature rise by the automatic temperature rise function at the next startup is not possible. In this case, the measured values (PV) separately rise toward their set values, and thus the temperature rise completion times are not the same.

● Requirements for automatic temperature rise learning start

Automatic temperature rise learning can be executed when all the following conditions are satisfied.

Operation mode state	RUN/STOP transfer	RUN
	PID/AT transfer	PID control
	Auto/Manual transfer	Auto mode
	Remote/Local transfer	Local mode
Parameter setting		The automatic temperature rise learning setting is “1: Learning”.
		Output limiter (high) ≥ 0.1 %, Output limiter (low) ≤ 99.9 %
Input value state		The measured value (PV) is not underscale or overscale.
		Input error determination point (high) ≥ Measured value (PV) ≥ Input error determination point (low)
		The measured value (PV) is stable.
		Set value (SV) > Measured value (PV) [Heat/Cool PID control]
Output value state		At startup, output is changed and saturated at the output limiter value (high) or the output limiter value (low).

● Requirements for automatic temperature rise learning cancellation

If any of the following states occur, automatic temperature rise learning is immediately stopped. In this case, automatic temperature rise learning remains set to “1: Learning”.

When the parameter is changed	The automatic temperature rise learning setting is changed to “0: No function”.
	When the PV bias, the PV digital filter, or the PV ratio is changed.
When the Operation mode is transferred	When the RUN/STOP mode is changed to the STOP mode.
	When the Auto/Manual mode is changed to the Manual mode.
	When the Remote/Local mode is changed to the Remote mode.
When the input value becomes abnormal	When the measured value (PV) goes to underscale or overscale.
	When the measured value (PV) goes to input error range. (Measured value (PV) ≥ Input error determination point (high) or Input error determination point (low) Measured value (PV))
The execution time for automatic temperature rise learning is exceeded.	Automatic temperature rise learning does not end after approximately 100 minutes has elapsed following the start of automatic temperature rise learning.
Power failure	When the power failure of more than 4 ms occurs.
Instrument error	When the instrument is in the FAIL state.

Automatic temperature rise function (with learning function):

Treating channels that have the same group number specification as one group, the automatic temperature rise function synchronizes the temperature rise of the other channels in the group to the channel that requires the most time for the measured value (PV) to reach the set value (SV).

By using the automatic temperature rise function to balance the temperature rise, uniform temperature control without any local burning or partial thermal expansion of the controlled system is possible.

Also, if started by turning on (1: Learning) the automatic temperature rise learning function, the data needed by automatic temperature rise can be automatically computed and automatic temperature rise is possible from the next starting.

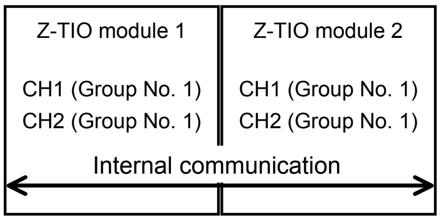
Since internal communication has a time lag (250 ms) in data transmission, when using it in a fast response control system, take this time lag into consideration.

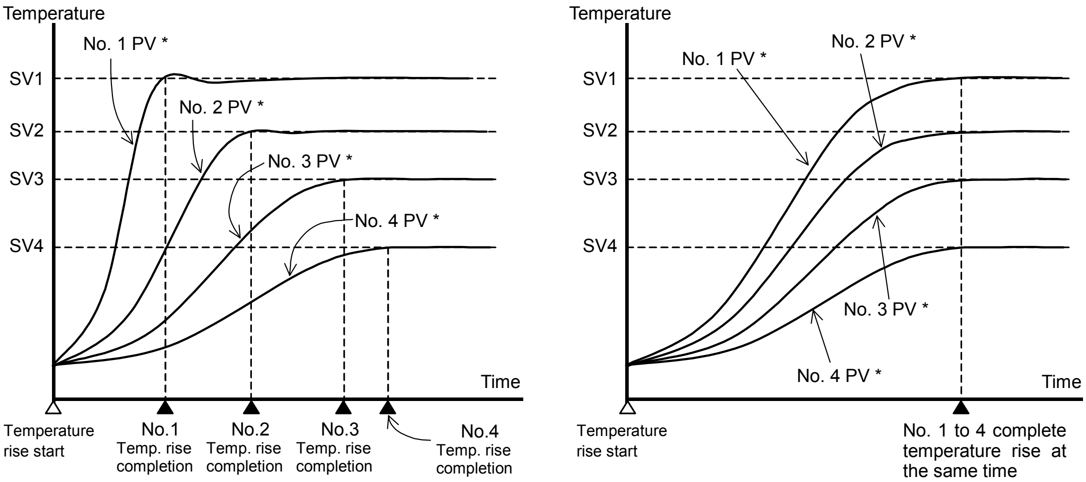
The maximum number of connectable Z-TIO modules at internal communication is 16, without regard to the number of groups.

The automatic temperature rise function can be used for a group of channels within connected modules (SRZ unit), or within a single module.

Example: Multi-point temperature control using two Z-TIO modules (2-channel type)

- When Z-TIO module 1 (CH1, CH2) and Z-TIO module 2 (CH1, CH2) are started without using the automatic temperature rise function (Automatic temperature rise group: “0” setting), the measured values (PV) separately rise toward their set values (SV1 to 4). As a result, each completes the temperature rise at a different time.
- When the system is started using the automatic temperature rise function after Z-TIO module 1 (CH1, CH2) and Z-TIO module 2 (CH1, CH2) are set to the same group number and automatic temperature rise learning is executed, the temperature rise of Z-TIO module 1 (CH1, CH2) [slave] and Z-TIO module 2 (CH1) [slave] are synchronized to the temperature rise of Z-TIO module 2 (CH2) [master], which requires the most time in the group for the measured value (PV) to reach the set value (SV). As a result, Z-TIO module 1 (CH1, CH2) and Z-TIO module 2 (CH1, CH2) complete the temperature rise simultaneously.





When automatic temperature rise not executed   When automatic temperature rise executed

* No. 1 PV: The PV of CH1 of Z-TIO module 1
No. 2 PV: The PV of CH2 of Z-TIO module 1
No. 3 PV: The PV of CH1 of Z-TIO module 2
No. 4 PV: The PV of CH2 of Z-TIO module 2

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● Requirements for automatic temperature rise start

When all the channels in a group satisfy the following conditions, automatic temperature rise is executed.

Operation mode state	RUN/STOP transfer	RUN
	PID/AT transfer	PID control
	Auto/Manual transfer	Auto mode
Parameter setting	Control action	PID control (reverse action or direct action)
		Heat/Cool PID control (air cooling, water cooling, cooling gain linear type) *
	Automatic temperature rise group	Other than 0
	Automatic temperature rise learning	0 (Unused)
Input value state		The measured value (PV) is not Underscale or Overscale.
		No burn out (input break or short circuit)
		Input error determination point (high) ≥ Measured value (PV) ≥ Input error determination point (low)
		Reverse action and Heat/Cool PID control (air cooling, water cooling, cooling gain linear type): Set value (SV) > Measured value (PV) at start of automatic temperature rise Direct action: Set value (SV) < Measured value (PV) at start of automatic temperature rise

* When in Heat/Cool PID control, an automatic temperature rise only in the temperature rise direction is enabled.

● Requirements for automatic temperature rise cancellation

Master: If even one of the channels in a group has entered any of the following states, automatic temperature rise of all the channels in the group immediately stops and switches to normal control.

Slave: If the slave channel has entered any of the following states, automatic temperature rise automatically stops and switches to normal control.

The channel which takes the longest time for the measured value (PV) to reach the set value (SV) of all the channels in the group automatically becomes the master.

Operation mode state	RUN/STOP transfer	When the RUN/STOP mode is changed to the STOP mode.
	PID/AT transfer	When the autotuning (AT) is activated.
	Auto/Manual transfer	When the Auto/Manual mode is changed to the Manual mode.
Parameter setting		When the proportional band is set to 0. (When the control type is changed to ON/OFF control)
Input value state		When the measured value (PV) goes to underscale or overscale.
		When the burnout occurs (input break or short circuit)
		When the measured value (PV) goes to input error range. (Measured value (PV) ≥ Input error determination point (high) or Input error determination point (low) ≥ Measured value (PV))
Power failure		When the power failure of more than 4 ms occurs.
Instrument error		When the instrument is in the FAIL state.
Other		The module unit has been inserted/removed

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● Procedure for using the automatic temperature rise function

1. Set the Automatic temperature rise group

For each Z-TIO module channel, set an automatic temperature rise group number in "Automatic temperature rise group" in the engineering setting data.

Automatic temperature rise group: 0 to 16 (0: Automatic temperature rise function OFF)

When the group number is set to "0", that controller does not perform automatic temperature rise.

Automatic temperature rise learning

2. Automatic temperature rise learning ON

For each Z-TIO module channel, set automatic temperature rise learning ON/OFF in "Automatic temperature rise learning" in the normal setting data.

Automatic temperature rise learning: 0 (Unused) [Factory set value]
1 (Learning)

3. Control stop

Since the automatic temperature rise learning function is performed, stop control and wait until the heater cools.

The automatic temperature rise learning function calculates the automatic temperature rise dead time and automatic temperature rise gradient data from the state of the measured value (PV) at startup.

4. Control start

Check that the heater is cold and then start control.

5. Automatic temperature rise learning start

When control starts, automatic temperature rise starts simultaneously.

6. Automatic temperature rise learning ends

When the automatic temperature rise dead time and automatic temperature rise gradient data are calculated, automatic temperature rise learning ends.

When the automatic temperature rise group and other set values were changed, execute automatic temperature rise learning again.

When automatic temperature rise learning is not established, the automatic temperature rise learning remains "1: Learning."

Automatic temperature rise

7. Automatic temperature rise effective from next startup

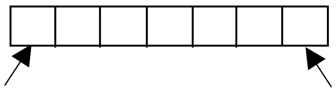
Automatic temperature rise can be executed from the next startup by using the calculated automatic temperature rise dead time and automatic temperature rise gradient data.

Communication switch for logic	RKC communication identifier	EF
	Modbus register address	014EH (334)

ON/OFF signal that applies the signal of event information occurring in the higher system as input to a logic calculation result (logic output).

Attribute: R/W
Digits: 7 digits
Number of data: 1 (Data of each module)
Data range: **RKC communication:** ASCII code data
Communication switch for logic is assigned as a digit image in ASCII code data of 7 digits.

ASCII code data of 7 digits:



Most significant digit ··············· Least significant digit

Data: 0: OFF 1: ON

[Communication switch for logic]

Least significant digit: Communication switch 1
2nd digit: Communication switch 2
3rd digit: Communication switch 3
4th digit: Communication switch 4
5th digit to Most significant digit: Unused

Modbus: 0 to 15 (bit data)
Communication switch for logic is assigned as a bit image in binary numbers.

Bit image: 0000000000000000

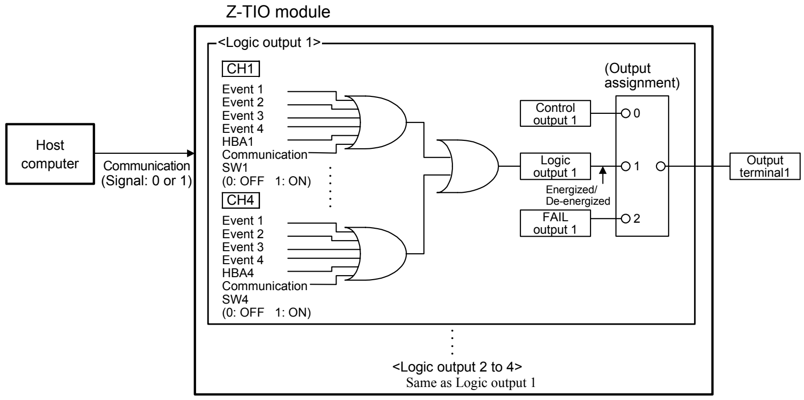
bit 15 ···························· bit 0

Bit data: 0: OFF 1: ON

bit 0: Communication switch 1
bit 1: Communication switch 2
bit 2: Communication switch 3
bit 3: Communication switch 4
bit 4 to bit 15: Unused

Factory set value: 0
Related parameters: Logic output monitor (P. 8-13), Output assignment (P. 8-75), Operation mode assignment (P. 8-126)

Example: Applying an event signal from a host computer to logic switch 1



☞ For a block diagram of the logic output selection function, see **11. APPENDIX (P. 11-6).**

8.2.2 Engineering setting data items

WARNING

The engineering setting data should be set according to the application before setting any parameter related to operation. Once the Initial setting data is set correctly, those data is not necessary to be changed for the same application under normal conditions. If they are changed unnecessarily, it may result in malfunction or failure of the instrument. RKC will not bear any responsibility for malfunction or failure as a result of improper changes in the Initial setting.

■ Setting procedure of engineering setting data items

When RUN/STOP switching (RKC communication identifier: RS, Modbus register address: 006DH) is set to “0: STOP (control stop)”, engineering setting data can be configured.

During RUN (control), the attribute of the engineering setting data is RO (read only).

■ Precaution against parameter change

If the following parameters are changed, related settings will also change.

Before changing a parameter, be sure to make a record of all the settings (normal setting data and engineering setting data).

After changing a parameter, be sure to check all the settings (normal setting data and engineering setting data).

● When the input type or the display unit parameter is changed

When the input type is changed, all the setting in the following table will be changed. When the display unit is changed, the settings which has ★ or ☆ mark will be changed. Reset the settings to the values that you wish to use.

Input type (RKC communication identifier: XI, Modbus address: 0176H to 0179H)
Display unit (RKC communication identifier: PU, Modbus address: 017AH to 017DH)

Items that are initialized:

Data type	Items	Default value
Engineering setting data	Decimal point position	TC/RTD inputs: 0 Voltage (V)/current (I) inputs: 1
	Input scale high ★	TC/RTD inputs: Maximum value of the selected input range Voltage (V)/current (I) inputs: 100.0
	Input scale low ★	TC/RTD inputs: Minimum value of the selected input range Voltage (V)/current (I) inputs: 0.0
	Input error determination point (high) ★	TC/RTD inputs: Input range high + (5 % of Input span) Voltage (V)/current (I) inputs: +105.0
	Input error determination point (low) ★	TC/RTD inputs: Input range low − (5 % of Input span) Voltage (V)/current (I) inputs: −5.0

★: Parameters to be initialized when display unit is changed.

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Data type	Items	Default value
Engineering setting data	Burnout direction	0: Upscale
	Event 1 channel setting	1 (Channel 1)
	Event 2 channel setting	
	Event 3 channel setting	
	Event 4 channel setting	
	Event 1 hold action	0 (OFF)
	Event 2 hold action	
	Event 3 hold action	
	Event 4 hold action	
	Event 1 interlock	0 (Unused)
	Event 2 interlock	
	Event 3 interlock	
	Event 4 interlock	
	Event 1 differential gap ★	TC/RTD inputs: 1 °C [°F]
	Event 2 differential gap ★	Voltage (V)/current (I) inputs:
	Event 3 differential gap ★	1 digit (Varies with the setting of the decimal point position)
	Event 4 differential gap ★	MV: 1.0 %
	Event 1 delay timer	0.0 seconds
	Event 2 delay timer	
	Event 3 delay timer	
	Event 4 delay timer	
	Force ON of Event 1 action	0000
	Force ON of Event 2 action	
	Force ON of Event 3 action	
	Force ON of Event 4 action	
	Start determination point ★	Value equivalent to 3 % of Input span
	ON/OFF action differential gap (upper) ★	TC/RTD inputs: 1 °C [°F]
	ON/OFF action differential gap (lower) ★	Voltage (V)/current (I) inputs: 0.1 % of Input span
	AT bias ★	0
	Proportional band limiter (high) [heat-side] ★	TC/RTD inputs: Input span Voltage (V)/current (I) inputs: 1000.0 %
	Proportional band limiter (low) [heat-side] ★	TC/RTD inputs: 0 °C [°F] Voltage (V)/current (I) inputs: 0.0 %
	Integral time limiter (high) [heat-side]	1 second setting (No decimal place): 3600 seconds 0.1 seconds setting (One decimal place): 1999.9 seconds
	Integral time limiter (low) [heat-side]	1 second setting (No decimal place): 0 seconds 0.1 seconds setting (One decimal place): 0.0 seconds
	Derivative time limiter (high) [heat-side]	1 second setting (No decimal place): 3600 seconds 0.1 seconds setting (One decimal place): 1999.9 seconds
	Derivative time limiter (low) [heat-side]	1 second setting (No decimal place): 0 seconds 0.1 seconds setting (One decimal place): 0.0 seconds
	Proportional band limiter (high) [cool-side] ★	TC/RTD inputs: Input span Voltage (V)/current (I) inputs: 1000.0 %
	Proportional band limiter (low) [cool-side] ★	TC/RTD inputs: 1 °C [°F] Voltage (V)/current (I) inputs: 0.1 %
	Integral time limiter (high) [cool-side]	1 second setting (No decimal place): 3600 seconds 0.1 seconds setting (One decimal place): 1999.9 seconds

★: Parameters to be initialized when display unit is changed.

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Data type	Items	Default value
Engineering setting data	Integral time limiter (low) [cool-side]	1 second setting (No decimal place): 0 seconds 0.1 seconds setting (One decimal place): 0.0 seconds
	Derivative time limiter (high) [cool-side]	1 second setting (No decimal place): 3600 seconds 0.1 seconds setting (One decimal place): 1999.9 seconds
	Derivative time limiter (low) [cool-side]	1 second setting (No decimal place): 0 seconds 0.1 seconds setting (One decimal place): 0.0 seconds
	Setting limiter (high) ★	Input scale high
	Setting limiter (low) ★	Input scale low
	Responsive action trigger point for EDS ★	TC/RTD inputs: 1 °C [°F] Voltage (V)/current (I) inputs: 1 %
Normal setting data	Event 1 set value (EV1) ✩	50
	Event 2 set value (EV2) ✩	
	Event 3 set value (EV3) ✩	
	Event 4 set value (EV4) ✩	
	Control loop break alarm (LBA) time	480 seconds
	LBA deadband ✩	0
	Set value (SV) ✩	TC/RTD inputs: 0 °C [°F] Voltage (V)/current (I) inputs: 0.0 %
	Proportional band [heat-side] ✩	TC/RTD inputs: 30 °C [°F] Voltage (V)/current (I) inputs: 30.0
	Integral time [heat-side]	240 seconds
	Derivative time [heat-side]	60 seconds
	Control response parameter	PID control: 0 (Slow) Heat/Cool PID control: 2 (Fast)
	Proportional band [cool-side] ✩	TC/RTD inputs: 30 °C [°F] Voltage (V)/current (I) inputs: 30.0
	Integral time [cool-side]	240 seconds
	Derivative time [cool-side]	60 seconds
	Overlap/Deadband ✩	TC/RTD inputs: 0 °C [°F] Voltage (V)/current (I) inputs: 0.0 %
	Setting change rate limiter (up) ✩	0 (0.0)
	Setting change rate limiter (down) ✩	0 (0.0)
	PV bias ✩	0
	PV ratio	1.000
	RS bias ✩	0
	RS ratio	1.000

★: Parameters to be initialized when display unit is changed.

✩: Parameters to be rounded when display unit is changed.

Items processed by limiter processing:

Data type	Items
Engineering setting data	Automatic temperature rise gradient data ✩

✩: Parameters to be rounded when display unit is changed.

- **When an event type parameter is changed**

When an event type setting is changed, the corresponding event settings will be initialized. Reset these settings to the values that you wish to use.

Event 1 type (RKC communication identifier: XA, Modbus address: 01A2H to 01A5H)
Event 2 type (RKC communication identifier: XB, Modbus address: 01BEH to 01C1H)
Event 3 type (RKC communication identifier: XC, Modbus address: 01DAH to 01DDH)
Event 4 type (RKC communication identifier: XD, Modbus address: 01F6H to 01F9H)

Data type	Items	Default value
Engineering setting data items	Event 1 hold action	0 (OFF)
	Event 2 hold action	
	Event 3 hold action [1]	
	Event 4 hold action [2]	
	Event 1 interlock	0 (Unused)
	Event 2 interlock	
	Event 3 interlock [1]	
	Event 4 interlock [2]	
	Event 1 differential gap	TC/RTD inputs: 1 °C [°F] Voltage (V)/current (I) inputs: 1 digit (Varies with the setting of the decimal point position) MV: 1.0 %
	Event 2 differential gap	
	Event 3 differential gap [1]	
	Event 4 differential gap [2]	
	Event 1 delay timer	0.0 seconds
	Event 2 delay timer	
	Event 3 delay timer [1]	
	Event 4 delay timer [2]	
	Force ON of Event 1 action	0000
	Force ON of Event 2 action	
	Force ON of Event 3 action [1]	
	Force ON of Event 4 action [2]	
Normal setting data items	Event 1 set value (EV1)	50
	Event 2 set value (EV2)	
	Event 3 set value (EV3) [1]	
	Event 4 set value (EV4) [2]	
	Control loop break alarm (LBA) time [3]	480 seconds
	LBA deadband [3]	0

[1] Except when the event 3 type is “Temperature rise completion”.
[2] Except when the event 4 type is “Control loop break alarm (LBA)”.
[3] When the event 4 type is changed to “Control loop break alarm (LBA)”.

● When the control action parameter is changed

When the control action setting (RKC communication identifier: XE, Modbus address: 0232H to 0235H) is changed, the settings in the following table will be changed. Reset the settings to the values that you wish to use.

Items that are initialized:

Data type	Items	Default value
Engineering setting data	Undershoot suppression factor	Heat/Cool PID control [Water cooling]: 0.100 Heat/Cool PID control [Air cooling]: 0.250 Heat/Cool PID control [Cooling gain linear type]: 1.000
Normal setting data	Control response parameter	When changed from heat/cool PID control to PID control or position proportioning control: 0 (Slow) When changed from PID control or position proportioning control to heat/cool PID control: 2 (Fast)
	Manual manipulated output value	When changed from heat/cool PID control or PID control to position proportioning control (without feedback resistance input): 0 When changed from heat/cool PID control or PID control to feedback resistance input burnout in position proportioning control (with feedback resistance input): 0

Items processed by limiter processing:

Data type	Items
Engineering setting data	Integral time limiter (high) [heat-side] *
	Integral time limiter (low) [heat-side] *
Normal setting data	Integral time *

* When changed from PID control or heat/cool PID control to position proportioning control, the setting range is processed by limiter processing.

● When the decimal point position parameter is changed

When the input decimal point position is changed (RKC communication identifier: XU, Modbus address: 017EH to 0181H), the decimal point positions of the settings in the following table are automatically converted. However, in some cases, the change of decimal point position may also change the set value. Where this occurs, reset the value to the value that you wish to use.

Data type	Items	
Engineering setting data	Input scale high	ON/OFF action differential gap (lower) [2]
	Input scale low	AT bias
	Input error determination point (high)	Proportional band limiter (high) [heat-side] [2]
	Input error determination point (low)	Proportional band limiter (low) [heat-side] [2]
	Event 1 differential gap [1]	Proportional band limiter (high) [cool-side] [2]
	Event 2 differential gap [1]	Proportional band limiter (low) [cool-side] [2]
	Event 3 differential gap [1]	Setting limiter (high)
	Event 4 differential gap [1]	Setting limiter (low)
	Start determination point	Automatic temperature rise gradient data
	ON/OFF action differential gap (upper) [2]	Responsive action trigger point for EDS
Normal setting data	Measured value (PV)	Set value (SV)
	SV monitor	Proportional band [heat-side] [2]
	Remote setting (RS) input value	Proportional band [cool-side] [2]
	Event 1 set value (EV1) [1]	Overlap/Deadband [2]
	Event 2 set value (EV2) [1]	Setting change rate limiter (up)
	Event 3 set value (EV3) [1]	Setting change rate limiter (down)
	Event 4 set value (EV4) [1]	PV bias
	LBA deadband	RS bias

[1] Only for deviation, process, or set value.
[2] Only for thermocouple (TC) or RTD inputs.

● When the input scale high limit/low limit parameter is changed

When the high limit or low limit of the input scale is changed, the settings in the following table will be changed. Reset the settings to the values that you wish to use.

Input scale high (RKC communication identifier: XV, Modbus address: 0182H to 0185H)
Input scale low (RKC communication identifier: XW, Modbus address: 0186H to 0189H)

Items that are initialized:

Data type	Items	Default value
Engineering setting data	Input error determination point (high)	Input range high + (5 % of Input span)
	Input error determination point (low)	Input range low – (5 % of Input span)
	Setting limiter (high)	Input scale high
	Setting limiter (low)	Input scale low

Items processed by limiter processing:

Data type	Items	
Engineering setting data	Event 1 differential gap [1]	AT bias
	Event 2 differential gap [1]	Proportional band limiter (high) [heat-side] [2]
	Event 3 differential gap [1]	Proportional band limiter (low) [heat-side] [2]
	Event 4 differential gap [1]	Proportional band limiter (high) [cool-side] [2]
	Start determination point	Proportional band limiter (low) [cool-side] [2]
	ON/OFF action differential gap (upper) [2]	Automatic temperature rise gradient data
	ON/OFF action differential gap (lower) [2]	Responsive action trigger point for EDS
Normal setting data items	Event 1 set value (EV1) [1]	Proportional band [cool-side] [2]
	Event 2 set value (EV2) [1]	Overlap/Deadband [2]
	Event 3 set value (EV3) [1]	Setting change rate limiter (up)
	Event 4 set value (EV4) [1]	Setting change rate limiter (down)
	LBA deadband	PV bias
	Set value (SV)	RS bias
	Proportional band [heat-side] [2]	

[1] Only for deviation, process, or set value.
[2] Only for thermocouple (TC) or RTD inputs.

● When the Integral/derivative time decimal point position parameter is changed

When the Integral/derivative time decimal point position is changed (RKC communication identifier: PK, Modbus address: 0236H to 0239H), the decimal point positions of the settings in the following table are automatically converted. However, in some cases, the change of decimal point position may also change the set value. Where this occurs, reset the value to the value that you wish to use.

Data type	Items	
Engineering setting data	Integral time limiter (high) [heat-side]	Integral time limiter (high) [cool-side]
	Integral time limiter (low) [heat-side]	Integral time limiter (low) [cool-side]
	Derivative time limiter (high) [heat-side]	Derivative time limiter (high) [cool-side]
	Derivative time limiter (low) [heat-side]	Derivative time limiter (low) [cool-side]
Normal setting data	Integral time [heat-side]	Integral time [cool-side]
	Derivative time [heat-side]	Derivative time [cool-side]

● When the EDS transfer time decimal point position parameter is changed

When the EDS transfer time decimal point position is changed (RKC communication identifier: NS, Modbus address: 0312H to 0315H), the decimal point positions of the settings in the following table are automatically converted. However, in some cases, the change of decimal point position may also change the set value. Where this occurs, reset the value to the value that you wish to use.

Data type	Items
Engineering setting data	EDS transfer time (for disturbance 1)
	EDS transfer time (for disturbance 2)

● When the output limiter high limit/low limit parameter is changed

When the high limit or low limit of the output limiter is changed, the settings in the following table will be changed (be processed by the limiter).

Output limiter (high) [heat-side] (RKC communication identifier: OH, Modbus address: 026AH to 026DH)
Output limiter (low) [heat-side] (RKC communication identifier: OL, Modbus address: 026EH to 0271H)
Output limiter (high) [cool-side] (RKC communication identifier: OX, Modbus address: 027AH, 027CH)
Output limiter (low) [cool-side] (RKC communication identifier: OY, Modbus address: 027EH, 0270H)

Data type	Items
Normal setting data	Manual manipulated output value

● When the soak time unit high limit/low limit parameter is changed

When the soak time unit (RKC communication identifier: RU, Modbus address: 0322H to 0325H) is changed, the settings in the following table will be changed (be processed by the limiter).

Data type	Items
Normal setting data	Area soak time

● When the setting limiter high limit/low limit parameter is changed

When the high limit or low limit of the setting limiter is changed, the settings in the following table will be changed (be processed by the limiter).

Setting limiter (high) (RKC communication identifier: SH, Modbus address: 0326H to 0329H)
Setting limiter (low) (RKC communication identifier: SL, Modbus address: 032AH to 032DH)

Data type	Items
Normal setting data	Set value (SV)

■ Data explanation

Input type	RKC communication identifier	XI
	Modbus register address	ch1: 0176H (374) ch3: 0178H (376) ch2: 0177H (375) ch4: 0179H (377)

Input type number is a number to indicate an input type.

Attribute: R/W

Digits: 7 digits

Number of data: 4 (Data of each channel)

Data range: 0 to 23

A measured input is a universal input but requires hardware selection (of a voltage (low) or (high) input group). The input select switch enables hardware selection. (See next page.)

Data range	Hardware	Factory set value
0: TC input K 1: TC input J 2: TC input R 3: TC input S 4: TC input B 5: TC input E 6: TC input N 7: TC input T 8: TC input W5Re/W26Re 9: TC input PLII 12: RTD input Pt100 13: RTD input JPt100 14: Current input 0 to 20 mA DC 15: Current input 4 to 20 mA DC 19: Voltage (low) input 0 to 1 V DC 20: Voltage (low) input 0 to 100 mV DC 21: Voltage (low) input 0 to 10 mV DC 22: Feedback resistance input 100 to 150 Ω 23: Feedback resistance input 151 Ω to 6 kΩ	Voltage (low) input group	Depends on model code When not specifying: 0
16: Voltage (high) input 0 to 10 V DC 17: Voltage (high) input 0 to 5 V DC 18: Voltage (high) input 1 to 5 V DC	Voltage (high) input group	

Do not set to any number (including 10 and 11) which is not described in the input range table above. This may cause malfunctioning.

As the decimal point position, input scale high and input scale low are initialized if the input type is changed, it is necessary to conduct the re-setting. A value of "equivalent to 3 % of input span" is automatically set at the start determination point.
For the parameters which will be initialized if the input type is changed, refer to **■ Precaution against parameter change (P. 8-61).**

Related parameters: Decimal point position (P. 8-71), Input scale high/low (P. 8-71)

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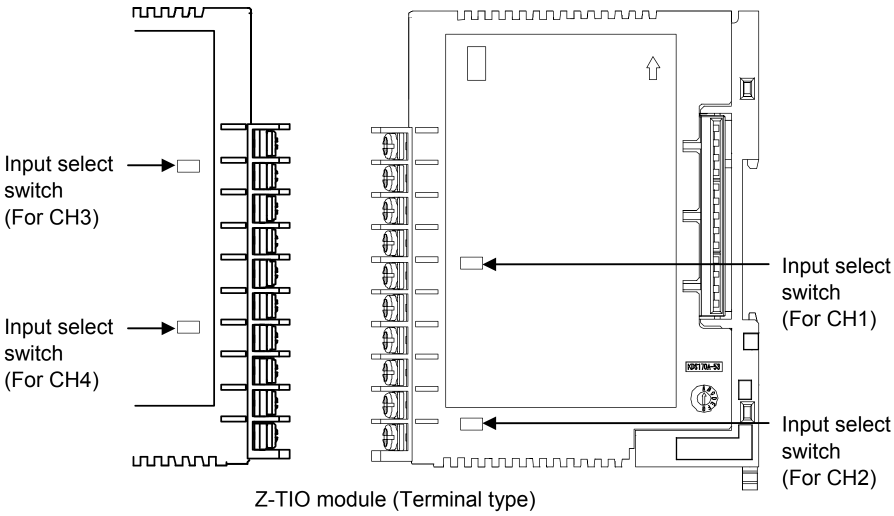
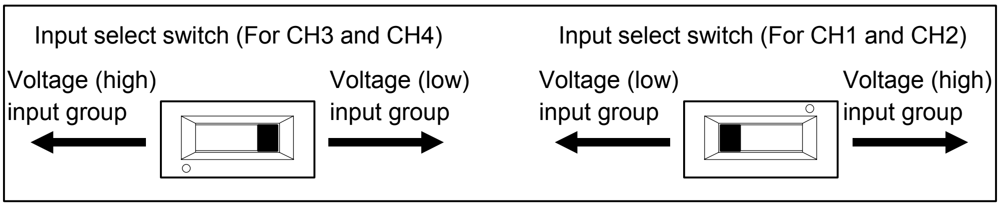
- **Hardware selection**

The voltage (low) or (high) input group is selected by the input select switch at the side of the module. Turn the measured value input switch by a small screwdriver.



Z-TIO module (Terminal type)



* The switch position is the same on the Z-TIO module (connector type).

Display unit	RKC communication identifier	PU
	Modbus register address	ch1: 017AH (378) ch3: 017CH (380) ch2: 017BH (379) ch4: 017DH (381)

Use to select the temperature unit for thermocouple (TC) and RTD inputs.

Attribute: R/W

Digits: 7 digits

Number of data: 4 (Data of each channel)

Data range: 0: °C
1: ° F

Factory set value: 0 (°C)

The invalidity in case of the voltage/current inputs.
The engineering unit for voltage/current input is expressed as %.

Decimal point position	RKC communication identifier	XU
	Modbus register address	ch1: 017EH (382) ch3: 0180H (384) ch2: 017FH (383) ch4: 0181H (385)

Use to select the decimal point position of the input range.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range:
0: No decimal place
1: One decimal place
2: Two decimal places
3: Three decimal places
4: Four decimal places

TC input: K, J, T, E: Only 0 or 1 can be set.
Other than the above: Only 0 can be set.
RTD input: Only 0 or 1 can be set.
Voltage (V)/Current (I) inputs: From 0 to 4 can be set.

Factory set value: Depends on model code
When not specifying: TC input: 1
Voltage (V)/Current (I) inputs: 1

Related parameters: Input type (P. 8-69), Input scale high/low (P. 8-71)

Input scale high	RKC communication identifier	XV
	Modbus register address	ch1: 0182H (386) ch3: 0184H (388) ch2: 0183H (387) ch4: 0185H (389)
Input scale low	RKC communication identifier	XW
	Modbus register address	ch1: 0186H (390) ch3: 0188H (392) ch2: 0187H (391) ch4: 0189H (393)

Use to set the high limit and low limit of the input scale range.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range:
[Input scale high]
TC/RTD inputs: Input scale low to Maximum value of the selected input range
Voltage (V)/Current (I) inputs: −19999 to +99999
(Varies with the setting of the decimal point position)
[Input scale low]
TC/RTD inputs: Minimum value of the selected input range to Input scale high
Voltage (V)/Current (I) inputs: −19999 to +99999
(Varies with the setting of the decimal point position)

Factory set value:
[Input scale high]
TC/RTD inputs: Maximum value of the selected input range
Voltage (V)/Current (I) inputs: 100.0
[Input scale low]
TC/RTD inputs: Minimum value of the selected input range
Voltage (V)/Current (I) inputs: 0.0

Related parameters: Input type (P. 8-69), Decimal point position (P. 8-71)

When a voltage/current input type is selected, the input scale high limit can be set lower than the input scale low limit. (Input scale high limit < Input scale low limit)

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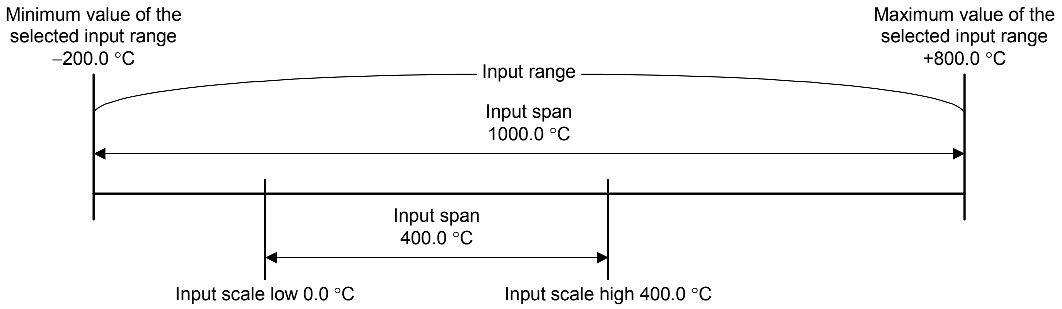
Function: The input range can be changed for temperature input.
For voltage/current input, display scaling can be made in the range of −19999 to +19999.

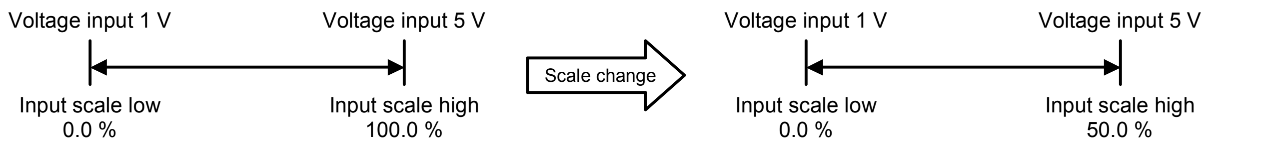
Example (temperature input): When the range of −200.0 to +800.0 °C for thermocouple Type K is changed to 0.0 to 400.0 °C



When the scale for temperature input is changed, it is recommended to be changed within the input range. If any value exceeding the input range is set, input resolution may vary.

If the input scale high or low limit is changed, a value of "equivalent to 3 % of input span" is automatically set at the start determination point.

Example (voltage (V)/Current (I) inputs):
When the input scale is changed to 50.0 % from 100.0 % at a voltage input of 1 to 5 V DC



When the voltage input is 1 V: Displays the "0.0" to the SV display.
When the voltage input is 5 V: Displays the "100.0" to the SV display.

When the voltage input is 1 V: Displays the "0.0" to the SV display.
When the voltage input is 5 V: Displays the "50.0" to the SV display.

Input range table

Input type		Data range	Hardware
TC input	K	−200.0 to +1372.0 °C (−328 to +2501 °F, 0.0 to 800.0 °F)	Voltage (low) input group
	J	−200.0 to +1200.0 °C (−328 to +2192 °F, 0.0 to 800.0 °F)	
	T	−200.0 to +400.0 °C (−328 to +752 °F, 0.0 to 752.0 °F)	
	S	−50 to +1768 °C (−58 to +3214°F)	
	R	−50 to +1768 °C (−58 to +3214°F)	
	E	−200.0 to +1000.0 °C (−328 to +1832 °F, 0.0 to 800.0 °F)	
	B	0 to 1800 °C (0 to 3272 °F)	
	N	0 to 1300 °C (0 to 2372 °F)	
	PLII	0 to 1390 °C (0 to 2534 °F)	
	W5Re/W26Re	0 to 2300 °C (0 to 4208 °F)	
RTD input	Pt100	−200.0 to +850.0 °C (−328 to +1562 °F, −328.0 to +752.0 °F)	
	JPt100	−200.0 to +640.0 °C (−328 to +1184 °F, −328.0 to +752.0 °F)	
Feedback resistance input		100 Ω to 6 kΩ (Standard 135 Ω)	
Current input	0 to 20 mA DC	Programmable range −19999 to +19999 (The decimal point position of the input range is selectable.)	
	4 to 20 mA DC		
Voltage (low) input	0 to 1 V DC		
	0 to 100 mV DC		
	0 to 10 mV DC		
Voltage (high) input	0 to 10 V DC		Voltage (high) input group
	0 to 5 V DC		
	1 to 5 V DC		

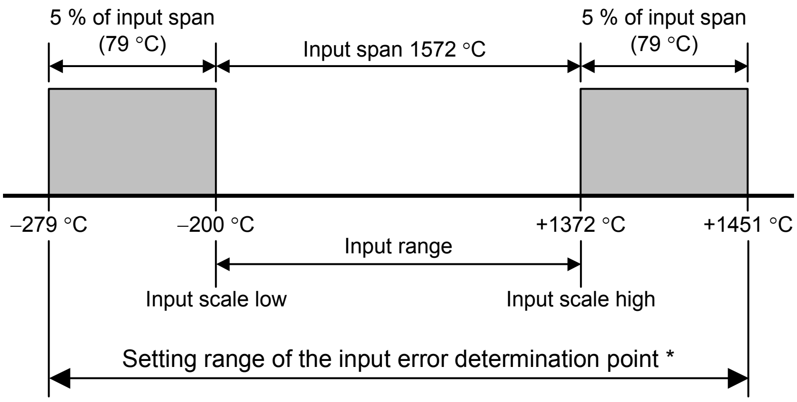
Input error determination point (high)	RKC communication identifier	AV
	Modbus register address	ch1: 018AH (394) ch3: 018CH (396) ch2: 018BH (395) ch4: 018DH (397)
Input error determination point (low)	RKC communication identifier	AW
	Modbus register address	ch1: 018EH (398) ch3: 0190H (400) ch2: 018FH (399) ch4: 0191H (401)

Use to set Input Error Determination Point (high/low). Input Error Determination function is activated when a measured value reaches the limit, and control output value selected by Action at input error will be output.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: [Input error determination point (high)]
Input error determination point (low limit) to (Input range high + 5 % of Input span)
[Input error determination point (low)]
(Input range low – 5 % of Input span) to Input error determination point (high limit)
Factory set value: [Input error determination point (high)]
Input range high + (5 % of Input span)
[Input error determination point (low)]
Input range low – (5 % of Input span)
Related parameters: Action (high/low) at input error (P. 8-103),
Manipulated output value at input error (P. 8-104)

Example: When the input scale range is –200 to +1372 °C

Input span: 1572
5 % of input span: 79 (78.6 was rounded off)
Setting range: –279 to +1451 °C



* However, the low limit value of the input error determination point is less than the high limit value of the input error determination point.

Burnout direction	RKC communication identifier	BS
	Modbus register address	ch1: 0192H (402) ch3: 0194H (404) ch2: 0193H (403) ch4: 0195H (405)

Use to select Burnout Direction in input break. When input break is detected by the module, the measured value go either Upscale or Downscale according to the Burnout Direction setting.

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

Data range: 0: Upscale
1: Downscale

Factory set value: 0 (Upscale)

The burnout direction setting is effective only for thermocouple input and voltage (low) input.

For the following types of input, the action when an input break occurs is fixed, regardless of the burnout direction setting.
RTD input: Upscale
Voltage (high) input: Downscale (display of about 0 V)
Current input: Downscale (display of about 0 mA)
Feedback resistance input: Upscale

Square root extraction	RKC communication identifier	XH
	Modbus register address	ch1: 0196H (406) ch3: 0198H (408) ch2: 0197H (407) ch4: 0199H (409)

Use to select Use/Unuse of the square root extraction for the measured value.

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

Data range: 0: Unused
1: Used

Factory set value: 0 (Unused)

Related parameters: PV low input cut-off (P. 8-36)

Function: The controller can receive the input signal directly from a differential pressure type flow transmitter by using Square Root Extraction Function without using a square root extractor.

Output assignment (Logic output selection function)	RKC communication identifier	E0
	Modbus register address	ch1: 019AH (410) ch3: 019CH (412) ch2: 019BH (411) ch4: 019DH (413)

This is used to assign the output function (control output, logic output result and FAIL output) for the output 1 (OUT1) to output 4 (OUT4).

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

Data range:
0: Control output
1: Logic output result
2: FAIL output

Factory set value:

4-CH type module
Output 1 (OUT1): 0 (Control output)
Output 2 (OUT2): 0 (Control output) *
Output 3 (OUT3): 0 (Control output)
Output 4 (OUT4): 0 (Control output) *

2-CH type module
Output 1 (OUT1): 0 (Control output)
Output 2 (OUT2): 0 (Control output)

* Disabled for heat/cool PID control and position proportioning control

Related parameters: Energized/De-energized (P. 8-76), Event type (P. 8-87), Heater break alarm (HBA) set value (P.8-32), Communication switch for logic (P. 8-60)

[Relation between output assignment and output type]

×: Valid –: Invalid

Output assignment \ Output type	Relay contact	Voltage pulse	Voltage output	Current output	Triac	Open-collector
0 (Control output)	×	×	×	×	×	×
1 (Logic output resulet)	×	×	–	–	×	×
2 (FAIL output)	×	×	–	–	×	×

☞ For the block diagram of Logic output selection function, see **11. APPENDIX (P. 11-6).**

Energized/De-energized (Logic output selection function)	RKC communication identifier	NA
	Modbus register address	ch1: 019EH (414) ch3: 01A0H (416) ch2: 019FH (415) ch4: 01A1H (417)

Energized/de-energized can be selected for any of outputs 1 (OUT1) to 4 (OUT4) that have an output function (logic output result) assigned.

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

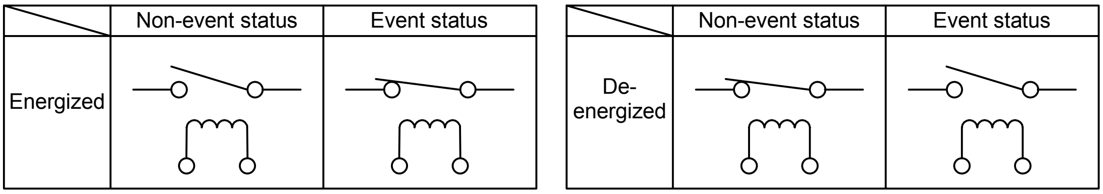
Data range: 0: Energized
1: De-energized

Factory set value: 0 (Energized)

Related parameters: Output assignment (P. 8-75), Event type (P. 8-77),
Heater break alarm (HBA) set value (P.8-32),
Communication switch for logic (P. 8-60)

Function: Energized: Relay contact is closed under the event or alarm status.
De-energized: Relay contact opens under the event or alarm status.

Diagram for explaining operation (At power-ON)



In the following cases, the selection is fixed at de-energized.

- An output that has an output assignment of “0: Control output”
- FAIL alarm (normal: contacts closed, error: contacts open)

Event 1 type	RKC communication identifier	XA
	Modbus register address	ch1: 01A2H (418) ch3: 01A4H (420) ch2: 01A3H (419) ch4: 01A5H (421)
Event 2 type	RKC communication identifier	XB
	Modbus register address	ch1: 01BEH (446) ch3: 01C0H (448) ch2: 01BFH (447) ch4: 01C1H (449)
Event 3 type	RKC communication identifier	XC
	Modbus register address	ch1: 01DAH (474) ch3: 01DCH (476) ch2: 01DBH (475) ch4: 01DDH (477)
Event 4 type	RKC communication identifier	XD
	Modbus register address	ch1: 01F6H (502) ch3: 01F8H (504) ch2: 01F7H (503) ch4: 01F9H (505)

Select event types. Four events (Event 1 to Event 4) can be set separately for each channel.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0 to 21

Data range	Factory set value
0: None	Depends on model code When not specifying: 0
Deviation action: 1: Deviation high (Using SV monitor value) [1] 2: Deviation low (Using SV monitor value) [1] 3: Deviation high/low (Using SV monitor value) [1] 4: Band (Using SV monitor value) [1] 14: Deviation high (Using local SV) [1] 15: Deviation low (Using local SV) [1] 16: Deviation high/low (Using local SV) [1] 17: Band (Using local SV) [1]	
Input value action: 5: Process high [1] 6: Process low [1]	
Set value action: 7: SV high 8: SV low	
Manipulated output value action: 10: MV high [heat-side] [1, 2] 11: MV low [heat-side] [1, 2] 12: MV high [cool-side] [1] 13: MV low [cool-side] [1]	
Deviation action between channels: 18: Deviation between channels high [1] 19: Deviation between channels low [1] 20: Deviation between channels high/low [1] 21: Deviation between channels band [1]	
9: Unused (Only for Event 1 and Event 2) 9: Temperature rise completion (Only for Event 3) 9: Control loop break alarm (LBA) (Only for Event 4)	

[1] Event hold action is available.
[2] The manipulated output value (MV) corresponds to the feedback resistance (FBR) input value when feedback resistance (FBR) input is used.

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Related parameters: Comprehensive event state (P. 8-4), Event state monitor (P. 8-9), Event set value (P. 8-20), Output assignment (P. 8-75), Event interlock (P. 8-83), Event differential gap (P. 8-84), Event delay timer (P. 8-85)

Funtion:

- **Event function**

Diagrams of the event action type are shown in the following.

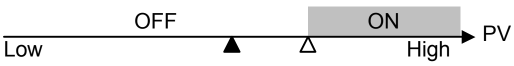
ON: Event action turned on, OFF: Event action turned off (▲: Set value (SV) △ : Event set value)

Deviation action:

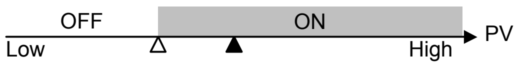
If the deviation (PV – SV) reaches the event set value, event ON occurs.

1: Deviation high (using SV monitor value), 14: Deviation high (using Local SV value)

(Event set value is greater than 0.)

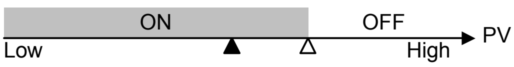


(Event set value is less than 0.)

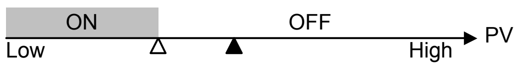


2: Deviation low (using SV monitor value), 15: Deviation low (using Local SV value)

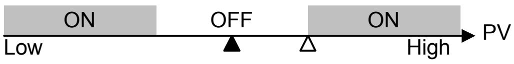
(Event set value is greater than 0.)



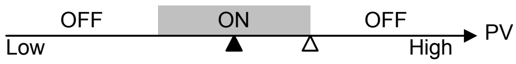
(Event set value is less than 0.)



3: Deviation high/low (using SV monitor value)
16: Deviation high/low (using Local SV value)



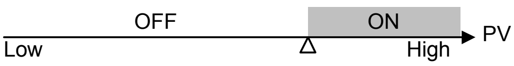
4: Band (using SV monitor value)
17: Band (using Local SV value)



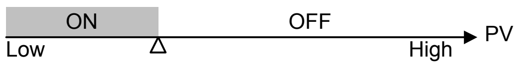
Input value action:

When the measured value (PV) reaches the event set value, event ON occurs.

5: Process high



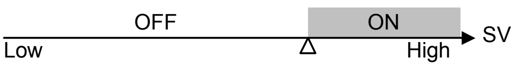
6: Process low



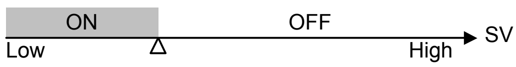
Set value action:

When the set value (SV) reaches the event set value, event ON occurs.

7: SV high:



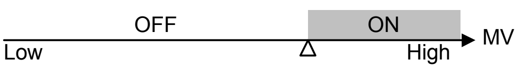
8: SV low:



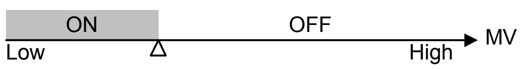
Manipulated output value action:

When the manipulated output value (MV) reaches the event set value, event ON occurs.

10: MV high [heat-side]
12: MV high [cool-side]



11: MV low [heat-side]
13: MV low [cool-side]



Deviation action between channels:

When the deviation between different channels (PV – PV of comparison channel) reaches the event set value, event ON occurs.

18: Deviation between channels high (Same action as "Deviation high")

19: Deviation between channels low (Same action as "Deviation low")

20: Deviation between channels high/low (Same action as "Deviation high/low")

21: Deviation between channels band (Same action as "Band")

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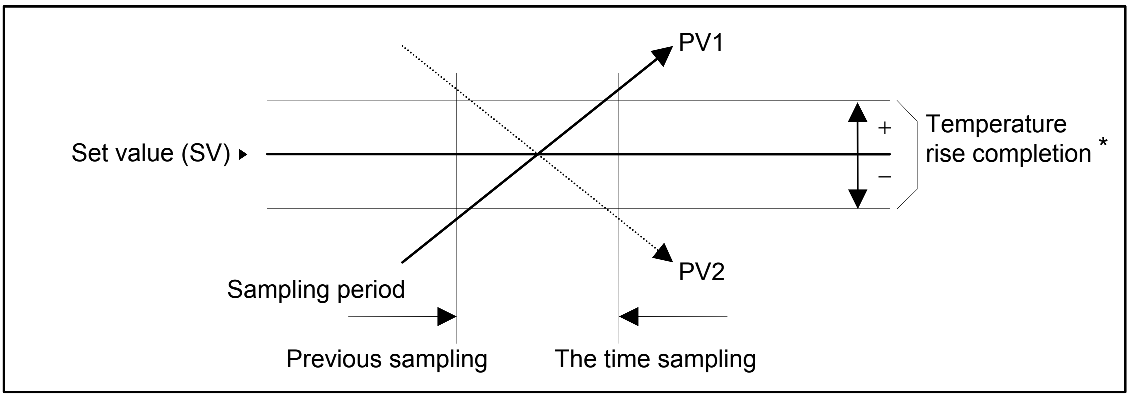
● Temperature rise completion function

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.



* The temperature rise completion range is set using the Event 3 set value.

The action of temperature rise completion is the same as "17: Band (using local SV)".
If the measured value (PV) is outside the temperature rise completion range even after temperature rise completion, temperature rise completion OFF will be indicated in the **Comprehensive event state (P. 8-4)**. If you wish to maintain temperature rise completion ON in the **Comprehensive event state (P. 8-4)** even when the measured value is outside the temperature rise completion range, set the **Event 3 interlock (P. 8-83)** to "1" (Used).

When temperature rise completion is not set, temperature rise completion of the **Comprehensive event state** is "0: OFF" in the STOP state, and "1: ON" in the RUN state.

● Control loop break alarm (LBA) function

For LBA function, see **Control loop break alarm (LBA) time (P. 8-21).**

Event 1 channel setting	RKC communication identifier	FA
	Modbus register address	ch1: 01A6H (422) ch3: 01A8H (424) ch2: 01A7H (423) ch4: 01A9H (425)
Event 2 channel setting	RKC communication identifier	FB
	Modbus register address	ch1: 01C2H (450) ch3: 01C4H (452) ch2: 01C3H (451) ch4: 01C5H (453)
Event 3 channel setting	RKC communication identifier	FC
	Modbus register address	ch1: 01DEH (478) ch3: 01E0H (480) ch2: 01DFH (479) ch4: 01E1H (481)
Event 4 channel setting	RKC communication identifier	FD
	Modbus register address	ch1: 01FAH (506) ch3: 01FCH (508) ch2: 01FBH (507) ch4: 01FDH (509)

Select the channel number for "PV of comparison channel" when "Deviation between channels" is selected for the event action type.

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

Data range: 1: Channel 1
2: Channel 2
3: Channel 3
4: Channel 4

Factory set value: 1 (Channel 1)

Related parameters: Event type (P. 8-77)

Event 1 hold action	RKC communication identifier	WA
	Modbus register address	ch1: 01AAH (426) ch3: 01ACH (428) ch2: 01ABH (427) ch4: 01ADH (429)
Event 2 hold action	RKC communication identifier	WB
	Modbus register address	ch1: 01C6H (454) ch3: 01C8H (456) ch2: 01C7H (455) ch4: 01C9H (457)
Event 3 hold action	RKC communication identifier	WC
	Modbus register address	ch1: 01E2H (482) ch3: 01E4H (484) ch2: 01E3H (483) ch4: 01E5H (485)
Event 4 hold action	RKC communication identifier	WD
	Modbus register address	ch1: 01FEH (510) ch3: 0200H (512) ch2: 01FFH (511) ch4: 0201H (513)

Use to set a event hold action for the Event.

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

Data range: 0 to 2

Data range	Factory set value
0: OFF 1: Hold action ON (Only hold action) • Validate the hold action when the power is turned on. • Validate the hold action when transferred from STOP (control STOP) to RUN (control RUN). 2: Re-hold action ON (hold and re-hold actions) • Validate the hold action when the power is turned on. • Validate the hold action when transferred from STOP (control STOP) to RUN (control RUN). • Validate the re-hold action when the set value (SV) is changed. However, if the rate of setting change limiter is set to any function other than “OFF (Unused)” or in the remote mode, the re-hold action becomes invalid.	Depends on model code When not specifying: 0

The hold action is effective when process, deviation, or manipulated output value action is selected for the event type.

Related parameters: Comprehensive event state (P. 8-4), Event state monitor (P. 8-9), Event set value (P. 8-20), Event type (P. 8-77), Event interlock (P. 8-83), Event differential gap (P. 8-84), Event delay timer (P. 8-85)

Function:

- **Hold action**

When Hold action is ON, the event action is suppressed at start-up or STOP to RUN until the measured value has entered the non-event range.

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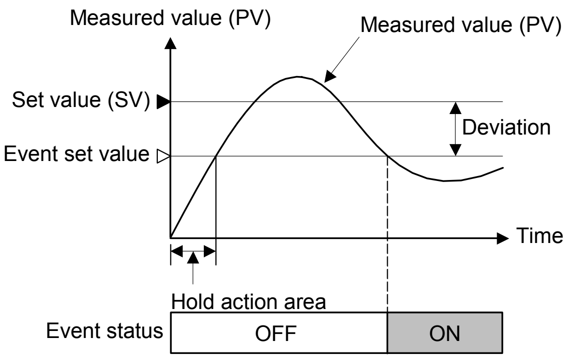
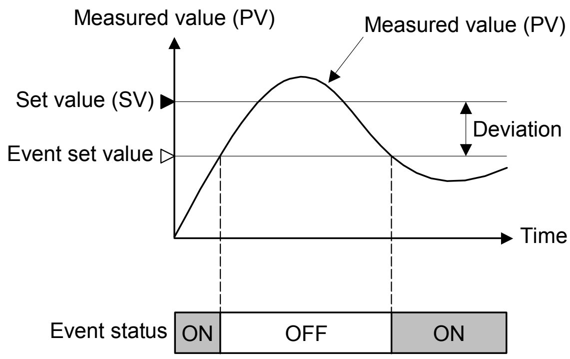
[With hold action]



[Without hold action]



● Re-hold action

When Re-hold action is ON, the event action is also suppressed at the control set value change until the measured value has entered the non-event range.

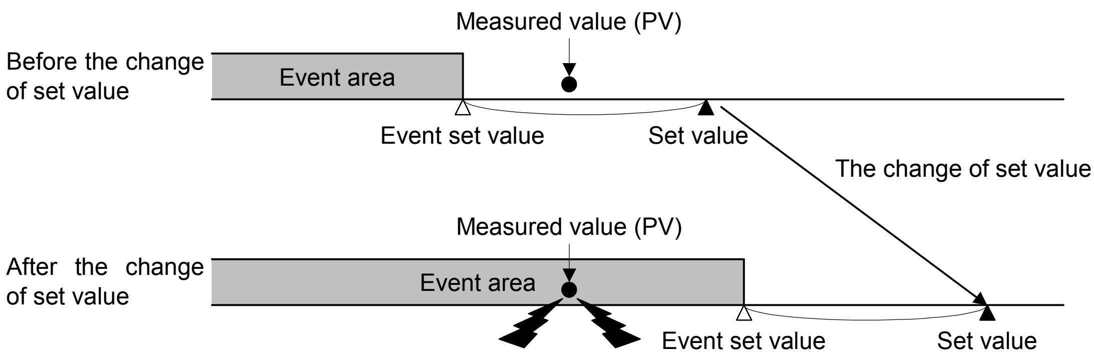
Action condition	1: Hold action ON (Only hold action)	2: Re-hold action ON (Hold and re-hold actions)
When the power is turned on	Hold action	Hold action
When transferred from STOP (control STOP) to RUN (control RUN)	Hold action	Hold action
When the set value (SV) is changed	Without hold and re-hold actions	Re-hold action

The re-hold action is invalid for any of the following. However, the hold action is valid.

- **When Setting change rate limiter other than "0 (Unused)" are set.**
- **When Remote/Local transfer is the remote mode.**

Example: When Event 1 type is the deviation low:

When Re-hold action is OFF and event output type is deviation, the event output is produced due to the set value change. The Re-hold action suppresses the alarm output until the measured value has entered the non-event range again.

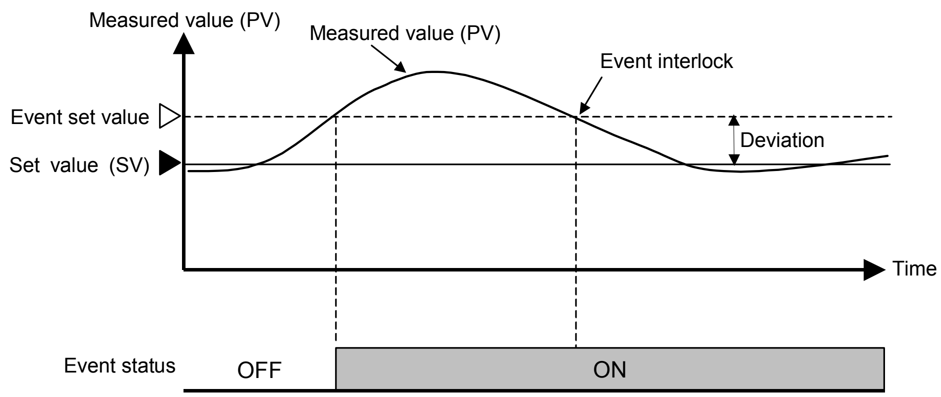


Event 1 interlock	RKC communication identifier	LF
	Modbus register address	ch1: 01AEH (430) ch3: 01B0H (432) ch2: 01AFH (431) ch4: 01B1H (433)
Event 2 interlock	RKC communication identifier	LG
	Modbus register address	ch1: 01CAH (458) ch3: 01CCH (460) ch2: 01CBH (459) ch4: 01CDH (461)
Event 3 interlock	RKC communication identifier	LH
	Modbus register address	ch1: 01E6H (486) ch3: 01E8H (488) ch2: 01E7H (487) ch4: 01E9H (489)
Event 4 interlock	RKC communication identifier	LI
	Modbus register address	ch1: 0202H (514) ch3: 0204H (516) ch2: 0203H (515) ch4: 0205H (517)

Use to select the interlock function for the Event.

Attribute: R/W
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range: 0: Unused
1: Used
Factory set value: 0 (Unused)
Related parameters: Comprehensive event state (P. 8-4), Event state monitor (P. 8-9), Event set value (P. 8-20), Event type (P. 8-77), Event differential gap (P. 8-84), Event delay timer (P. 8-85), Force ON of Event action (P. 8-87)
Function: The event interlock function is used to hold the event state even if the measured value (PV) is out of the event area after its entry into the area once.

Example: When the event interlock function is used for deviation high



[Without Event hold action]

Event 1 differential gap	RKC communication identifier	HA
	Modbus register address	ch1: 01B2H (434) ch3: 01B4H (436) ch2: 01B3H (435) ch4: 01B5H (437)
Event 2 differential gap	RKC communication identifier	HB
	Modbus register address	ch1: 01CEH (462) ch3: 01D0H (464) ch2: 01CFH (463) ch4: 01D1H (465)
Event 3 differential gap	RKC communication identifier	HC
	Modbus register address	ch1: 01EAH (490) ch3: 01ECH (492) ch2: 01EBH (491) ch4: 01EDH (493)
Event 4 differential gap	RKC communication identifier	HD
	Modbus register address	ch1: 0206H (518) ch3: 0208H (520) ch2: 0207H (519) ch4: 0209H (521)

Use to set a differential gap of the Event.

Attribute: R/W

Digits: 7 digits

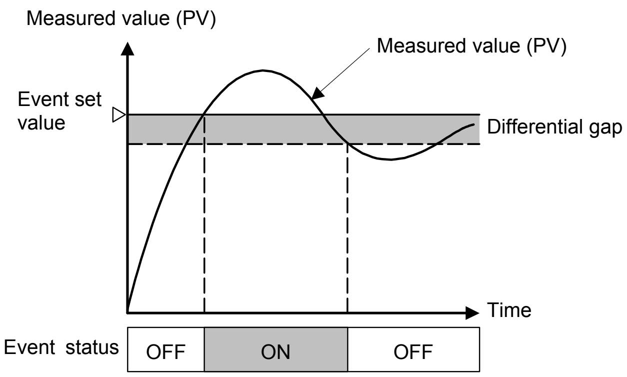
Number of data: 4 (Data of each channel)

Data range:
① Deviation, process, set value, Deviation action between channels, or Temperature rise completion (Only for Event 3):
0 to Input span (Unit: °C [°F])
② MV: 0.0 to 110.0 %

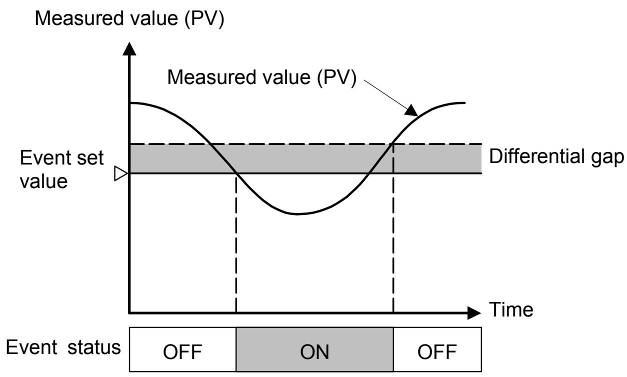
Factory set value:
① Deviation, process, set value, Deviation action between channels, or Temperature rise completion (Only for Event 3):
TC/RTD inputs: 1 °C
Voltage (V)/current (I) inputs: 0.1 %
② MV: 0.1 %

Related parameters: Comprehensive event state (P. 8-9), Event state monitor (P. 8-9), Event set value (P. 8-20), Event type (P. 8-77), Event interlock (P. 8-83), Event delay timer (P. 8-85), Force ON of Event action (P. 8-87)

Function: It prevents chattering of event output due to the measured value fluctuation around the event set value.



Process high



Process low

When the event 4 type is “9: Control loop break alarm (LBA)”, the event 4 hold action setting is not effective.

Event 1 delay timer	RKC communication identifier	TD
	Modbus register address	ch1: 01B6H (438) ch3: 01B8H (440) ch2: 01B7H (439) ch4: 01B9H (441)
Event 2 delay timer	RKC communication identifier	TG
	Modbus register address	ch1: 01D2H (466) ch3: 01D4H (468) ch2: 01D3H (467) ch4: 01D5H (469)
Event 3 delay timer	RKC communication identifier	TE
	Modbus register address	ch1: 01EEH (494) ch3: 01F0H (496) ch2: 01EFH (495) ch4: 01F1H (497)
Event 4 delay timer	RKC communication identifier	TF
	Modbus register address	ch1: 020AH (522) ch3: 020CH (524) ch2: 020BH (523) ch4: 020DH (525)

Event delay timer is to set an output delay time for event outputs.

Attribute: R/W

Digits: 7 digits

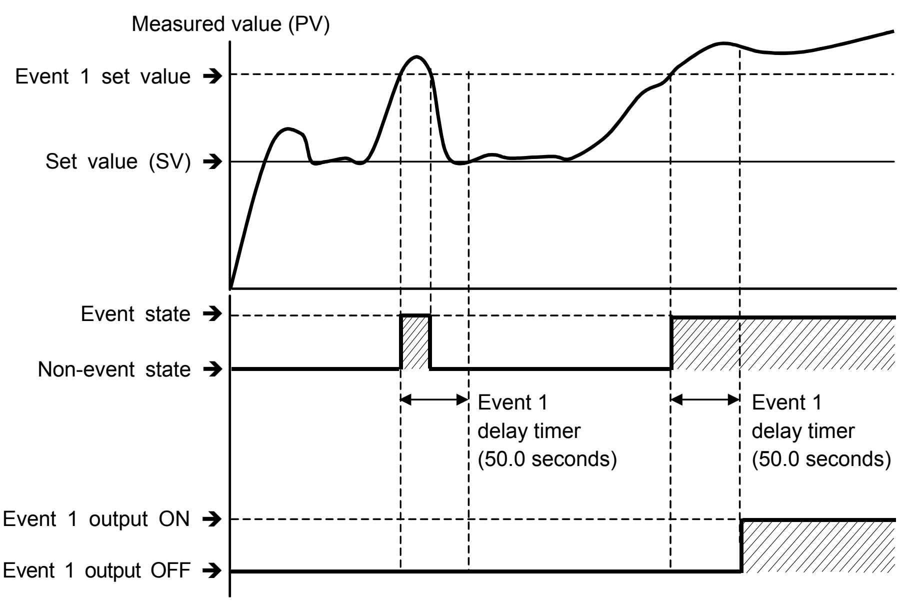
Number of data: 4 (Data of each channel)

Data range: 0 to 18000 seconds

Factory set value: 0 second

Related parameters: Comprehensive event state (P. 8-4), Event state monitor (P. 8-9), Event set value (P. 8-20), Event type (P. 8-77), Event interlock (P. 8-83), Event differential gap (P. 8-84), Force ON of Event action (P. 8-87)

Function: When an event condition becomes ON status, the output is suppressed until the Delay Timer set time elapses. After the time is up, if the event output is still ON status, the output will be produced.



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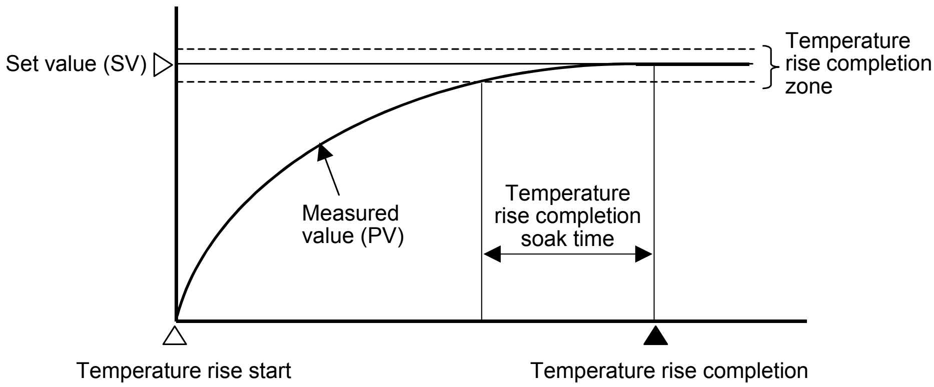
The event delay timer is also activated for the following cases.
- When set to the event state simultaneously with power turned on.
- When set to the event state simultaneously with control changed to RUN (control start) from STOP (control stop).

In the event wait state, no event output is turned on even after the event delay timer preset time has elapsed.

The event delay timer is reset for the following cases.
- When power failure occurs while the event delay timer is being activated
- When control is changed to STOP (control stop) from RUN (control start) while the event delay timer is being activated

When the Event 3 type is "9: Temperature rise completion", the Event 3 delay timer will be the temperature rise completion soak time *.

* Temperature rise completion soak time: The time until the temperature rise is complete after the measured value (PV) enters the temperature rise completion zone.



Force ON of Event 1 action	RKC communication identifier	OA
	Modbus register address	ch1: 01BAH (442) ch3: 01BCH (444) ch2: 01BBH (443) ch4: 01BDH (445)
Force ON of Event 2 action	RKC communication identifier	OB
	Modbus register address	ch1: 01D6H (470) ch3: 01D8H (472) ch2: 01D7H (471) ch4: 01D9H (473)
Force ON of Event 3 action	RKC communication identifier	OC
	Modbus register address	ch1: 01F2H (498) ch3: 01F4H (500) ch2: 01F3H (499) ch4: 01F5H (501)
Force ON of Event 4 action	RKC communication identifier	OD
	Modbus register address	ch1: 020EH (526) ch3: 0210H (528) ch2: 020FH (527) ch4: 0211H (529)

Select the operation state that is output (force ON) as the event action.

Attribute: R/W

Digits: 7 digits

Number of data: 4 (Data of each channel)

Data range: **RKC communication:** ASCII code data

The event action is assigned as a digit image in ASCII code data of 7 digits.

ASCII code data of 7 digits:

Most significant digit ·············· Least significant digit

Data: 0: Invalid 1: Valid

Least significant digit:
Event output turned on at input error occurrence

2nd digit: Event output turned on in manual mode

3rd digit: Event output turned on during the autotuning (AT) function is being executed

4th digit: Event output turned on during the setting change rate limiter is being operated

5th to Most significant digit:
Unused

Modbus: 0 to 15 (bit data)

The event action is assigned as a bit image in binary numbers.

Bit image: 0000000000000000

bit 15 ·························· bit 0

Bit data: 0: Invalid 1: Valid

bit 0: Event output turned on at input error occurrence

bit 1: Event output turned on in manual mode

bit 2: Event output turned on during the autotuning (AT) function is being executed

bit 3: Event output turned on during the setting change rate limiter is being operated

bit 4 to bit 15: Unused

Factory set value: 0

Related parameters: Input error determination point (high/low) (P. 8-73),
Action (high/low) at input error (P. 8-103)

This setting is not effective when the event type is “0: None”.

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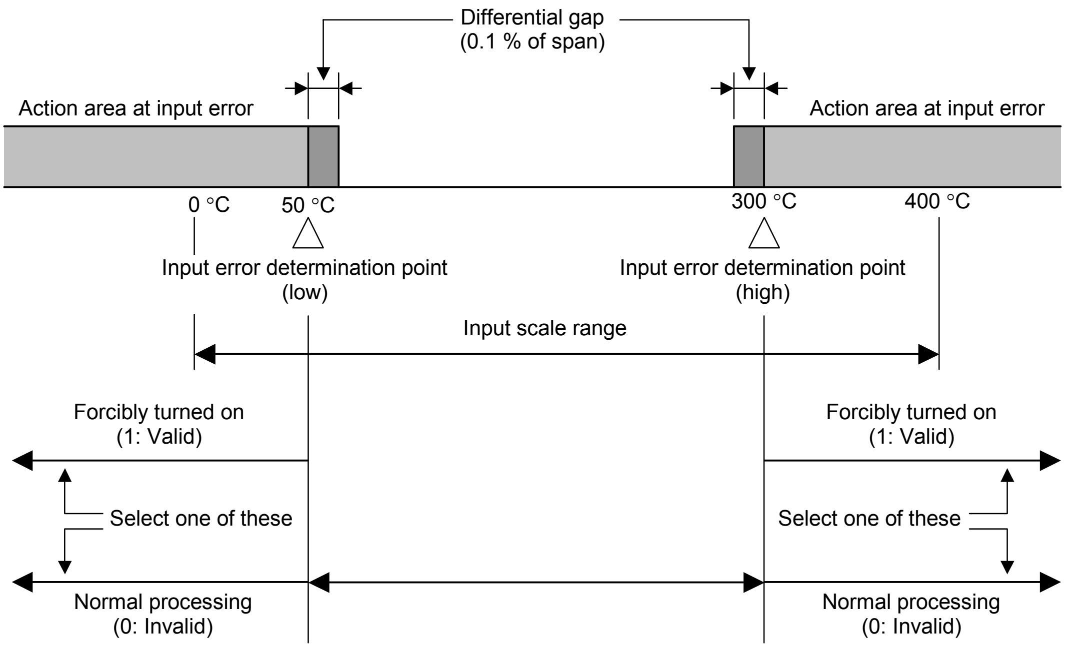
Example: When "0: Force ON at input error" is selected

Input range: 0 to 400 °C
Input error determination point (high): 300 °C
Input error determination point (low): 50 °C



"0: Invalid": The event output is produced depending on the selected event action status.
"1: Valid": The event output is forcibly turned on regardless of the event action status.

CT ratio	RKC communication identifier	XS
	Modbus register address	ch1: 0212H (530) ch3: 0214H (532) ch2: 0213H (531) ch4: 0215H (533)

Use to set the number of turns (ratio) of the current transformer that is used with the heater break alarm (HBA).

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0 to 9999
Factory set value: CTL-6-P-N: 800
CTL-12-S56-10L-N: 1000
Related parameters: Comprehensive event state (P. 8-4),
Heater break alarm (HBA) state monitor (P. 8-9),
Heater break alarm (HBA) set value (P. 8-32),
Heater break determination point (P. 8-34),
Heater melting determination point (P. 8-34), CT assignment (P. 8-89),
Heater break alarm (HBA) type (P. 8-90)

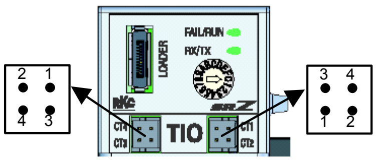
CT assignment	RKC communication identifier	ZF
	Modbus register address	ch1: 0216H (534) ch3: 0218H (536) ch2: 0217H (535) ch4: 0219H (537)

Use to assign the heater break (HBA) function to an output.

Attribute: R/W
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range: 0: None 3: OUT3
1: OUT1 4: OUT4
2: OUT2
Factory set value: 1 (OUT1)
Related parameters: Comprehensive event state (P. 8-4),
Heater break alarm (HBA) state monitor (P. 8-9),
Heater break alarm (HBA) set value (P. 8-32),
Heater break determination point (P. 8-34),
Heater melting determination point (P. 8-34), CT ratio (P. 8-89),
Heater break alarm (HBA) type (P. 8-90)

It is possible to detect three-phase heater breaks by assigning the same output number to the outputs for CT determination.

Pin No.	Description
1	CT4 (CH4)
2	
3	CT3 (CH3)
4	



Pin No.	Description
1	CT2 (CH2)
2	
3	CT1 (CH1)
4	

For example, on a module with four CT inputs like that above, three-phase heater breaks can be detected by assigning the same output number to CT1 and CT2, and CT3 and CT4 respectively.

Heater break alarm (HBA) type	RKC communication identifier	ND
	Modbus register address	ch1: 021AH (538) ch3: 021CH (540) ch2: 021BH (539) ch4: 021DH (541)

Use to select the heater break alarm (HBA) type.

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

Data range: 0: Heater break alarm (HBA) type A
[Time-proportional control output]
1: Heater break alarm (HBA) type B
[Continuous control output and time-proportional control output]

Factory set value: 1 (Heater break alarm (HBA) type B)

Related parameters: Comprehensive event state (P. 8-4),
Heater break alarm (HBA) state monitor (P. 8-9),
Heater break alarm (HBA) set value (P. 8-32),
Heater break determination point (P. 8-34),
Heater melting determination point (P. 8-34),
CT ratio (P. 8-89), CT assignment (P. 8-89)

Function: **Heater break alarm (HBA) type A:**

Heater Break Alarm (HBA) type A can only be used with time-proportional control output (relay, voltage pulse, or triac output).

The HBA function monitors the current flowing through the load by a dedicated current transformer (CT), compares the measured value with the HBA set values, and detects a fault in the heating circuit.

Heater break alarm (HBA) type B:

Heater Break Alarm (HBA) type B can be used with both continuous control output (current/voltage continuous output) and time-proportional control output (relay, voltage pulse output, or triac).

The HBA function assumes that the heater current value is proportional * to the control output value of the controller, otherwise viewed as the manipulated variable (MV), and compare it with the CT input value to detect a fault in the heating or cooling circuit.

* It is assumed that the current value flowing through the load is at maximum when the control output from the controller is 100 %, and the minimum current value flowing through the load is zero (0) when the control output from the controller is 0 %.

Number of heater break alarm (HBA) delay times	RKC communication identifier	DH
	Modbus register address	ch1: 021EH (542) ch3: 0220H (544) ch2: 021FH (543) ch4: 0221H (545)

To prevent producing a false alarm, the alarm function waits to produce an alarm status until the measured CT input value is in an alarm range for the preset number of consecutive sampling cycles.

Attribute: R/W

Digits: 7 digits

Number of data: 4 (Data of each channel)

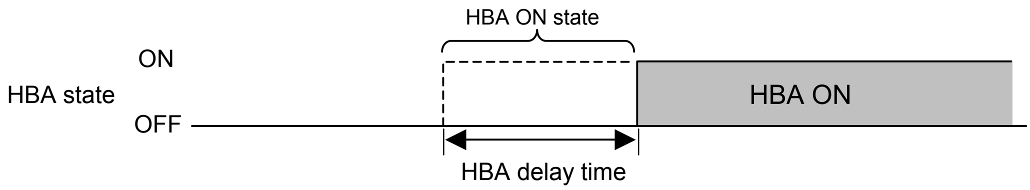
Data range: 0 to 255 times

Factory set value: 5 times

Related parameters: Comprehensive event state (P. 8-4),
Current transformer (CT) input value monitor (P. 8-7),
Heater break alarm (HBA) state monitor (P. 8-9),
Heater break alarm (HBA) set value (P. 8-9),
Heater break determination point (P. 8-34),
Heater melting determination point (P. 8-34),
CT ratio (P. 8-89), CT assignment (P. 8-89)

Function: Heater break alarm (HBA) delay time = Number of delay times × Sampling time (Sampling time: 500 ms)

Example: When the number of delay times is 5 times:
HBA delay time = 5 times × 500 ms = 2500 ms = 2.5 seconds



Hot/Cold start	RKC communication identifier	XN
	Modbus register address	ch1: 0222H (546) ch3: 0224H (548) ch2: 0223H (547) ch4: 0225H (549)

Use to select the start mode at power recovery.

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

Data range: 0: Hot start 1
1: Hot start 2
2: Cold start

Factory set value: 0 (Hot start 1)

Related parameters: RUN/STOP transfer (P. 8-17), Operation mode (P. 8-52), Start determination point (P. 8-93)

Function: The operation of this instrument is not affected by a power failure of 4 ms or less. The control start mode at power recovery after more than 4 ms power failure can be selected as follows.

Action when power failure recovers	**Operation mode when power failure recovers**	**Output value when power failure recovers**	
Hot start 1	Same as that before power failure	Near the output value before power failure occurs.	
Hot start 2	Same as that before power failure	Auto mode	Value as a result of control computation [2]
		Manual mode	Output limiter (low limit) [3]
Cold start	Manual	Output limiter (low limit) [3]	

[1] Even when control is started by switching from STOP to RUN with the operation mode set to “Control”, operation will take place in the start mode selected with Hot/Cold start.

[2] The result of control computation varies with the control response parameter.

[3] If there is no feedback resistance (FBR) input in position proportioning action, the following results.
- Hot start 2 (manual mode): No output (no control motor is driven)
- Cold start: No output (no control motor is driven)

If the startup tuning (ST) function is executed or an automatic temperature rise is made just when the power is turned on or selection is made from STOP to RUN as one of the startup conditions, control starts at Hot start 2 even if set to Hot start 1 (factory set value).

Start determination point	RKC communication identifier	SX
	Modbus register address	ch1: 0226H (550) ch3: 0228H (552) ch2: 0227H (551) ch4: 0229H (553)

Determination point always set to Hot start 1 when recovered from power failure. The start determination point becomes the deviation setting from the set value (SV).

Attribute: R/W

Digits: 7 digits

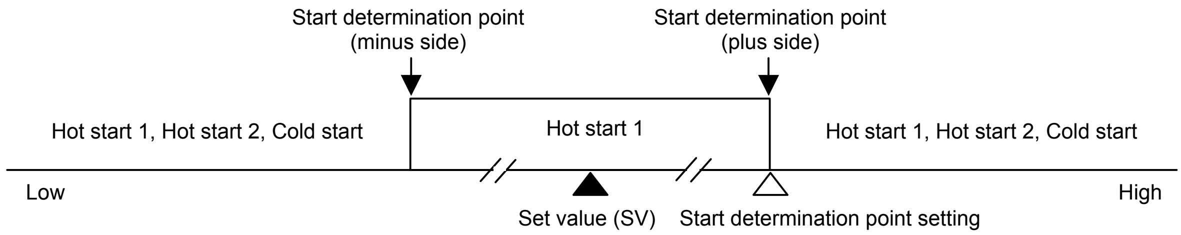
Number of data: 4 (Data of each channel)

Data range: 0 to Input span (The unit is the same as input value.)
(0: Action depending on the Hot/Cold start selection)

Factory set value: Depends on specification (value equivalent to 3% of the input span)

Related parameters: RUN/STOP transfer (P. 8-17), Hot/Cold start (P. 8-92)

Function:
- The start state is determined according to the measured value (PV) level [deviation from set value] at power recovery.
- When a measured value (PV) is between the determination points on the + (plus) and – (minus) sides, always started from “Hot start 1” when recovered.
- When a measured value (PV) is out of the determination points or the start determination point is set at “0”, operation starts from any start state selected by Hot/Cold start.



SV tracking	RKC communication identifier	XL
	Modbus register address	ch1: 022AH (554) ch3: 022CH (556) ch2: 022BH (555) ch4: 022DH (557)

To select Use/Unuse of SV tracking.

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

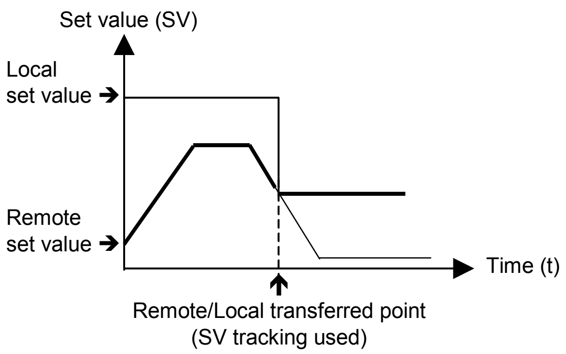
Data range: 0: Unused
1: Used

Factory set value: 1 (Used)

Related parameters: Remote/Local transfer (P. 8-17)

Function: With SV Tracking function, when Remote/Local mode is transferred from Remote to Local, the set value used in Remote mode before the mode transfer will be kept using in Local mode to prevent rapid set value change.

Operation mode:	Local →	Remote →	Local
Set value used	Local set value	Remote set value	Local set value
SV tracking used	Local set value ≠ Remote set value	Local set value ≠ Remote set value	Local set value = Remote set value
SV tracking unused	Local set value ≠ Remote set value	Local set value ≠ Remote set value	Local set value ≠ Remote set value



MV transfer function [Action taken when changed to Manual mode from Auto mode]	RKC communication identifier	OT
	Modbus register address	ch1: 022EH (558) ch3: 0230H (560) ch2: 022FH (559) ch4: 0231H (561)

The manipulated output value used for manual control is selected when the operation mode in changed to the manual mode from the automatic mode.

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

Data range:
0: Manipulated output value (MV) in Auto mode is used. [Balanceless/Bumpless function]
1: Manipulated output value (MV) in previous Manual mode is used.

Factory set value: 0 (Balanceless/Bumpless function)

Related parameters: Auto/Manual transfer (P. 8-16)

Function: For the balanceless/bumpless function, see **Auto/Manual transfer (P. 8-16).**

Control action	RKC communication identifier	XE
	Modbus register address	ch1: 0232H (562) ch3: 0234H (564) ch2: 0233H (563) ch4: 0235H (565)

Use to select the control action type.

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

Data range:
0: Brilliant II PID control (Direct action)
1: Brilliant II PID control (Reverse action)
2: Brilliant II Heat/Cool PID control [Water cooling]
3: Brilliant II Heat/Cool PID control [Air cooling]
4: Brilliant II Heat/Cool PID control [Cooling gain linear type]
5: Position proportioning control

Factory set value: Depends on model code
When not specifying: 1 (Brilliant II PID control (Reverse action))

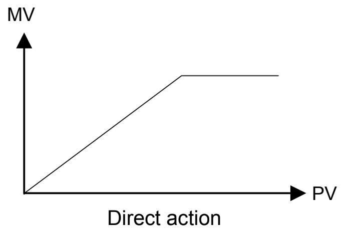
Function:

- **PID control (direct action)**

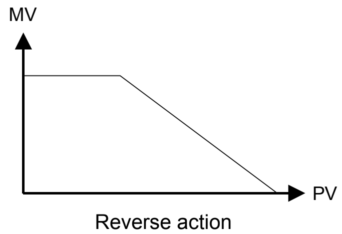
The manipulated output value (MV) increases as the measured value (PV) increases.
This action is used generally for cool control.

- **PID control (reverse action)**

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



Direct action



Reverse action

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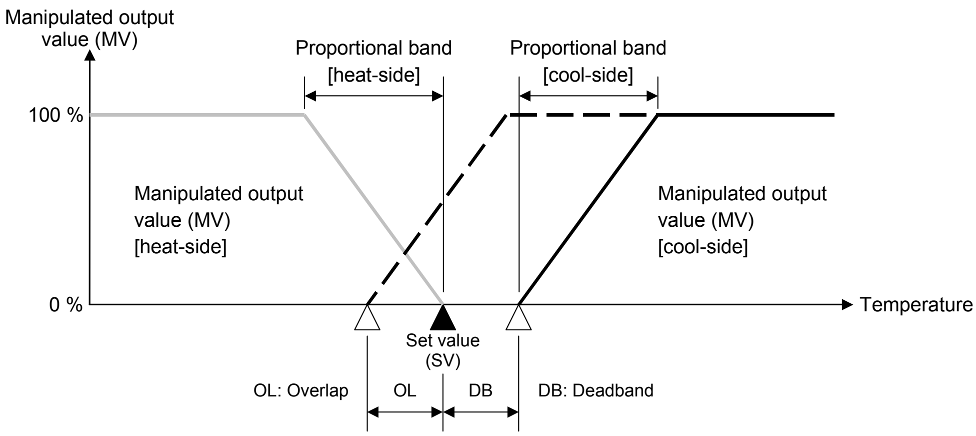
- **Heat/Cool PID control**

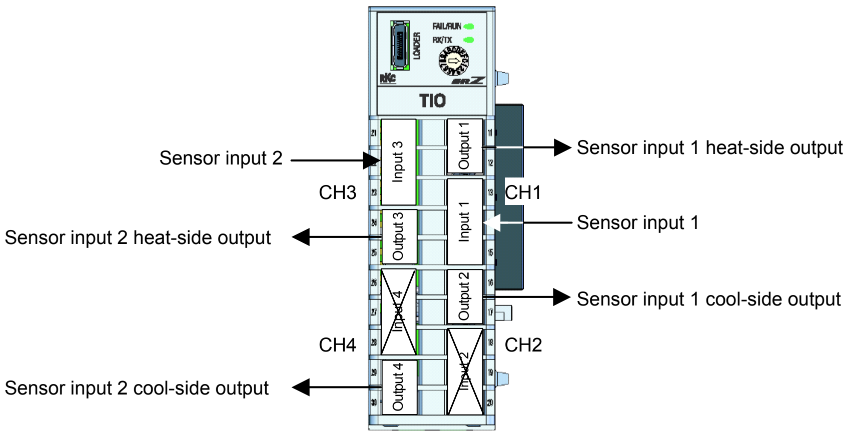
In heat/cool control, only one controller enables heat and cool control. For example, this is effective when cool control is required in extruder cylinder temperature control.

Water cooling/Air cooling: The algorithm assuming plastic molding machine heat/cool control is employed. Even in equipment provided with a cooling mechanism having nonlinear characteristics, it responds quickly to attain the characteristic responding to the set value with small overshooting.

Cooling gain linear type: The algorithm assuming applications without nonlinear cooling capability found in plastic molding machines is employed.



The input/output configuration for heat/cool control using a 4-channel module is shown below. There is no CH3 and CH4 when a 2-channel module is used.



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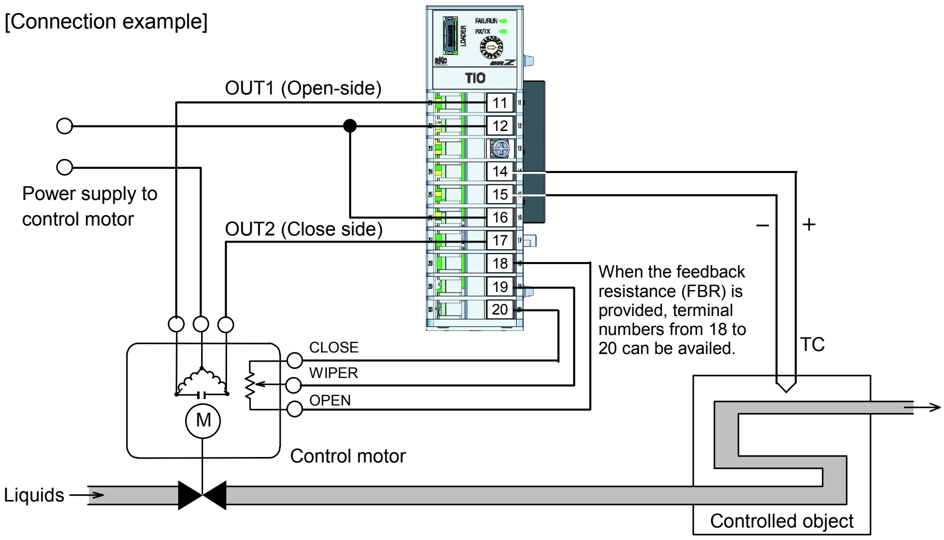
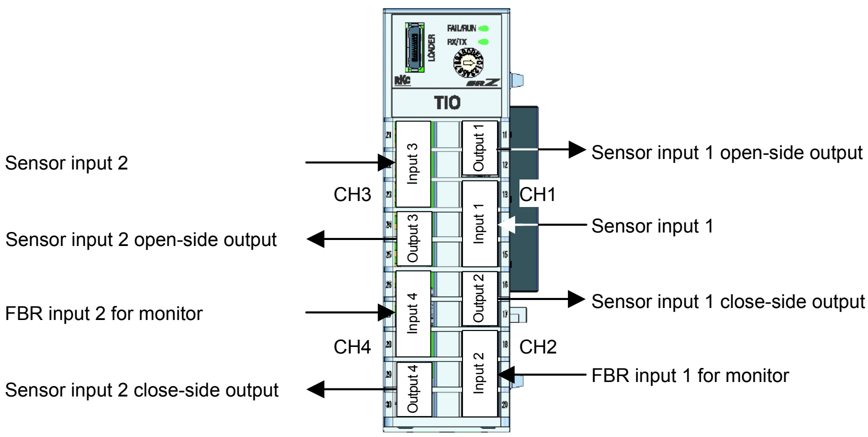
- **Position proportioning control**

Position proportioning control converts the control output value of the controller into the corresponding signal to control a motor driven valve (control motor) and then performs temperature control of a controlled object by regulating fluid flow.

Position proportional control without feedback resistance is used on this instrument, and control is possible without feedback resistance (FBR) input. If feedback resistance input is selected for the **Input type (P. 8-39)**, feedback resistance (FBR) input will be enabled and it will be possible to use "Manual manipulated output value" and "Manipulated output value at STOP".



The input/output configuration for position proportioning control using a 4-channel module is shown below. On a 4-channel module, the **Input type (P. 8-69)** can be set to feedback resistance input for control channels CH2 and CH4 of the module to enable position proportioning control with feedback resistance (FBR) input.
There is no CH3 and CH4 on a 2-channel module.



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The settings vary as shown below depending on whether or not there is feedback resistance (FBR) input. Configure settings for position proportional control in the order of the arrows (→).

(×: Valid, –: Invalid)

Parameter (Engineering setting data)	With Feedback resistance (FBR) input	Without Feedback resistance (FBR) input	Description
Control action *	×	×	Selects the position proportioning control.
Manipulated output value at STOP mode [heat-side]	×	–	Sets the valve position at control STOP.
Output limiter (high) [heat-side] Output limiter (low) [heat-side]	×	–	Sets the high-limit/low-limit value of the valve position.
Output value with AT turned on Output value with AT turned off	×	–	Sets the upper limit and lower limit values of the valve position which is opened and closed by output ON/OFF at autotuning (AT) execution.
Open/Close output neutral zone *	×	×	Sets the output OFF zone between open-side and close-side outputs.
Action at feedback resistance (FBR) input error	×	–	Sets the action at feedback resistance (FBR) input error.
Feedback adjustment	×	–	Adjusts the feedback resistance (FBR) input.
Control motor time *	×	×	Sets the control motor time required for rotation from the fully closed position to the fully opened position.
Integrated output limiter	–	×	Sets the integrated output limiter which integrates the output and sets the output to OFF when the result reached the set value when an open-side (or close-side) output is outputted continuously.
Valve action at STOP *	×	×	Sets the action of open-side and close-side outputs at control STOP.

* These parameters are necessary to set regardless of the presence or absence of feedback resistance (FBR) input.

Startup tuning (ST) cannot be executed by position proportioning control. In addition, the output change rate limiter also becomes invalid.

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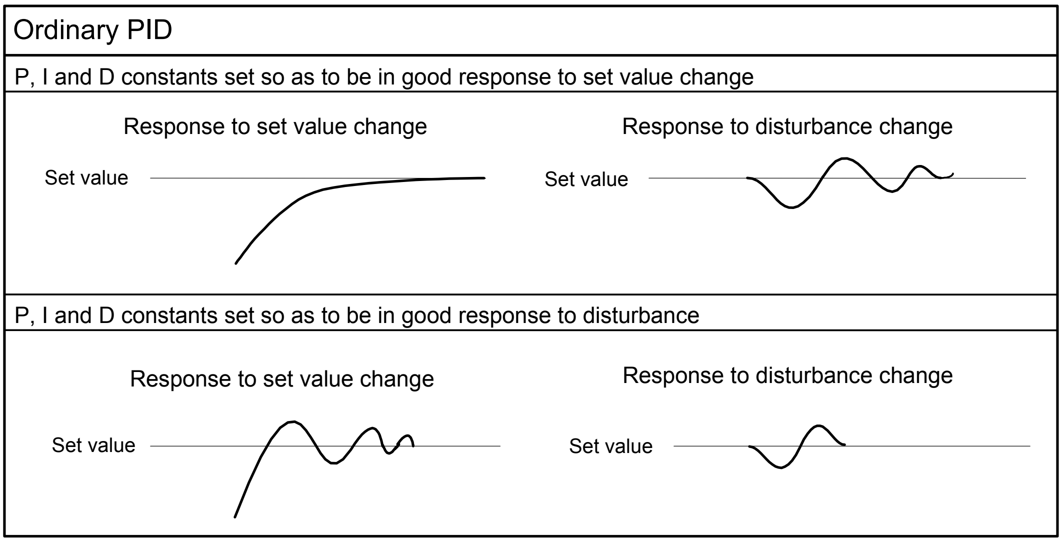
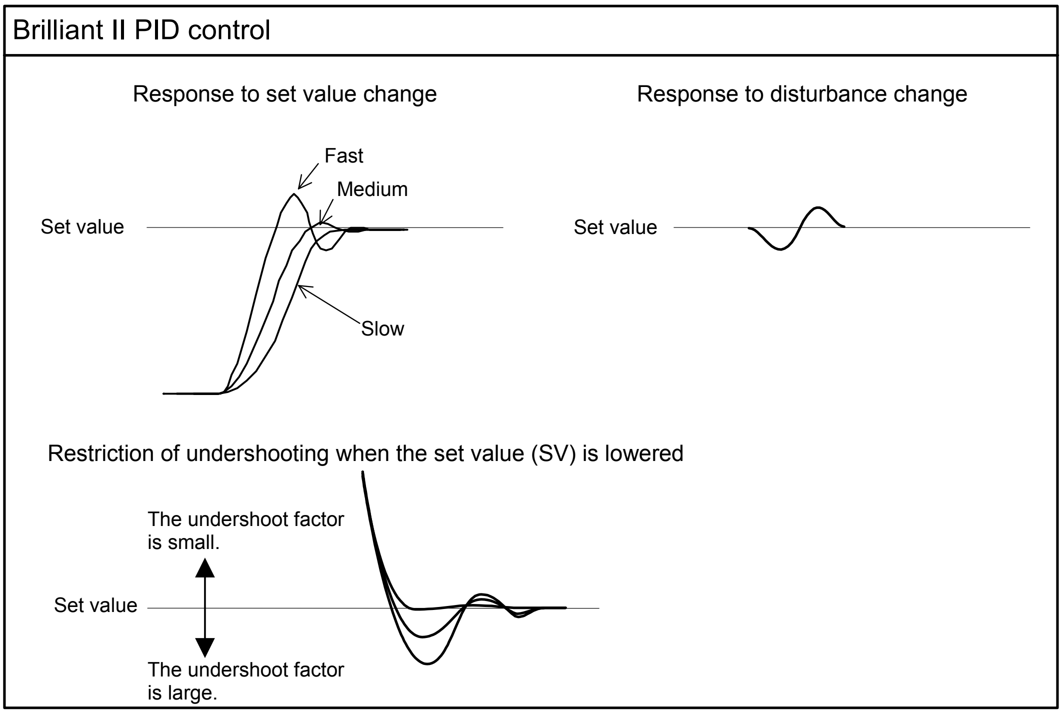
- **Brilliant II PID control**

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 II 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.” In addition, the controller is provided with the function which restricts the amount of undershooting caused by the cooling nonlinear characteristic possessed by plastic molding machines when the set value (SV) is lowered in heat/cool control.





Integral/derivative time decimal point position	RKC communication identifier	PK
	Modbus register address	ch1: 0236H (566) ch3: 0238H (568) ch2: 0237H (567) ch4: 0239H (569)

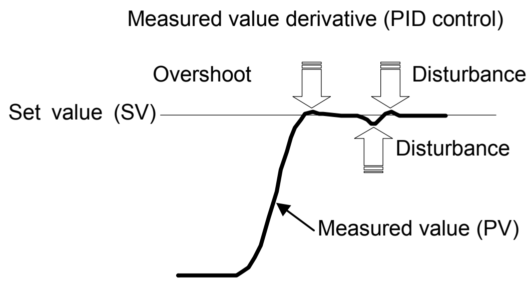
Use to select a decimal point position of integral time and derivative time.

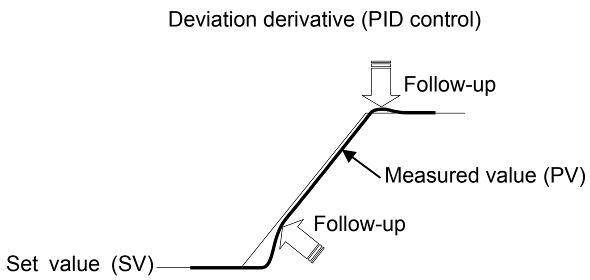
Attribute: R/W
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range: 0: 1 second setting (No decimal place)
1: 0.1 seconds setting (One decimal place)
Factory set value: 0 (1 second setting)
Related parameters: Integral time (P. 8-24), Derivative time (P. 8-25),
Integral time limiter (high/low) [heat-side/cool-side] (P. 8-114, P. 8-116),
Derivative time limiter (high/low) [heat-side/cool-side] (P. 8-115, P. 8-116)

Derivative action	RKC communication identifier	KA
	Modbus register address	ch1: 023AH (570) ch3: 023CH (572) ch2: 023BH (571) ch4: 023DH (573)

Use to select the derivative action.

Attribute: R/W
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range: 0: Measured value derivative
1: Deviation derivative
Factory set value: 0 (Measured value derivative)
Related parameters: PID/AT transfer (P. 8-14)
Function: Measured value derivative:
PID control putting much emphasis on response most adaptive to fixed set point control (mode)
Deviation derivative:
PID control putting much emphasis on follow-up most adaptive to ramp control or cascade control using a ratio of setting change limiter, etc. It is effective to restrict speed deviation in ramp control and also to restrict the amount of overshooting when changed to "soak" from "ramp."



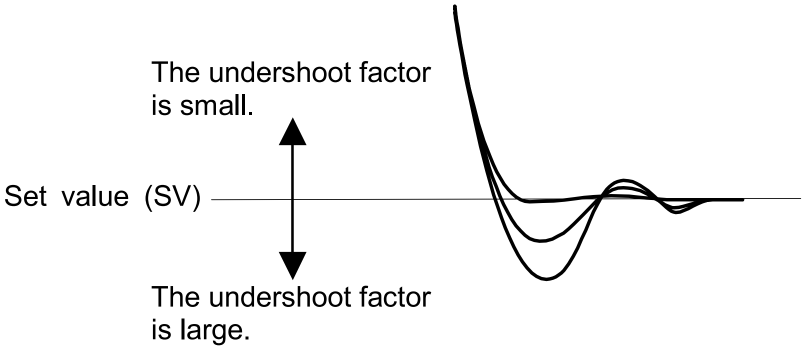


In position proportioning control, action becomes "Measured value derivative" regardless of the setting.

Undershoot suppression factor	RKC communication identifier	KB
	Modbus register address	ch1: 023EH (574) ch3: 0240H (576) ch2: Unused ch4: Unused

This is a factor to restrict undershooting on the cool side. The smaller the value, the smaller the undershooting.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.000 to 1.000
Factory set value: Brilliant II Heat/Cool PID control [Water cooling type]: 0.100
Brilliant II Heat/Cool PID control [Air cooling type]: 0.250
Brilliant II Heat/Cool PID control [Cooling gain linear type]: 1.000
Related parameters: Control action (P. 8-95)
Function: This function restricts undershooting caused by the cooling nonlinear characteristic possessed by plastic molding machines when the set value (SV) is lowered.



The undershooting restriction factor is invalid even if set when control is not in Heat/Cool PID control.

Derivative gain	RKC communication identifier	DG
	Modbus register address	ch1: 0242H (578) ch3: 0244H (580) ch2: 0243H (579) ch4: 0245H (581)

Use to set a gain used for the derivative action in PID control. Derivative gain should not be changed under ordinary operation.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.1 to 10.0
Factory set value: 6.0
Related parameters: Derivative time (P. 8-25)

Under ordinary operation, it is not necessary to change the factory set value.

ON/OFF action differential gap (upper)	RKC communication identifier	IV
	Modbus register address	ch1: 0246H (582) ch3: 0248H (584) ch2: 0247H (583) ch4: 0249H (585)
ON/OFF action differential gap (lower)	RKC communication identifier	IW
	Modbus register address	ch1: 024AH (586) ch3: 024CH (588) ch2: 024BH (587) ch4: 024DH (589)

ON/OFF action differential gap (upper): Use to set the ON/OFF control differential gap (upper).
ON/OFF action differential gap (lower): Use to set the ON/OFF control differential gap (lower).

Attribute: R/W

Digits: 7 digits

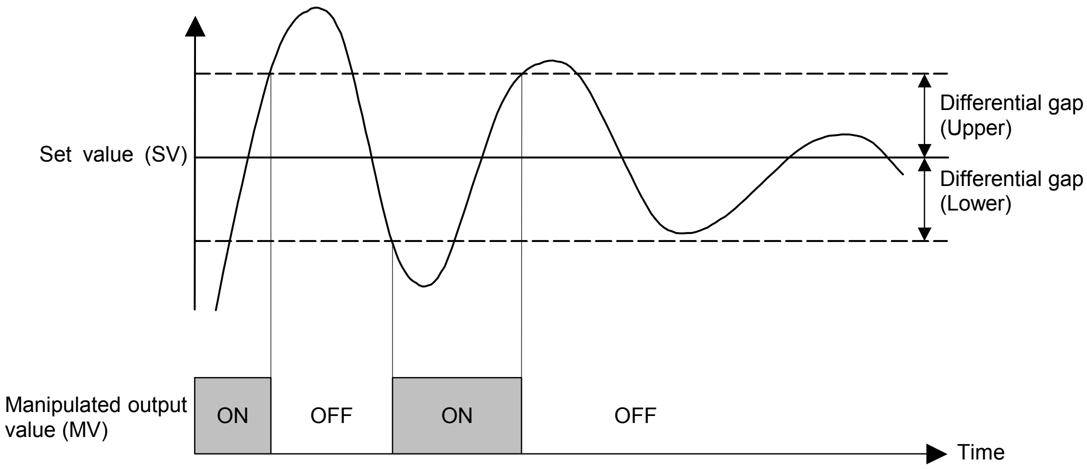
Number of data: 4 (Data of each channel)

Data range: TC/RTD inputs: 0 (0.0) to Input span (Unit: °C [°F])
Voltage (V)/Current (I) inputs: 0.0 to 100.0 % of input span

Factory set value: ON/OFF action differential gap (upper):
TC/RTD inputs: 1 °C [°F]
Voltage (V)/Current (I) inputs: 0.1 %
ON/OFF action differential gap (lower):
TC/RTD inputs: 1 °C [°F]
Voltage (V)/Current (I) inputs: 0.1 %

Related parameters: Proportional band [heat-side] (P. 8-23)

Function: ON/OFF control is possible when the proportional band is set to “0” or “0.0”. In ON/OFF control with Reverse action, when the measured value (PV) is smaller than the set value (SV), the manipulated output (MV) is 100 % or ON. When the PV is higher than the SV, the MV is 0 % or OFF. Differential gap setting prevents control output from repeating ON and OFF too frequently.



Action (high) at input error	RKC communication identifier	WH
	Modbus register address	ch1: 024EH (590) ch3: 0250H (592) ch2: 024FH (591) ch4: 0251H (593)
Action (low) at input error	RKC communication identifier	WL
	Modbus register address	ch1: 0252H (594) ch3: 0254H (596) ch2: 0253H (595) ch4: 0255H (597)

Action (high) at input error:
Use to select the action when the measured value reaches the input error determination point (high).
Action (low) at input error:
Use to select the action when the measured value reaches the input error determination point (low).

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

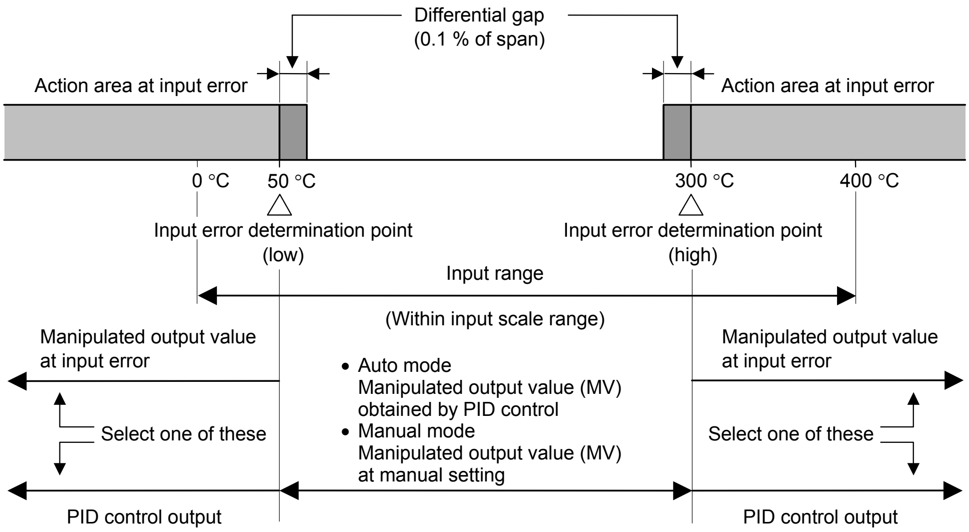
Data range: 0: Normal control (PID control output)
1: Manipulated output value at input error

Factory set value: Input error determination point (high): 0 (Normal control)
Input error determination point (low): 0 (Normal control)

Related parameters: Input error determination point (high/low) (P. 8-73), Manipulated output value at input error (P. 8-104)

Function: Input Error Determination

Example: Input range: 0 to 400 °C
Input error determination point (high): 300 °C
Input error determination point (low): 50 °C



[Manipulated output action at input error]

- Auto mode
  Selected to the manual mode just when determined to be at input error to output the manipulated output value set by the "manipulated output value at input error."
- Manual mode
  Not selected to the "manipulated output value at input error" even if determined to be at input error.

When selected to RUN (control start) with any input error (burnout, etc.) occurring at STOP (control stop), not selected to the "manipulated output value at input error" (both in Auto and Manual modes).

Manipulated output value at input error	RKC communication identifier	OE
	Modbus register address	ch1: 0256H (598) ch3: 0258H (600) ch2: 0257H (599) ch4: 0259H (601)

When the measured value reaches Input Error Determination Point and Action at Input Error is set to “1: Manipulated output value at input error”, this manipulated value is output.

Attribute: R/W

Digits: 7 digits

Number of data: 4 (Data of each channel)

Data range: −105.0 to +105.0 %

Factory set value: 0.0 %

Related parameters: Action (high/low) at input error (P. 8-103), Output limiter (high/low) (P. 8-107), Valve action at STOP (P. 8-119)

The actual output value becomes the value restricted by the output limiter.

When the control action is the position proportioning action:
When there is no feedback resistance (FBR) input or the same input breaks, action taken at that time is in accordance with the valve action setting at STOP.

Manipulated output value at STOP mode [heat-side]	RKC communication identifier	OF
	Modbus register address	ch1: 025AH (602) ch3: 025CH (604) ch2: 025BH (603) ch4: 025DH (605)
Manipulated output value at STOP mode [cool-side]	RKC communication identifier	OG
	Modbus register address	ch1: 025EH (606) ch3: 0260H (608) ch2: Unused ch4: Unused

Manipulated output value to be output at STOP (control stop).

Attribute: R/W

Digits: 7 digits

Number of data: 4 (Data of each channel)

Data range: −5.0 to +105.0 %

Factory set value: Manipulated output value at STOP mode [heat-side] −5.0 %
Manipulated output value at STOP mode [cool-side]: −5.0 %

Related parameters: RUN/STOP transfer (P. 8-17), Operation mode (P. 8-52)

When the control action is the position proportioning action:
Only when there is feedback resistance (FBR) input and it does not break, the manipulated output value [heat-side] at STOP is output.

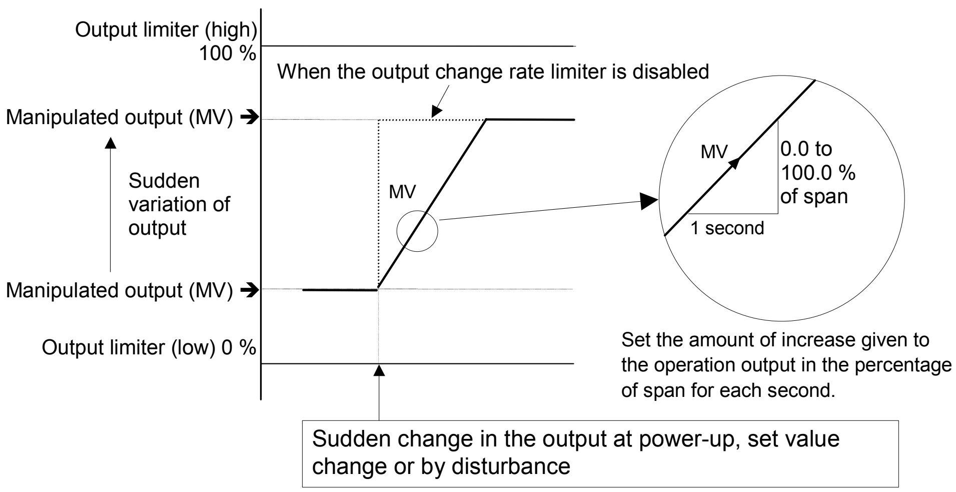
Output change rate limiter (up) [heat-side]	RKC communication identifier	PH
	Modbus register address	ch1: 0262H (610) ch3: 0264H (612) ch2: 0263H (611) ch4: 0265H (613)
Output change rate limiter (down) [heat-side]	RKC communication identifier	PL
	Modbus register address	ch1: 0266H (614) ch3: 0268H (616) ch2: 0267H (615) ch4: 0269H (617)
Output change rate limiter (up) [cool-side]	RKC communication identifier	PX
	Modbus register address	ch1: 0272H (626) ch3: 0274H (628) ch2: Unused ch4: Unused
Output change rate limiter (down) [cool-side]	RKC communication identifier	PY
	Modbus register address	ch1: 0276H (630) ch3: 0278H (632) ch2: Unused ch4: Unused

Set the output change rate limiter (up, down) that limits change in the output.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.0 to 100.0 %/second (0.0: OFF)
Factory set value:
Output change rate limiter (up) [heat-side]: 0.0
Output change rate limiter (down) [heat-side]: 0.0
Output change rate limiter (up) [cool-side]: 0.0
Output change rate limiter (down) [cool-side]: 0.0
Related parameters: Output limiter (high/low) (P. 8-107)
Function: The output change rate limiter limits the variation of manipulated output (MV) per second. This function is suitable for an application in which a sudden MV change is not acceptable. Invalid when the control action is the position proportioning action.

[The output change rate limiter is effective.]

- The MV reaches 100 % when the power is turned on to the controller and such a sudden output change is not acceptable in the application.
- A sudden output change occurs at the SV change and it is not acceptable in the application.



The output changes at specific rates set by Output Change Rate Limiter (up) even under the situations where a sudden output change would occur without Output Change Rate Limiter function. There is also independent Output Change Rate Limiter (down).

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- If the Output Change Rate is set smaller, it will cause slow control response and affect Derivative action.
- When the Output Change Rate Limiter is used, you may not be able to obtain appropriate PID constants by autotuning.
- The Output Change Rate Limiter is particularly effective when a sudden MV change may create uncontrollable situation cause a large current flow. Also, it is very effective current output or voltage output is used as control output.

Output limiter (high) [heat-side]	RKC communication identifier	OH
	Modbus register address	ch1: 026AH (618) ch3: 026CH (620) ch2: 026BH (619) ch4: 026DH (621)
Output limiter (low) [heat-side]	RKC communication identifier	OL
	Modbus register address	ch1: 026EH (622) ch3: 0270H (624) ch2: 026FH (623) ch4: 0271H (625)
Output limiter (high) [cool-side]	RKC communication identifier	OX
	Modbus register address	ch1: 027AH (634) ch3: 027CH (636) ch2: Unused ch4: Unused
Output limiter (low) [cool-side]	RKC communication identifier	OY
	Modbus register address	ch1: 027EH (638) ch3: 0280H (640) ch2: Unused ch4: Unused

Use to set the high limit value (low limit value) of manipulated output (MV).

Attribute: R/W

Digits: 7 digits

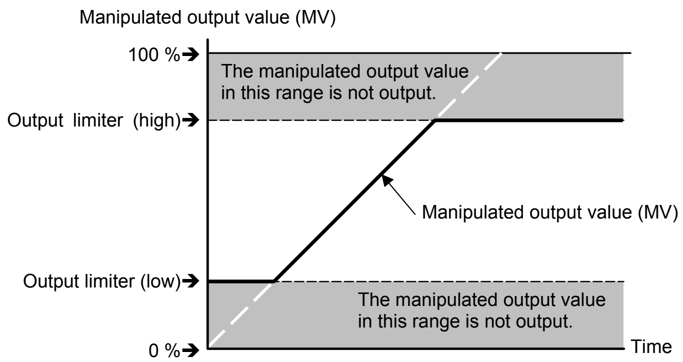
Number of data: 4 (Data of each channel)

Data range:
Output limiter (high) [heat-side]: Output limiter (low) [heat-side] to 105.0 %
Output limiter (low) [heat-side]: −5.0 % to Output limiter (high) [heat-side]
Output limiter (high) [cool-side]: Output limiter (low) [cool-side] to 105.0 %
Output limiter (low) [cool-side]: −5.0 % to Output limiter (high) [cool-side]

Factory set value:
Output limiter (high) [heat-side]: 105.0 %
Output limiter (low) [heat-side]: −5.0 %
Output limiter (high) [cool-side]: 105.0 %
Output limiter (low) [cool-side]: −5.0 %

Related parameters: Manipulated output value at input error (P. 8-104), Output change rate limiter (up/down) (P. 8-106), Output value with AT turned on (P. 8-110), Output value with AT turned off (P. 8-110)

Function: This is the function which restricts the high and low limits of manipulated output values (MV).



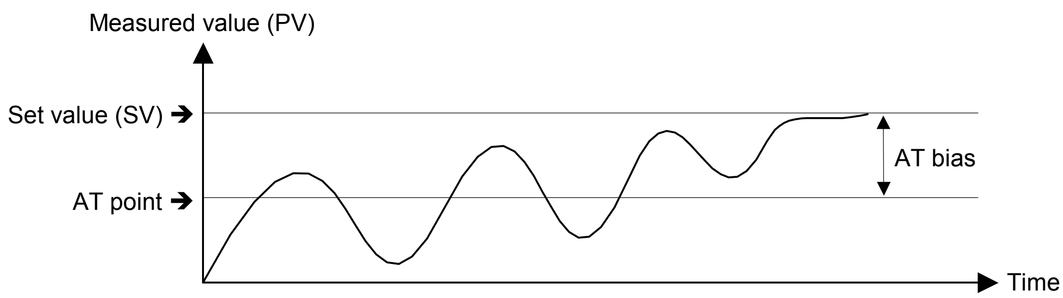
When the control action is the position proportioning action:
Only when there is feedback resistance (FBR) input and it does not break, the output limiter (high/low) [heat-side] becomes valid.

AT bias	RKC communication identifier	GB
	Modbus register address	ch1: 0282H (642) ch3: 0284H (644) ch2: 0283H (643) ch4: 0285H (645)

Use to set a bias to move the set value only when autotuning is activated.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: –Input span to +Input span
Factory set value: 0
Related parameters: PID/AT transfer (P. 8-14)
Function: The AT bias is used to prevent overshoot during autotuning in the application which does not allow overshoot even during autotuning. RKC autotuning method uses ON/OFF control at the set value to calculate the PID values.
However, if overshoot is a concern during autotuning, the desired AT bias should be set to lower the set point during autotuning so that overshoot is prevented.

[Example] AT When AT bias is set to the minus (–) side.

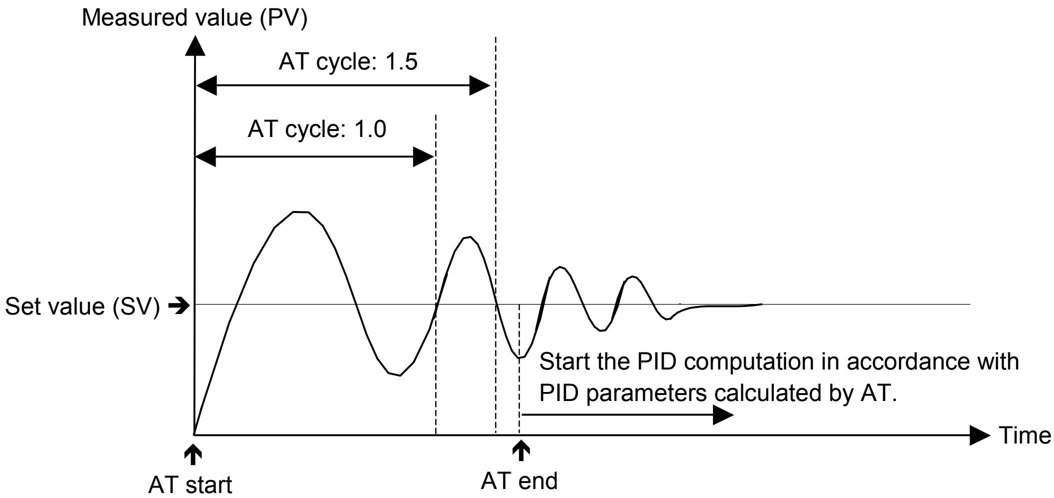


AT cycles	RKC communication identifier	G3
	Modbus register address	ch1: 0286H (646) ch3: 0288H (648) ch2: 0287H (647) ch4: 0289H (649)

The number of ON/OFF cycles is selected when the autotuning (AT) function is executed.

Attribute: R/W
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range: 0: 1.5 cycles
1: 2.0 cycles
2: 2.5 cycles
3: 3.0 cycles
Factory set value: 1 (2.0 cycles)
Related parameters: PID/AT transfer (P. 8-14)

[Example] When the AT cycle is set to 1.5 cycle and the autotuning (AT) function is executed just after the power is turned on.



Output value with AT turned on	RKC communication identifier	OP
	Modbus register address	ch1: 028AH (650) ch3: 028CH (652) ch2: 028BH (651) ch4: 028DH (653)
Output value with AT turned off	RKC communication identifier	OQ
	Modbus register address	ch1: 028EH (654) ch3: 0290H (656) ch2: 028FH (655) ch4: 0291H (657)

Output value with AT turned on:
This parameter is for limiting the manipulated output value (ON side) while the autotuning (AT) function is being executed.

Output value with AT turned off:
This parameter is for limiting the manipulated output value (OFF side) while the autotuning (AT) function is being executed.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: Output value with AT turned on: Output value with AT turned off to +105.0 %
Output value with AT turned off: −105.0 % to Output value with AT turned on
Factory set value: Output value with AT turned on: +105.0 %
Output value with AT turned off: −105.0 %
Related parameters: PID/AT transfer (P. 8-14), Output limiter (high/low) (P. 8-107)

The actual output value becomes the value restricted by the output limiter.

When the control action is the position proportioning action:
Only when there is feedback resistance (FBR) input and it does not break, the output value with AT turned on or output value with AT turned off becomes valid.

Output value with AT turned on:
High limit value for feedback resistance input while the autotuning (AT) function is being executed

Output value with AT turned off:
Low limit value for feedback resistance input while the autotuning (AT) function is being executed

- **Plus (+)/minus (−) setting when in heat/cool PID control**

Set the output value with AT turned on to a plus (+) value.	Output value with the heat-side turned on = Output value with AT turned on Output value with the heat-side turned off = Output limiter low [heat-side]
Set the output value with AT turned off to a minus (−) value.	Output value with the cool-side turned on = Output value with AT turned off Output value with the cool-side turned off = Output limiter low [cool-side]
Set the output values with AT turned on and off to plus (+) values.	The autotuning (AT) function is executed only on the heat-side. Output value with the heat-side turned on = Output value with AT turned on Output value with the heat-side turned off = Output value with AT turned off (Output value with AT turned on > Output value with AT turned off)
Set the output values with AT turned on and off to minus (−) values.	The autotuning (AT) function is executed only on the cool-side. Output value with the cool-side turned on = Output value with AT turned off Output value with the cool-side turned off = Output value with AT turned on (Output value with AT turned on > Output value with AT turned off)

AT differential gap time	RKC communication identifier	GH
	Modbus register address	ch1: 0292H (658) ch3: 0294H (660) ch2: 0293H (659) ch4: 0295H (661)

Use to set an ON/OFF action differential gap time for autotuning. This function prevents the AT function from malfunctioning caused by noise.

Attribute: R/W

Digits: 7 digits

Number of data: 4 (Data of each channel)

Data range: 0.0 to 50.0 seconds

Factory set value: 10.0 seconds

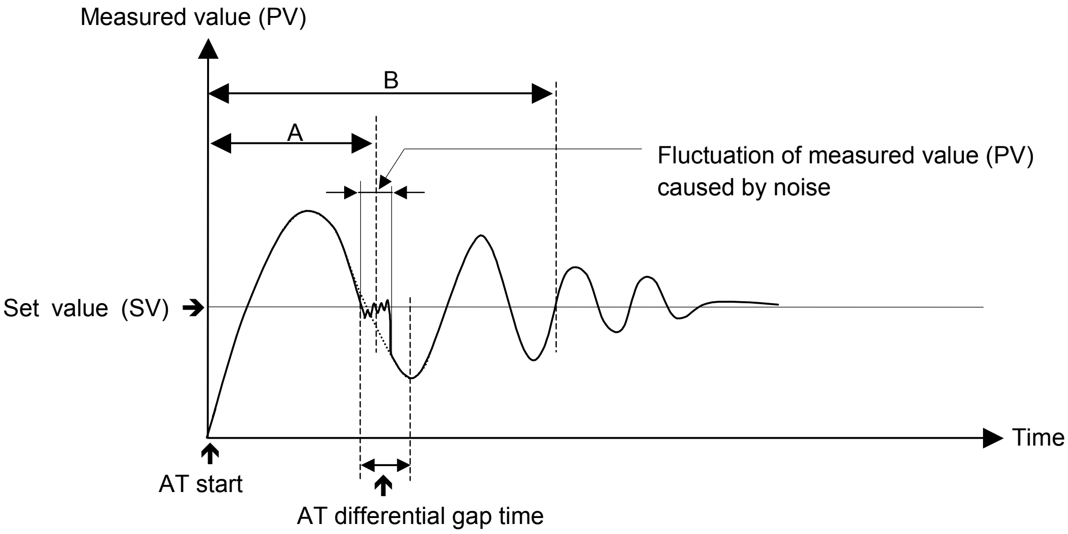
Related parameters: PID/AT transfer (P. 8-14)

Function: In order to prevent the output from chattering due to the fluctuation of a measured value (PV) caused by noise during autotuning, the output on or off state is held until "AT differential gap time" has passed after the output on/off state is changed to the other.
Set "AT differential gap time" to "1/100 × Time required for temperature rise."

[Example]

A: AT cycle time the AT differential gap time set to 0.00 second
The output chatters due to the fluctuation of the measured value (PV) caused by noise, and autotuning function is not able to monitor appropriate cycles to calculate suitable PID values.

B: AT cycle time when the AT differential gap time is set to "Time corresponding to 0.25 cycles." The fluctuation of a measured value (PV) caused by noise is ignored and as a result autotuning function is able to monitor appropriate cycles to calculate suitable PID values.



The factory set value of the AT cycle is 2 cycles.

Proportional band adjusting factor [heat-side]	RKC communication identifier	KC
	Modbus register address	ch1: 0296H (662) ch3: 0298H (664) ch2: 0297H (663) ch4: 0299H (665)
Proportional band adjusting factor [cool-side]	RKC communication identifier	KF
	Modbus register address	ch1: 02A2H (674) ch3: 02A4H (676) ch2: Unused ch4: Unused

Proportional band adjusting factor [heat-side]:
This is a factor which is multiplied by the proportional band [heat-side] calculated by executing the autotuning (AT) function.
Proportional band adjusting factor [cool-side]:
This is a factor which is multiplied by the proportional band [cool-side] calculated by executing the autotuning (AT) function.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.01 to 10.00 times
Factory set value: Proportional band adjusting factor [heat-side]: 1.00 times
Proportional band adjusting factor [cool-side]: 1.00 times
Related parameters: PID/AT transfer (P. 8-14), Proportional band (P. 8-23)

The Proportional band adjusting factor [cool-side] is valid only during Heat/Cool PID control.

Integral time adjusting factor [heat-side]	RKC communication identifier	KD
	Modbus register address	ch1: 029AH (666) ch3: 029CH (662) ch2: 029BH (661) ch4: 029DH (663)
Integral time adjusting factor [cool-side]	RKC communication identifier	KG
	Modbus register address	ch1: 02A6H (678) ch3: 02A8H (680) ch2: Unused ch4: Unused

Integral time adjusting factor [heat-side]:
This is a factor which is multiplied by the integral time [heat-side] calculated by executing the autotuning (AT) function.
Integral time adjusting factor [cool-side]:
This is a factor which is multiplied by the integral time [cool-side] calculated by executing the autotuning (AT) function.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.01 to 10.00 times
Factory set value: Integral time adjusting factor [heat-side]: 1.00 times
Integral time adjusting factor [cool-side]: 1.00 times
Related parameters: PID/AT transfer (P. 8-14), Integral time (P. 8-24)

The Integral time adjusting factor [cool-side] is valid only during Heat/Cool PID control.

Derivative time adjusting factor [heat-side]	RKC communication identifier	KE
	Modbus register address	ch1: 029EH (670) ch3: 02A0H (672) ch2: 029FH (671) ch4: 02A1H (673)
Derivative time adjusting factor [cool-side]	RKC communication identifier	KH
	Modbus register address	ch1: 02AAH (682) ch3: 02ACH (684) ch2: Unused ch4: Unused

Derivative time adjusting factor [heat-side]:
This is a factor which is multiplied by the derivative time [heat-side] calculated by executing the autotuning (AT) function.

Derivative time adjusting factor [cool-side]:
This is a factor which is multiplied by the derivative time [cool-side] calculated by executing the autotuning (AT) function.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.01 to 10.00 times
Factory set value: Derivative time adjusting factor [heat-side]: 1.00 times
Derivative time adjusting factor [cool-side]: 1.00 times
Related parameters: PID/AT transfer (P. 8-14), Derivative time (P. 8-25)

The Derivative time adjusting factor [cool-side] is valid only during Heat/Cool PID control.

Proportional band limiter (high) [heat-side]	RKC communication identifier	P6
	Modbus register address	ch1: 02AEH (686) ch3: 02B0H (688) ch2: 02AFH (687) ch4: 02B1H (689)
Proportional band limiter (low) [heat-side]	RKC communication identifier	P7
	Modbus register address	ch1: 02B2H (690) ch3: 02B4H (692) ch2: 02B3H (691) ch4: 02B5H (693)

Proportional band limiter (high) [heat-side]: Use to set the high limit value of proportional band [heat-side].
Proportional band limiter (low) [heat-side]: Use to set the low limit value of proportional band [heat-side].
(However, Proportional band limiter (high) [heat-side] ≥ Proportional band limiter (low) [heat-side])

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: TC/RTD inputs: 0 (0.0) to Input span (Unit: °C [°F])
Voltage (V)/Current (I) inputs: 0.0 to 1000.0 % of input span
0 (0.0): ON/OFF action
(Heat/Cool PID control: heat-side and cool-side are both ON/OFF action)
Factory set value: Proportional band limiter (high) [heat-side]:
TC/RTD inputs: Input span
Voltage (V)/Current (I) inputs: 1000.0 %
Proportional band limiter (low) [heat-side]:
TC/RTD inputs: 0 (0.0)
Voltage (V)/Current (I) inputs: 0.0 %
Related parameters: PID/AT transfer (P. 8-14), Startup tuning (ST) (P. 8-53), Proportional band [heat-side] (P. 8-23), Decimal point position (P. 8-71)
Function: The proportional band [heat-side] range is restricted while the startup tuning (ST) and autotuning (AT) functions are being executed.

Integral time limiter (high) [heat-side]	RKC communication identifier	I6
	Modbus register address	ch1: 02B6H (694) ch3: 02B8H (696) ch2: 02B7H (695) ch4: 02B9H (697)
Integral time limiter (low) [heat-side]	RKC communication identifier	I7
	Modbus register address	ch1: 02BAH (698) ch3: 02BCH (700) ch2: 02BBH (699) ch4: 02BDH (701)

Integral time limiter (high) [heat-side]: Use to set the high limit value of integral time [heat-side].
Integral time limiter (low) [heat-side]: Use to set the low limit value of integral time [heat-side].
(However, Integral time limiter (high) [heat-side] ≥ Integral time limiter (low) [heat-side])

Attribute: R/W

Digits: 7 digits

Number of data: 4 (Data of each channel)

Data range:
PID control or heat/cool PID control: 0 to 3600 seconds or 0.0 to 1999.9 seconds
Position proportioning control: 1 to 3600 seconds or 0.1 to 1999.9 seconds

Factory set value:
Integral time limiter (high) [heat-side]:
PID control or heat/cool PID control: 3600 seconds
Position proportioning control: 3600 seconds

Integral time limiter (low) [heat-side]:
PID control or heat/cool PID control: 0 seconds
Position proportioning control: 1 second

Related parameters: PID/AT transfer (P. 8-14), Integral time [heat-side] (P. 8-24), Startup tuning (ST) (P. 8-53), Integral/derivative time decimal point position (P. 8-100)

Function: The integral time [heat-side] range is restricted while the startup tuning (ST) and autotuning (AT) functions are being executed.

If the autotuning (AT) function is executed when the integral time limiter (high) [heat-side] is set at “0” or “0.0,” P and D values suitable to PD control (heat-side) are calculated (excluding the Position proportioning control).

Derivative time limiter (high) [heat-side]	RKC communication identifier	D6
	Modbus register address	ch1: 02BEH (702) ch3: 02C0H (704) ch2: 02BFH (703) ch4: 02C1H (705)
Derivative time limiter (low) [heat-side]	RKC communication identifier	D7
	Modbus register address	ch1: 02C2H (706) ch3: 02C4H (708) ch2: 02C3H (707) ch4: 02C5H (709)

Derivative time limiter (high) [heat-side]: Use to set the high limit value of derivative time [heat-side].
Derivative time limiter (low) [heat-side]: Use to set the low limit value of derivative time [heat-side].
(However, Derivative time limiter (high) [heat-side] ≥ Derivative time limiter (low) [heat-side])

Attribute: R/W

Digits: 7 digits

Number of data: 4 (Data of each channel)

Data range: 0 to 3600 seconds or 0.0 to 1999.9 seconds

Factory set value: Derivative time limiter (high) [heat-side]: 3600 seconds
Derivative time limiter (low) [heat-side]: 0 seconds

Related parameters: PID/AT transfer (P. 8-14), Derivative time [heat-side] (P. 8-25), Startup tuning (ST) (P. 8-53), Integral/derivative time decimal point position (P. 8-100)

Function: The derivative time [heat-side] range is restricted while the startup tuning (ST) and autotuning (AT) functions are being executed.

If the autotuning (AT) function is executed when the derivative time limiter (high) [heat-side] is set at “0” or “0.0”, P and I values suitable to PI control (heat-side) are calculated.

Proportional band limiter (high) [cool-side]	RKC communication identifier	P8
	Modbus register address	ch1: 02C6H (710) ch3: 02C8H (712) ch2: Unused ch4: Unused
Proportional band limiter (low) [cool-side]	RKC communication identifier	P9
	Modbus register address	ch1: 02CAH (714) ch3: 02CCH (716) ch2: Unused ch4: Unused

Proportional band limiter (high) [cool-side]: Use to set the high limit value of proportional band [cool-side].
Proportional band limiter (low) [cool-side]: Use to set the low limit value of proportional band [cool-side].
(However, Proportional band limiter (high) [cool-side] ≥ Proportional band limiter (low) [cool-side])

Attribute: R/W

Digits: 7 digits

Number of data: 4 (Data of each channel)

Data range: TC/RTD inputs: 1 (0.1) to Input span (Unit: °C [°F])
Voltage (V)/Current (I) inputs: 0.1 to 1000.0 % of input span

Factory set value: Proportional band limiter (high) [cool-side]:
TC/RTD inputs: Input span
Voltage (V)/Current (I) inputs: 1000.0 %
Proportional band limiter (low) [cool-side]:
TC/RTD inputs: 1 (0.1)
Voltage (V)/Current (I) inputs: 0.1 %

Related parameters: PID/AT transfer (P. 8-14), Proportional band [cool-side] (P. 8-23), Decimal point position (P. 8-71)

Function: The proportional band [cool-side] range is restricted while the autotuning (AT) functions are being executed.

The Proportional band limiter (high) [cool-side] and Proportional band limiter (low) [cool-side] are valid only during Heat/Cool PID control.

Integral time limiter (high) [cool-side]	RKC communication identifier	I8
	Modbus register address	ch1: 02CEH (718) ch3: 02D0H (720) ch2: Unused ch4: Unused
Integral time limiter (low) [cool-side]	RKC communication identifier	I9
	Modbus register address	ch1: 02D2H (722) ch3: 02D4H (724) ch2: Unused ch4: Unused

Integral time limiter (high) [cool-side]: Use to set the high limit value of integral time [cool-side].
Integral time limiter (low) [cool-side]: Use to set the low limit value of integral time [cool-side].
(However, Integral time limiter (high) [cool-side] ≥ Integral time limiter (low) [cool-side])

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0 to 3600 seconds or 0.0 to 1999.9 seconds
Factory set value: Integral time limiter (high) [cool-side]: 3600 seconds
Integral time limiter (low) [cool-side]: 0 seconds
Related parameters: PID/AT transfer (P. 8-14), Integral time [cool-side] (P. 8-24), Integral/derivative time decimal point position (P. 8-100)
Function: The integral time [cool-side] range is restricted while the autotuning (AT) functions are being executed.

The Integral time limiter (high) [cool-side] and Integral time limiter (low) [cool-side] are valid only during Heat/Cool PID control.

If the autotuning (AT) function is executed when the integral time limiter (high) [cool-side] is set at “0” or “0.0”, P and D values suitable to PD control (cool-side) are calculated.

Derivative time limiter (high) [cool-side]	RKC communication identifier	D8
	Modbus register address	ch1: 02DAH (730) ch3: 02DCH (732) ch2: Unused ch4: Unused
Derivative time limiter (low) [cool-side]	RKC communication identifier	D9
	Modbus register address	ch1: 02DEH (734) ch3: 02E0H (736) ch2: Unused ch4: Unused

Derivative time limiter (high) [cool-side]: Use to set the high limit value of derivative time [cool-side].
Derivative time limiter (low) [cool-side]: Use to set the low limit value of derivative time [cool-side].
(However, Derivative time limiter (high) [cool-side] ≥ Derivative time limiter (low) [cool-side])

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0 to 3600 seconds or 0.0 to 1999.9 seconds
Factory set value: Derivative time limiter (high) [cool-side]: 3600 seconds
Derivative time limiter (low) [cool-side]: 0 seconds
Related parameters: PID/AT transfer (P. 8-14), Derivative time [cool-side] (P. 8-25), Integral/derivative time decimal point position (P. 8-100)
Function: The derivative time [cool-side] range is restricted while the autotuning (AT) functions are being executed.

The Derivative time limiter (high) [cool-side] and Derivative time limiter (low) [cool-side] are valid only during Heat/Cool PID control.

If the autotuning (AT) function is executed when the derivative time limiter (high) [cool-side] is set at “0” or “0.0”, P and I values suitable to PI control (cool-side) are calculated.

Open/Close output neutral zone	RKC communication identifier	V2
	Modbus register address	ch1: 02DEH (734) ch3: 02E0H (736) ch2: Unused ch4: Unused

Use to set Open/Close output neutral zone.

Attribute: R/W

Digits: 7 digits

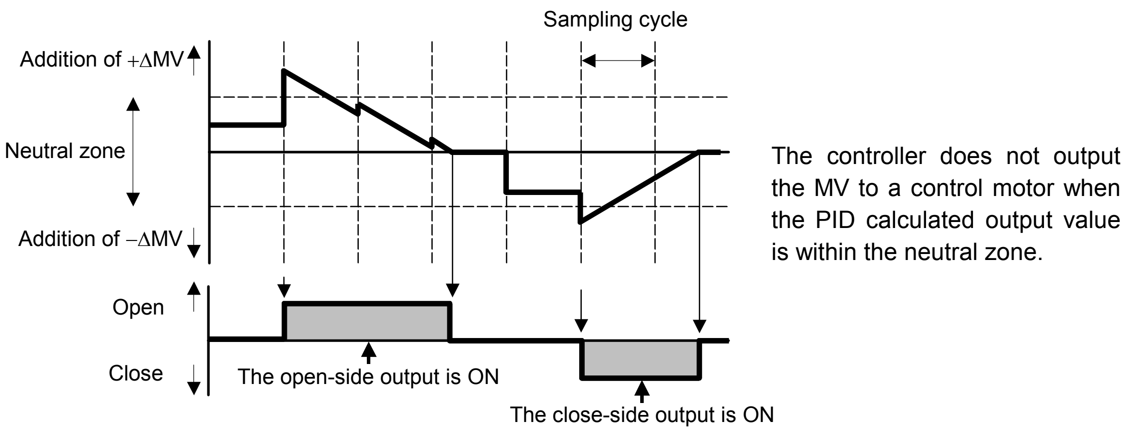
Number of data: 4 (Data of each channel)

Data range: 0.1 to 10.0 %

Factory set value: 2.0 %

Related parameters: Control action (P. 8-95)

Function: The neutral zone is used to prevent a control motor from repeating ON/OFF too frequently. When the PID calculated output value is within the neutral zone, the controller will not output the MV to a control motor.



Action at feedback resistance (FBR) input error	RKC communication identifier	SY
	Modbus register address	ch1: 02E2H (738) ch3: 02E4H (740) ch2: Unused ch4: Unused

Use to select an action at the feedback resistance (FBR) input break.

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

Data range: 0: Action depending on the value action at STOP
1: Control action continued

Factory set value: 0 (Action depending on the value action at STOP)

Related parameters: Valve action at STOP (P. 8-119)

Only when there is feedback resistance (FBR) input and feedback resistance (FBR) input is disconnected, action taken at that time is in accordance with the action at feedback resistance (FBR) input error.

Feedback adjustment	RKC communication identifier	FV
	Modbus register address	ch1: 02E6H (742) ch3: 02E8H (744) ch2: Unused ch4: Unused

Feedback Adjustment function is to adjust controller's output value to match the feedback resistance (FBR) of the control motor.
After the adjustment, the manipulated output value of 0 to 100 % obtained after PID computation matches the valve position signal of the fully closed position to the fully opened position [feedback resistance (FBR) input] sent from the control motor.

- The adjustment have to be completed before starting operation.
- Always make sure that the wiring (P. 4-5) is correct and the control motor operates normally before the adjustment.

Attribute: R/W
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range: 0: Adjustment end
1: During adjustment on the open-side
2: During adjustment on the close-side
Factory set value: —

When opening calibration is attempted in a burnout state, calibration is forced to return to "0: Adjustment end" after three seconds.

Control motor time	RKC communication identifier	TN
	Modbus register address	ch1: 02EAH (746) ch3: 02ECH (748) ch2: Unused ch4: Unused

This is the time required until the control motor is fully opened from its fully closed state.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 5 to 1000 seconds
Factory set value: 10 seconds
Related parameters: Integrated output limiter (P. 8-119)

Integrated output limiter	RKC communication identifier	OI
	Modbus register address	ch1: 02EEH (750) ch3: 02F0H (752) ch2: Unused ch4: Unused

This is a restricted value when the output on the open or closed side is integrated.

Attribute: R/W

Digits: 7 digits

Number of data: 4 (Data of each channel)

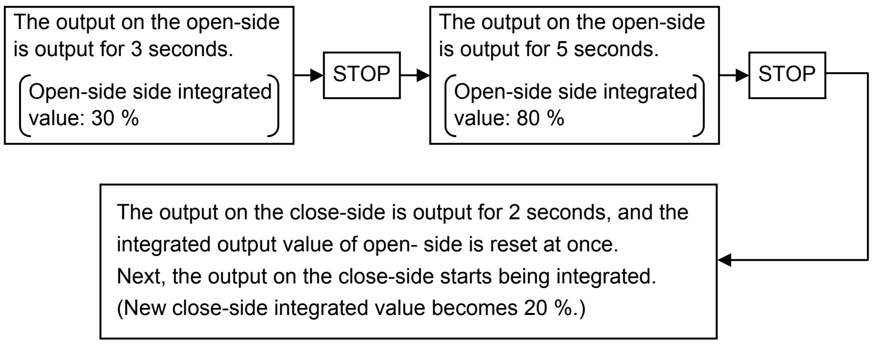
Data range: 0.0 to 200.0 % of control motor time (0.0: Integrated output limiter OFF)

Factory set value: 150.0 %

Related parameters: RUN/STOP transfer (P. 8-17), Operation mode (P. 8-52),
Control motor time (P. 8-118)

If the output on the open (or closed) side is output in succession, it is integrated and if the result reaches the integrated output limiter value, the output on the open (or closed) side is turned off. In addition, if the output on the open (or closed) side is reversed, the integrated value is reset.

[Example] If control is started at the fully closed state when the control motor time is set at 10 seconds and the integrated output limiter value is set at 100 %, the following results.



The control motor time is invalid when the feedback resistance (FBR) input was used.

Valve action at STOP	RKC communication identifier	VS
	Modbus register address	ch1: 02F2H (754) ch3: 02F4H (756) ch2: Unused ch4: Unused

Select the valve action when feedback resistance (FBR) input is disabled or "0 (Action depending on the value action setting at STOP)" is set for the action when a feedback resistance (FBR) input break occurs.

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

Data range:
0: Close-side output OFF, Open-side output OFF
1: Close-side output ON, Open-side output OFF
2: Close-side output OFF, Open-side output ON

Factory set value: 0 (Close-side output OFF, Open-side output OFF)

Related parameters: Action at feedback resistance (FBR) input error (P. 8-117)

ST proportional band adjusting factor	RKC communication identifier	KI
	Modbus register address	ch1: 02F6H (758) ch3: 02F8H (760) ch2: 02F7H (759) ch4: 02F9H (761)
ST integral time adjusting factor	RKC communication identifier	KJ
	Modbus register address	ch1: 02FAH (762) ch3: 02FCH (764) ch2: 02FBH (763) ch4: 02FDH (765)
ST derivative time adjusting factor	RKC communication identifier	KK
	Modbus register address	ch1: 02FEH (766) ch3: 0300H (768) ch2: 02FFH (767) ch4: 0301H (769)

ST proportional band adjusting factor:
This is a factor which is multiplied by the proportional band calculated by executing the startup tuning (ST) function.
ST integral time adjusting factor:
This is a factor which is multiplied by the integral time calculated by executing the startup tuning (ST) function.
ST proportional band adjusting factor:
This is a factor which is multiplied by the derivative time calculated by executing the startup tuning (ST) function.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.01 to 10.00 times
Factory set value: ST proportional band adjusting factor: 1.00 times
ST integral time adjusting factor: 1.00 times
ST derivative time adjusting factor: 1.00 times
Related parameters: Startup tuning (ST) (P. 8-53)

ST start condition	RKC communication identifier	SU
	Modbus register address	ch1: 0302H (770) ch3: 0304H (772) ch2: 0303H (771) ch4: 0305H (773)

Timing (starting condition) to activate the startup tuning (ST) function is selected.

Attribute: R/W
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range:
0: Activate the startup tuning (ST) function when the power is turned on; when transferred from STOP to RUN; or when the set value (SV) is changed.
1: Activate the startup tuning (ST) function when the power is turned on; or when transferred from STOP to RUN.
2: Activate the startup tuning (ST) function when the set value (SV) is changed.
Factory set value: 0
Related parameters: Startup tuning (ST) (P. 8-53)

If the startup tuning (ST) function is executed or an automatic temperature rise is made just when the power is turned on or selection is made from STOP to RUN as one of the startup conditions, control starts at Hot start 2 even if set to Hot start 1 (factory set value).

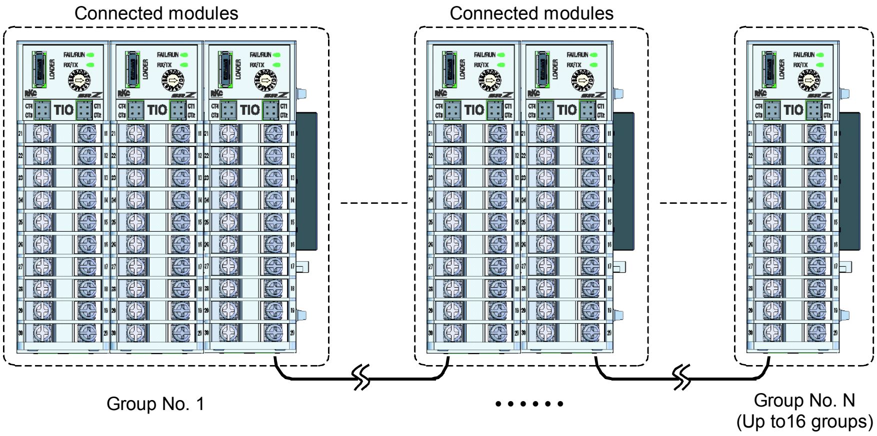
See **Hot/Cold start (P. 8-92).**

Automatic temperature rise group	RKC communication identifier	Y7
	Modbus register address	ch1: 0306H (774) ch3: 0308H (776) ch2: 0307H (775) ch4: 0309H (777)

Group number when conducting an automatic temperature rise.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0 to 16 (0: Automatic temperature rise function OFF)
Factory set value: 0
Related parameters: Automatic temperature rise learning (P. 8-56), Automatic temperature rise dead time (P. 8-121), Automatic temperature rise gradient data (P. 8-122)
Function: For the automatic temperature rise, see **Automatic temperature rise function [with learning function] (P. 8-57).**

A group number can be set for each channel to perform control whereby the temperature rise of all channels with the same group number is synchronized. Channels in connected modules and channels in a single module can operate as a same group.



Automatic temperature rise dead time	RKC communication identifier	RT
	Modbus register address	ch1: 030AH (778) ch3: 030CH (780) ch2: 030BH (779) ch4: 030DH (781)

Control response dead time of a controlled object. It is calculated by automatic temperature rise learning.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.1 to 1999.9 seconds
Factory set value: 10.0 seconds
Related parameters: Automatic temperature rise learning (P. 8-56), Automatic temperature rise group (P. 8-121), Automatic temperature rise gradient data (P. 8-122)
Function: For the automatic temperature rise, see **Automatic temperature rise function [with learning function] (P. 8-57).**

Automatic temperature rise dead time can be prepared at the same time as startup tuning (ST) is performed.

Automatic temperature rise gradient data	RKC communication identifier	R2
	Modbus register address	ch1: 030EH (782) ch3: 0310H (784) ch2: 030FH (783) ch4: 0311H (785)

This parameter is used to set the temperature change per one minute when the automatic temperature rise is performed. It is calculated by automatic temperature rise learning.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.1 to Input span/minutes
Factory set value: 1.0
Related parameters: Automatic temperature rise learning (P. 8-56),
Automatic temperature rise group (P. 8-121),
Automatic temperature rise dead time (P. 8-121),
Function: For the automatic temperature rise, see **Automatic temperature rise function [with learning function] (P. 8-57).**

Automatic temperature rise gradient data can be prepared at the same time as startup tuning (ST) is performed.

EDS transfer time decimal point position	RKC communication identifier	NS
	Modbus register address	ch1: 0312H (786) ch3: 0314H (788) ch2: 0313H (787) ch4: 0315H (789)

Use to select a decimal point position of EDS transfer time.

Attribute: R/W
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range: 0: 1 second setting (No decimal place)
1: 0.1 seconds setting (One decimal place)
Factory set value: 0 (1 second setting)
Related parameters: EDS transfer time (P. 8-49)

Output average processing time for EDS	RKC communication identifier	NV
	Modbus register address	ch1: 0316H (790) ch3: 0318H (792) ch2: 0317H (791) ch4: 0319H (793)

Processing time for obtaining the output value average, which is used internally.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0.1 to 200.0 seconds
Factory set value: 1.0 second
Related parameters: EDS mode (P. 8-44), EDS value 1 (P. 8-48), EDS value 2 (P. 8-48), EDS transfer time (P. 8-49), EDS action time (P. 8-49), EDS action wait time (P. 8-50), EDS value learning times (P. 8-50), EDS start signal (P. 8-51), Responsive action trigger point for EDS (P. 8-123)

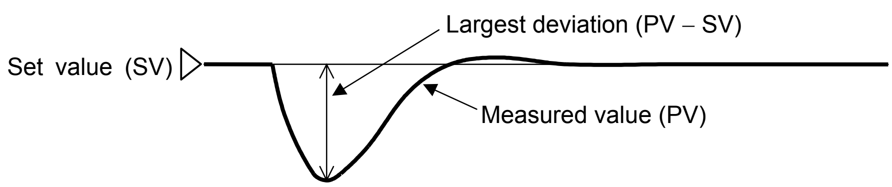
When periodic oscillations occur in the measured value (PV), the oscillations may affect the output value. This may cause incorrect measurements during tuning mode and learning mode of the EDS function, and thus it is necessary to set the period of the oscillation cycle. For example, if the measured value (PV) oscillates due to the effects of shot timing in an injection molding machine, set the shot time.

Responsive action trigger point for EDS	RKC communication identifier	NW
	Modbus register address	ch1: 031AH (794) ch3: 031CH (796) ch2: 031BH (795) ch4: 031DH (797)

Set the deviation at which a response is triggered following the occurrence of an external disturbance.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 0 to Input span (Unit: °C [°F], %)
Factory set value: 1
Related parameters: EDS mode (P. 8-44), EDS value 1 (P. 8-48), EDS value 2 (P. 8-48), EDS transfer time (P. 8-49), EDS action time (P. 8-49), EDS action wait time (P. 8-50), EDS value learning times (P. 8-50), EDS start signal (P. 8-51), Output average processing time for EDS (P. 8-123)

Set this to approximately 1/4 of the largest deviation (PV – SV) of the external disturbance response of PID control.



Setting change rate limiter unit time	RKC communication identifier	HU
	Modbus register address	ch1: 031EH (798) ch3: 0320H (800) ch2: 031FH (799) ch4: 0321H (801)

Set the time unit for Setting Change Rate Limiter (UP/DOWN).

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 1 to 3600 seconds
Factory set value: 60 seconds
Related parameters: Setting change rate limiter (up) (P. 8-29), Setting change rate limiter (down) (P. 8-29)

Soak time unit	RKC communication identifier	RU
	Modbus register address	ch1: 0322H (802) ch3: 0324H (804) ch2: 0323H (803) ch4: 0325H (805)

Use to select the time unit for Area Soak Time.

Attribute: R/W
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range:
- 0: 0 hours 00 minutes to 99 hours 59 minutes
  - [RKC communication] 0 hours 00 minutes to 99 hours 59 minutes
  - [Modbus] 0 to 5999 minutes
- 1: 0 minutes 00 seconds to 199 minutes 59 seconds
  - [RKC communication] 0 minutes 00 seconds to 199 minutes 59 seconds
  - [Modbus] 0 to 11999 seconds

Factory set value: RKC communication: 1 (0 minutes 00 seconds to 199 minutes 59 seconds)
Modbus: 1 (0 to 11999 seconds)
Related parameters: Memory area soak time monitor (P. 8-11), Area soak time (P. 8-30)

Setting limiter (high)	RKC communication identifier	SH
	Modbus register address	ch1: 0326H (806) ch3: 0328H (808) ch2: 0327H (807) ch4: 0329H (809)
Setting limiter (low)	RKC communication identifier	SL
	Modbus register address	ch1: 032AH (810) ch3: 032CH (812) ch2: 032BH (811) ch4: 032DH (813)

Setting limiter (high): Use to set a high limit of the set value.
Setting limiter (low): Use to set a low limit of the set value.

Attribute: R/W

Digits: 7 digits

Number of data: 4 (Data of each channel)

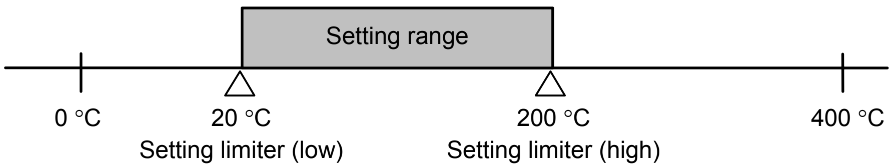
Data range: Setting limiter (high): Setting limiter (low) to Input scale high
Setting limiter (low): Input scale low to Setting limiter (high)

Factory set value: Setting limiter (high): Input scale high
Setting limiter (low): Input scale low

Related parameters: Decimal point position (P. 8-71), Input scale high/low (P. 8-71)

Function: Setting Limiter is to set the range of the set value (SV).

[Example] The input range (input scale range) is from 0 to 400 °C, the setting limiter (high) is 200 °C, and the setting limiter (low) is 20 °C.



PV transfer function	RKC communication identifier	TS
	Modbus register address	ch1: 032EH (814) ch3: 0330H (816) ch2: 032FH (815) ch4: 0331H (817)

It is selected whether or not measured value (PV) with the operation mode transferred to Auto mode from Manual mode is used as set value (SV). It is possible to prevent a manipulated output value (MV) from its sudden change by substituting measured value (PV) for set value (SV).。

Attribute: R/W

Digits: 1 digit

Number of data: 4 (Data of each channel)

Data range: 0: Unused
1: Used

Factory set value: 0 (Unused)

Related parameters: Auto/Manual transfer (P. 8-16)

Operation mode assignment 1 (Logic output selection function) Logic output 1 to 4	RKC communication identifier	EA
	Modbus register address	ch1: 0332H (818) ch3: 0334H (820) ch2: 0333H (819) ch4: 0335H (821)
Operation mode assignment 2 (Logic output selection function) Logic output 5 to 8	RKC communication identifier	EB
	Modbus register address	ch1: 0336H (822) ch3: 0338H (824) ch2: 0337H (823) ch4: 0339H (825)

Assign operation modes to logic outputs 1 to 8.

Attribute: R/W

Digits: 7 digits

Number of data: 4 (Data of each channel)

Data range:
0: No assignment
1: Operation mode (monitor, control)
2: Operation mode (monitor, event function, control)
3: Auto/Manual
4: Remote/Local
5: Interlock release

Factory set value:
Operation mode assignment 1: 0 (No assignment)
Operation mode assignment 2: 0 (No assignment)

Related parameters: Logic output monitor (P. 8-13), Output assignment (P. 8-75), Communication switch for logic (P. 8-60)

☞ For the block diagram of Logic output selection function, see **11. APPENDIX (P. 11-6).**

SV select function	RKC communication identifier	KM
	Modbus register address	ch1: 033AH (826) ch3: 033CH (828) ch2: 033BH (827) ch4: 033DH (829)

Select the slave action in response to the set input from the master when operation is switched from Local mode to Remote mode.

Attribute: R/W
Digits: 1 digit
Number of data: 4 (Data of each channel)
Data range: 0: Remote SV function
1: Cascade control function
2: Ratio setting function
3: Cascade control 2 function
Factory set value: 0 (Remote SV function)
Related parameters: RS bias * (P. 8-36), RS ratio * (P. 8-37), RS digital filter * (P. 8-37), Remote SV function master channel module address * (P. 8-133), Remote SV function master channel selection * (P. 8-134)

* Common settings of the SV select function (remote SV, cascade control, ratio setting, cascade control 2)

Function:

Since internal communication has a time lag (250 ms) in data transmission, when using it in a fast response control system, take this time lag into consideration.
[The salve set value (remote SV) is updated at each time lag.]

The maximum number of both master and slave Z-TIO modules that can be connected is 16.

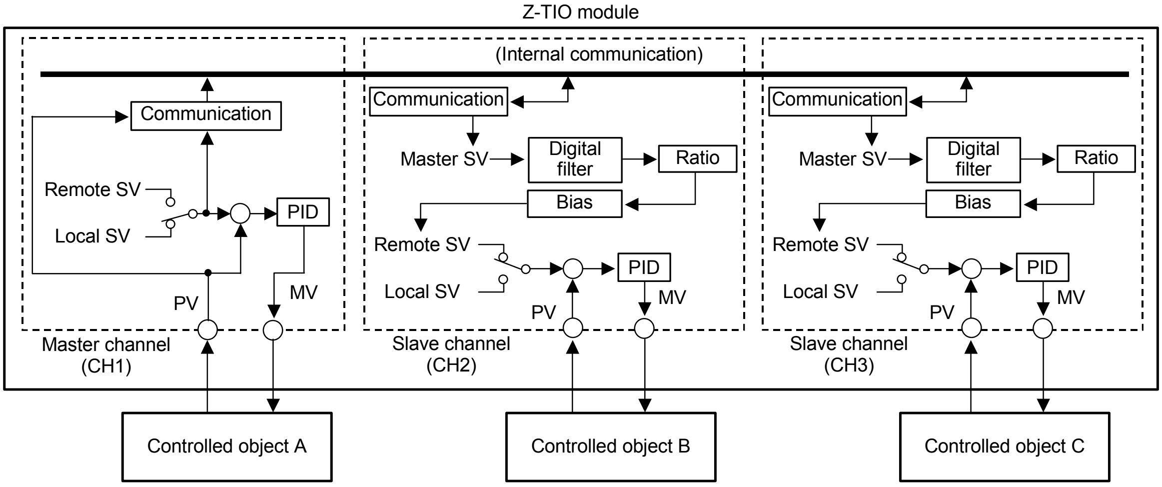
The SV select function only operates within connected modules (SRZ unit).

● **Remote SV function**

The remote SV function controls the measured value (PV) of the channel specified as the master as a remote SV.

Example: Performing remote SV control using CH1 to CH3 of the Z-TIO module

CH1 is set as the master channel and the remaining channels (CH2, CH3) are used as slaves. The measured value (PV) of the master will be the set value (SV) of the slaves.



Block diagram of Remote SV by internal communication

- **Cascade control function/Cascade control 2 function**

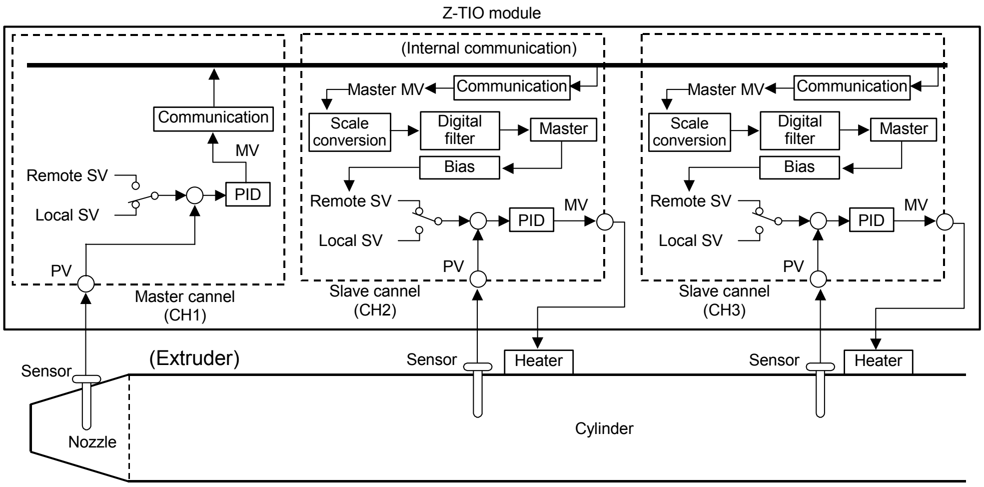
Cascade control monitors the controlled object temperature in the master unit and then corrects the set value in the slave unit depending on the deviation between the target value (set value) and actual temperature. The slave unit controls the non-controlled object (heater, refrigeration device, etc). As a result, the controlled object temperature can be reached and controlled at the target value.

At cascade control that uses internal communication, one of the channels of the connected modules is specified the master, and the other arbitrary channels of the modules are controlled as slaves.

Example: Cascade control using CH1 to CH3 of the Z-TIO module

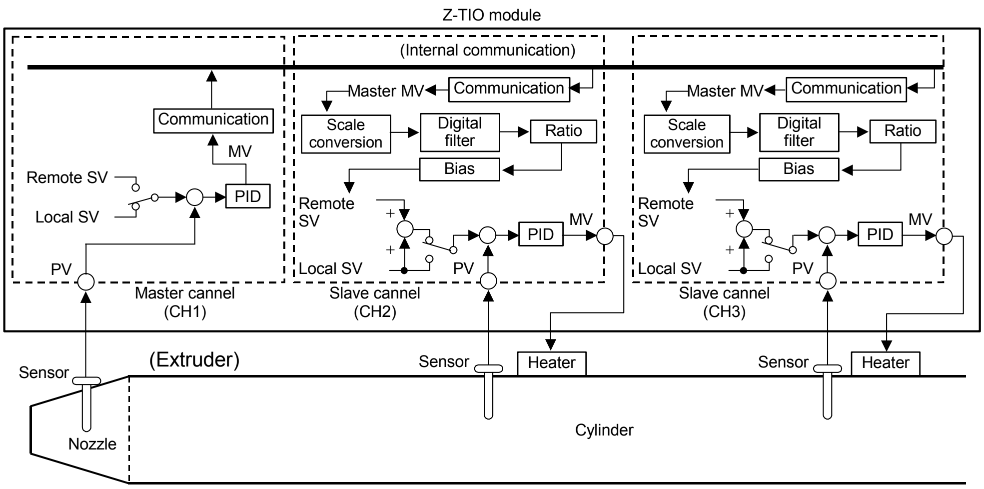
CH1 is set as the master channel and the remaining channels (CH2, CH3) are used as slaves.
If “1: Cascade control function” is selected with the SV select function, the manipulated output (MV) of the master will be the set value (SV) of the slave. If “3: Cascade control 2 function” is selected, the sum of the manipulated output (MV) of the master and the set local set value (SV) will be the set value (SV) of the slave.

“1: Cascade control function”:



Block diagram of cascade control by internal communication

“3: Cascade control 2 function”:



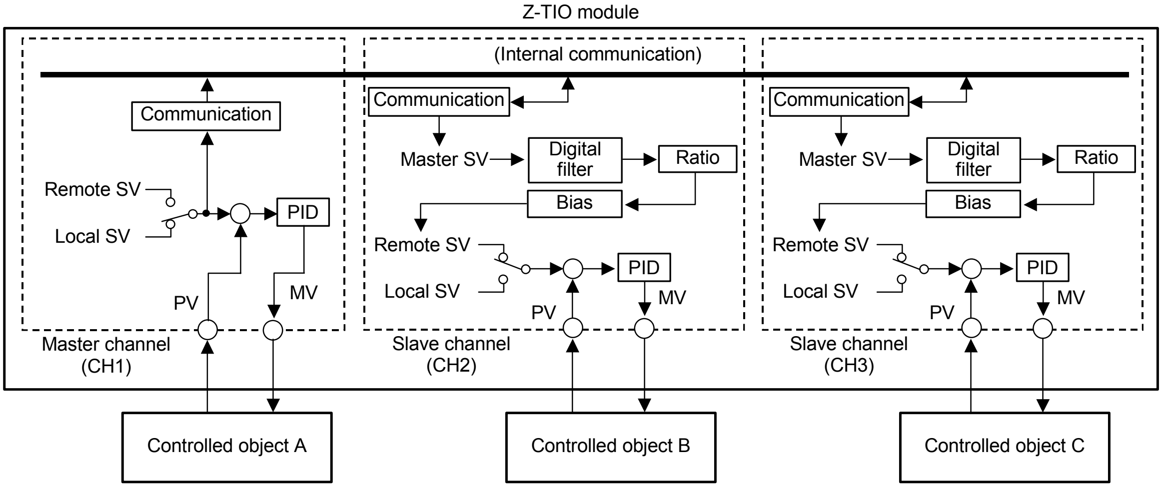
Block diagram of cascade control 2 by internal communication

● Ratio setting function

Ratio setting exercises control with the product of the set value (SV) from the master multiplied by a fixed ratio as the slave set value (SV).

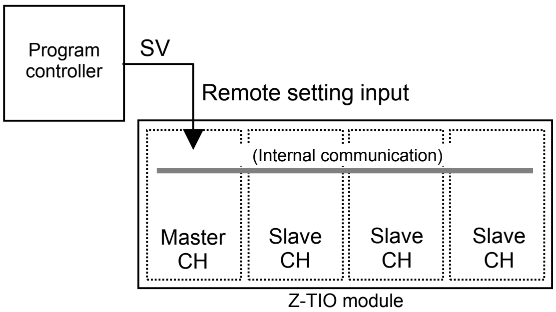
Example: Ratio setting control using CH1 to CH3 of the Z-TIO module

Specify CH1 as the master and use the remaining channels (CH2, CH3) as slaves. The product of the master set value (SV) multiplied by a fixed ratio becomes the slave set value (SV).

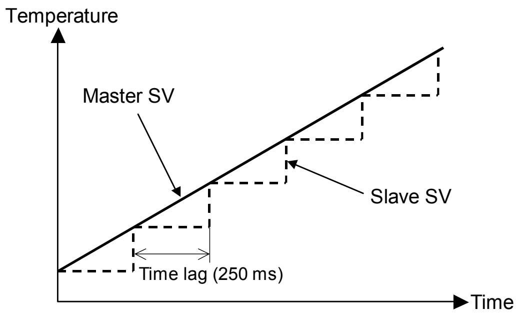


Block diagram of Ratio setting by internal communication

When ratio setting by internal communication by a connection like that shown below was performed, a difference in the master SV change and slave SV change is generated.
Input the program controller set value (SV) to the ratio setting master by internal communication as remote setting input.



The master SV values continuously change gradually, the same as the program controller set value (SV), but since there is a time lag due to internal communication, the slave SV changes in a stepped state.



Master SV change and slave SV change

● Operation flow (common procedure for SV select function operation)

1. Set SV select function operation

Set the function that you wish to have operate in the slave channel of the Z-TIO module.

2. Set the Master channel module address

In the slave channel, set the module address number of the module that includes the channel to be specified as the master.

Remote SV function master channel module address:
−1 (Master channel is selected from itself)
0 to 99 (Master channel is selected from other modules)

3. Select the Master channel

In the slave channel, select the channel number that will be the master in the master channel module. This setting is not required in the master channel.

Remote SV function master channel selection: 1 to 99

4. Remote/Local transfer

Change the slave channel to Remote mode.

5. Control start

6. Ajust the RS bias

7. Ajust the RS digital filter

8. Ajust the RS ratio

Perform adjustment after the start of control (P. 8-131) by setting the bias, digital filter, and ratio at each slave with respect to the set input from the master. Set these according to the actual operation state.

When the controller selected as the master was placed into the Remote mode, the RS bias, RS digital filter, and RS ratio can be set.

Data on RS bias, RS ratio and RS digital filter is that in cascade control or ratio setting.

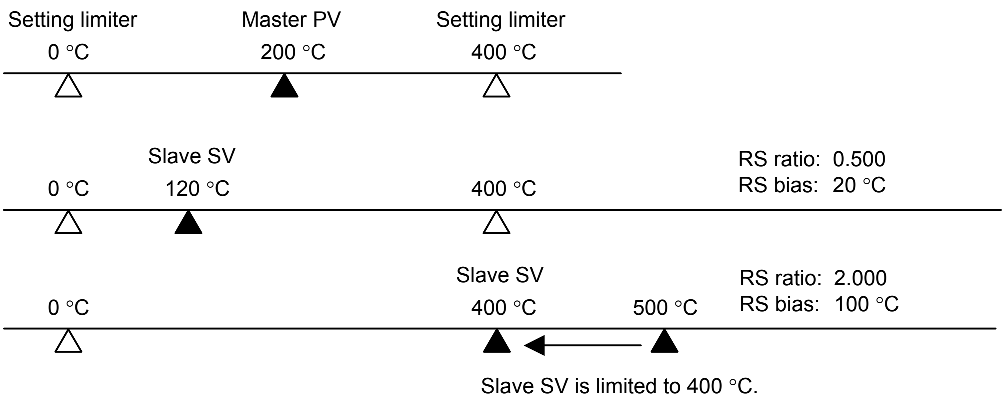
● Adjustment after control starting

Examples of using the ratio and bias for each function are given below.

Example 1: Remote SV function
When the master and slave setting limiter range is 0 to 400 °C

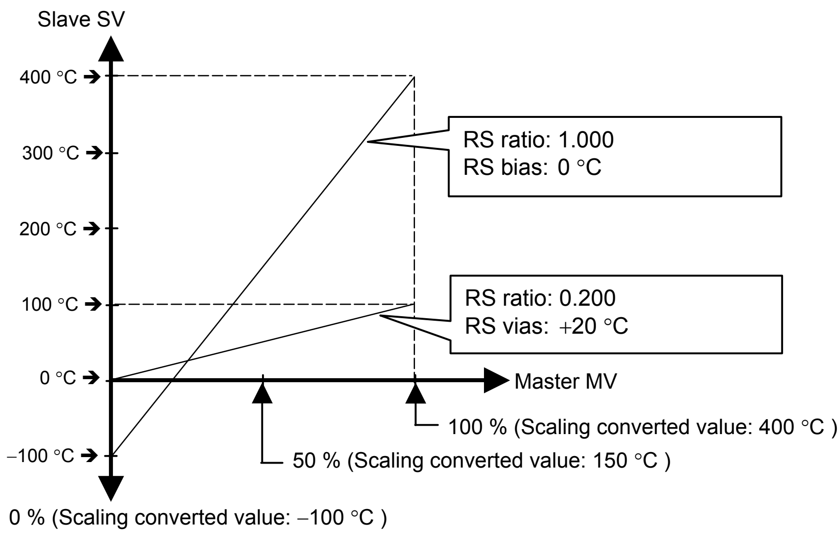
- RS ratio of slave: 0.500, RS bias of slave: 20 °C
  Master measured value (PV): 200 °C → Slave set value (SV): 120 °C
- RS ratio of slave: 2.000, RS bias of slave: 100 °C
  Master measured value (PV): 200 °C → Slave set value (SV): 400 °C *

  * According to the calculated value, the slave set value (SV) becomes 500 °C but since the setting limiter range is 0 to 400 °C, the slave set value (SV) becomes the setting limiter high limit value: 400 °C



Example 2: Cascade control function/Cascade control 2 function
When the output scale of master is 0 to 100 % and the input scale of slave is −100 to +400 °C

- RS ratio of slave: 1.000, RS bias of slave: 0 °C
  Slave input scale for master output scale 0 to 100 % is −100 to +400 °C
- RS ratio of slave: 0.200, RS bias of slave: +20 °C
  Slave input scale for master output scale 0 to 100 % is 0 to 100 °C



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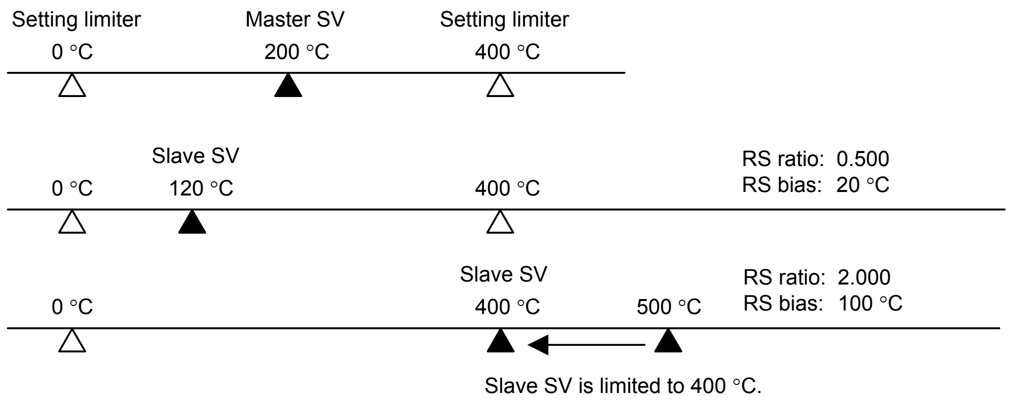
Example 3: Ratio setting function
When the master and slave setting limiter range is 0 to 400 °C

- RS ratio of slave: 0.500, RS bias of slave: 20 °C
  Master set value (SV): 200 °C → Slave set value (SV): 120 °C
- RS ratio of slave: 2.000, RS bias of slave: 100 °C
  Master set value (SV): 200 °C → Slave set value (SV): 400 °C *

  * According to the calculated value, the slave set value (SV) becomes 500 °C but since the setting limiter range is 0 to 400 °C, the slave set value (SV) becomes the setting limiter high limit value: 400 °C



Remote SV function master channel module address	RKC communication identifier	MC
	Modbus register address	ch1: 033EH (830) ch3: 0340H (832) ch2: 033FH (831) ch4: 0341H (833)

In the slave channel, set the module address number of the module that includes the channel to be specified as the master.

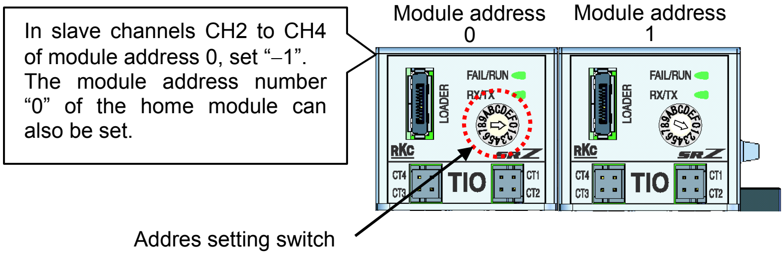
Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: −1 (Master channel is selected from itself)
0 to 99 (Master channel is selected from other modules)
Factory set value: −1
Related parameters: SV select function (P. 8-127),
Remote SV function master channel selection * (P. 8-134)

* Common settings of the SV select function (remote SV, cascade control, ratio setting, cascade control 2)

To specify the address number of a Z-TIO module, set the number that is set in the address setting switch (0 to F) as a decimal number (0 to 15). To specify the address number of a Z-DIO module, set the number that is set in the address setting switch (0 to F) as a decimal number (0 to 15) with "16" added.

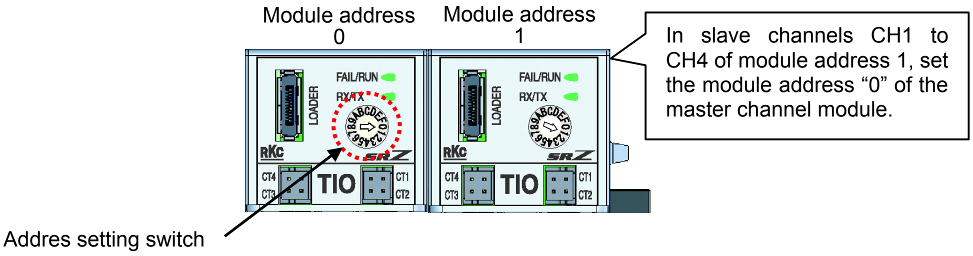
Example 1: Selecting the master channel from the home module

Master channel: CH1 of module address 0
Slave channel: CH2 to CH4 of module address 0



Example 2: Selecting the master channel from other than the home module

Master channel: CH1 to CH4 of module address 0
Slave channel: CH1 to CH4 of module address 1



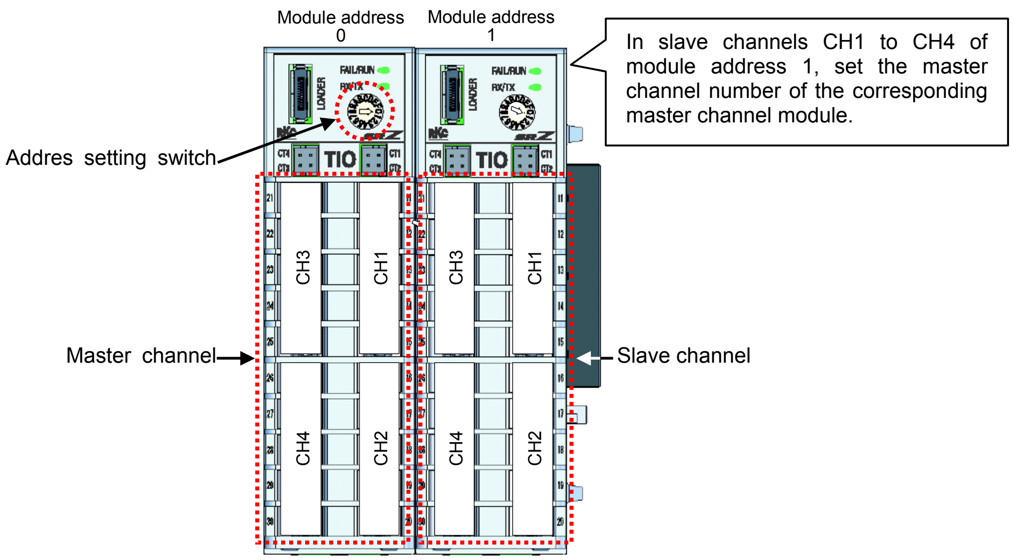
Remote SV function master channel selection	RKC communication identifier	MN
	Modbus register address	ch1: 0342H (834) ch3: 0344H (836) ch2: 0343H (835) ch4: 0345H (837)

In the slave channel, select the channel number that will be the master in the master channel module.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 1 to 99
Factory set value: 1
Related parameters: SV select function (P. 8-127),
Remote SV function master channel module address (P. 8-133)

Example: Combining the master channel and slave channels as shown below

	Module address	CH			
Master channel	Module address 0	CH1	CH2	CH3	CH4
Slave channel	Module address 1	CH1	CH2	CH3	CH4



There is no need for this setting (selecting the master channel) in the master channel.

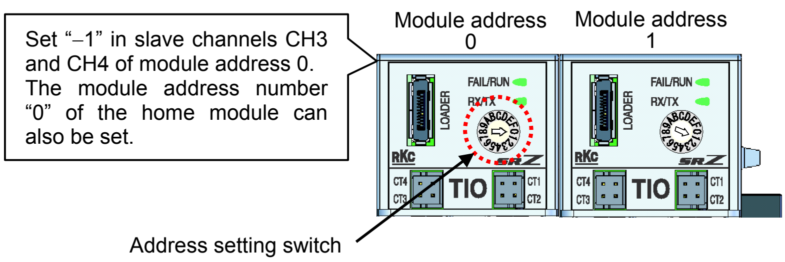
Output distribution master channel module address	RKC communication identifier	DY
	Modbus register address	ch1: 0346H (838) ch3: 0348H (840) ch2: 0347H (839) ch4: 0349H (841)

To output the manipulated output value calculated in the master channel from the slave channel, set (in the slave channel) the module address number of the module that includes the channel to be specified as the master.

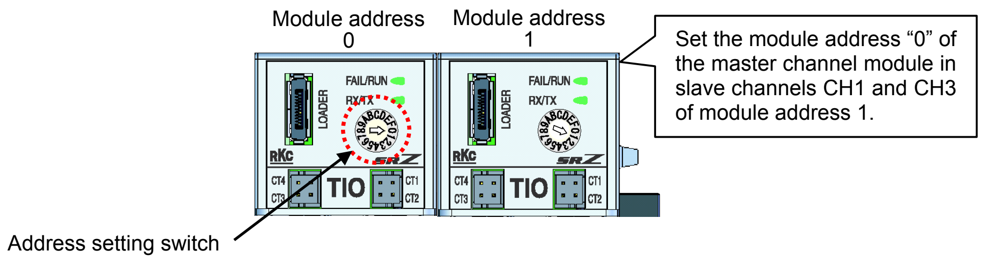
Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: −1 (Master channel is selected from itself)
0 to 99 (Master channel is selected from other modules)
Factory set value: −1
Related parameters: Output distribution selection (P. 8-38),
Output distribution master channel selection (P. 8-136)

To specify the address number of a Z-TIO module, set the number that is set in the address setting switch (0 to F) as a decimal number (0 to 15). To specify the address number of a Z-DIO module, set the number that is set in the address setting switch (0 to F) as a decimal number (0 to 15) with “16” added.

Example 1: Selecting the master channel from the home module
Master channel: CH1 of module address 0
Slave channel: CH3 and CH4 of module address 0



Example 2 Selecting the master channel from other than the home module
Master channel: CH1 of module address 0
Slave channel: CH1 and CH3 of module address 1



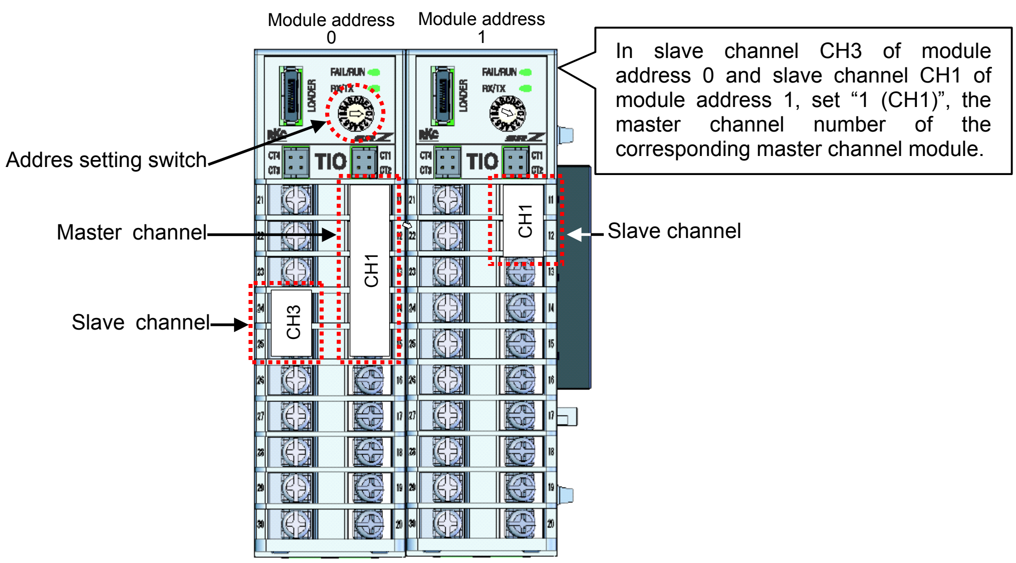
Output distribution master channel selection	RKC communication identifier	DZ
	Modbus register address	ch1: 034AH (842) ch3: 034CH (844) ch2: 034BH (843) ch4: 034DH (845)

In the slave channel, select the channel number in the master channel module that will be the master.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 1 to 99
Factory set value: 1
Related parameters: Output distribution selection (P. 8-38), Output distribution master channel module address (P. 8-135)

Example: Combining the master channel and slave channels as shown below

	Module address	CH	Input	Output
Master channel	Module address 0	CH1	Sensor input	Control output
Slave channel	Module address 0	CH3		Distribution output
	Module address 1	CH1		Distribution output



There is no need for this setting (selecting the master channel) in the master channel.

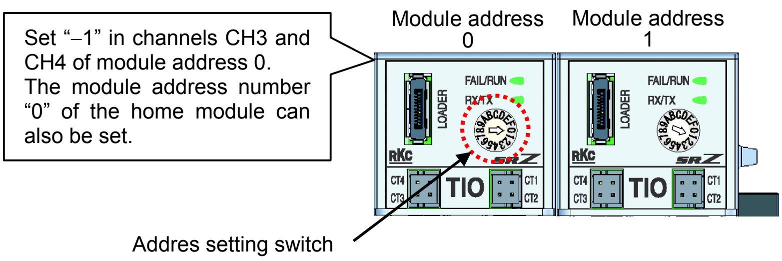
Address of interacting modules	RKC communication identifier	RL
	Modbus register address	ch1: 034EH (846) ch3: 0350H (848) ch2: 034FH (847) ch4: 0351H (849)

In the Z-TIO module, set the module address number of the module with the channel that you wish to link.

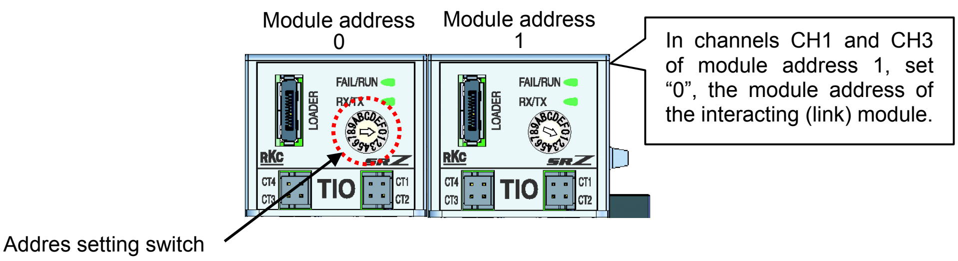
Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: −1 (Interact with its own module address)
0 to 99 (Interact with the addresses of other modules)
Factory set value: −1
Related parameters: Channel selection of interacting modules (P. 8-138),
Selection switch of interacting modules (P. 8-138)

To specify the address number of a Z-TIO module, set the number that is set in the address setting switch (0 to F) as a decimal number (0 to 15). To specify the address number of a Z-DIO module, set the number that is set in the address setting switch (0 to F) as a decimal number (0 to 15) with “16” added.

Example 1: Selecting channels of the home module that you wish to link
Channels that you wish to link to the action of CH1 of module address 0:
CH3 and CH4 of module address 0



Example 2: Selecting channels of other than the home module that you wish to link
Channels that you wish to link to the action of CH1 of module address 0:
CH1 and CH3 of module address 1



Channel selection of interacting modules	RKC communication identifier	RM
	Modbus register address	ch1: 0352H (850) ch3: 0354H (852) ch2: 0353H (851) ch4: 0355H (853)

In the Z-TIO module, select the interacting channel number of the module to be linked for interaction.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: 1 to 99
Factory set value: 1
Related parameters: Address of interacting modules (P. 8-137),
Selection switch of interacting modules (P. 8-138)

Becomes valid when the selected module is "Z-TIO module."

Selection switch of interacting modules	RKC communication identifier	RN
	Modbus register address	ch1: 0356H (854) ch3: 0358H (856) ch2: 0357H (855) ch4: 0359H (857)

Select the action that you wish to link.

Attribute: R/W
Digits: 7 digits
Number of data: 4 (Data of each channel)
Data range: **RKC communication:** ASCII code data
The operation mode state is assigned as a digit image in ASCII code data of 7 digits.

ASCII code data of 7 digits:

Most ··································· Least
significant digit significant digit

Data:
0: No interaction
1: Interact with other channels

Least significant digit: Memory area number
2nd digit: Operation mode
3rd digit: Auto/Manual
4th digit: Remote/Local
5th digit EDS start signal
6th digit Interlock release
Most significant digit: Suspension of area soak time

Modbus: 0 to 127 (bit data)
The operation mode state is assigned as a bit image in binary numbers.

Bit image: 0000000000000000

bit 15 ···························· bit 0

Data:
0: No interaction
1: Interact with other channels

bit 0: Memory area number
bit 1: Operation mode
bit 2: Auto/Manual
bit3: Remote/Local
bit 4: EDS start signal
bit 5: Interlock release
bit 6: Suspension of area soak time
bit 7 to bit 15:
Unused

Factory set value: 0 (No interaction)
Related parameters: Address of interacting modules (P. 8-137),
Channel selection of interacting modules (P. 8-138),
DI function assignment (P. 8-154), Memory area setting signal (P. 8-156)

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Example 1: Switching the memory areas of all channels of two Z-TIO modules

Base interacting module: CH1 of modules address 0

Module to be linked: CH2 to CH4 of module address 0

CH1 to CH4 of module address 1

Z-TIO 1 (module address: 0)

Interacting *

CH1	Memory area transfer		
	Address of interacting modules	Setting not necessary	
	Channel selection of interacting modules	Setting not necessary	
	Selection switch of interacting modules	0	Specify 0 (No interaction)
CH2	Memory area transfer		
	Address of interacting modules	−1 or 0	Specify the home module
	Channel selection of interacting modules	1	Specify CH1
	Selection switch of interacting modules	1	Specify 1 (Interact with other channels) in the memory area number
CH3	Memory area transfer		
	Address of interacting modules	−1 or 0	Specify the home module
	Channel selection of interacting modules	1	Specify CH1
	Selection switch of interacting modules	1	Specify 1 (Interact with other channels) in the memory area number
CH4	Memory area transfer		
	Address of interacting modules	−1 or 0	Specify the home module
	Channel selection of interacting modules	1	Specify CH1
	Selection switch of interacting modules	1	Specify 1 (Interact with other channels) in the memory area number

Z-TIO 2 (module address: 1)

CH1	Memory area transfer		
	Address of interacting modules	0	Specify module address 0
	Channel selection of interacting modules	1	Specify CH1 of module address 0
	Selection switch of interacting modules	1	Specify 1 (Interact with other channels) in the memory area number
CH2	Memory area transfer		
	Address of interacting modules	0	Specify module address 0
	Channel selection of interacting modules	1	Specify CH1 of module address 0
	Selection switch of interacting modules	1	Specify 1 (Interact with other channels) in the memory area number
CH3	Memory area transfer		
	Address of interacting modules	0	Specify module address 0
	Channel selection of interacting modules	1	Specify CH1 of module address 0
	Selection switch of interacting modules	1	Specify 1 (Interact with other channels) in the memory area number
CH4	Memory area transfer		
	Address of interacting modules	0	Specify module address 0
	Channel selection of interacting modules	1	Specify CH1 of module address 0
	Selection switch of interacting modules	1	Specify 1 (Interact with other channels) in the memory area number

* In the above example, when the memory area number (RKC communication identifier: ZA, Modbus address: 006EH) of CH1 of module address 0 is changed, the memory area numbers of linked channels all change at the same time.

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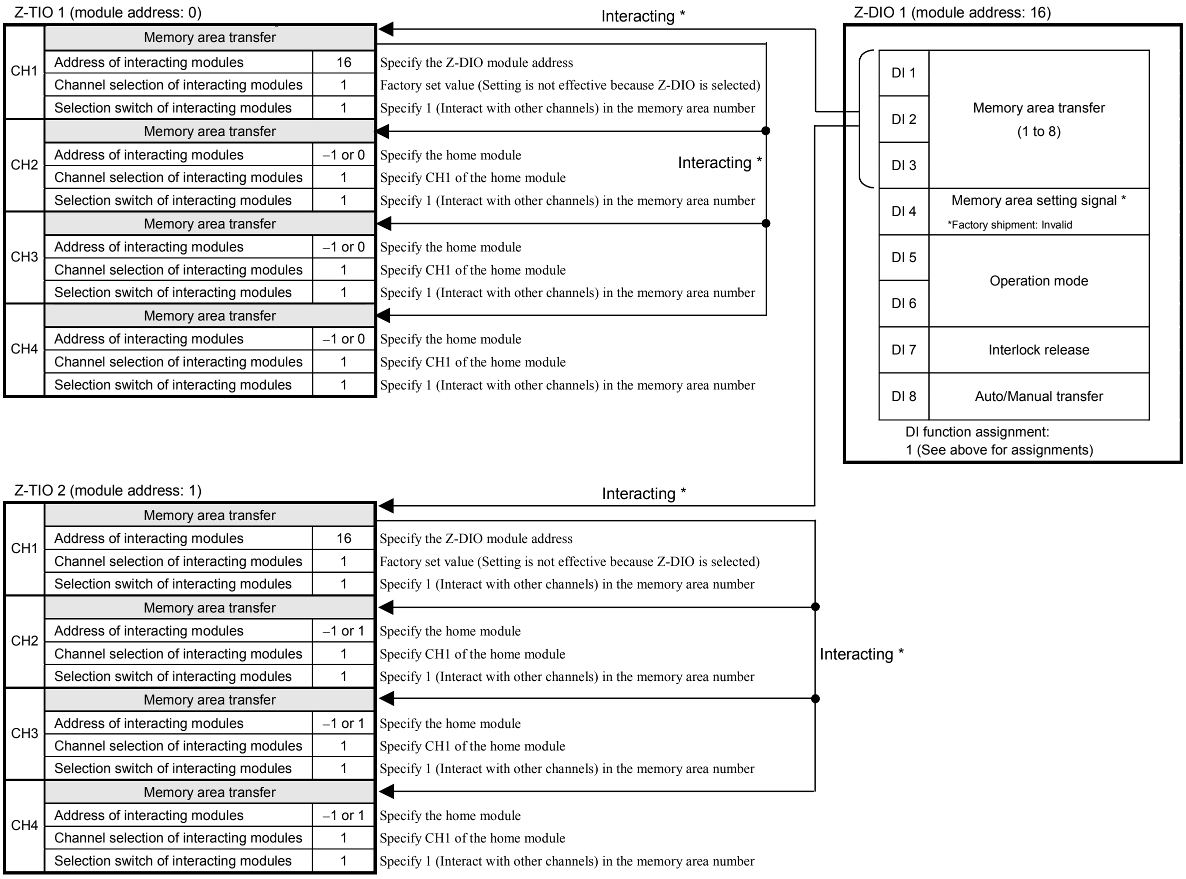
Example 2: Switching the memory areas of all channels of two Z-TIO modules using one Z-DIO module

Base interacting module: Z-DIO module (module address 16)
Module to be linked: CH1 to CH4 of module address 0
CH1 to CH4 of module address 1



* In the above example, the memory area numbers of all channels of the two linked Z-TIO modules are changed at once at the timing of the DI signals (DI1 to DI3) of the Z-DIO module.

The interval from the change of the setting signal specified as the master channel to the change of the data of the linked channels may be as long as 250 ms in some cases.

Control RUN/STOP holding setting	RKC communication identifier	X1
	Modbus register address	035AH (858)

It is set whether or not the operation mode before the power supply is turned off is held when the power supply is turned on or power failure recovers.

Attribute: R/W
Digits: 1 digit
Number of data: 1 (Data of each module)
Data range: 0: Not holding (STOP start)
1: Holding (RUN/STOP hold)
Factory set value: 1 (Holding)
Related parameters: RUN/STOP transfer (P. 8-17), Hot/Cold start (P. 8-92), Start determination point (P. 8-93)

When “0: Not holding (STOP mode)” is selected, the action at restoration of power will be as follows.

	Operation mode when power failure recovers	Output value when power failure recovers
STOP mode	Started in the control stop (STOP) state regardless of the RUN mode before power failure. [1]	Manipulated output value at STOP mode [2]

[1] If changed to RUN from STOP by RUN/STOP selection after start, set to the operation mode before power failure occurs.
[2] For position proportioning control (no feedback resistance input), the action will be the same as the “Valve action at STOP” setting.

Interval time	RKC communication identifier	ZX
	Modbus register address	035BH (859)

RS-485 sets the transmission transfer time to accurately assure the sending/receiving selection timing.

Attribute: R/W
Digits: 7 digits
Number of data: 1 (Data of each module)
Data range: 0 to 250 ms
Factory set value: 10 ms

The sending and receiving of RS-485 communication is conducted through two wires; consequently, the transmission and reception of data requires precise timing. Then, set the desired transmission transfer time to secure the time until the transmission line is changed to data receiving after the host computer ends its sending.
The controller’s interval time must match the specifications of the host computer.

MEMO

8.3 Communication Data of Z-DIO Module

8.3.1 Normal setting data items

Model code	RKC communication identifier	ID
	Modbus register address	—

This value is the type identifier code of the Z-DIO module.

Attribute: RO
Digits: 32 digits
Number of data: —
Data range: —
Factory set value: —

ROM version	RKC communication identifier	VR
	Modbus register address	—

This value is a version of the ROM loaded on the Z-DIO module.

Attribute: RO
Digits: 8 digits
Number of data: —
Data range: The version of loading software
Factory set value: —

Digital input (DI) state 1	RKC communication identifier	L1
Digital input (DI) state 2	RKC communication identifier	L6
Digital input (DI) state	Modbus register address	0000H (0)

Each digital input (DI) state of the Z-DIO module is expressed in bit data items.

Attribute: RO

Digits: 7 digits

Number of data: 1 (Data of each module)

Data range: **RKC communication:** ASCII code data

The digital input (DI) state is assigned as a digit image in ASCII code data of 7 digits.

ASCII code data of 7 digits:

Most significant digit ·············· Least significant digit

Data: 0: Contact open 1: Contact closed

[Digital input (DI) state 1]
Least significant digit: DI 1
2nd digit: DI 2
3rd digit: DI 3
4th digit: DI 4
5th digit to Most significant digit: Unused

[Digital input (DI) state 2]
Least significant digit: DI 5
2nd digit: DI 6
3rd digit: DI 7
4th digit: DI 8
5th digit to Most significant digit: Unused

Modbus: 0 to 255 (bit data)

The digital input (DI) state is assigned as a bit image in binary numbers.

Bit image: 0000000000000000

bit 15 ··························· bit 0

Bit data: 0: Contact open
1: Contact closed

bit 0: DI 1
bit 1: DI 2
bit 2: DI 3
bit 3: DI 4
bit 4: DI 5
bit 5: DI 6
bit 6: DI 7
bit 7: DI 8
bit 8 to bit 15: Unused

Factory set value: —

Related parameters: DI function assignment (P. 8-154), Memory area setting signal (P. 8-156)

Digital output (DO) state 1	RKC communication identifier	Q2
Digital output (DO) state 2	RKC communication identifier	Q3
Digital output (DO) state	Modbus register address	0001H (1)

Each digital output (DO) state of the Z-DIO module is expressed in bit data items.

Attribute: RO

Digits: 7 digits

Number of data: 1 (Data of each module)

Data range: **RKC communication:** ASCII code data

The digital output (DO) state is assigned as a digit image in ASCII code data of 7 digits.

ASCII code data of 7 digits:

Most significant digit ·············· Least significant digit

Data: 0: OFF 1: ON

[Digital output (DO) state 1]
Least significant digit: DO 1
2nd digit: DO 2
3rd digit: DO 3
4th digit: DO 4
5th digit to Most significant digit: Unused

[Digital output (DO) state 2]
Least significant digit: DO 5
2nd digit: DO 6
3rd digit: DO 7
4th digit: DO 8
5th digit to Most significant digit: Unused

Modbus: 0 to 225 (bit data)
The digital output (DO) state is assigned as a bit image in binary numbers.

Bit image: 0000000000000000

bit 15 ··························· bit 0

Bit data: 0: OFF 1: ON

bit 0: DO 1
bit 1: DO 2
bit 2: DO 3
bit 3: DO 4
bit 4: DO 5
bit 5: DO 6
bit 6: DO 7
bit 7: DO 8
bit 8 to bit 15: Unused

Factory set value: —

Related parameters: Comprehensive event state (P. 8-4), Burnout state monitor (P. 8-8), Event state monitor (P. 8-9), Heater break alarm (HBA) state monitor (P. 8-9)

DO manual output (P. 8-147), DO signal assignment module address (P. 8-157), DO output assignment (P. 8-158), DO energized/de-energized (P. 8-159)

DO output distribution bias (P. 8-151), DO output distribution ratio (P. 8-151), DO proportional cycle time (P. 8-152), Minimum ON/OFF time of DO proportioning cycle (P. 8-152), DO output distribution master channel module address (P. 8-160), DO output distribution master channel selection (P. 8-161), DO manipulated output value (MV) at STOP mode (P. 8-162), DO output limiter (high/low) (P. 8-162)

Error code	RKC communication identifier	ER
	Modbus register address	0002H (2)

Each error state of the Z-DIO module is expressed in bit data items.

Attribute: RO

Digits: 7 digits

Number of data: 1 (Data of each module)

Data range: 0 to 2 (digits)

The error state is assigned as a bit image in binary numbers.

However, send data from the SRZ be changed to decimal ASCII code from the bit image in binary numbers for RKC communication.

Bit image: 0000000000000000

bit 15 ··························· bit 0

bit 0: Unused

bit 1: Data back-up error

bit 2 to bit 15: Unused

Bit data: 0: OFF 1: ON

Factory set value: —

Integrated operating time monitor	RKC communication identifier	UT
	Modbus register address	0003H (3)

This value is an integrated operating time of the Z-DIO module.

Attribute: RO

Digits: 7 digits

Number of data: 1 (Data of each module)

Data range: 0 to 19999 hours

Factory set value: —

Backup memory state monitor	RKC communication identifier	EM
	Modbus register address	0004H (4)

The contents of the RAM and those of the FRAM can be checked.

Attribute: RO

Digits: 1 digit

Number of data: 1 (Data of each module)

Data range: 0: The content of the backup memory does not coincide with that of the RAM.

1: The content of the backup memory coincides with that of the RAM.

Factory set value: —

RUN/STOP transfer	RKC communication identifier	SR
	Modbus register address	0046H (70)

Use to transfer the RUN (control RUN) or STOP (control STOP).

Attribute: R/W

Digits: 1 digit

Number of data: 1 (Data of each channel)

Data range: 0: STOP (Control STOP)
1: RUN (Control RUN)

Factory set value: 0 (STOP)

Related parameters: DI function assignment (P. 8-154), DO output distribution selection (P. 8-149), DO output assignment (P. 8-158), Control RUN/STOP holding setting (P. 8-163)

When used together with RKC panel mounted controllers (HA400/900, FB400/900, etc.), be careful that the numbers of indicating “RUN/STOP” of this instrument are opposite from those of the above controllers (0: Control RUN, 1: Control STOP).

DO manual output 1	RKC communication identifier	Q4
DO manual output 2	RKC communication identifier	Q5
DO manual output	Modbus register address	0047H (71)

ON/OFF signal for each digital output (DO1 to DO8).

Attribute: R/W

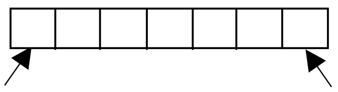
Digits: 7 digits

Number of data: 8 (Data of each channel)

Data range: **RKC communication:** ASCII code data

The DO manual output (DO) state is assigned as a digit image in ASCII code data of 7 digits.

ASCII code data of 7 digits:



Most significant digit ··············· Least significant digit

Data: 0: OFF 1: ON

[DO manual output 1]
Least significant digit: DO1 manual output
2nd digit: DO2 manual output
3rd digit: DO3 manual output
4th digit: DO4 manual output
5th digit to Most significant digit: Unused

[DO manual output 2]
Least significant digit: DO5 manual output
2nd digit: DO6 manual output
3rd digit: DO7 manual output
4th digit: DO8 manual output
5th digit to Most significant digit: Unused

Continued on the next page.

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Modbus: 0 to 255 (bit data)
The DO manual output is assigned as a bit image in binary numbers.

Bit image: 0000000000000000
bit 15 ··························· bit 0

Bit data: 0: OFF 1: ON

bit 0: DO1 manual output
bit 1: DO2 manual output
bit 2: DO3 manual output
bit 3: DO4 manual output
bit 4: DO5 manual output
bit 5: DO6 manual output
bit 6: DO7 manual output
bit 7: DO8 manual output
bit 8 to bit 15:
Unused

Factory set value: 0 (OFF)

Related parameters: Digital output (DO) state (P. 8-145),
DO signal assignment module address (P. 8-157), DO output assignment (P. 8-158),
DO energized/de-energized (P. 8-159)

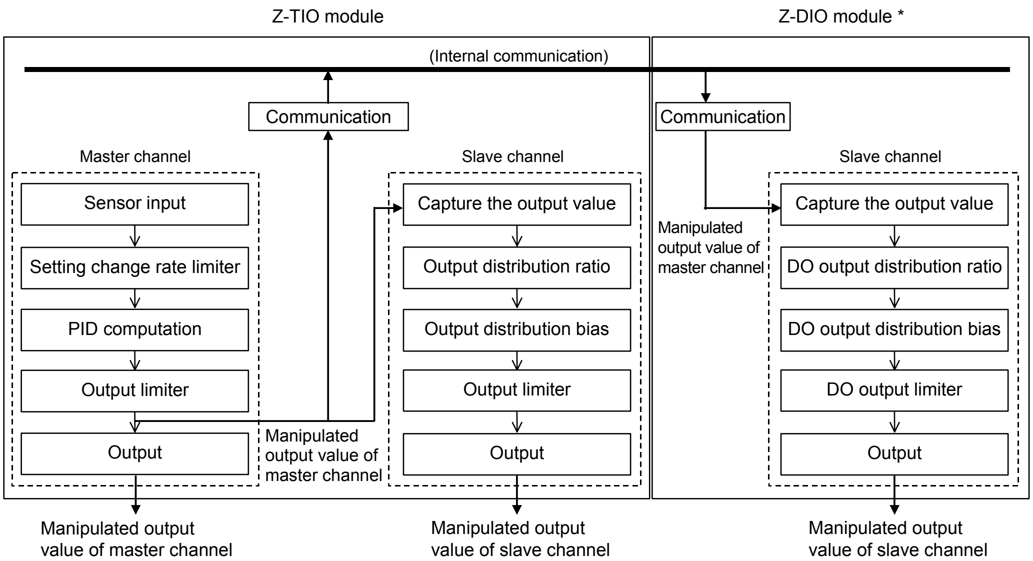
DO output distribution selection	RKC communication identifier	DO
	Modbus register address	ch1: 0048H (72) ch5: 004CH (76) ch2: 0049H (73) ch6: 004DH (77) ch3: 004AH (74) ch7: 004EH (78) ch4: 004BH (75) ch8: 004FH (79)

Select whether or not the manipulated output value of the specified master channel is output from DO.

Attribute: R/W
Digits: 1 digit
Number of data: 8 (Data of each channel)
Data range: 0: DO output
1: Distribution output
Factory set value: 0 (DO output)
Related parameters: Digital output (DO) state (P. 8-145), DO output distribution bias (P. 8-151), DO output distribution ratio (P. 8-151), DO proportional cycle time (P. 8-152), DO minimum ON/OFF time of proportioning cycle (P. 8-152), DO output distribution master channel module address (P. 8-160), DO output distribution master channel selection (P. 8-161), DO manipulated output value (MV) at STOP mode (P. 8-162), DO output limiter (high/low) (P. 8-162)

Function: The output distribution function outputs the manipulated output value calculated for the master channel as a manipulated output value from DO of the slave channels. Bias and ratio calculations can also be applied to the manipulated output value calculated for the master channel before it is output from DO of the slave channels.

Number of output distribution channels: 187 channels maximum
(excluding the master channel)
[When Z-DIO module: 16 modules, Z-TIO module 4CH type: 15 modules]



* Distribution output from Z-DIO module becomes open collector output or relay contact output.

The manipulated output values of the master channel and slave channels are each output within the limit of the output limiter.

The output distribution function only functions within modules that are connected together (SRZ unit).

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- **Operation flow**

1. Set the DO output distribution master channel module address

In the slave channel, set the module address of the module that includes the channel to be specified as the master channel.

DO output distribution master channel module address:
 −1 (Master channel is selected from itself)
 0 to 99 (Master channel is selected from other modules)

2. Select the DO output distribution master channel

In the slave channel, select the channel number of the channel that will be the master channel in the master channel module. This setting is not required in the master channel.

DO output distribution master channel: 1 to 99

3. DO output distribution selection

Set DO output distribution switching to “1: Distribution output”.
(If DO output is to be used, set “0: DO output”.)

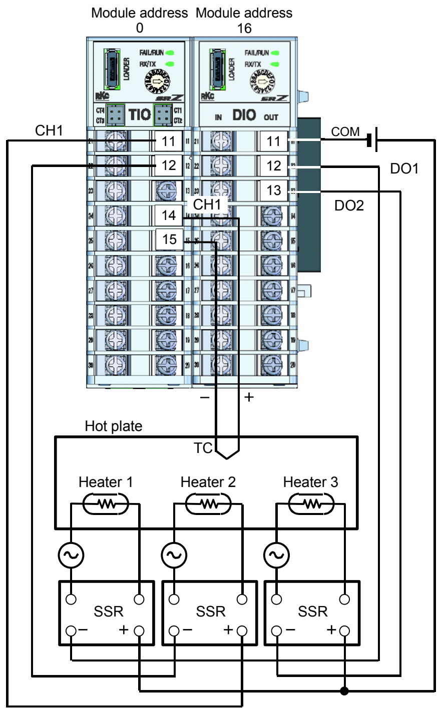
4. Control start

5. Ajust the DO output distribution bias

6. Ajust the DO output distribution ratio

In each slave, set the bias and ratio for the manipulated output value from the master. Select these settings as needed based on the actual operation state.

Example: When using one Z-TIO module (4CH type) and one Z-DIO module



Master/Slave:

Master/Slave	Module address	CH/DO	Input	Ourpur
Master channel (Heater 2)	Module address 0	CH1	Sensor input	Control output
Slave channel (Heater 1)	Module address 16	DO1		Distribution output
Slave channel (Heater 3)	Module address 16	DO2		Distribution output

Setting (Z-TIO module):

Setting items	Module address 0
	CH1 (Master)
Output distribution selection	0 (Control output)

Setting (Z-DIO module):

Setting items	Module address 16	
	DO1 (Slave)	DO2 (Slave)
DO proportional cycle time	Set any value	
DO output distribution master channel module address	0 (Set Z-TIO module address 0)	0 (Set Z-TIO module address 0)
DO output distribution master channel selection	1 (Set CH1 of Z-TIO module)	1 (Set CH1 of Z-TIO module)
DO output distribution selection	**1 (Distribution output)**	**1 (Distribution output)**
DO output distribution bias	Set as needed	
DO output distribution ratio	Set as needed	

DO output distribution bias	RKC communication identifier	O8
	Modbus register address	ch1: 0050H (80) ch5: 0054H (84) ch2: 0051H (81) ch6: 0055H (85) ch3: 0052H (82) ch7: 0056H (86) ch4: 0053H (83) ch8: 0057H (87)

The bias which is added to the manipulated output value of the master channel that is distributed to DO and output.

Attribute: R/W

Digits: 7 digits

Number of data: 8 (Data of each channel)

Data range: −100.0 to +100.0 %

Factory set value: 0.0 %

Related parameters: Digital output (DO) state (P. 8-145), DO output distribution selection (P. 8-149), DO output distribution ratio (P. 8-151), DO proportional cycle time (P. 8-152), DO minimum ON/OFF time of proportioning cycle (P. 8-152), DO output distribution master channel module address (P. 8-160), DO output distribution master channel selection (P. 8-161), DO manipulated output value (MV) at STOP mode (P. 8-162), DO output limiter (high/low) (P. 8-162)

This item is enabled when the output distribution function is used.

DO output distribution ratio	RKC communication identifier	O9
	Modbus register address	ch1: 0058H (88) ch5: 005CH (92) ch2: 0059H (89) ch6: 005DH (93) ch3: 005AH (90) ch7: 005EH (94) ch4: 005BH (91) ch8: 005FH (95)

The ratio (magnification) which is applied to the manipulated output value of the master channel that is distributed to DO and output.

Attribute: R/W

Digits: 7 digits

Number of data: 8 (Data of each channel)

Data range: −9.999 to +9.999

Factory set value: 1.000

Related parameters: Digital output (DO) state (P. 8-145), DO output distribution selection (P. 8-149), DO output distribution bias (P. 8-151), DO proportional cycle time (P. 8-152), DO minimum ON/OFF time of proportioning cycle (P. 8-152), DO output distribution master channel module address (P. 8-160), DO output distribution master channel selection (P. 8-161), DO manipulated output value (MV) at STOP mode (P. 8-162), DO output limiter (high/low) (P. 8-162)

This item is enabled when the output distribution function is used.

DO proportional cycle time	RKC communication identifier	V0
	Modbus register address	ch1: 0094H (148) ch5: 0098H (152) ch2: 0095H (149) ch6: 0099H (153) ch3: 0096H (150) ch7: 009AH (154) ch4: 0097H (151) ch8: 009BH (155)

Use to set DO proportional cycle time for the DO output.

Attribute: R/W

Digits: 7 digits

Number of data: 8 (Data of each channel)

Data range: 0.1 to 100.0 seconds

Factory set value: Relay contact output: 20.0 seconds
Open-collector output: 2.0 seconds

Related parameters: Digital output (DO) state (P. 8-145), DO output distribution selection (P. 8-149), DO output distribution bias (P. 8-151), DO output distribution ratio (P. 8-151), DO minimum ON/OFF time of proportioning cycle (P. 8-152), DO output distribution master channel module address (P. 8-160), DO output distribution master channel selection (P. 8-161), DO manipulated output value (MV) at STOP mode (P. 8-162), DO output limiter (high/low) (P. 8-162)

This item is enabled when the output distribution function is used.

DO minimum ON/OFF time of proportioning cycle	RKC communication identifier	VJ
	Modbus register address	ch1: 009CH (156) ch5: 00A0H (160) ch2: 009DH (157) ch6: 00A1H (161) ch3: 009EH (158) ch7: 00A2H (162) ch4: 009FH (159) ch8: 00A3H (163)

This is the minimum ON/OFF time of the time proportioning cycle.

Attribute: R/W

Digits: 7 digits

Number of data: 8 (Data of each channel)

Data range: 0 to 1000 ms

Factory set value: 0 ms

Related parameters: Digital output (DO) state (P. 8-145), DO output distribution selection (P. 8-149), DO output distribution bias (P. 8-151), DO output distribution ratio (P. 8-151), DO proportional cycle time (P. 8-152), DO output distribution master channel module address (P. 8-160), DO output distribution master channel selection (P. 8-161), DO manipulated output value (MV) at STOP mode (P. 8-162), DO output limiter (high/low) (P. 8-162)

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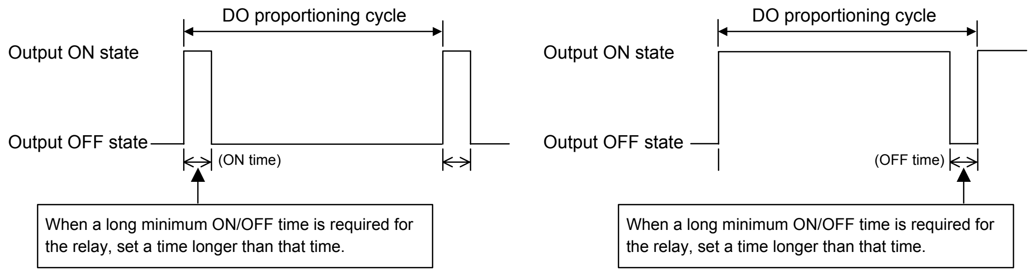
Function: The DO minimum ON/OFF time of the proportioning cycle is used to prevent output ON or OFF when the output is greater than 0 % or less than 100 %. This is useful when you wish to establish a minimum ON/OFF time to prolong the life of the relay.



Operation will not take place if “DO proportional cycle time ≤ DO minimum ON/OFF time of proportioning cycle”.

This item is enabled when the output distribution function is used.

8.3.2 Engineering setting data items

> **⚠ WARNING**
>
> The engineering setting data should be set according to the application before setting any parameter related to operation. Once the Initial setting data is set correctly, those data is not necessary to be changed for the same application under normal conditions. If they are changed unnecessarily, it may result in malfunction or failure of the instrument. RKC will not bear any responsibility for malfunction or failure as a result of improper changes in the Initial setting.

■ Setting procedure of engineering setting data items

When RUN/STOP switching (RKC communication identifier: RS, Modbus register address: 0046H) is set to “0: STOP (control stop)”, engineering setting data can be configured.

📖 During RUN (control), the attribute of the engineering setting data is RO (read only).

■ Data explanation

DI function assignment	RKC communication identifier	H2
	Modbus register address	00A4H (164)

This item is used to assign functions (memory areas, operation modes, etc.) to digital inputs DI1 to DI8.

Attribute: R/W
Digits: 7 digits
Number of data: 1 (Data of each module)
Data range: 0 to 29 (see P. 8-155.)
Factory set value: 1
Related parameters: Address of interacting modules (P. 8-137),
Selection switch of interacting modules (P. 8-138),
Digital input (DI) state (P. 8-144), Memory area setting signal (P. 8-156)

📖 Switching of functions that have been assigned digital inputs (DI1 to DI8) using the switch of interacting modules is performed by DI switching.

📖 To switch Z-TIO module functions* using DI of a Z-DIO module, the following communication data items must be configured in the Z-TIO module.

* Applicable functions: Memory area transfer, Operation mode transfer, AUTO/MAN, REM/LOC, EDS start signal, Interlock release, Soak stop

Address of interacting module: Set the module address of the applicable Z-DIO module
Selection switch of interacting modules: Set the applicable bit to “1”

📖 Switching of Z-TIO module functions using DI of a Z-DIO module applies to the entire SRZ unit (multiple Z-TIO or Z-DIO modules connected together).

Continued on the next page.

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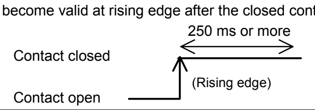
● DI assignment table

<table>
<tr><th>Set value</th><th>DI1</th><th>DI2</th><th>DI3</th><th>DI4</th><th>DI5</th><th>DI6</th><th>DI7</th><th>DI8</th></tr>
<tr><td>0</td><td colspan="8">No assignment</td></tr>
<tr><td>1</td><td colspan="3" rowspan="25">Memory area transfer (1 to 8) [1]</td><td rowspan="25">Area set [2]</td><td colspan="2" rowspan="15">Operation mode [3]</td><td rowspan="5">Interlock release</td><td>AUTO/MAN [4]</td></tr>
<tr><td>2</td><td>REM/LOC [4]</td></tr>
<tr><td>3</td><td>EDS start signal 1</td></tr>
<tr><td>4</td><td>Soak stop</td></tr>
<tr><td>5</td><td>RUN/STOP [4]</td></tr>
<tr><td>6</td><td rowspan="4">AUTO/MAN [4]</td><td>REM/LOC [4]</td></tr>
<tr><td>7</td><td>EDS start signal 1</td></tr>
<tr><td>8</td><td>Soak stop</td></tr>
<tr><td>9</td><td>RUN/STOP [4]</td></tr>
<tr><td>10</td><td rowspan="3">REM/LOC [4]</td><td>EDS start signal 1</td></tr>
<tr><td>11</td><td>Soak stop</td></tr>
<tr><td>12</td><td>RUN/STOP [4]</td></tr>
<tr><td>13</td><td rowspan="2">EDS start signal 1</td><td>Soak stop</td></tr>
<tr><td>14</td><td rowspan="2">RUN/STOP [4]</td></tr>
<tr><td>15</td><td>Soak stop</td></tr>
<tr><td>16</td><td rowspan="6">Interlock release</td><td rowspan="6">AUTO/MAN [4]</td><td rowspan="3">REM/LOC [4]</td><td>EDS start signal 1</td></tr>
<tr><td>17</td><td>Soak stop</td></tr>
<tr><td>18</td><td>RUN/STOP [4]</td></tr>
<tr><td>19</td><td rowspan="2">EDS start signal 1</td><td>Soak stop</td></tr>
<tr><td>20</td><td rowspan="2">RUN/STOP [4]</td></tr>
<tr><td>21</td><td>Soak stop</td></tr>
<tr><td>22</td><td rowspan="3">AUTO/MAN</td><td rowspan="3">REM/LOC</td><td rowspan="2">EDS start signal 1</td><td>Soak stop</td></tr>
<tr><td>23</td><td rowspan="3">RUN/STOP [4]</td></tr>
<tr><td>24</td><td rowspan="2">Soak stop</td></tr>
<tr><td>25</td><td>REM/LOC</td><td>EDS start signal 1</td></tr>
<tr><td>26</td><td>Memory area transfer (1, 2) [1]</td><td>Area set [2]</td><td>Interlock release</td><td>RUN/STOP [4]</td><td>AUTO/MAN [4]</td><td>REM/LOC [4]</td><td colspan="2">Operation mode [3]</td></tr>
<tr><td>27</td><td colspan="3">Memory area transfer (1 to 8) [1]</td><td>Area set [2]</td><td colspan="2">Operation mode [3]</td><td rowspan="2">EDS start signal 1</td><td rowspan="2">EDS start signal 2</td></tr>
<tr><td>28</td><td>Memory area transfer (1, 2) [1]</td><td>Area set [2]</td><td rowspan="2">Interlock release</td><td rowspan="2">RUN/STOP [4]</td><td rowspan="2">AUTO/MAN [4]</td><td rowspan="2">REM/LOC [4]</td></tr>
<tr><td>29</td><td>EDS start signal 1</td><td>EDS start signal 2</td><td colspan="2">Operation mode [3]</td></tr>
</table>

RUN/STOP: RUN/STOP transfer (Contact closed: RUN)
AUTO/MAN: Auto/Manual transfer (Contact closed: Manual mode)
REM/LOC: Remote/Local transfer (Contact closed: Remote mode)
Interlock release (Contact closed: Interlock release)
EDS start signal 1 (Contact closed: EDS start signal ON [for disturbance 1])
EDS start signal 2 (Contact closed: EDS start signal ON [for disturbance 2])
Soak stop (Contact closed: Soak stop)

DI signal will become valid at rising edge after the closed contact is held for 250ms.



[1] Memory area transfer (×:Contact open –: Contact closed)

	Memory area number							
	1	2	3	4	5	6	7	8
DI1	×	–	×	–	×	–	×	–
DI2	×	×	–	–	×	×	–	–
DI3	×	×	×	×	–	–	–	–

[2] Area set becomes invalid prior to factory shipment.

[3] Operation mode transfer (×:Contact open –: Contact closed)

	Operation mode			
	Unused	Monitor	Monitor + Event function	Control
DI5 (DI7)	×	–	×	–
DI6 (DI8)	×	×	–	–

[4] Actual device states (AUTO/MAN, REM/LOC, RUN/STOP)

	DI-switched state	Communication-switched state	Actual device state
Auto/Manual transfer [a] (AUTO/MAN)	Manual (Contact closed)	Manual → Auto	Manual mode
		Auto → Manual	
	Auto (Contact open)	Manual → Auto	Auto mode
		Auto → Manual	
Remote/Local transfer [a] (REM/LOC)	Remote (Contact closed)	Remote → Local	Remote mode
		Local → Remote	
	Local (Contact open)	Remote → Local	Local mode
		Local → Remote	
RUN/STOP [b]	RUN (Contact closed)	STOP → RUN	RUN
		RUN → STOP	STOP
	STOP (Contact open)	STOP → RUN	STOP

[a] Device state when AUTO/MAN or REM/LOC assigned to DI is set so that the Z-TIO module and Z-DIO module are linked using the Master-slave mode of the Z-TIO module.

[b] STOP of RUN/STOP switching is given priority regardless of communication or DI switching.

Memory area setting signal	RKC communication identifier	E1
	Modbus register address	00A5H (165)

Use to select the memory area setting signal for memory area transfer.

Attribute: R/W
Digits: 1 digit
Number of data: 1 (Data of each module)
Data range: 0: Valid
1: Invalid
Factory set value: 1 (Invalid)
Related parameters: Address of interacting modules (P. 8-137),
Selection switch of interacting modules (P. 8-138),
Digital input (DI) state (P. 8-144), DI function assignment (P. 8-154)

- **Transfer timing of Memory area (control area)**

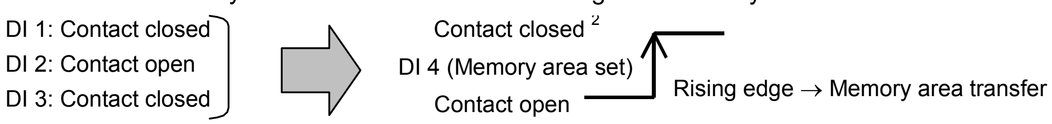
When “0 (Valid)” is selected:

After selecting the memory area number by the applicable contacts DI, the memory area number is changed when contact DI (Area Set) is closed from the open condition (Rising edge).

[Example] Change the memory area number to 6

First, close the contacts between DI1 and DI3 and the common terminal. Next, open the contact between DI2 and the common. Then, close the contact between DI4 (Area Set) and the common from open status (Rising edge), the memory area number in the controller will change to “6”.

1. Select the Memory area number [1]   ***2.*** Change the Memory area



[1] DI function assignment:
When “1 (factory set value)” is selected

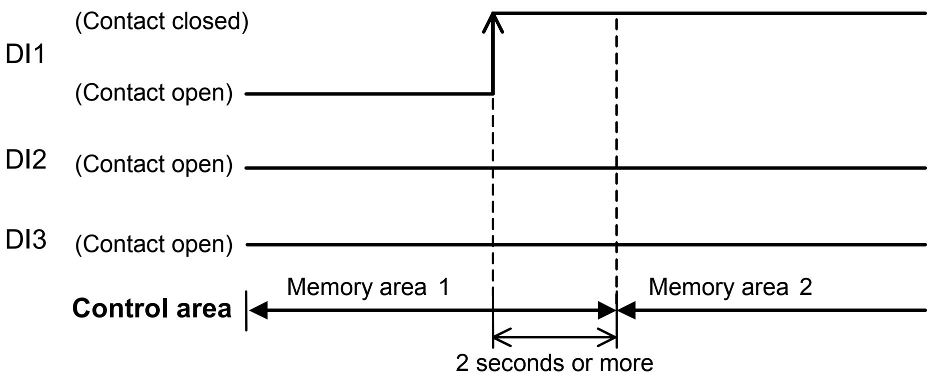
[2] To make contact activation valid, it is necessary to maintain the same contact state (contact closed) for more than 250 ms.

When “0 (Invalid)” is selected:

The memory area number is set by area switching input, and becomes effective two seconds after it is set.

[Example] Change the memory area number from 1 to 2.

Close the DI1 contact and open the DI2 and DI3 contacts. The memory area number is changed to “2” after a lapse of 2 seconds following the setting.



DO signal assignment module address 1 [DO1 to DO4]	RKC communication identifier	LQ
	Modbus register address	00A6H (166)
DO signal assignment module address 2 [DO5 to DO8]	RKC communication identifier	LR
	Modbus register address	00A7H (167)

Specify the module to be used at the DO signal selected by DO output assignment.

Attribute: R/W

Digits: 7 digits

Number of data: 1 (Data of each module)

Data range: −1, 0 to 99

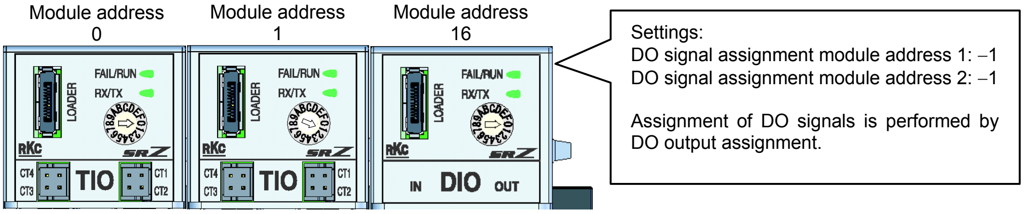
Factory set value: DO signal assignment module address 1: −1
DO signal assignment module address 2: −1

Related parameters: Comprehensive event state (P. 8-4), Burnout state monitor (P. 8-8), Event state monitor (P. 8-9), Heater break alarm (HBA) state monitor (P. 8-9), Digital output (DO) state (P. 8-145), DO manual output (P. 8-147), DO output assignment (P. 8-158), DO energized/de-energized (P. 8-159)

When "−1" is selected, all of the signals of the same type (except temperature rise completion and DO manual output value) are *OR*-operated and produced as outputs from DO.

To specify the address number of a Z-TIO module, set the number that is set in the address setting switch (0 to F) as a decimal number (0 to 15). To specify the address number of a Z-DIO module, set the number that is set in the address setting switch (0 to F) as a decimal number (0 to 15) with "16" added.

Example: Processing the same signal of two Z-TIO modules (event output, etc.) by *OR* logic



DO output assignment 1 [DO1 to DO4]	RKC communication identifier	LT
	Modbus register address	00A8H (168)
DO output assignment 2 [DO5 to DO8]	RKC communication identifier	LX
	Modbus register address	00A9H (169)

Assignments to digital outputs (DO1 to DO8) for output of event results of the Z-TIO module and DO manual output states of the Z-DIO module

Attribute: R/W

Digits: 7 digits

Number of data: 1 (Data of each module)

Data range: 0 to 13 (see below)

Factory set value: DO output assignment1: 1
DO output assignment2: 1

Related parameters: Digital output (DO) state (P. 8-145), DO manual output (P. 8-147), DO signal assignment module address (P. 8-157), DO output assignment (P. 8-158), DO energized/de-energized (P. 8-159)

● DO assignment table

[DO1 to DO4]

Set value	DO1	DO2	DO3	DO4
0	No assignment			
1	DO1 manual output	DO2 manual output	DO3 manual output	DO4 manual output
2	Event 1 comprehensive output [1]	Event 2 comprehensive output [2]	Event 3 comprehensive output [3]	Event 4 comprehensive output [4]
3	Event 1 (CH1)	Event 2 (CH1)	Event 3 (CH1)	Event 4 (CH1)
4	Event 1 (CH2)	Event 2 (CH2)	Event 3 (CH2)	Event 4 (CH2)
5	Event 1 (CH3)	Event 2 (CH3)	Event 3 (CH3)	Event 4 (CH3)
6	Event 1 (CH4)	Event 2 (CH4)	Event 3 (CH4)	Event 4 (CH4)
7	Event 1 (CH1)	Event 1 (CH2)	Event 1 (CH3)	Event 1 (CH4)
8	Event 2 (CH1)	Event 2 (CH2)	Event 2 (CH3)	Event 2 (CH4)
9	Event 3 (CH1)	Event 3 (CH2)	Event 3 (CH3)	Event 3 (CH4)
10	Event 4 (CH1)	Event 4 (CH2)	Event 4 (CH3)	Event 4 (CH4)
11	HBA (CH1)	HBA (CH2)	HBA (CH3)	HBA (CH4)
12	Burnout status (CH1)	Burnout status (CH2)	Burnout status (CH3)	Burnout status (CH4)
13	Temperature rise completion [5]	HBA comprehensive output [6]	Burnout state comprehensive output [7]	DO4 manual output

[DO5 to DO8]

Set value	DO5	DO6	DO7	DO8
0	No assignment			
1	DO5 manual output	DO6 manual output	DO7 manual output	DO8 manual output
2	Event 1 comprehensive output [1]	Event 2 comprehensive output [2]	Event 3 comprehensive output [3]	Event 4 comprehensive output [4]
3	Event 1 (CH1)	Event 2 (CH1)	Event 3 (CH1)	Event 4 (CH1)
4	Event 1 (CH2)	Event 2 (CH2)	Event 3 (CH2)	Event 4 (CH2)
5	Event 1 (CH3)	Event 2 (CH3)	Event 3 (CH3)	Event 4 (CH3)
6	Event 1 (CH4)	Event 2 (CH4)	Event 3 (CH4)	Event 4 (CH4)
7	Event 1 (CH1)	Event 1 (CH2)	Event 1 (CH3)	Event 1 (CH4)
8	Event 2 (CH1)	Event 2 (CH2)	Event 2 (CH3)	Event 2 (CH4)
9	Event 3 (CH1)	Event 3 (CH2)	Event 3 (CH3)	Event 3 (CH4)
10	Event 4 (CH1)	Event 4 (CH2)	Event 4 (CH3)	Event 4 (CH4)
11	HBA (CH1)	HBA (CH2)	HBA (CH3)	HBA (CH4)
12	Burnout status (CH1)	Burnout status (CH2)	Burnout status (CH3)	Burnout status (CH4)
13	Temperature rise completion [5]	HBA comprehensive output [6]	Burnout state comprehensive output [7]	DO8 manual output

[1] Logical *OR* of Event 1 (ch1 to ch4)
[2] Logical *OR* of Event 2 (ch1 to ch4)
[3] Logical *OR* of Event 3 (ch1 to ch4)
[4] Logical *OR* of Event 4 (ch1 to ch4)
[5] Temperature rise completion status (ON when temperature rise completion occurs for all channels for which event 3 is set to temperature rise completion.)
[6] Logical *OR* of HBA (ch1 to ch4)
[7] Logical *OR* of burnout state (ch1 to ch4)

DO energized/de-energized	RKC communication identifier	NB
	Modbus register address	ch1: 00AAH (170) ch5: 00AEH (174) ch2: 00ABH (171) ch6: 00AFH (175) ch3: 00ACH (172) ch7: 00B0H (176) ch4: 00ADH (173) ch8: 00B1H (177)

Energized/de-energized can be selected for digital outputs DO1 to DO8.

Attribute: R/W

Digits: 7 digits

Number of data: 8 (Data of each channel)

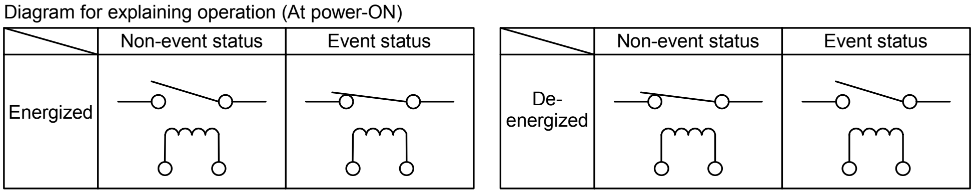
Data range: 0: Energized
1: De-energized

Factory set value: 0 (Energized)

Related parameters: Comprehensive event state (P. 8-4), Burnout state monitor (P. 8-8), Event state monitor (P. 8-9), Heater break alarm (HBA) state monitor (P. 8-9) Digital output (DO) state (P. 8-145), DO manual output (P. 8-147), DO signal assignment module address (P. 8-157), DO output assignment (P. 8-158)

Function: Energized: Relay contact is closed under the event or alarm status.
De-energized: Relay contact opens under the event or alarm status.

Diagram for explaining operation (At power-ON)



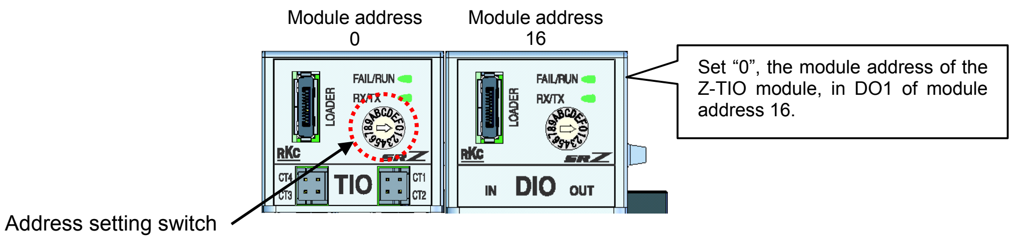
DO output distribution master channel module address	RKC communication identifier	DD
	Modbus register address	ch1: 00B2H (178) ch5: 00B6H (182) ch2: 00B3H (179) ch6: 00B7H (183) ch3: 00B4H (180) ch7: 00B8H (184) ch4: 00B5H (181) ch8: 00B9H (185)

To output the manipulated output value calculated in the master channel from the DO of the slave channel, set the module address number of the module that includes the channel to be specified as the master channel.

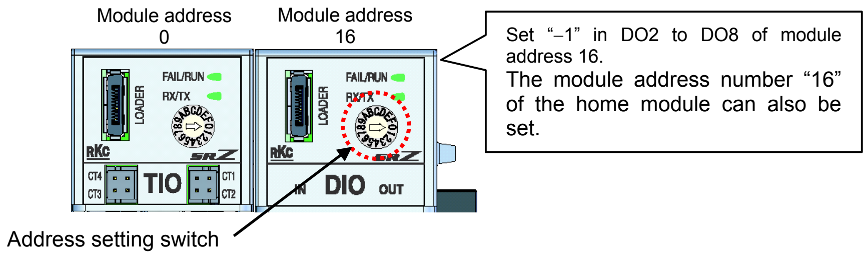
Attribute: R/W
Digits: 7 digits
Number of data: 8 (Data of each channel)
Data range: −1 (Master channel is selected from itself)
0 to 99 (Master channel is selected from other modules)
Factory set value: −1
Related parameters: Digital output (DO) state (P. 8-145), DO output distribution selection (P. 8-149), DO output distribution bias (P. 8-151), DO output distribution ratio (P. 8-151), DO proportional cycle time (P. 8-152), DO minimum ON/OFF time of proportioning cycle (P. 8-152), DO output distribution master channel selection (P. 8-161), DO manipulated output value (MV) at STOP mode (P. 8-162), DO output limiter (high/low) (P. 8-162)

To specify the address number of a Z-TIO module, set the number that is set in the address setting switch (0 to F) as a decimal number (0 to 15). To specify the address number of a Z-DIO module, set the number that is set in the address setting switch (0 to F) as a decimal number (0 to 15) with "16" added.

Example 1: Setting the CH1 control output of the Z-TIO module as the master in DO1 of the Z-DIO module



Example 2: Setting DO1 of the Z-DIO module as the master in DO2 to DO8 of the same module.

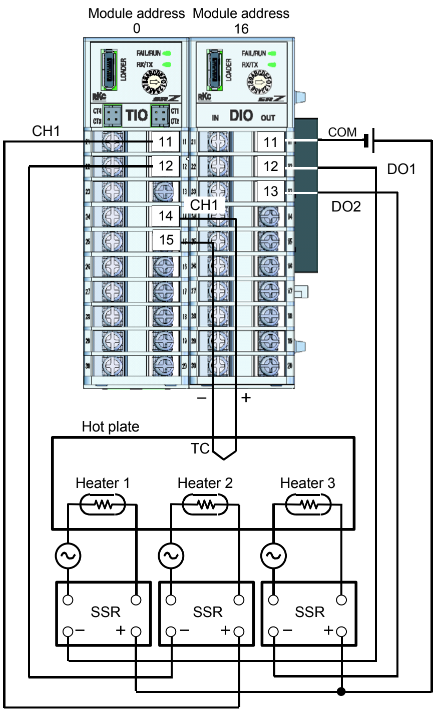


DO output distribution master channel selection	RKC communication identifier	DJ
	Modbus register address	ch1: 00BAH (186) ch5: 00BEH (190) ch2: 00BBH (187) ch6: 00BFH (191) ch3: 00BCH (188) ch7: 00C0H (192) ch4: 00BDH (189) ch8: 00C1H (193)

Select the channel number that will be the master in the master channel module.

Attribute: R/W
Digits: 7 digits
Number of data: 8 (Data of each channel)
Data range: 1 to 99
Factory set value: 1
Related parameters: Digital output (DO) state (P. 8-145), DO output distribution selection (P. 8-149), DO output distribution bias (P. 8-151), DO output distribution ratio (P. 8-151), DO proportional cycle time (P. 8-152), DO minimum ON/OFF time of proportioning cycle (P. 8-152), DO output distribution master channel module address (P. 8-160) DO manipulated output value (MV) at STOP mode (P. 8-162), DO output limiter (high/low) (P. 8-162)

Example: Combining the master channel and slave channels as shown below



Master/Slave:

Master/Slave	Module address	CH/DO	Input	Ourpur
Master channel (Heater 2)	Module address 0	CH1	Sensor input	Control output
Slave channel (Heater 1)	Module address 16	DO1		Distribution output
Slave channel (Heater 3)	Module address 16	DO2		Distribution output

Setting (Z-TIO module):

Setting items	Module address 0 CH1 (Master)
Output distribution selection	0 (Control output)

Setting (Z-DIO module):

Setting items	Module address 16	
	DO1 (Slave)	DO2 (Slave)
DO proportional cycle time	Set any value	
DO output distribution master channel module address	0 (Set Z-TIO module address 0)	0 (Set Z-TIO module address 0)
DO output distribution master channel selection	**1** **(Set CH1 of Z-TIO module)**	**1** **(Set CH1 of Z-TIO module)**
DO output distribution selection	1 (Distribution output)	1 (Distribution output)
DO output distribution bias	Set as needed	
DO output distribution ratio	Set as needed	

There is no need for this setting (selecting the master channel) in the master channel.

DO manipulated output value (MV) at STOP mode	RKC communication identifier	OJ
	Modbus register address	ch1: 00C2H (194) ch5: 00C6H (198) ch2: 00C3H (195) ch6: 00C7H (199) ch3: 00C4H (196) ch7: 00C8H (200) ch4: 00C5H (197) ch8: 00C9H (201)

Manipulated output value that is output from the Z-DIO module (DO1 to DO4, DO5 to DO8) when STOP (control stop) occurs.

Attribute: R/W
Digits: 7 digits
Number of data: 8 (Data of each channel)
Data range: −5.0 to +105.0 %
Factory set value: −5.0 %
Related parameters: Digital output (DO) state (P. 8-145), RUN/STOP transfer (P. 8-147), DO output distribution selection (P. 8-149), DO output distribution bias (P. 8-151), DO output distribution ratio (P. 8-151), DO proportional cycle time (P. 8-152), DO minimum ON/OFF time of proportioning cycle (P. 8-152), DO output distribution master channel module address (P. 8-160) DO output distribution master channel selection (P. 8-161), DO output limiter (high/low) (P. 8-162)

This item is enabled when the output distribution function is used.

DO output limiter (high)	RKC communication identifier	D3
	Modbus register address	ch1: 00CAH (202) ch5: 00CEH (206) ch2: 00CBH (203) ch6: 00CFH (207) ch3: 00CCH (204) ch7: 00D0H (208) ch4: 00CDH (205) ch8: 00D1H (209)
DO output limiter (low)	RKC communication identifier	D4
	Modbus register address	ch1: 00D2H (210) ch5: 00D6H (214) ch2: 00D3H (211) ch6: 00D7H (215) ch3: 00D4H (212) ch7: 00D8H (216) ch4: 00D5H (213) ch8: 00D9H (217)

Use to set the high limit value (low limit value) of manipulated output (MV).

Attribute: R/W
Digits: 7 digits
Number of data: 8 (Data of each channel)
Data range: DO output limiter (high): DO output limiter (low) to 105.0 %
DO output limiter (low): −5.0 % to DO output limiter (high)
Factory set value: DO output limiter (high): 105.0 %
DO output limiter (low): −5.0 %

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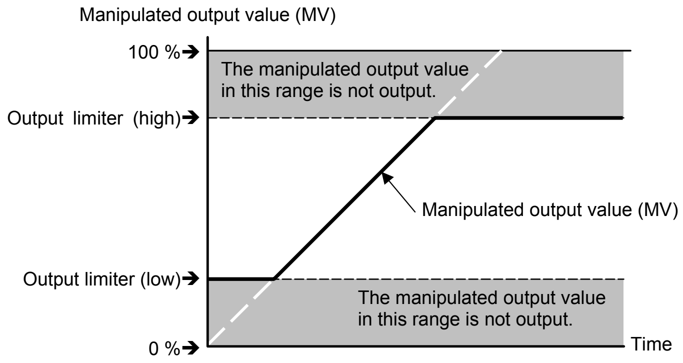
Related parameters: Digital output (DO) state (P. 8-145), RUN/STOP transfer (P. 8-147), DO output distribution selection (P. 8-149), DO output distribution bias (P. 8-151), DO output distribution ratio (P. 8-151), DO proportional cycle time (P. 8-152), DO minimum ON/OFF time of proportioning cycle (P. 8-152), DO output distribution master channel module address (P. 8-160) DO output distribution master channel selection (P. 8-161), DO manipulated output value (MV) at STOP mode (P. 8-162)

Function: This function limits the output (high limit and low limit) when the manipulated output value (MV) of the master channel is output from DO.



This item is enabled when the output distribution function is used.

Control RUN/STOP holding setting	RKC communication identifier	X1
	Modbus register address	00DAH (218)

When the power is turned on or restored after a power interruption, this setting determines whether or not the operation mode (RUN/STOP state) before the power of the Z-DIO module went off is held.

Attribute: R/W

Digits: 7 digits

Number of data: 1 (Data of each module)

Data range: 0: Not holding (STOP start)
1: Holding (RUN/STOP hold)

Factory set value: 1 (Holding)

Related parameters: RUN/STOP transfer (P. 8-147)

When "0: Not holding (STOP mode)" is selected, the action at restoration of power will be as follows.

	Operation mode when power failure recovers	Output value when power failure recovers	
STOP mode	Started in the control stop (STOP) state regardless of the RUN mode before power failure.	DO output	Contact open
		Distribution output	Manipulated output value at STOP mode

Interval time	RKC communication identifier	ZX
	Modbus register address	00DBH (219)

RS-485 sets the transmission transfer time to accurately assure the sending/receiving selection timing.

Attribute: R/W
Digits: 7 digits
Number of data: 1 (Data of each module)
Data range: 0 to 250 ms
Factory set value: 10 ms

The sending and receiving of RS-485 communication is conducted through two wires; consequently, the transmission and reception of data requires precise timing. Then, set the desired transmission transfer time to secure the time until the transmission line is changed to data receiving after the host computer ends its sending.
The controller's interval time must match the specifications of the host computer.

TROUBLE SHOOTING

9

Solutions for Problems

This section explains probable causes and treatment procedures if any abnormality occurs in the instrument. For any inquiries, please contact RKC sales office or the agent, to confirm the specifications of the product.

If it is necessary to replace a device, always strictly observe the warnings below.

⚠ 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. If the module is replaced, it is necessary to re-set each data item.

■ Z-TIO/Z-DIO module

Problem	Probable cause	Solution
FAIL/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 Z-TIO (or Z-DIO) module
RX/TX lamp does not flash	Wrong connection, no connection or disconnection of the communication cable	Confirm the connection method or condition and connect correctly
	Breakage, wrong wiring, or imperfect contact of the communication cable	Confirm the wiring or connector and repair or replace the wrong one
	CPU section defect	Replace Z-TIO (or Z-DIO) module
The FAIL/RUN lamp is lit (red): FAIL status	CPU section or power section defect	Replace Z-TIO (or Z-DIO) module

■ RKC communication

Problem	Probable cause	Solution
No response	Wrong connection, no connection or disconnection of the communication cable	Confirm the connection method or condition and connect correctly
	Breakage, wrong wiring, or imperfect contact of the communication cable	Confirm the wiring or connector and repair or replace the wrong one
	Mismatch of the setting data of communication speed and data bit configuration with those of the host computer	Confirm the settings and set them correctly
	Wrong address setting	
	Error in the data format	Reexamine the communication program
	Transmission line is not set to the receive state after data send	
EOT return	The specified identifier is invalid	Confirm the identifier is correct or that with the correct function is specified. Otherwise correct it
	Error in the data format	Reexamine the communication program
NAK return	Error occurs on the line (parity bit error, framing error, etc.)	Confirm the cause of error, and solve the problem appropriately. (Confirm the transmitting data, and resend data)
	BCC error	
	The data exceeds the setting range	Confirm the setting range and transmit correct data
	The block data length of the transmission exceeds 128 bytes	Divide the block using ETB before sending it
	The specified identifier is invalid	Confirm the identifier is correct or that with the correct function is specified. Otherwise correct it

■ Modbus

Problem	Probable cause	Solution
No response	Wrong connection, no connection or disconnection of the communication cable	Confirm the connection method or condition and connect correctly
	Breakage, wrong wiring, or imperfect contact of the communication cable	Confirm the wiring or connector and repair or replace the wrong one
	Mismatch of the setting data of communication speed and data bit configuration with those of the host computer	Confirm the settings and set them correctly
	Wrong address setting	
	There is length of query message exceeds set range	
	A transmission error (overrun error, framing error, parity error or CRC-16 error) is found in the query message	Re-transmit after time-out occurs or verify communication program
	The time interval between adjacent data in the query message is too long, exceeding 24 bit's time	
Error code 1	Function cod error (Specifying nonexistent function code)	Confirm the function code
Error code 2	When the mismatched address is specified	Confirm the address of holding register
Error code 3	When the data written exceeds the setting range	Confirm the setting data
Error code 4	Self-diagnostic error	Turn off the power to the instrument. If the same error occurs when the power is turned back on, please contact RKC sales office or the agent.

MEMO

SPECIFICATIONS 10

10.1 Z-TIO module

■ Measuring input

Number of inputs: 4 point or 2 point (Isolated between each input)

Input type:

• Temperature, Current, Voltage (low) and Feedback resistance input group *

Thermocouple (TC)
K, J, T, S, R, E, B, N (JIS-C1602-1995)
PL II (NBS), W5Re/W26Re (ASTM-E988-96)

RTD: Pt100 (JIS-C1604-1997)
JPt100 (JIS-C1604-1981 of Pt100)
3-wire system

Voltage: 0 to 10 mV DC, 0 to 100 mV DC, 0 to 1 V DC

Current: 4 to 20 mA DC, 0 to 20 mA DC

Feedback resistance (FBR) input:
100 Ω to 6 kΩ (standard: 135 Ω)
[FBR inputs can be used to minitor FBR (feedback resistance)]

• Voltage (high) input group *

Voltage: 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC

* Universal input
(Use the input select switch to change input group.)

Input range:

TC input

Input type	Measured range
K	–200.0 to +1372.0 °C (–328 to +2501 °F, 0.0 to 800.0 °F)
J	–200.0 to +1200.0 °C (–328 to +2192 °F, 0.0 to 800.0 °F)
T	–200.0 to +400.0 °C (–328 to +752 °F, 0.0 to 752.0 °F)
S	–50 to +1768 °C (–58 to +3214 °F)
R	–50 to +1768 °C (–58 to +3214 °F)
E	–200.0 to +1000.0 °C (–328 to +1832 °F, 0.0 to 800.0 °F)
B	0 to 1800 °C (32 to 3272 °F)
N	0 to 1300 °C (32 to +2372 °F)
PLII	0 to 1390 °C (32 to 2534 °F)
W5Re/W26Re	0 to 2300 °C (32 to 4208 °F)

RTD input

Input type	Measured range
Pt100	–200.0 to +850.0 °C (–328 to +1562 °F, –328.0 to +752.0 °F)
JPt100	–200.0 to +640.0 °C (–328 to +1184 °F, –328.0 to +752.0 °F)

Voltage/Current input

Input type		Measured range
Voltage (low)	0 to 10 mV DC, 0 to 100 mV DC, 0 to 1 V DC	Programmable range (–19999 to +19999)
Voltage (high)	0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC	
Current	0 to 20 mA DC, 4 to 20 mA DC	

Feedback resistance input

Measuring range	100 Ω to 6 kΩ (standard: 135 Ω)

Sampling cycle:	250 ms
Influence of external resistance:	Approx. 0.125 μV/Ω (Converted depending on TC types)
Influence of input lead:	Approx. 0.02 %/Ω of PV (RTD input) 10 Ω or less per wire
Input impedance:	TC input: 1 MΩ or more Voltage (low) input: 1 MΩ or more Voltage (high) input: Approx. 1 MΩ Current input: Approx. 50 Ω
Sensor current:	Approx. 250 μA (RTD input)
Action at input beak:	TC input: Upscale or downscale RTD input: Upscale Voltage (low) input: Upscale or downscale Voltage (high) input: Downscale (Indicates value near 0 V) Current input: Downscale (Indicates value near 0 mA) Feedback resistance input: Upscale
Action at input short circuit:	Downscale (RTD input, Feedback resistance input)
Action at input error:	Setting range of Input error determination point (high/low): Input scale low − (5 % of input span) to Input scale high + (5 % of input span) High/Low individual setting Manipulated output value at input error: −105.0 to +105.0 %
Input correction:	PV bias: −Input span to +Input span PV ratio: 0.500 to 1.500 First order lag digital filter: 0.0 to 100.0 seconds (0.0: OFF)

Square root extraction function (Voltage input, Current input):

Calculation method: Measured value
= √ (Input value × PV ratio + PV bias)

Low level cutoff: 0.00 to 25.00 % of input span

■ Current transformer (CT) input [optional]

Number of inputs:	4 points or 2 points
CT type:	CTL-6-P-N or CTL-12-S56-10-N (Sold separately)
Input range:	CTL-6-P-N: 0.0 to 30.0 A CTL-12-S56-10L-N: 0.0 to 100.0 A
Sampling cycle:	500 ms

■ Output (OUT1 to OUT4)

Number of outputs: 4 points or 2 points

Output contents: Used for control output or logic output

Output type:

• Relay contact output

Contact type:	1a contact
Contact rating (Resistive load):	250 V AC 3 A, 30 V DC 1 A
Electrical life:	300,000 times or more (Rated load)
Mechanical life:	50 million times or more (Switching: 180 times/min)
Proportional cycle time *:	0.1 to 100.0 seconds
Minimum ON/OFF time:	0 to 1000 ms

• Voltage pulse output (Not isolated between output and power supply)

Output voltage:	0/12 V DC (Rating) ON voltage: 11.0 V or more, 13.0 V or less OFF voltage: 0.2 V or less
Allowable load resistance:	600 Ω or more
Proportional cycle time *:	0.1 to 100.0 seconds
Minimum ON/OFF time:	0 to 1000 ms

• Current output (Not isolated between output and power supply)

Output current (Rating):	4 to 20 mA DC, 0 to 20 mA DC
Output range:	1 to 21 mA DC, 0 to 21 mA DC
Allowable load resistance:	600 Ω or less
Output impedance:	1 MΩ or more

• Voltage output (Not isolated between output and power supply)

Output voltage (Rating):	0 to 1 V DC, 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC
Output range:	−0.05 to +1.05 V DC, −0.25 to +5.25 V DC, 0.8 to 5.2 V DC, −0.5 to +10.5 V DC
Allowable load resistance:	1 kΩ or more
Output impedance:	0.1 Ω or less

• Triac output

Output method:	AC output (Zero-cross method)
Allowable load current:	0.5 A (Ambient temperature 40 °C or less) Ambient temperature 50 °C: 0.3 A
Load voltage:	75 to 250 V AC
Minimum load current:	30 mA
ON voltage:	1.6 V or less (at maximum load current)
Proportional cycle time *:	0.1 to 100.0 seconds
Minimum ON/OFF time:	0 to 1000 ms

• Open collector output

Output method:	Sink type
Allowable load current:	100 mA
Load voltage:	30 V DC or less
Minimum load current:	0.5 mA
ON voltage:	2 V or less (at maximum load current)
Leakage current at OFF:	0.1 mA or less
Proportional cycle time *:	0.1 to 100.0 seconds
Minimum ON/OFF time:	0 to 1000 ms

* When control output is selected.

■ Performance (at the ambient temperature 23 ±2 °C, mounting angle ±3°)

Input accuracy:

Measured input:

Input type	Input range	Accuracy
K, J, T, PLII, E	Less than −100 °C	±2.0 °C
	−100 °C or more, less than +500° C	±1.0 °C
	500 °C or more	±(0.2 % of Reading +1 digit)
S, R, N, W5Re/W26Re	Less than 1000 °C	±2.0 °C
	1000 °C or more	±(0.2 % of Reading +1 digit)
B	Less than 400 °C	±70.0 °C
	400 or more, less than 1000 °C	±2.0 °C
	1000 °C or more	±(0.2 % of Reading +1 digit)
Pt100、JPt100	Less than 200 °C	±0.4 °C
	200 °C or more	±(0.2 % of Reading +1 digit)
Voltage input	±0.2 % of input span	
Current input		
Feedback resistance input	±0.2 % of input span ±1 digit (for adjustment span of open and close)	

Current transformer (CT) input:
±5 % of Reading ±1 digit or ±2 A (whichever is larger)

Noise rejection:
Nomal mode: 60dB or more (50/60Hz)
Common mode: 120dB or more (50/60Hz)

Output accuracy:
Current output: 3.0 % of span
Voltage output: 3.0 % of span

Cold-junction temperature compensation error (Close horizontal mounting):
Within ±1.0 °C (Terminal type)
Within ±2.0 °C (Connector type)

Influence of physical orientation (± 90°):
- Input:
  - TC input: ±0.6 % of input span or ±3.0 °C or less
  - RTD input: ±0.5 °C or less
  - Voltage/Current input: Less than ±0.2 % of input span
- Output: Less than ±0.3 % of output span

■ Indication lamp

Number of indicates: 2 points

Indication contents:
- Operation state indication (1 point)
  - When normal (RUN): A green lamp is on
  - Self-diagnostic error (FAIL): A green lamp flashes
  - Instrument abnormality (FAIL): A red lamp is on
- Communication state indication (1 point)
  - During data send and receive (RX/TX): A green lamp turns on

■ Control

Control method:

a) Brilliant II PID control (Direct action/Reverse action is selectable)
b) Brilliant II Heat/Cool PID control (Water cooling)
c) Brilliant II Heat/Cool PID control (Air cooling)
d) Brilliant II Heat/Cool PID control (Cooling gain linear)
e) Position proportioning PID control without FBR
a) to e) is selectable

Autotuning (AT):

a) Enhanced AT
(Brilliant II PID control or Position proportioning control)
b) Heat/Cool PID control for AT

Startup tuning (ST):

When in Heat/Cool PID control, it is possible to execute the startup tuning (ST) function only in the temperature rise direction.
The PID values on the heat side are automatically calculated.
Becomes invalid when in position proportioning control.

■ Brilliant II PID control

Setting range:

a) Proportional band (P) *
- Temperature input: 0 to Input span (unit: °C [°F])
- Voltage/current input: 0.0 to 1000.0 % of input span

* 0 [0.0]: ON/OFF action
ON/OFF action differential gap: Temperature input: 0.0 to Input span (unit: °C [°F])
Voltage/current input: 0.0 to 10.0 % of input span

b) Integral time (I): 0 to 3600 seconds or 0.0 to 1999.9 seconds
(0 [0.0]: Integral action OFF)
c) Derivative time (D): 0 to 3600 seconds or 0.0 to 1999.9 seconds
(0 [0.0]: Derivative action OFF)
d) Control response parameter:
Slow, Medium and Fast (3-step selection)
P or PD action: Fast (fixed)
e) Output limiter (high): Output limiter (low) to +105.0 %
f) Output limiter (low): −5.0 % to Output limiter (high)
g) Output change rate limiter (up/down):
0.0 to 100.0 %/seconds
(0.0: Output change rate limiter OFF)
Up/Down individual setting
h) Manual reset: −100.0 to +100.0 %
i) Manual output: Output limiter (low) to Output limiter (high)
j) Manipulated output value at (MV) at STOP mode:
−5.0 to +105.0 %
k) Derivative action: 0 (Measured value derivative),
1 (Deviation derivative)
l) Derivative gain: 0.1 to 10.0
m) Integral/derivative time decimal point position:
0 (1 second setting), 1 (0.1 seconds setting)

Balanceless/bumpless:

When the mode is transferred from Manual mode to Auto mode, control starts at manual output value.

■ Brilliant II heat/cool PID control (Only CH1 and CH3 can be set)

Setting range:

a) Proportional band (P) *
- Temperature input: 0 to Input span (unit: °C [°F])
- Voltage/current input: 0.0 to 1000.0 % of input span

* 0 [0.0]: ON/OFF action
ON/OFF action differential gap: Temperature input: 0.0 to Input span (unit: °C [°F])
Voltage/current input: 0.0 to 10.0 % of input span

b) Integral time (I): 0 to 3600 seconds or 0.0 to 1999.9 seconds
(0 [0.0]: Integral action OFF)

c) Derivative time (D): 0 to 3600 seconds or 0.0 to 1999.9 seconds
(0 [0.0]: Derivative action OFF)

d) Proportional band [cool-side]:
- Temperature input: 1 (0.1) to Input span (unit: °C [°F])
- Voltage/current input: 0.1 to 1000.0 % of input span

e) Integral time [cool-side]:
0 to 3600 seconds or 0.0 to 1999.9 seconds
(0 [0.0]: Integral action OFF)

f) Derivative time [cool-side]:
0 to 3600 seconds or 0.0 to 1999.9 seconds
(0 [0.0]: Derivative action OFF)

g) Overlap/Deadband:
- Temperature input: −Input span to +Input span (unit: °C [°F])
- Voltage/current input: −100.0 to +100.0 % of input span
Minus (−) setting results in overlap.
(However, the overlapping range is within the proportional range.)

h) Control response parameter:
Slow, Medium and Fast (3-step selection)
P or PD action: Fast (fixed)

i) Output limiter (high): Output limiter (low) to +105.0 %
Heat-side/Cool-side individual setting

j) Output limiter (low): −5.0 % to Output limiter (high)
High/Low individual setting

k) Output change rate limiter (up/down) (heat-side, cool-side):
0.0 to 100.0 %/seconds
(0.0: Output change rate limiter OFF)
Heat-side/Cool-side individual setting

l) Manual reset: −100.0 to +100.0 %

m)Manual output: −Output limiter (high) [cool-side] to
Output limiter (high) [heat-side]

n) Manipulated output value at (MV) at STOP mode:
−5.0 to +105.0 %
Heat-side/Cool-side individual setting

o) Derivative action: 0 (Measured value derivative),
1 (Deviation derivative)

p) Derivative gain: 0.1 to 10.0

q) Integral/derivative time decimal point position:
0 (1 second setting), 1 (0.1 seconds setting)

Balanceless/bumpless: When the mode is transferred from Manual mode to Auto mode, control starts at manual output value.

■ Position proportioning PID control without FBR (Only CH1 and CH3 can be set)

Setting range:

a) Proportional band (P) *
- Temperature input: 0 to Input span (unit: °C [°F])
- Voltage/current input: 0.0 to 1000.0 % of input span

* 0 [0.0]: ON/OFF action
ON/OFF action differential gap: Temperature input: 0.0 to Input span (unit: °C [°F])
Voltage/current input: 0.0 to 10.0 % of input span

b) Integral time (I): 1 to 3600 seconds or 0.1 to 1999.9 seconds
c) Derivative time (D): 0 to 3600 seconds or 0.0 to 1999.9 seconds
d) Control response parameter:
Slow, Medium, Fast (3-step selection)
e) Control motor time: 5 to 1000 seconds
f) Output limiter (high): Output limiter (low) to +105.0 %
g) Output limiter (low): −5.0 % to Output limiter (high)
h) Integrated output limiter:
0.0 to 200.0 % of control motor time
(0.0: OFF)
Invalid when Feedback resistance (FBR) input is used.
i) Open/Close output neutral zone: 0.1 to 10.0 %
j) Open/Close output differential gap: 0.1 to 5.0 %
k) Manipulated output value (MV) at STOP mode:
−5.0 to +105.0 %
When Feedback resistance (FBR) input is provided, and it is not input break.
l) Valve action at STOP: ① Open-side output OFF, Close-side output OFF
② Open-side output OFF, Close-side output ON
③ Open-side output ON, Close-side output OFF
①, ②, or ③ is selectable
m) Manual output:
When there is a feedback resistance (FBR) input and no feedback resistance (FBR) input is disconnected:
Output limiter (low) to Output limiter (high)
When there is no feedback resistance (FBR) input or the feedback resistance (FBR) input is disconnected:
0 (Open-side output OFF, Close-side output OFF)
1 (Open-side output OFF, Close-side output ON)
2 (Open-side output ON, Close-side output OFF)
n) Derivative action: 0 (Measured value derivative),
1 (Deviation derivative)
o) Derivative gain: 0.1 to 10.0
p) Integral/derivative time decimal point position:
0 (1 second setting), 1 (0.1 seconds setting)

Balanceless/bumpless: When the mode is transferred from Manual mode to Auto mode, control starts at manual output value.

■ Event function [optional]

Number of events:	4 points/channel
Event action:	Deviation high, Deviation low, Deviation high/low, Band, Process high, Process low, SV high, SV low, MV high [heat-side]*, MV low [heat-side]*, MV high [cool-side], MV low [cool-side] Deviation high (Local SV), Deviation low (Local SV), Deviation high/low (Local SV), Band (Local SV) Deviation between channels high, Deviation between channels low, Deviation between channels high/low, Deviation between channels band Temperature rise completion (Event 3 only) Control loop break alarm (LBA) (Event 4 only) * Position proportioning control: Feedback resistance (FBR) input value
Setting range:	• Deviation Event setting: −Input span to +Input span Differential gap: 0 to span • Process Event setting: Same as input range Differential gap: 0 to Input span • SV Event setting: Same as input range Differential gap: 0 to Input span • MV Event setting: −5.0 to +105.0 % Differential gap: 0.0 to 110.0 % • Deviation between channels Event setting: −Input span to +Input span Differential gap: 0 to span Channel setting: Channel 1 to 4 • Temperature rise completion Event setting: −Input span to +Input span Differential gap: 0 to span • Control loop break alarm (LBA) (Heat/cool control: LBA is not selectable) LBA time: 0 to 7200 seconds (0: LBA function OFF) LBA deadband (LBD): 0 to Input span
Additional function:	Hold action: Hold action is selectable from Hold action OFF, Hold action ON, and Re-hold action ON. Valid only when the event action (Process, Deviation, or MV) is selected. Delay timer: 0.0 to 18000 seconds Interlock: 0 (Unused), 1 (Used) Force ON of Event action: 0 (Invalid), 1 (Valid)

■ Heater break alarm (HBA) [time-proportional control output (optional)]

Number of HBA: 4 points or 2 points

Setting range: 0.0 to 100.0 A (0.0: HBA function OFF)
[HBA function OFF: The current value monitoring is available]
CT assignment: 0 (HBA function OFF)
1 (OUT1) to 4 (OUT4)
HBA does not action when control output ON time is 0.1 second or less.

Additional function: Number of HBA delay times: 0 to 255 times

■ Heater break alarm (HBA) [continuous control output (optional)]

Number of HBA: 4 points or 2 points

Setting range: 0.0 to 100.0 A (0.0: HBA function OFF)
[HBA function OFF: The current value monitoring is available]
Heater break determination point:
0.0 to 100.0 % of HBA set value
(0.0: HBA function OFF)
Heater melting determination point:
0.0 to 100.0 % of HBA set value
(0.0: HBA function OFF)
CT assignment: 0 (HBA function OFF)
1 (OUT1) to 4 (OUT4)

■ Multi-memory area function [optional]

Number of areas: 8 area/channel

Stored parameters: Set value (SV), Event function 1 to 4, LBA time, LBA deadband,
Proportional band, Integral time, Derivative time,
Control response parameter, Proportional band [cool-side],
Integral time [cool-side], Derivative time [cool-side],
Overlap/Deadband, Manual reset,
Setting change rate limiter (up), Setting change rate limiter (down),
Soak time setting, Link area number

Method of area transfer: Communication function (optional)
Inaternal communication
Area soak time

Memory area link function: Link area number: 0 to 8 (0: No link)
Soak time: 00 minutes 00 seconds to 199 minutes 59 seconds or
00 hours 00 minutes to 99 hours 59 minutes
(Selectable)
Accuracy: ±(0.5 % of set value +0.25 seconds)
Area soak time stop function:
0 (No function)
1 (Event 1) to 4 (Event 4)

■ Communication

Interface: Based on RS-485 EIA standard

Connection method: 2-wire system, half-duplex multi-drop connection

Synchronous method: Start/stop synchronous type

Communication speed: 4800 bps, 9600 bps, 19200 bps, 38400 bps

Data bit configuration:
Start bit: 1
Data bi: RKC communication: 7 or 8
Modbus: 8
Parity bit: Without or 1 (Odd or Even)
Stop bit: 1

Protocol:
RKC communication (ANSI X3.28-1976 subcategory 2.5, B1)
Modbus-RTU
(Selectable)

Error control:
RKC communication: Vertical parity, Horizontal parity
Modbus: CRC-16

Termination resistor: Externally terminal connected

Interval time: 0 to 250 ms

Data mapping function: Up to 16 items (Modbus only)

Maximum connections: Up to 16 Z-TIO modules
The maximum number of SRZ modules (including other function modules) on the same communication line is 31.

Signal logic: RS-485

Signal voltage	Logic
V (A) − V (B) ≥ 2 V	0 (SPACE)
V (A) − V (B) ≤ −2 V	1 (MARK)

Voltage between V (A) and V (B) is the voltage of (A) terminal for the (B) terminal.

■ Loader communication function

Interface: Connection with a loader communication cable for our USB converter COM-K (sold separately).

Synchronous method: Start/stop synchronous type

Communication speed: 38400 bps

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

Protocol: ANSI X3.28 subcategory 2.5, B1

Maximum connections: 1 point

■ Logic output function

Number of logic output points:	8 points
Input:	Event output 1 (CH1 to CH4), Event output 2 (CH1 to CH4), Event output 3 (CH1 to CH4), Event output 4 (CH1 to CH4), Heater break alarm1 to 4, Communication switch for logic 1 to 4, FAIL signal

Output assignment selection (each output terminal):

0 (Control output), 1 (Logic outputs result)

Operation mode assignment selection:

0 (No assignment)
1 (monitor, control)
2 (monitor, event function, control)
3 (Auto/Manual)
4 (Remote/Local)
5 (Interlock release)

Additional function: Energized/De-energized: 0 (Energized), 1 (De-energized)
Can be selected for each logic output 1 to 4 (OUT1 to OUT4)

■ SV select function

● Remote SV function

Setting range:

SV select function:	0 (Remote SV function)
Master channel module address:	−1, 0 to 99
Master channel selection:	1 to 99
RS digital filter:	0.0 to 100.0 seconds (0: Filter OFF)
RS bias:	−Input span to + Input span
RS ratio:	0.001 to 9.999

● Ratio setting function

Setting range:

SV select function:	2 (Ratio setting function)
Master channel module address:	Common to Remote SV function setting
Master channel selection:	Common to Remote SV function setting
Ratio setting bias:	Common to RS bias setting
Ratio setting ratio:	Common to RS ratio setting
Ratio setting filter:	Common to RS digital filter setting

● Cascade control

Setting range:

SV select function:	1 (Cascade control function) 3 (Cascade control 2 function)
Master channel module address:	Common to Remote SV function setting
Master channel selection:	Common to Remote SV function setting
Cascade bias:	Common to RS bias setting
Cascade ratio:	Common to RS ratio setting
Cascade filter:	Common to RS digital filter setting

■ Output distribution function

Setting range:

Output distribution master channel module address:
−1, 0 to 99
Master channel selection: 1 to 99
Output distribution bias: −100.0 to +100.0 %
Output distribution ratio: −9.999 to +9.999
Output distribution selection: 0 (Control output),
1 (Distribution output)

■ Automatic temperature rise function

Setting range:

Automatic temperature rise group:
0 to 16 (0: Automatic temperature rise function OFF)
Automatic temperature rise learning: 0 (Unused), 1 (Learning)
Automatic temperature rise dead time: 0.1 to 1999.9 seconds
Automatic temperature rise gradient data: 0.1 to Input span/minutes

■ EDS function

Setting range:

Output distribution master channel module address:
−1, 0 to 99
EDS mode (for disturbance 1, for disturbance 2):
0 (No function), 1 (EDS function mode),
2 (Learning mode), 3 (Tuning mode)
EDS value 1 (for disturbance 1, for disturbance 2):
−100.0 to +100.0 %
EDS value 2 (for disturbance 1, for disturbance 2):
−100.0 to +100.0 %
EDS transfer time (for disturbance 1, for disturbance 2):
0 to 3600 seconds or 0.0 to 1999.9 seconds
EDS action time (for disturbance 1, for disturbance 2):
1 to 3600 seconds
EDS value learning times: 0 to 10 times
EDS action wait time (for disturbance 1, for disturbance 2):
0.0 to 600.0 seconds
EDS transfer time decimal point position:
0 (1 second setting), 1 (0.1 seconds setting)
Output average processing time for EDS:
0.1 to 200.0 seconds
Responsive action trigger point for EDS:
0 to Input span
EDS start signal: 0 (Start signal OFF),
1 (Start signal ON [for disturbance 1]),
2 (Start signal ON [for disturbance 2])

■ Peak current suppression function

This function is effective for modules connected each other by connectors on the base.
The peak current suppression function is performed in coupleds modules.

■ Master-slave mode

Setting range:
Address of interacting modules: −1, 0 to 99
Channel selection of interacting modules: 1 to 99
Selection switch of interacting modules:
0 (No interaction)
1 (Interact with other channels)
bit 0: Memory area number
bit 1: Operation mode
bit 2: Auto/Manual
bit 3: Remote/Local
bit 4: EDS start signal
bit 5: Interlock release
bit 6: Suspension of area soak time

■ Self-diagnostic function

Control stop:
Adjustment data error (Err 1)
Data back-up error (Err 2)
A/D conversion error (Err 4)
Logic output data error (Err 32)

Action stop (Error number is not displayed [Operation: Impossible]):
Power supply voltage monitoring
Watchdog timer

Instrument status:
When a self-diagnostic error occurs: All output OFF
Display: A green lamp flashes (Self-diagnostic error (FAIL))
A red lamp is on (Instrument abnormality (FAIL))

■ Power

Power supply voltage:
21.6 to 26.4 V DC [Including power supply voltage variation]
(Rating 100 to 240 V AC)

Power consumption (at maximum load):
140 mA max. (at 24 V DC) [4CH type]
80 mA max. (at 24 V DC) [2CH type]
Rush current: 10 A or less

■ Standard

Safety standards:
UL: UL61010-1
cUL: CAN/CSA-C22.2 No. 61010-1

CE marking:
LVD: EN61010-1
OVERVOLTAGE CATEGORYII,
POLLUTION DEGREE 2,
Class II (Reinforced insulation)
EMC: EN61326

C-Tick:
AS/NZS CISPR 11 (equivalent to EN55011)

■ General specifications

Insulation resistance:

Between measuring terminal and grounding:
20 MΩ or more at 500 V DC
Between power supply terminal and grounding:
20 MΩ or more at 500 V DC
Between power supply and measuring terminals:
20 MΩ or more at 500 V DC
When grounding is not provided: Between panels

Withstand voltage:

Time: 1 min.	①	②	③	④
① Grounding terminal				
② Power terminal	750 V AC			
③ Measured input terminal	750 V AC	750 V AC	400 V AC	
④ Output terminal (Relay contact, Triac)	1500 V AC	2300 V AC	2300 V AC	2300 V AC
⑤ Output terminal (Voltage, Current) Communication terminal	750 V AC		750 V AC	2300 V AC

Power failure: A power failure of 4 ms or less will not affect the control action.

Memory backup: Backed up by non-volatile memory (FRAM)
Number of writing: Approx. 10,000,000,000 times or more
Data storage period: Approx. 10 years

Allowable ambient temperature: −10 to +50 °C

Allowable ambient humidity: 5 to 95 % RH
(Absolute humidity: MAX.W.C 29.3 g/m^3 dry air at 101.3 kPa)

Installation environment conditions:
Indoor use
Altitude up to 2000 m

Transportation and Storage environment conditions:
Vibration:
- Amplitude: < 7.5 mm (2 to 9 Hz)
- Acceleration: < 20 m/s^2 (9 to 150 Hz)
  Each direction of XYZ axes

Shock: Height 800 mm or less

Temperature:
- At storage: −25 to +70 °C
- At transport: −40 to +70 °C

Humidity: 5 to 95 % RH (Non condensing)

Storage period: Within the warranty period

Mounting and Structure: Mounting method: DIN rail mounting or Panel mounting
Case material: PPE [Flame retardancy: UL94 V-1]
Panel sheet material: Polyester

Weight: Terminal type module: Approx. 160 g
Connector type module: Approx. 140 g

■ Isolation between Inputs and Outputs

▬ : Isolated
── : Not isolated

<table>
<tr><td>Power supply</td><td rowspan="7"></td><td>Output 1 (OUT1)</td></tr>
<tr><td>Measured input (CH1)</td><td rowspan="2">Output 2 (OUT2)</td></tr>
<tr><td>Measured input (CH2)</td></tr>
<tr><td>Measured input (CH3)</td><td rowspan="2">Output 3 (OUT3)</td></tr>
<tr><td>Measured input (CH4)</td></tr>
<tr><td>Communication</td><td>Output 4 (OUT4)</td></tr>
</table>

When outputs (OUT1 to OUT4) are relay outputs or triac outputs, isolation is not made between “the outputs and the power supply” and “the outputs and the communication”.

10.2 Z-DIO module

■ Digital input (DI)

Number of inputs:	None or 8 points (DI1 to DI8) Isolated input (each common block) Number of commons: 2 points (DI 4 points/common)
Input method:	Voltage contact input (Sink type) Open state: 5 V or less Close state: 17.5 V or more Contact current: 3.0 mA or less Allowable applied voltage: 26.4 V DC or less
Capture judgment time:	250 ms

■ Digital output (DO)

Number of outputs:

None or 8 points (DO1 to DO8)
Isolation input (each common block)
Number of commons: 2 points (DO 4 points/common)

Output method:

• Relay contact output

Contact type:	1a contact
Contact rating (Resistive load):	250 V AC 1 A, 30 V DC 1 A
Electrical life:	300,000 times or more (Rated load)
Mechanical life:	20 million times or more (Switching: 300 times/min)
Proportional cycle time*:	0.1 to 100.0 seconds
Minimum ON/OFF time*:	0 to 1000 ms

• Open collector output (Sink type)

Output method:	Sink type
Allowable load current:	100 mA
Load voltage:	30 V DC or less
Minimum load current:	0.5 mA
ON voltage:	2 V or less (at maximum load current)
Leakage current at OFF:	0.1 mA or less
Proportional cycle time*:	0.1 to 100.0 seconds
Minimum ON/OFF time*:	0 to 1000 ms

* Valid only when the output distribution function is used.

■ Indication lamp

Number of indicates: 2 points

Indication contents:

• Operation state indication (1 point)

When normal (RUN):	A green lamp is on
Self-diagnostic error (FAIL):	A green lamp flashes
Instrument abnormality (FAIL):	A red lamp is on

• Communication state indication (1 point)

During data send and receive (RX/TX):	A green lamp turns on

■ Digital input (DI) function

The following Z-TIO functions can be assigned as digital input:

Setting range: DI function assignment: 0 to 29 (See P. 1-6)

Signal details:
Memory area transfer, Area set*, Operation mode, Interlock release, Auto/Manual transfer, Remote/Local transfer, RUN/STOP transfer, Area soak time stop function, EDS start signal

* Valid/Invalid of the memory area setting signal can be set. (Default: Invalid)

■ Digital output (DO) function

The following signals can be assigned as digital output:

Setting range: DO output assignment 1 (DO1 to DO4),
DO output assignment 2 (DO5 to DO8):
0 to 13 (see P. 1-7)

Signal details:

Z-TIO module: Event output 1 to 4 states,
Heater break alarm (HBA) state,
Temperature rise completion,
Burnout state

Z-DIO module: DO manual output 1 to 8 states

DO signal assignment module address 1 (DO1 to DO4):
−1, 0 to 99
DO signal assignment module address 2 (DO5 to DO8):
−1, 0 to 99
DO manual output (DO1 to DO8):
0 (OFF), 1 (ON)
DO energized/de-energized: 0 (Energized), 1 (De-energized)

DO operational cycle: 0.25 seconds

■ Output distribution function

Outputs the value calculated by another channel of Z-TIO or Z-DIO modules from the DO.

Setting range: DO output distribution master channel module address:
−1, 0 to 99
DO output distribution master channel selection:
1 to 99
DO output distribution bias: −100.0 to +100.0 %
DO output distribution ratio: −9.999 to +9.999
DO output distribution selection:
0 (DO output), 1 (Distribution output)
DO output limiter (high): DO output limiter (low) to +105.0 %
DO output limiter (low): −5.0 % to DO output limiter (high)
DO_manipulated output value (MV) at STOP mode:
−5.0 to +105.0 %

■ Communication

Interface: Based on RS-485 EIA standard

Connection method: 2-wire system, half-duplex multi-drop connection

Synchronous method: Start/stop synchronous type

Communication speed: 4800 bps, 9600 bps, 19200 bps, 38400 bps

Data bit configuration:
Start bit: 1
Data bit: RKC communication: 7 or 8
Modbus: 8
Parity bit: Without or 1 (Odd or Even)
Stop bit: 1

Protocol: RKC communication (ANSI X3.28-1976 subcategory 2.5, B1)
Modbus-RTU
(Selectable)

Error control:
RKC communication: Vertical parity, Horizontal parity
Modbus: CRC-16

Termination resistor: Externally terminal connected

Interval time: 0 to 250 ms

Data mapping function: Up to 16 items (Modbus only)

Maximum connections: 16 modules (Z-DIO module)
The maximum number of SRZ modules (including other function modules) on the same communication line is 31.

Signal logic: RS-485

Signal voltage	Logic
V (A) − V (B) ≥ 2 V	0 (SPACE)
V (A) − V (B) ≤ −2 V	1 (MARK)

Voltage between V (A) and V (B) is the voltage of (A) terminal for the (B) terminal.

■ Loader communication function

Interface: Connection with a loader communication cable for our USB converter COM-K (sold separately).

Synchronous method: Start/stop synchronous type

Communication speed: 38400 bps

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

Protocol: ANSI X3.28 subcategory 2.5, B1

Maximum connections: 1 point

■ Self-diagnostic function

Function stop: Date back-up error (Err 2)

Action stop (Error number is not displayed [Operation: Impossible]):
Power supply voltage monitoring
Watchdog timer

Instrument status: When a self-diagnostic error occurs: All output OFF
Display: A green lamp flashes (Self-diagnostic error (FAIL))
A red lamp is on (Instrument abnormality (FAIL))

■ Power

Power supply voltage: 21.6 to 26.4 V DC [Including power supply voltage variation]
(Rating 24 V DC)

Power consumption (at maximum load):
70 mA max. (at 24 V DC)
Rush current: 10 A or less

■ Standard

Safety standards: UL: UL61010-1
cUL: CAN/CSA-C22.2 No.61010-1

CE marking: LVD: EN61010-1
OVERVOLTAGE CATEGORYII,
POLLUTION DEGREE 2,
Class II (Reinforced insulation)
EMC: EN61326

C-Tick: AS/NZS CISPR 11 (equivalent to EN55011)

■ General specifications

Insulation resistance: 20 MΩ or more at 500 V DC (Between each insulation block)

Withstand voltage:

Time: 1 min.	①	②	③	④	⑤	⑥
① Grounding terminal						
② Power terminal	750 V AC					
③ DI terminal	750 V AC	750 V AC	750 V AC			
④ DO terminal (Relay)	1500 V AC	2300 V AC	2300 V AC	2300 V AC		
⑤ DO terminal	750 V AC	750 V AC	750 V AC	2300 V AC	750 V AC	
⑥ Communication terminal	750 V AC		750 V AC	2300 V AC	750 V AC	750 V AC

Power failure: A power failure of 4 ms or less will not affect the control action.

Memory backup: Backed up by non-volatile memory (FRAM)
Number of writing: 10,000,000,000 times or more
Data storage period: Approx. 10 years

Allowable ambient temperature: −10 to +50 °C

Allowable ambient humidity: 5 to 95 % RH
(Absolute humidity: MAX.W.C 29.3 g/m^3 dry air at 101.3 kPa)

Installation environment conditions:
Indoor use
Altitude up to 2000 m

Transportation and Storage environment conditions:

Vibration:
- Amplitude: < 7.5 mm (2 to 9 Hz)
- Acceleration: < 20 m/s^2 (9 to 150 Hz)

Each direction of XYZ axes

Shock: Height 800 mm or less

Temperature:
- At storage: –25 to +70 °C
- At transport: –40 to +70 °C

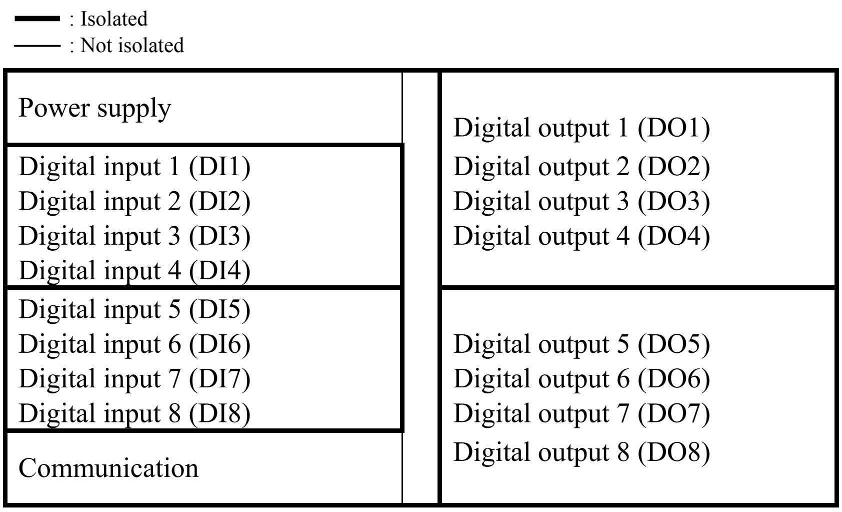
Humidity: 5 to 95 % RH (Non condensing)

Storage period: Within the warranty period

Mounting and Structure:
Mounting method: DIN rail mounting or Panel mounting
Case material: PPE [Flame retardancy: UL94 V-1]
Panel sheet material: Polyester

Weight:
Terminal type module: Approx. 150 g
Connector type module: Approx. 130 g

■ Isolation between DI and DO



MEMO

APPENDIX 11

11.1 ASCII 7-bit Code Table

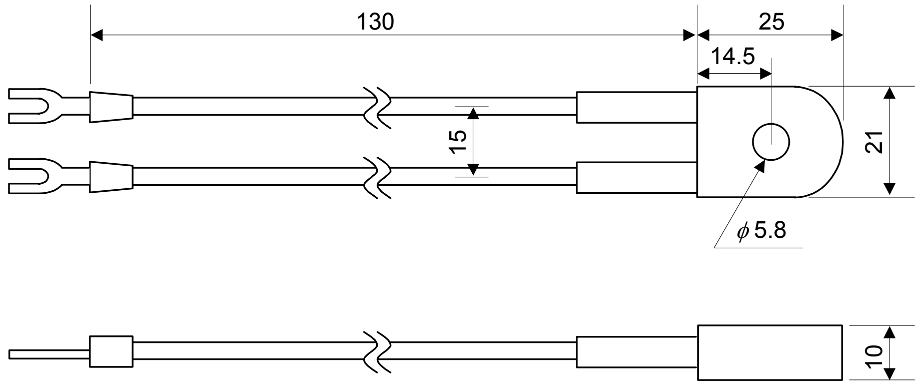
This table is only for use with RKC communication.

					b7	0	0	0	0	1	1	1	1
					b6	0	0	1	1	0	0	1	1
					b5	0	1	0	1	0	1	0	1
b5 to b7	b4	b3	b2	b1		0	1	2	3	4	5	6	7
	0	0	0	0	0	NUL	DLE	SP	0	@	P	‘	p
	0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
	0	0	1	0	2	STX	DC2	”	2	B	R	b	r
	0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
	0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
	0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
	0	1	1	0	6	ACK	SYM	&	6	F	V	f	v
	0	1	1	1	7	BEL	ETB	’	7	G	W	g	w
	1	0	0	0	8	BS	CAN	(	8	H	X	h	x
	1	0	0	1	9	HT	EM	)	9	I	Y	i	y
	1	0	1	0	A	LF	SUB	*	:	J	Z	j	z
	1	0	1	1	B	VT	ESC	+	;	K	[	k	{
	1	1	0	0	C	FF	FS	,	<	L	¥	l	|
	1	1	0	1	D	CR	GS	–	=	M	]	m	}
	1	1	1	0	E	SO	RS	.	>	N	^	n	˜
	1	1	1	1	F	SI	US	/	?	O	_	o	DEL

11.2 Current Transformer (CT) Dimensions

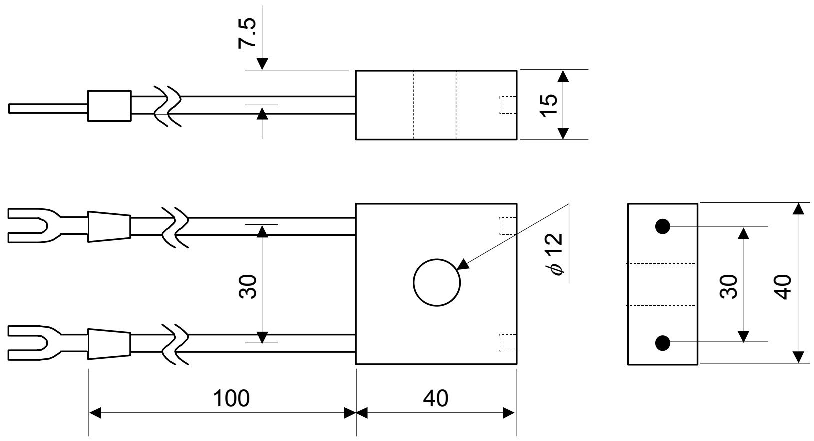
■ CTL-6-P-N (For 0 to 30 A)

(Unit: mm)



■ CTL-12-S56-10L-N (For 0 to 100 A)

(Unit: mm)



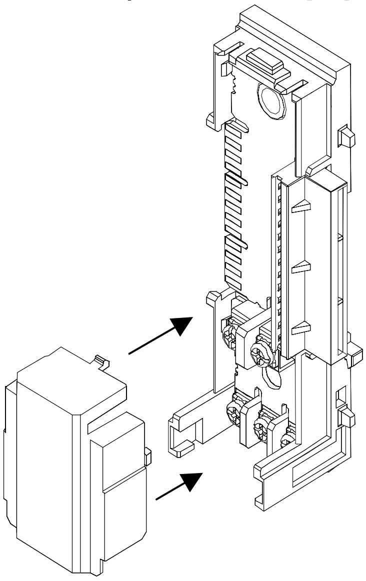
11.3 Cover

WARNING

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

When mounting and removing the terminal cover, apply pressure very carefully for avoid damage to the terminal cover.

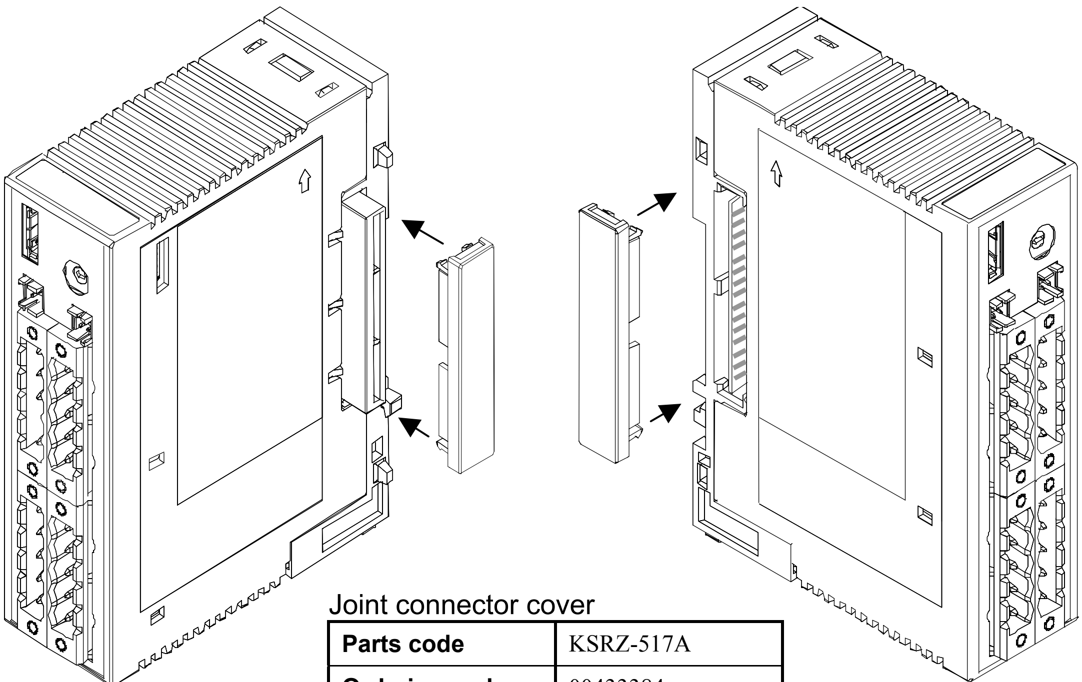
■ Power terminal cover (standard equipment)



Power terminal cover

Parts code	KSRZ-518A
Ordering code	00433376

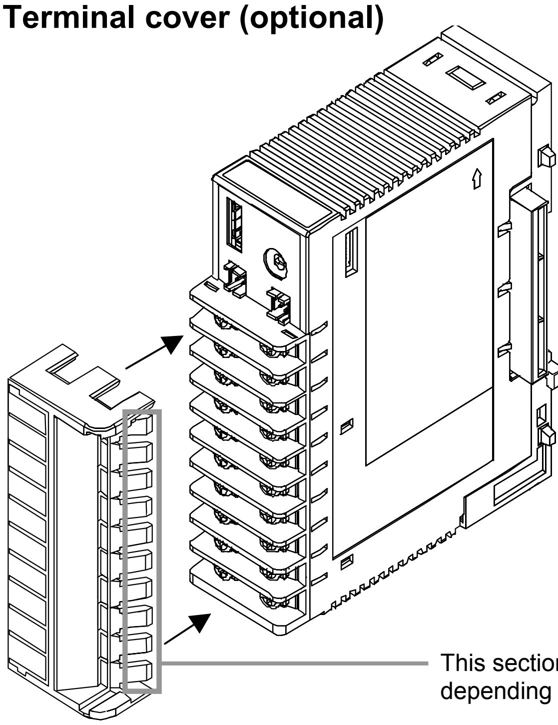
■ Joint connector cover (standard equipment)



Joint connector cover

Parts code	KSRZ-517A
Ordering code	00433384

■ Terminal cover (optional)



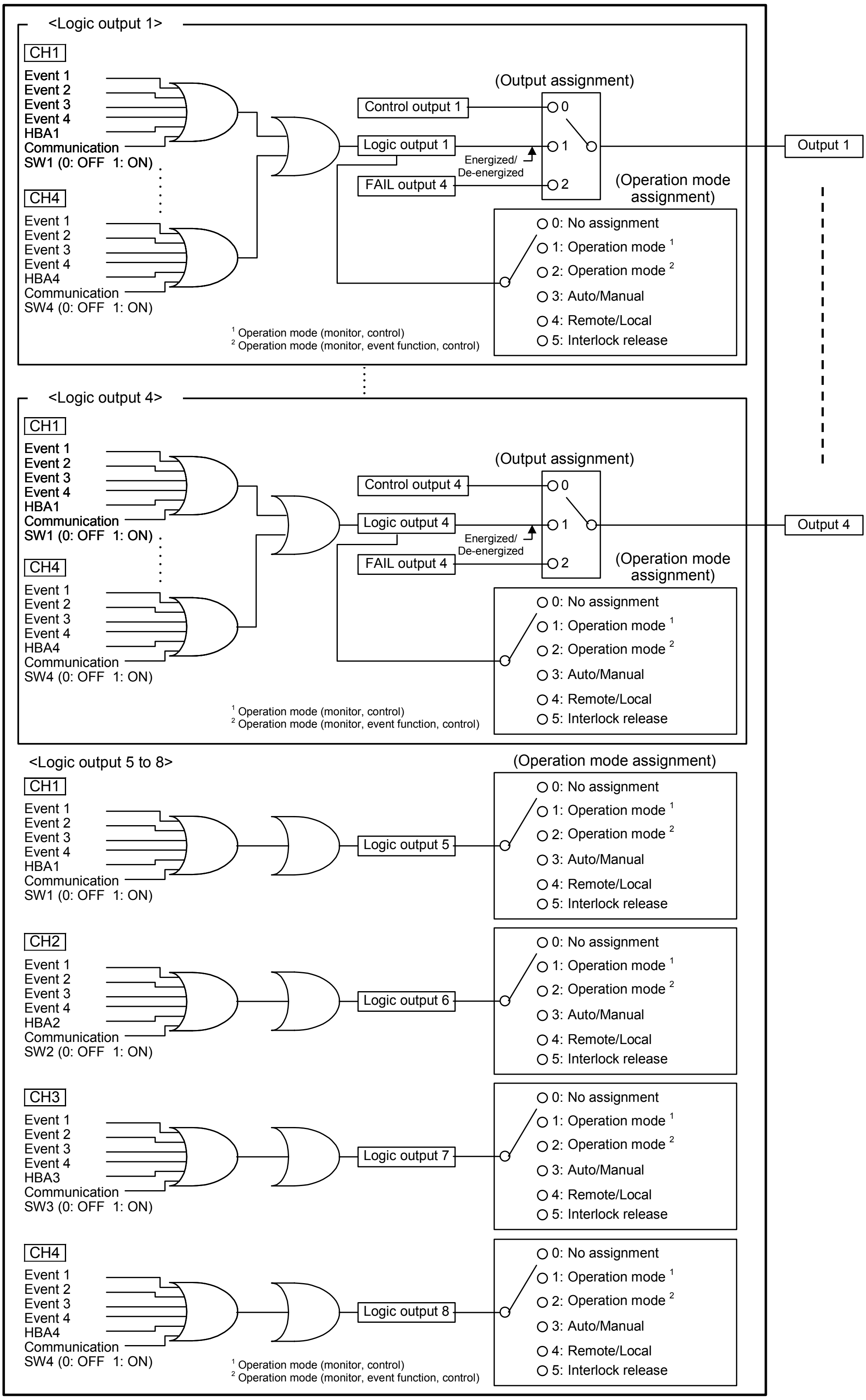
This section can be removed by bending it. Remove and then use it depending on the wiring condition.

Terminal cover

Parts code	KSRZ-510A
Ordering code	00433392

11.4 Block Diagram of Logic Output Selection Function

Z-TIO module

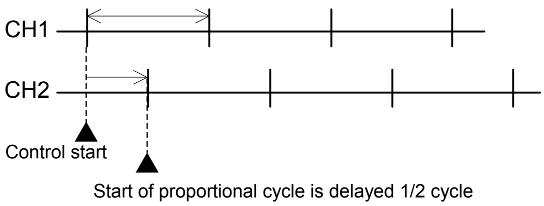


11.5 Peak Current Suppression Function

When the output type is time proportional output, the peak current suppression function changes the start timing of the proportional cycle so that the outputs of the channels do not turn ON simultaneously. The peak current suppression function operates within one Z-TIO module. To use this function, the proportional cycle time (P. 8-40) and the output limiter (P. 8-107) must be set to the required conditions.

■ Action

Two-division setting:



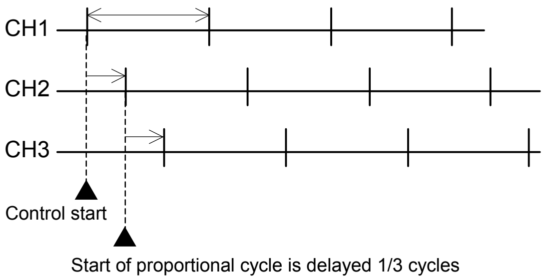
<Output limiter setting conditions>*

When two channels are prevented from turning ON simultaneously (two-division setting), the output limiters of the channels affected by the two-division setting must be set to 50 % or less.

When the output limiters of all channels are set to 50% or less, CH1 and CH2, and CH3 and CH4, will not turn ON simultaneously.

When the output limiters of three channels are set to 50% or less, the two channels with the lowest channel numbers will not turn ON simultaneously.
For example, if CH1 through CH3 are set to 50% or less, CH1 and CH2 will not turn ON simultaneously.

Three-division setting:

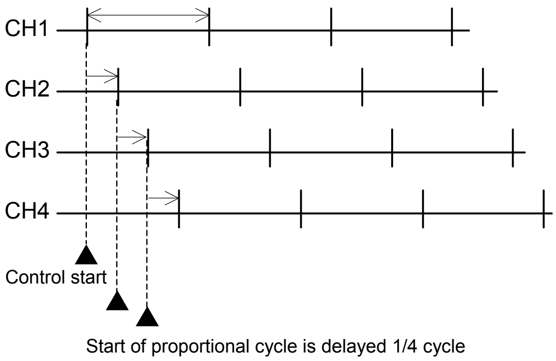


<Output limiter setting conditions>*

When three channels are prevented from turning ON simultaneously (three-division setting), the output limiters of the channels affected by the three-division setting must be set to 33.3 % or less.

When the output limiters of all four channels are 33.3 % or less, CH1, CH2, and CH3 will not turn ON simultaneously.

Four-division setting:



<Output limiter setting conditions>*

When four channels are prevented from turning ON simultaneously (four-division setting), the output limiters all four channels affected by the four-division setting must be set to 25 % or less.

* The output limiter setting conditions are determined in the order “Four-division setting > three-division setting > two-division setting”.

■ Requirements for start of peak current suppression function

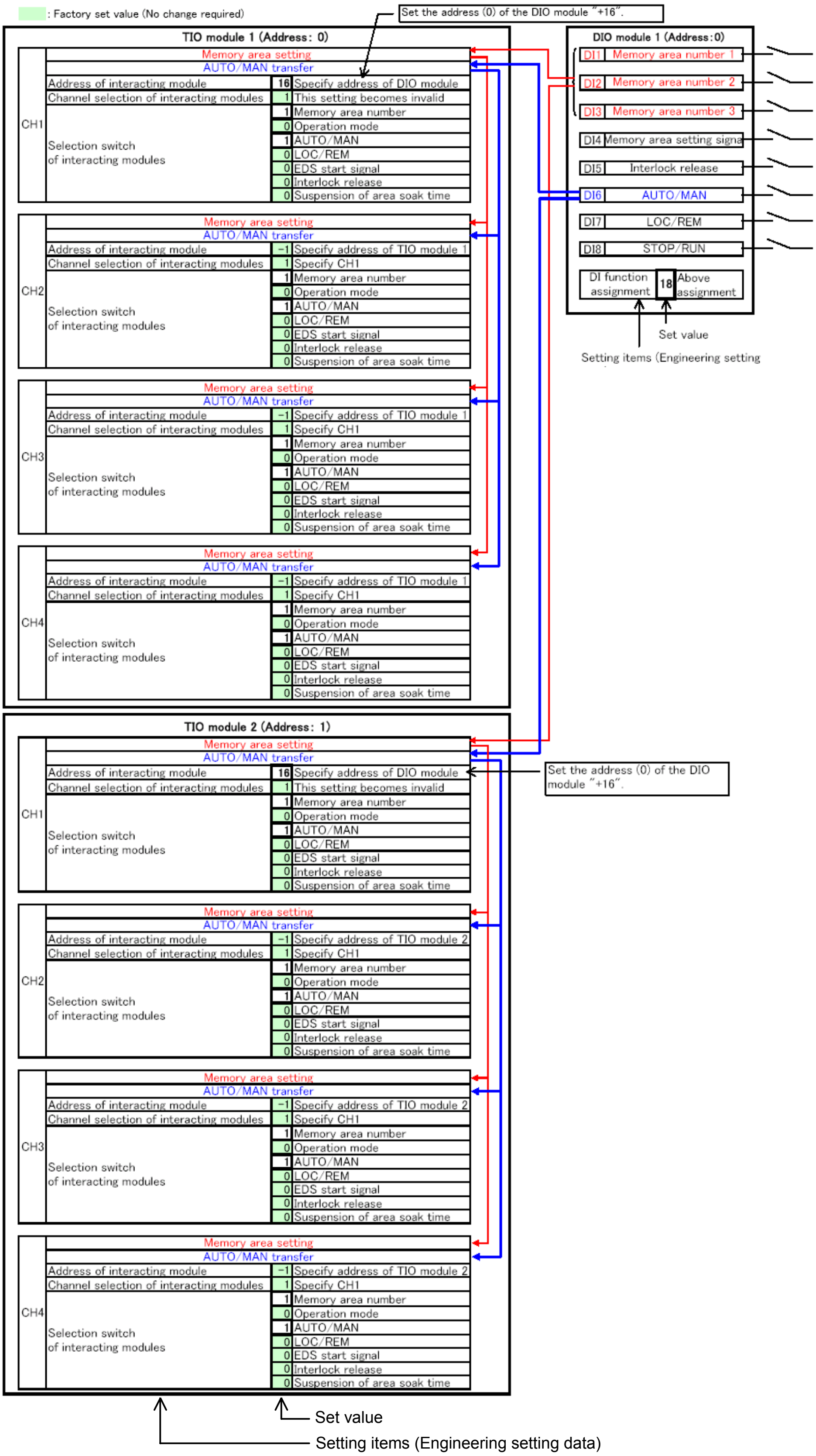
Requirements for start	The start timing of control (RUN/STOP transfer: RUN, operation mode: control) must be the same for each applicable channel.
	The proportional cycles of the applicable channels must be the same.
	The control action must be PID control (direct action/reverse action).

Caution is required if the proportional cycle is changed after starting, as the channels may turn ON simultaneously

11.6 Example of using DI/DO

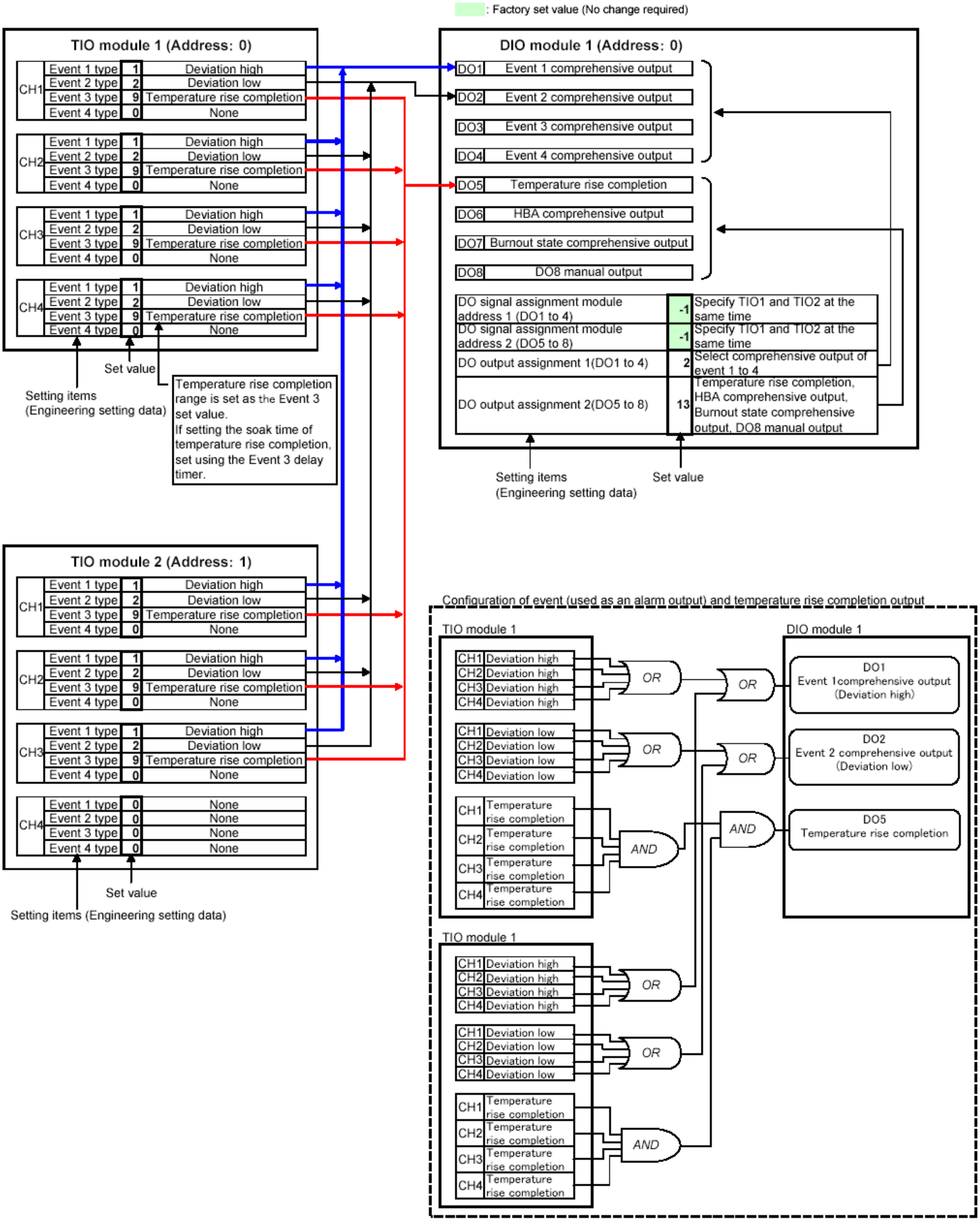
■ Example of using DI

Using one Z-DIO module to configure memory area settings and perform AUTO/MAN switching in two Z-TIO modules



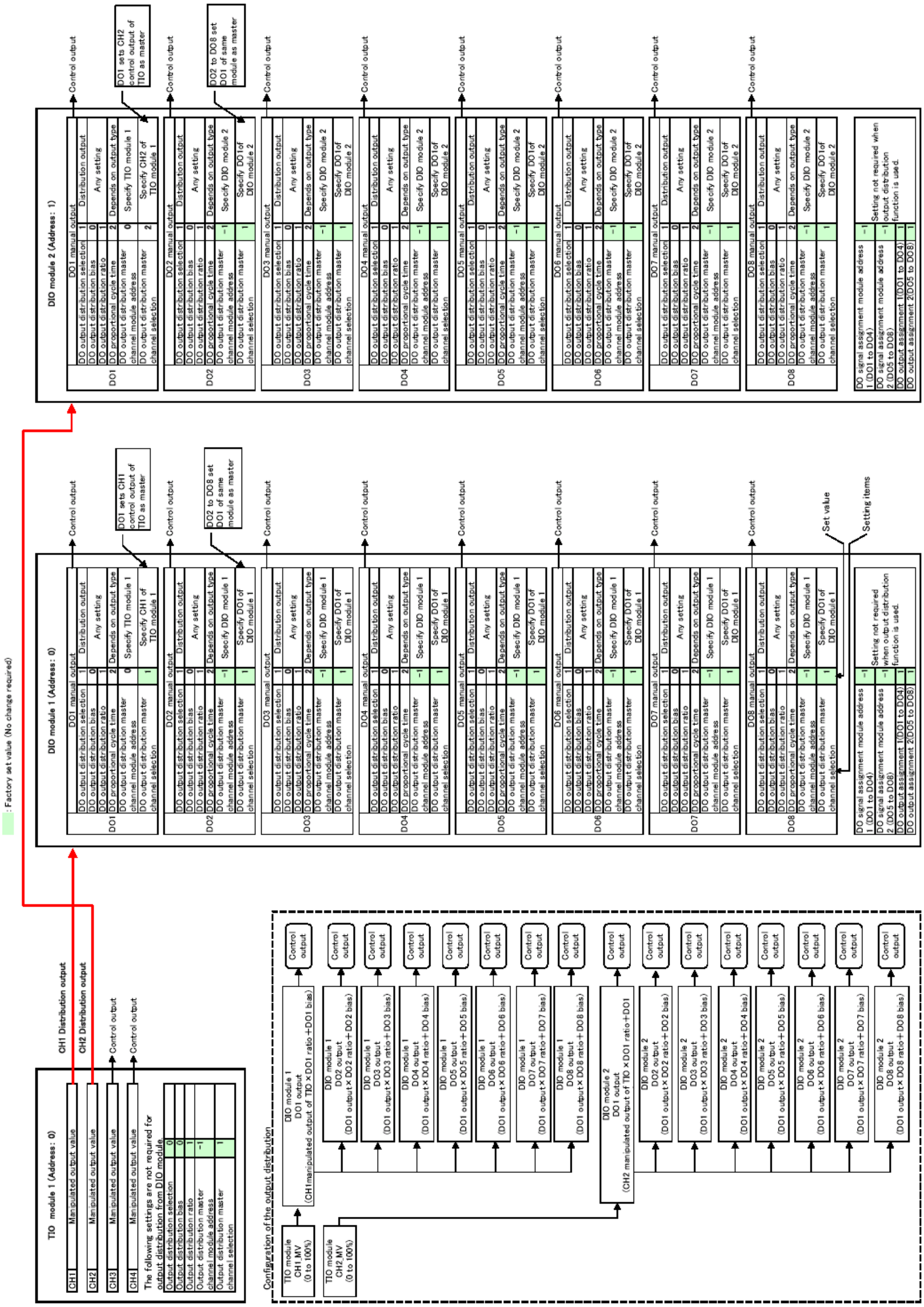
■ Example of using DO

When outputting events (used as an alarm) and temperature rise completion of two Z-TIO modules from one Z-DIO module



■ Example of output distribution from Z-DIO module

When outputting distribution of control output of CH1 and CH2 of Z-TIO module from Z-DIO module



Alphabetical order

E

F

H

I

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