Module Type Controller SRZ

High Accuracy Module

Z-TIO-G

Instruction Manual

RKC® RKC INSTRUMENT INC.

IMS01T28-E4

- Modbus is a registered trademark of Schneider Electric.
- Company names and product names used in this manual are the trademarks or registered trademarks of the respective companies.

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

SYMBOLS

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

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

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

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

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

 : This mark indicates where additional information may be located.

- Various symbols are used on the equipment, they have the following meaning.

 : Direct current

 : Alternating current

 : Safety precaution (Refer to the this Manual)

⚠ 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 the instrument and the equipment.
- This instrument must be used in accordance with the specifications to prevent fire or damage to the instrument and the 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 may occur and warranty is void under these conditions.

CAUTION

- This product is intended for use with industrial machines, test and measuring equipment. (It is not designed for use with medical equipment and nuclear energy plant.)
- This is a Class A instrument. In a domestic environment, this instrument may cause radio interference, in which case the user may be required to take additional measures.
- This instrument is protected from electric shock by reinforced insulation. Provide reinforced insulation between the wire for the input signal and the wires for instrument power supply, source of power and loads.
- Be sure to provide an appropriate surge control circuit respectively for the following:
  - If input/output or signal lines within the building are longer than 30 meters.
  - If input/output or signal lines leave the building, regardless the length.
- This instrument is designed for installation in an enclosed instrumentation panel. All high-voltage connections such as power supply terminals must be enclosed in the instrumentation panel to avoid electric shock to 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 dissipation.
- 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 may occur. Use a soft, dry cloth to remove stains from the instrument.
- To avoid damage to the instrument display, do not rub with an abrasive material or push the front panel with a hard object.
- Do not connect modular connectors to telephone line.
- When high alarm with hold action/re-hold action is used for Event function, alarm does not turn on while hold action is in operation. Take measures to prevent overheating which may occur if the control device fails.

NOTICE

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

1.1 Features

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

The Z-TIO-G module is a high accurate and high resolution type temperature control module with measuring accuracy of ±0.050 °C and resolution of 0.001 °C.
Dual loop control is available with a single Z-TIO-G module.
The communication interface is only RS-485.

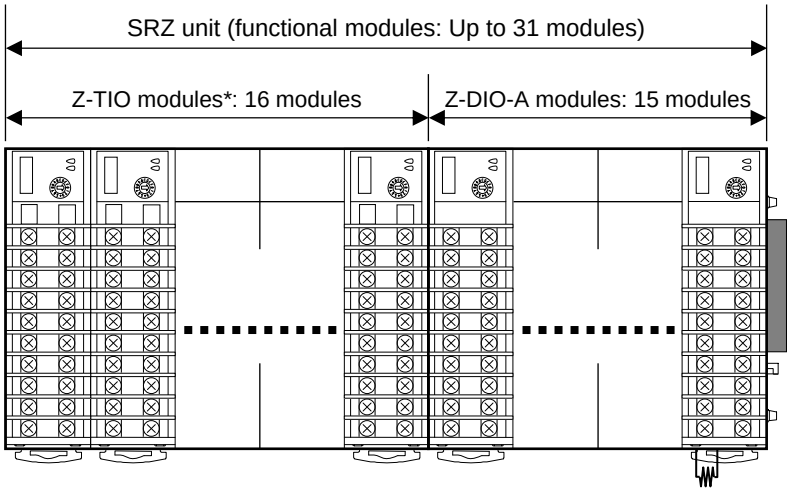
■ Number of temperature controls

Up to 16 Z-TIO-G modules can be connected on the same communication line. When 16 Z-TIO-G modules are used, temperature control of up to 32 channels is possible.
When the Z-TIO-G module is used with other types of Z-TIO modules in the same system (unit), the maximum connection of modules is 16 modules. However, if 4-channel type modules are used in the system, the maximum number of channels can be more than 32 channels.

■ Joinable modules

The Z-TIO-G module can be used together with Z-TIO-A/B/C/D modules, Z-DIO-A module and Z-CT module. (The Z-TIO-C/D modules, mainly used for PLC communication, are connectable only through the host communication.)
When Z-TIO-A/B/C/D/G modules, Z-DIO-A module and Z-CT module are used in the same system (unit), up to 31 modules can be connect in the single unit. (Note that the same module can be used up to 16 modules.)
The Z-COM module cannot be connected to the Z-TIO-G module.

[Example of module configuration]



* Different types of Z-TIO modules can be used in the same system (unit).
  Z-TIO-A/B: Temperature control modules (standard type)
  Z-TIO-C/D: Temperature control modules (PLC communication type)
  Z-TIO-G: Temperature control module (high accurate type)


"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-A and Z-CT).

1.2 Checking the Product

Before using this product, check each of the following:

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

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

■ Accessories

Description	Q'TY	Remarks
☐ Z-TIO-G Installation Manual (IMS01T26-X☐)	1	Enclosed with instrument
☐ Joint connector cover KSRZ-517A	2	Enclosed with instrument
☐ Power terminal cover KSRZ-518A	1	Enclosed with instrument
☐ PFF transformer PFT-02A	1	Optional When ordered PFF function, this transformer is attached. (separate packing)

■ Separate volumes

Description	Q'TY	Remarks
☐ Z-TIO-G Instruction Manual (IMS01T28-E4)	1	This manual (sold separately) * * This manual can be downloaded from the RKC official website: https://www.rkcinst.com/english/manual_load.htm

■ Optional (sold separately)

Description	Q'TY	Remarks
☐ End plate DEP-01	2	————
☐ Terminal cover KSRZ-510A	1	For the terminal type module

1.3 Model Code

Check that the product received is correctly 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.

■ Suffix code

Z-TIO-G □−□ □/N □ □−□ □□□
(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							
Output 1 (OUT1)	Relay contact output		M						
	Voltage pulse output		V						
	Voltage output, Current output (Refer to Output Code Table)		□						
	Triac output		T						
	Open collector output		D						
Output 2 (OUT2)	Relay contact output			M					
	Voltage pulse output			V					
	Voltage output, Current output (Refer to Output Code Table)			□					
	Triac output *			T					
	Open collector output			D					
Current transformer (CT) input	None				N				
Power feed forward input	None					N			
	Power feed forward input **					2			
Quick start code	No quick start code (Configured to 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]	Quick start code is not specified							No code	
	PID control with AT (Reverse action)							F	
	PID control with AT (Direct action)							D	
Measured input and Range (all channel common) [Quick start code 1]	No specify quick start code								No code
	Refer to range code table.								□□□

* The following standards do not apply to triac output type.
CE/UL/cUL/RCM

** One 200-240 V AC transformer [PFT-02A] included

● 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

Input	Type	Code	Range
RTD input	Pt100	D38	−50.000～+150.000 °C
		D39	−50.00～+250.00 °C
		D41	−150.00～+150.00 °C
Voltage input	0 to 1 V DC	301	Programmable range (Factory set value: 0.000 to 100.000)

■ 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.

□ □ □ □−N □
(1) (2) (3) (4) (5) (6)

Specifications		Quick start code 2 (Initial setting code)					
		(1)	(2)	(3)	(4)	(5)	(6)
Event function 1 (EV1) *	None	N					
	Event function 1 (Refer to Event type code table)	□					
Event function 2 (EV2) *	None		N				
	Event function 2 (Refer to Event type code table)		□				
Event function 3 (EV3) *	None			N			
	Event function 3 (Refer to Event type code table)			□			
	Temperature rise completion			6			
Event function 4 (EV4) *	None				N		
	Event function 4 (Refer to Event type code table)				□		
	Control loop break alarm (LBA)				5		
CT type	None					N	
Communication protocol	RKC communication (ANSI X3.28-1976)						1
	Modbus						2

* 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)

● Event type code table

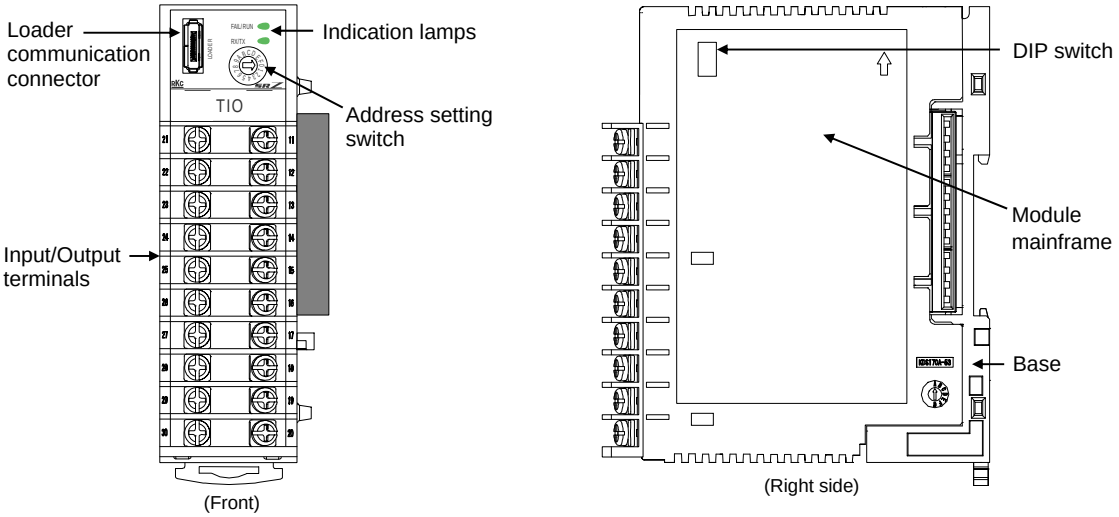
Code	Type
A	Deviation high
B	Deviation low
C	Deviation high/low
D	Band
E	Deviation high with hold action
F	Deviation low with hold action
G	Deviation high/low with hold action

Code	Type
H	Process high
J	Process low
K	Process high with hold action
L	Process low with hold action
Q	Deviation high with re-hold action
R	Deviation low with re-hold action
T	Deviation high/low with re-hold action

Code	Type
V	SV high
W	SV low
1	MV high
2	MV low

1.4 Parts Description

■ Module mainframe



● 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

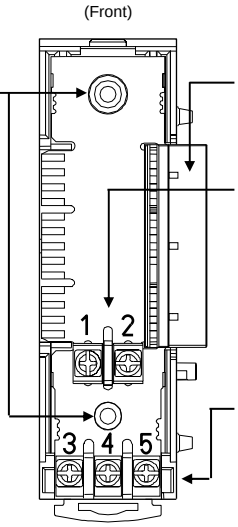
● Switches

Address setting switch	Sets the Z-TIO-G module address. (Refer to P. 3-2.)
DIP switch	Sets the communication speed, data bit configuration, and communication protocol. (Refer to P. 3-4.)

● Connector/Terminals

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 communication tool (PROTEM2) [2] can be installed on the computer, to enable data management monitoring and settings from the computer. [1] For the COM-K, refer to the **COM-K Instruction Manual (IMR01Z01-E□).** [2] The communication tool can be downloaded from the RKC official website: https://www.rkcinst.com/.
Input/Output terminals	Signals of measurement inputs, control outputs, digital inputs and power feed forward inputs are assigned.

■ Base



Mounting holes (M3 screw)

Holes for screws to fix the base to a panel, etc.
Customer must provide the M3 screws.

Joint connector

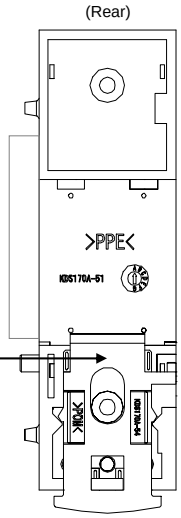
Used to mechanically and electrically connect each module.

Power supply terminals

Supply power to only one of the joined modules, and all of the joined modules will receive power.
(Refer to **5.1 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.

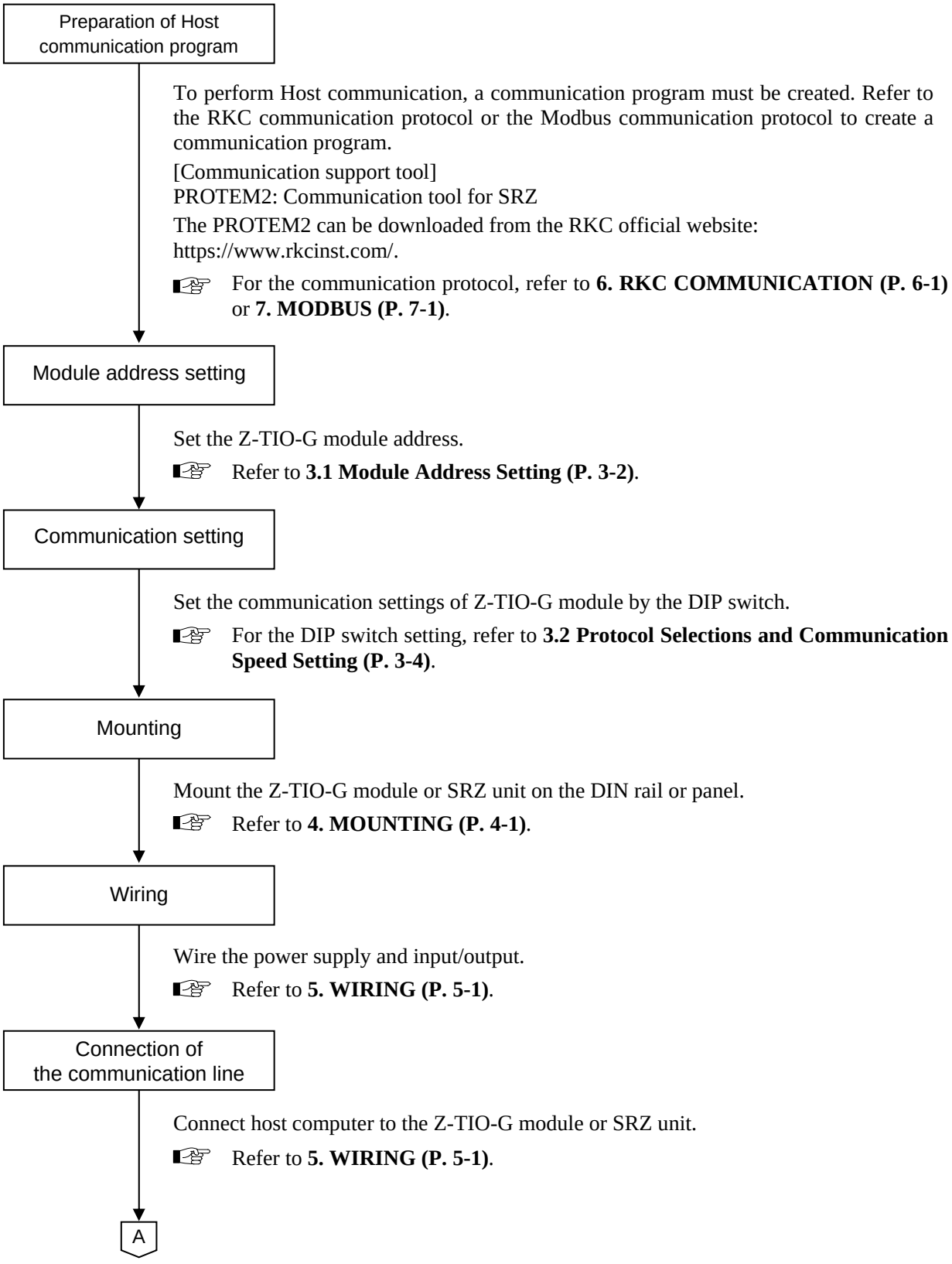
MEMO

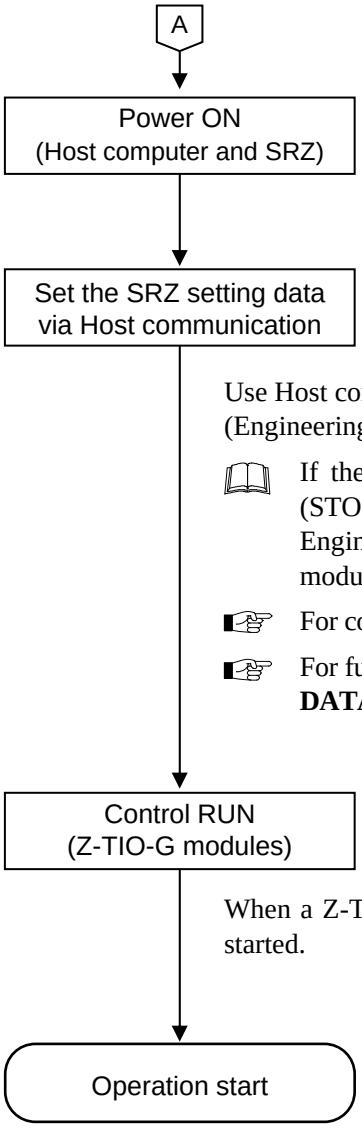
SETTING PROCEDURE TO OPERATION

2

2.1 When Use Host Communication

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





Use Host communication to configure communication data in the Z-TIO-G modules. (Engineering data and operation data, etc.)

If the Z-TIO-G module is set to control start (RUN), switch to control stop (STOP).
Engineering data can only be set in Z-TIO-G modules when the Z-TIO-G module is stopped.

For communication data, refer to **8. COMMUNICATION DATA LIST (P. 8-1)**.

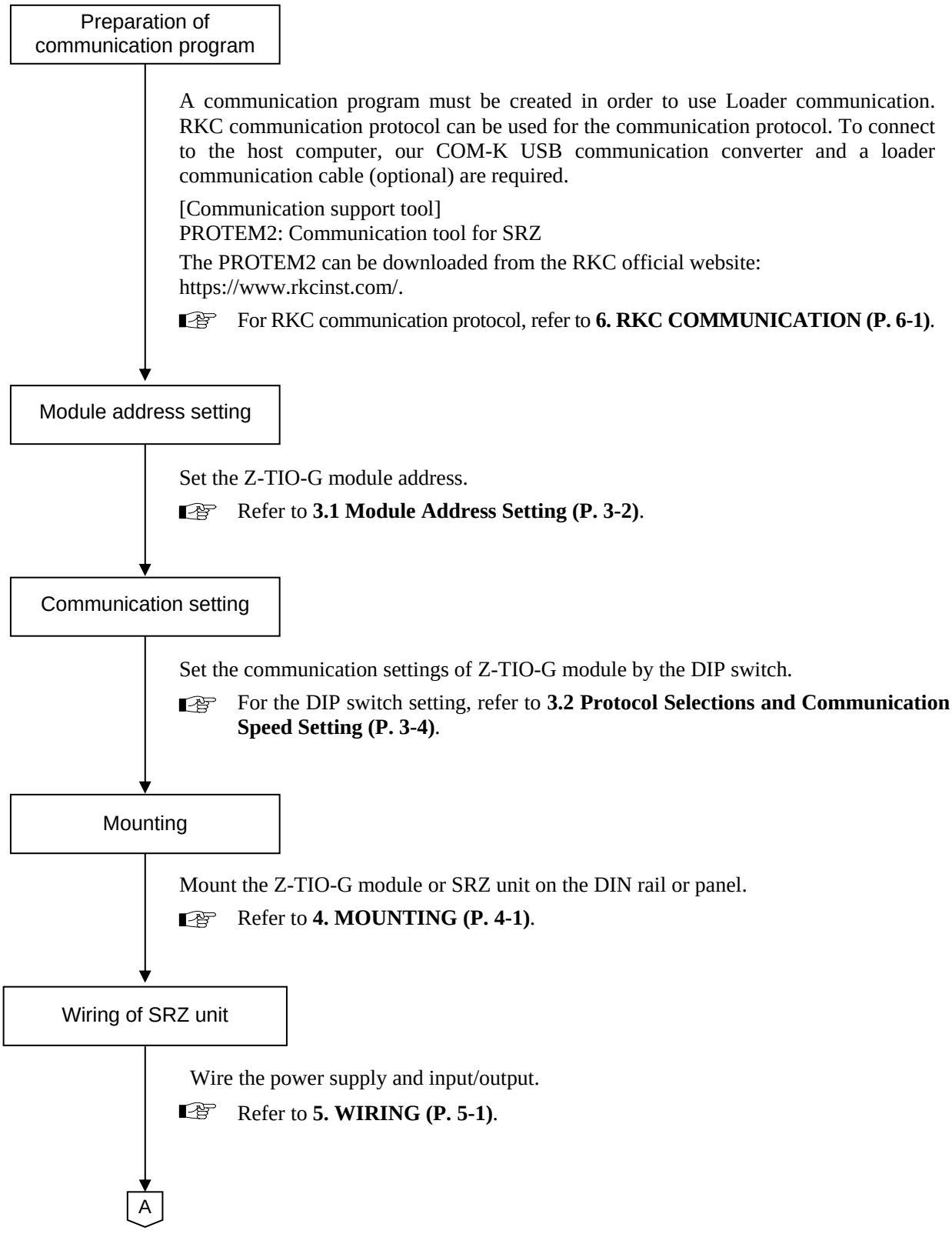
For function description of communication data, refer to **9. COMMUNICATION DATA DESCRIPTION (P. 9-1)**.

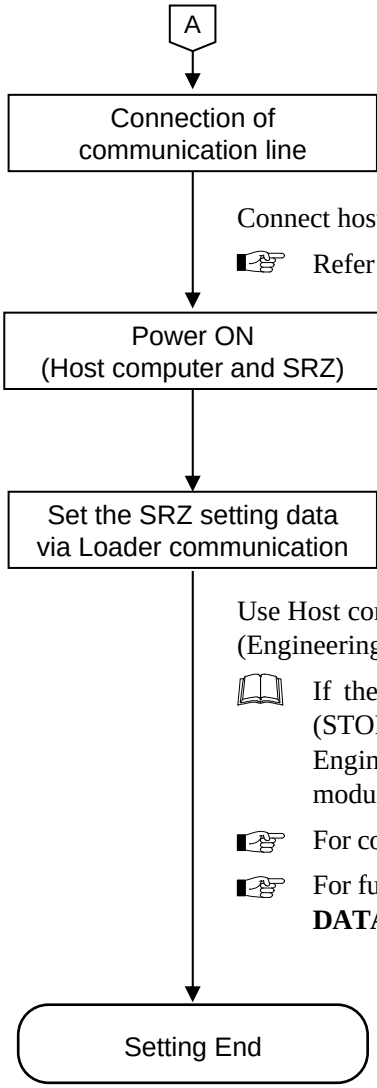
When a Z-TIO-G module is set to RUN, the setting becomes valid and the control is started.

2.2 When Performing Operation Setting via Loader Communication

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

The Loader port is only for parameter setup.





Connect host computer to the Z-TIO-G module or SRZ unit.

☞ Refer to **5. WIRING (P. 5-1)**.

Use Host communication to configure communication data in the Z-TIO-G modules. (Engineering data and operation data, etc.)

If the Z-TIO-G module is set to control start (RUN), switch to control stop (STOP).
Engineering data can only be set in Z-TIO-G modules when the Z-TIO-G module is stopped.

☞ For communication data, refer to **8. COMMUNICATION DATA LIST (P. 8-1)**.

☞ For function description of communication data, refer to **9. COMMUNICATION DATA DESCRIPTION (P. 9-1)**.

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COMMUNICATION SETTINGS

3

3.1 Module Address Setting

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

⚠ 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.

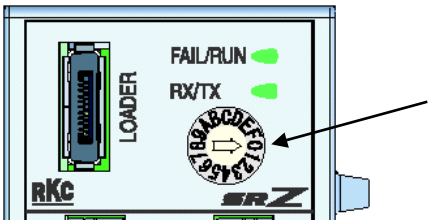
CAUTION

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 number]
Factory set value: 0

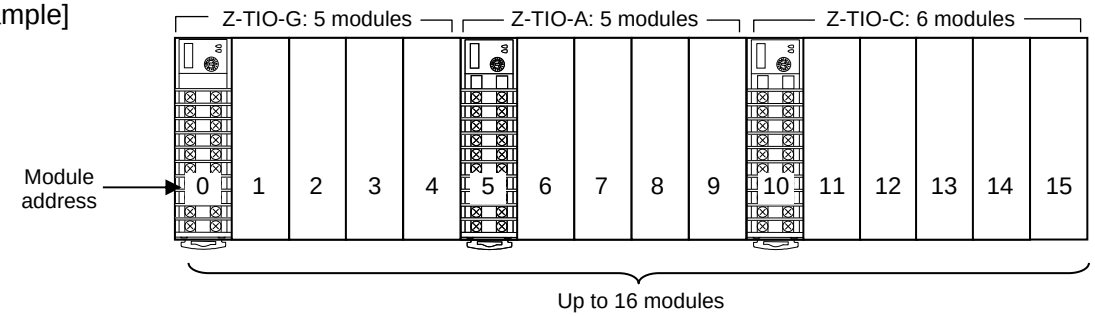
The module address number:

RKC communication	0 to 15 (decimal)
Modbus	1 to 16 (decimal) The value obtained by adding “1” to the set address corresponds to the address used for the actual program.
Loader communication	0 The module address of Z-TIO-G module is fixed to zero. The setting of address setting switch is ignored.

■ Addresses when Z-TIO-G modules and other Z-TIO modules are joined

The maximum number of modules of the same type that can be connected is 16.
Z-TIO-G modules and Z-TIO-A/B/C/D modules are considered to be the same type, and thus when these are joined, configure the addresses within the range 0 to F (0 to 15 decimal).

[Example]

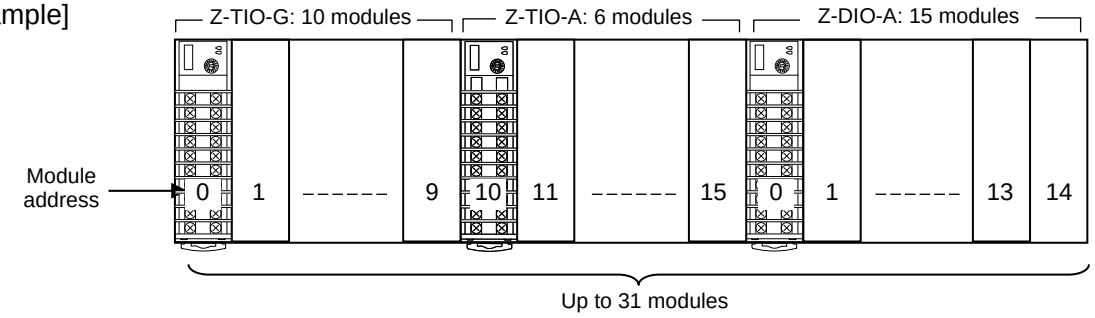


Z-TIO-A/B/G modules and Z-TIO-C/D modules can be joined only when host communication is used.

■ Addresses when Z-TIO-G modules and other Z-DIO-A modules are joined

When Z-TIO modules (Z-TIO-A/B/C/D/G) and Z-DIO-A modules are used connected in the same system (unit), address setting can be done between 0 and F (0 to 15: hexadecimal) independently.
The maximum number of modules that can be connected in the same system is 31 when different types of modules (Z-TIO and Z-DIO-A) are used.

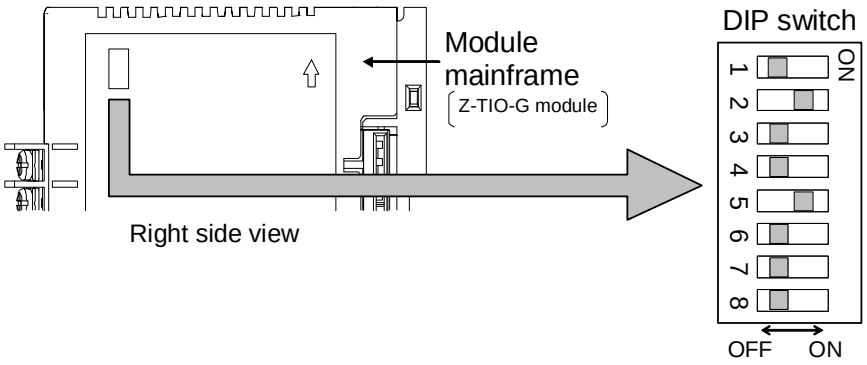
[Example]



3.2 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 Z-TIO-G modules 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.



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
ON	OFF	OFF	**Do not set this one**
ON	OFF	ON	

Setting range of Modbus

Setting range of RKC communication

Factory set value: Data 8-bit, without parity, stop 1-bit

* When the Modbus communication protocol is selected, this setting becomes invalid.

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.

3.3 Loader Communication Setting

The loader communication has a preset configuration for module address, communication speed, communication protocol and data bit configuration of the Z-TIO-G module. Communication setup is not required for the Z-TIO-G module.
Adjust the communication setting on the host side same as that for the Z-TIO-G module.

Address, communication speed, communication protocol and data bit configuration at the time of loader communication.

Name	Data (fixed value)
Address	0
Communication speed	38400 bps
Communication protocol	RKC communication Based on ANSI X3.28-1976 subcategories 2.5 and B1
Data bit configuration	Data bit: 8 Parity bit: Without Stop bit: 1

3.4 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

This instrument provides such actions and outputs as described below when input error is detected.

● Action at input break

RTD input: Upscale
Current input: Upscale

● Action at input short circuit

RTD input: Upscale

● Output at input error

Setting range of Input error determination point:

Input scale low – (5 % of input span) to Input scale high + (5 % of input span)

This setting is also used for the determination of forced activation of the event at input error.

Action selection at input error:

・Normal control (Factory set value)
・Manipulated output value at input error

Action depends on the setting of Action at input error (high) or Action at input error (low).

Setting range of Manipulated output value at input error:

–5.0 to +105.0 %

Actual output value is restricted by the output limiter.

Event output: Action depends on the setting of Force ON of Event action.

☞ Refer to **Functional explanation of the action at input error (P. 9-70, 9-62)** for the action at the time of 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, refer to **9. COMMUNICATION DATA DESCRIPTION (P. 9-1)**.

■ 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, refer to **Hot/Cold start (P. 9-63).**

■ 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.

3.5 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.

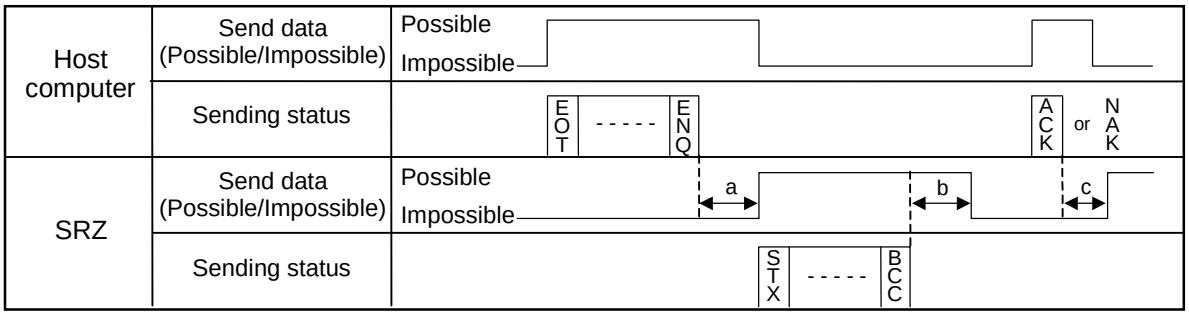
Modbus

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

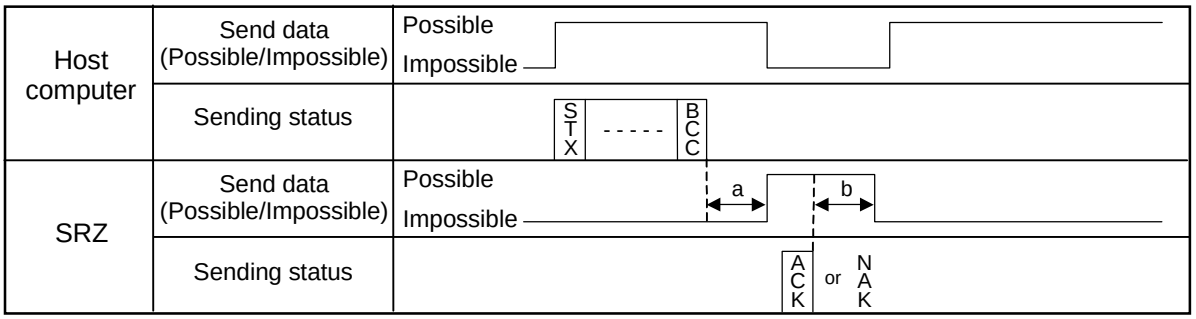
RS-485 communication is conducted through two wires, therefore the transmission and reception of data requires precise timing.

● 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 required 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.

4 MOUNTING

4.1 Mounting Cautions

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

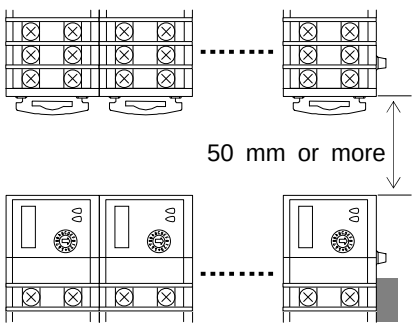
> **⚠ WARNING**
>
> To prevent electric shock or instrument failure, always turn off the power before mounting or removing the instrument.

(1) This instrument is intended to be used under the following environmental conditions.
(IEC 61010-1) [POLLUTION DEGREE 2]

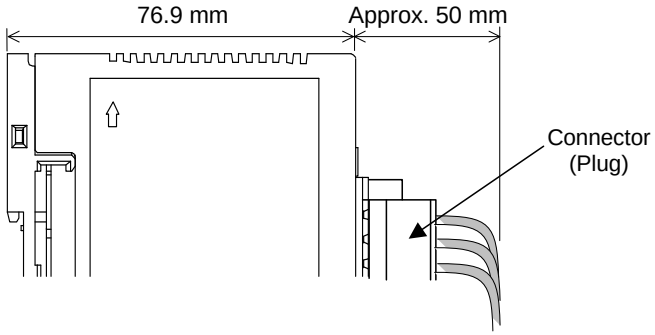
(2) Use this instrument within the following environment conditions:
- Allowable ambient temperature: –10 to +50 °C
- Allowable ambient humidity: 5 to 95 %RH
  (Absolute humidity: MAX.W.C 29 g/m^3 dry air at 101.3 kPa)
- Installation environment conditions: Indoor use
  Altitude up to 2000 m

(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.

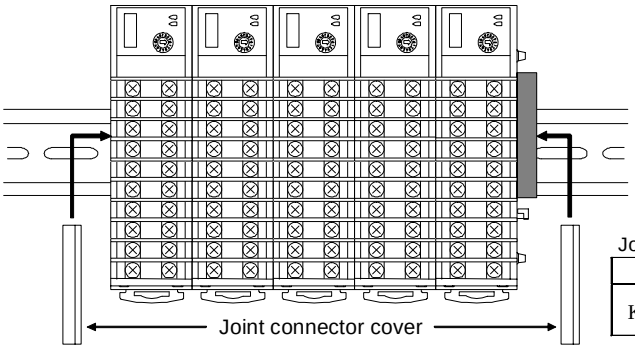
(4) Mount this instrument in the panel considering the following conditions:
- Provide adequate ventilation space so that heat does not build up.
- Do not mount this instrument directly above the equipment that generates large amount of heat (heaters, transformers, semi-conductor functional devices, large-wattage resistors).
- If the ambient temperature rises above 50 °C, cool this instrument with a forced air fan, cooler, etc. Cooled air should not blow directly on this instrument.
- 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
- **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.



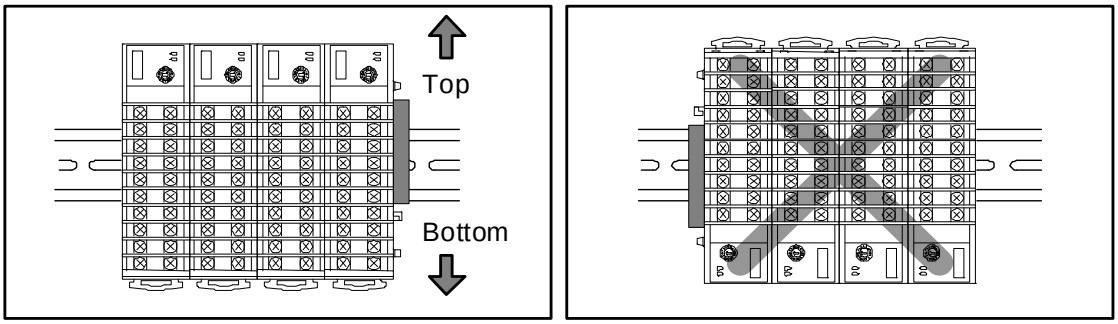
- **Mounting the joint connector cover**
  It is recommended to use a plastic cover on the connector on both sides of the mounted modules for protection of connectors.



Joint connector cover (Standard equipment)

Parts code	Ordering code	Q'ty
KSRZ-517A	00433384	2

- **Installing direction of SRZ unit**
  Mount the SRZ unit in the direction specified as shown below.

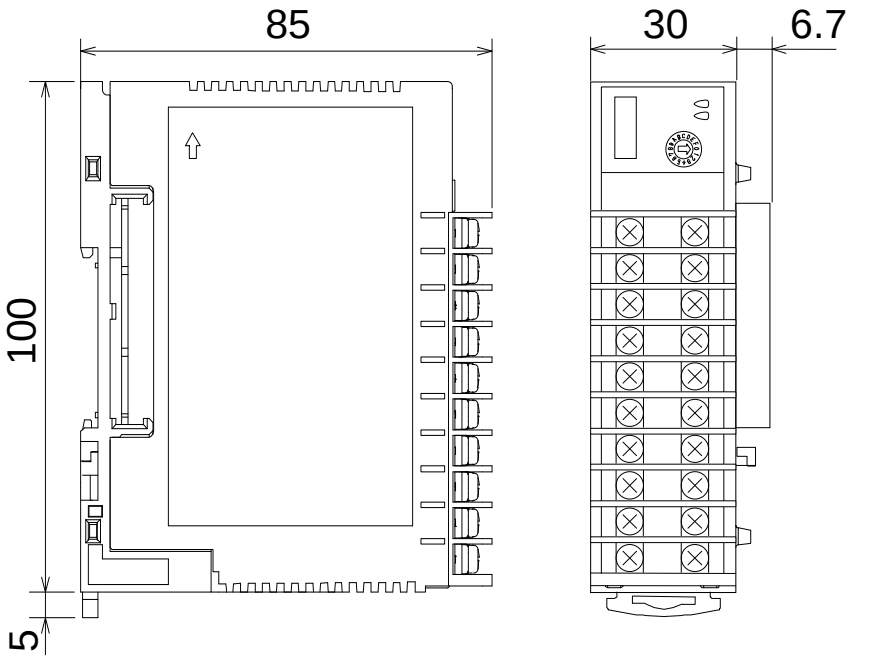


(5) In case this instrument is connected to a supply by means of a permanent connection, a switch or circuit-breaker shall be included in the installation. This should be in close proximity to the equipment and within easy reach of the operator. It should be marked as the disconnecting device for the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

4.2 Dimensions

<Terminal type module>

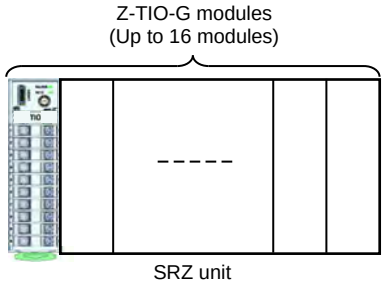
(Unit: mm)



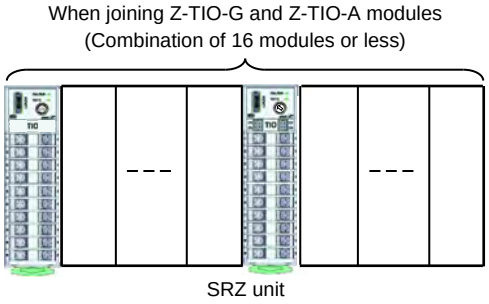
4.3 Important Points When Joining Modules

When joining the Z-TIO-G modules, note the following:

■ The maximum number of joined Z-TIO-G modules that can be connected to one host computer is 16.

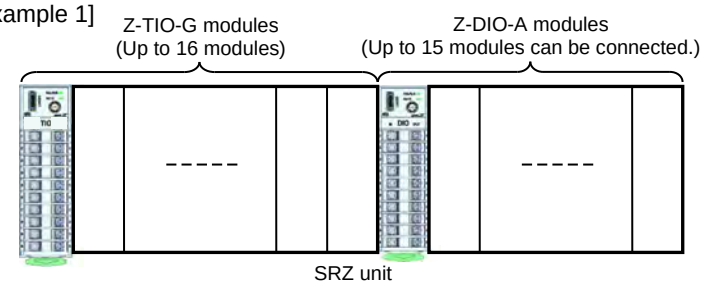


■ The Z-TIO-G module can be connected to Z-TIO-A/B/C/D modules.
The Z-TIO-G module is identified as the same type as the Z-TIO-A/B/C/D modules. This means that the maximum connection is 16.
The Z-TIO-C/D modules are available with a host communication only.

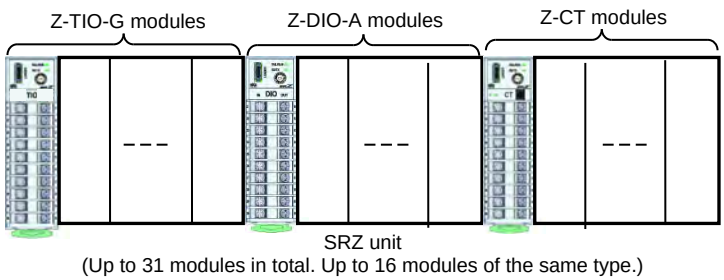


■ The Z-TIO-G module can be used with Z-DIO-A and Z-CT modules.
The maximum connection in this case (Z-TIO-A/B/C/D/G, Z-DIO-A and Z-CT modules) is 31 in total.

[Example 1]



[Example 2]

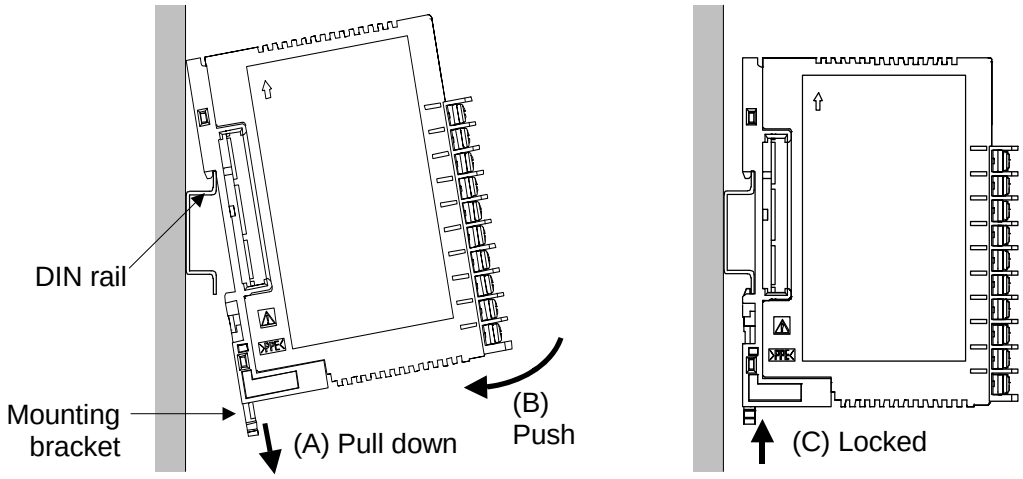


4.4 DIN Rail Mounting and Removing

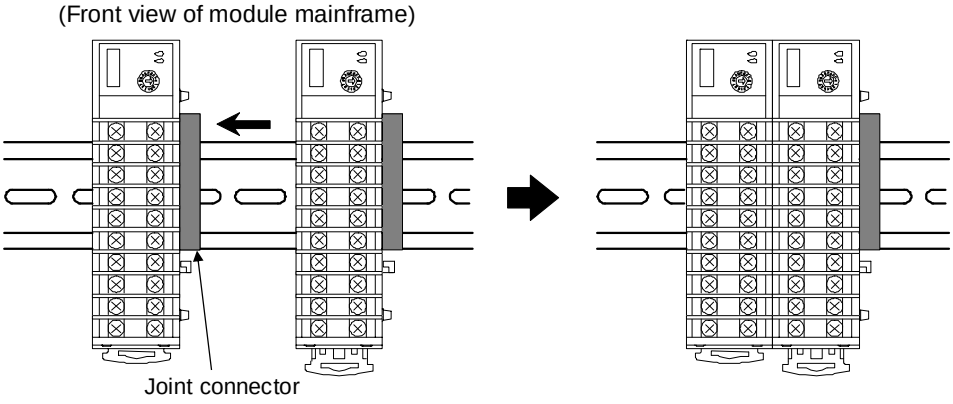
■ Mounting procedures

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).

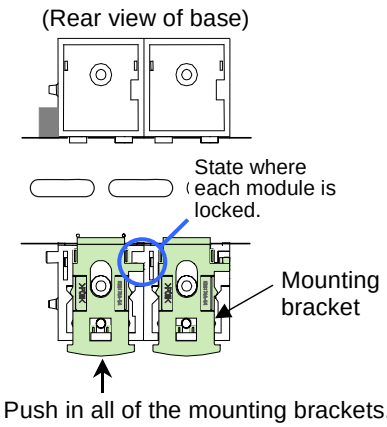
2. Slide the mounting bracket up to secure the module to the DIN rail (C).



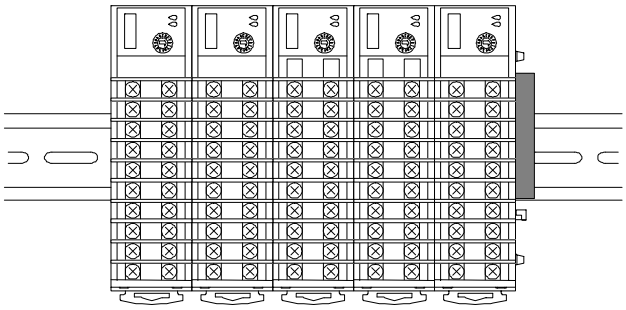
3. Mount the modules on the DIN rail. Slide the modules until the modules are closely joined together and the joint connectors are securely connected.



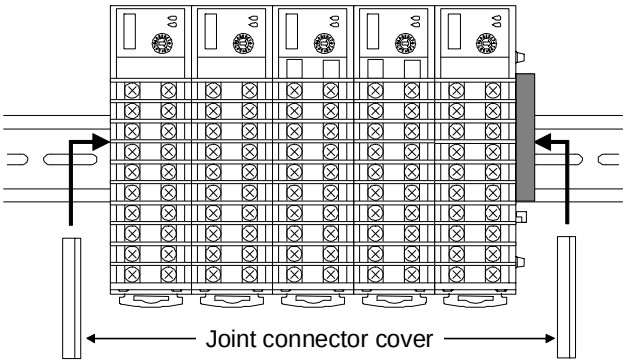
4. Push in the mounting brackets to lock the modules together and fix to the DIN rail.



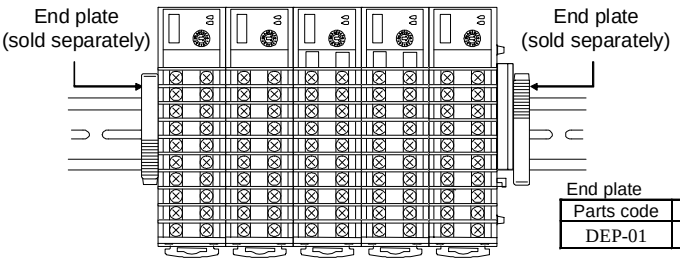
5. Connect the required number of function modules.



6. Install a plastic cover on the connector on both sides of the mounted modules for protection of connectors.



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



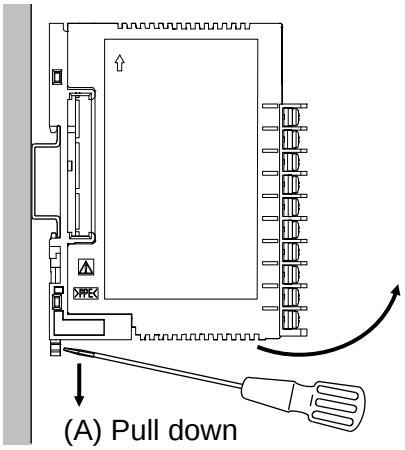
End plate

Parts code	Ordering code	Q'ty
DEP-01	00434944	2

■ Removal procedures

1. Pull down a mounting bracket with a slotted screwdriver (A).

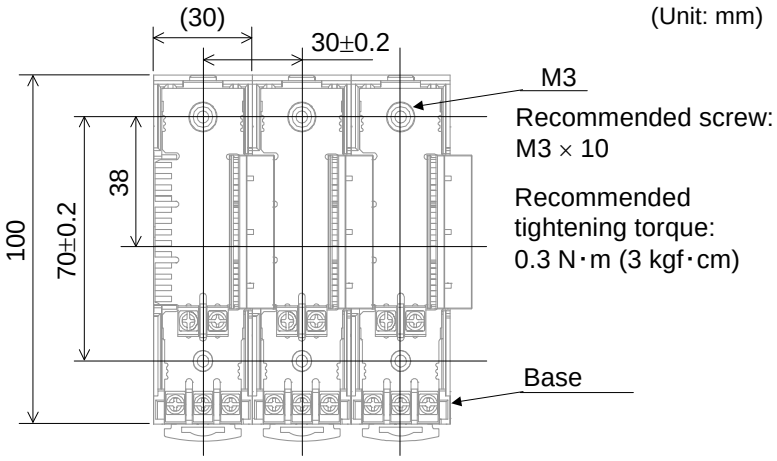
2. Lift the module from bottom, and take it off (B).



4.5 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)

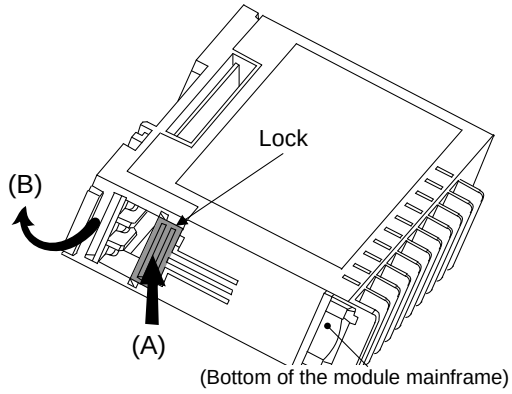


Fig. 1: Removing the base

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

☞ Refer to the **4.4 DIN Rail Mounting and Removing (P. 4-6).**

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)

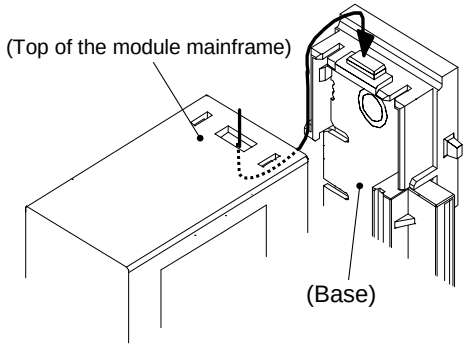


Fig. 2: Mounting the module mainframe

5 WIRING

5.1 Wiring Cautions

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

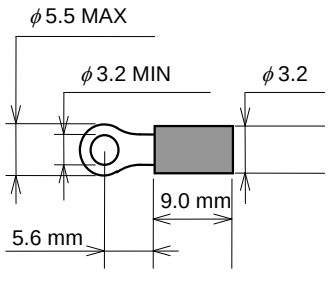
⚠ WARNING

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

- 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.
- Allow approximately 8 seconds for contact output when 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 input, supply power from a "SELV" circuit defined as IEC 60950-1.
- A suitable power supply should be considered in end-use equipment. The power supply must be in compliance with a limited-energy circuits (maximum available current of 5.6 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.

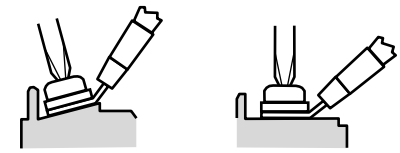
  Power consumption (at maximum load): 120 mA max. (at 24 V DC)
  Rush current: 10 A or less
- When using a relay contact output as a control output, connect the secondary circuits isolated from the mains circuit. For example, connect an isolation transformer between the mains circuit and the instrument. The relay output terminal of the instrument needs to be wired to the secondary side of the isolation transformer.
- For the terminal type module, use the specified solderless terminals. Only these specified solderless terminals can be used due to the insulation between the terminals.

  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 0.25 to 1.65 mm^2
  Specified 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)



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

When tightening a screw of the instrument, make sure to fit the screwdriver properly into the screw head mounted tilted or flat as shown in the right figure. Tightening the screw with excessive torque may damage the screw thread.



For isolated device input/output blocks, refer to the following:

▬▬: Isolated
——: Not isolated

Power supply		Output 1 (OUT1) [1, 2]
Measured input (CH1)		
Measured input (CH2)		Output 2 (OUT2) [1, 2]
Communication		

[1] When all outputs are continuous output (current output, voltage output) or voltage pulse output, there is no need for isolation between outputs. There is also no need for isolation between each output and the power supply, and no need for isolation between each output and communication.

[2] When the output type is relay contact output or triac output *, isolation is required between this output and other blocks (power supply, communication, and output).

* The following standards do not apply to triac output type.
CE/UL/cUL/RCM

5.2 Connecting Precautions

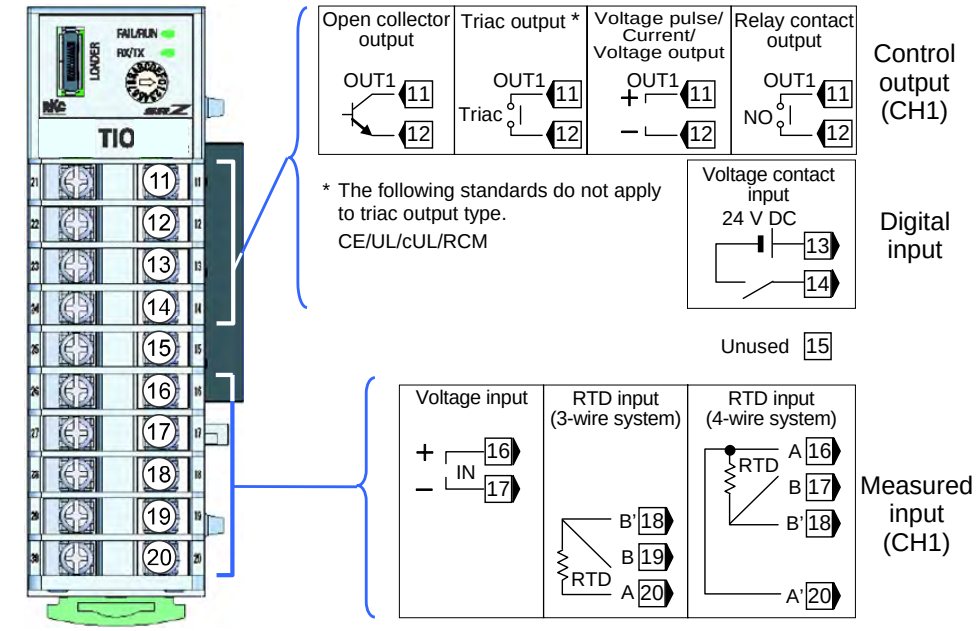
⚠ WARNING

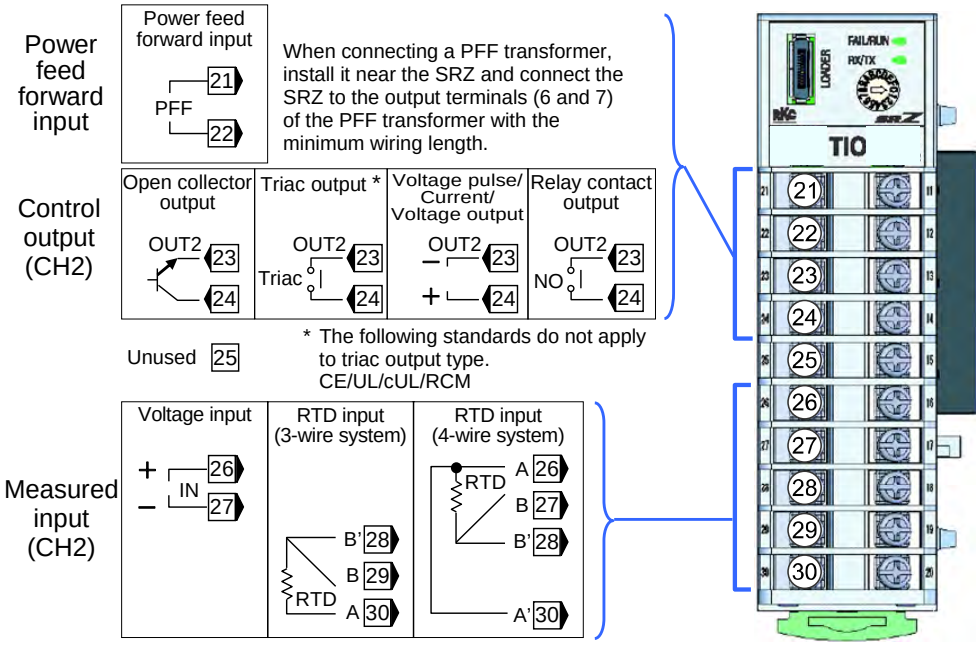
To prevent electric shock or instrument failure, turn off the power before connecting or disconnecting the instrument and peripheral equipment.

- 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.

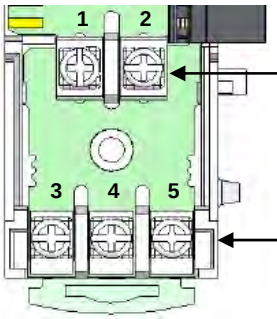
5.3 Terminal Configuration

■ Input/Output terminals





■ Power supply terminals, Communication terminals



Power supply terminals

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

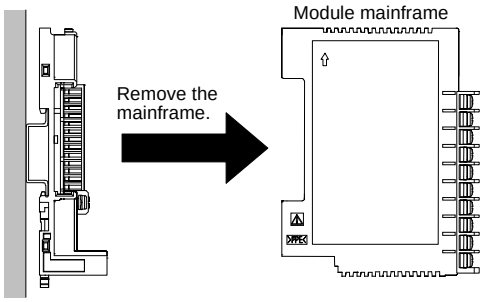
Communication terminals (RS-485)

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

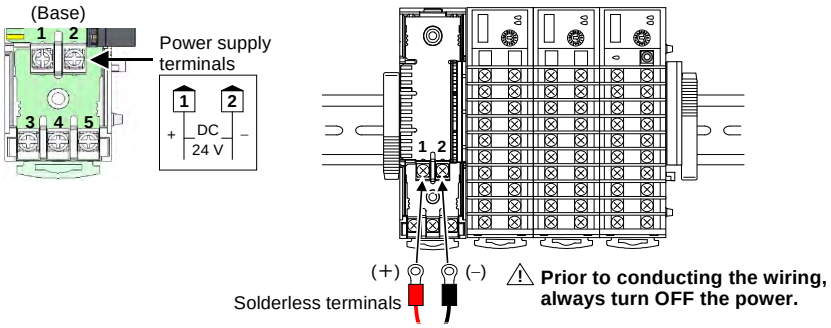
● Connecting to the base terminals

As an example, the method of connecting to the power terminals (terminal numbers 1 and 2) is shown below.

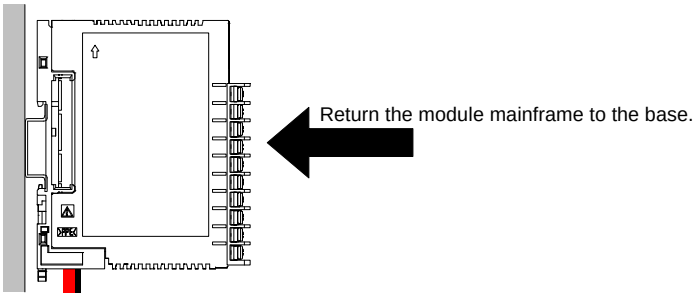
1. Remove the module mainframe to which the power wiring will be connected.



2. Attach the solderless terminals to the power terminals with a Phillips head screwdriver.



3. Return the module mainframe to the base. This completes the wiring work.



Connections to the communication terminals (terminal numbers 3 to 5) are made in the same way.

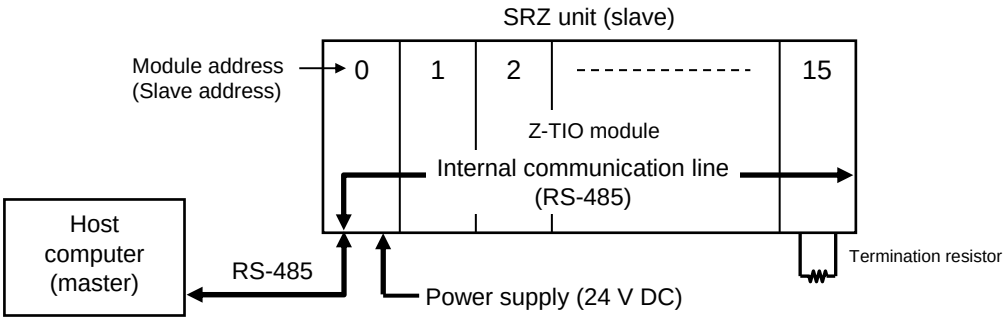
5.4 Connection to Host Computer

■ Configurations that can be connected to a host computer

Examples of configurations of SRZ units that can be connected to a host computer are shown below.

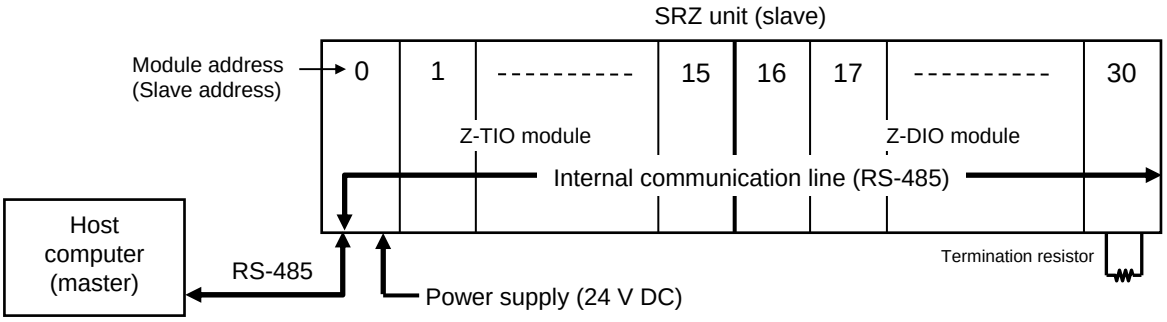
📖 "SRZ unit" refers to a unit consisting of only Z-TIO modules, or a unit in which Z-TIO modules are connected to several other function modules (Z-DIO and Z-CT).

● 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



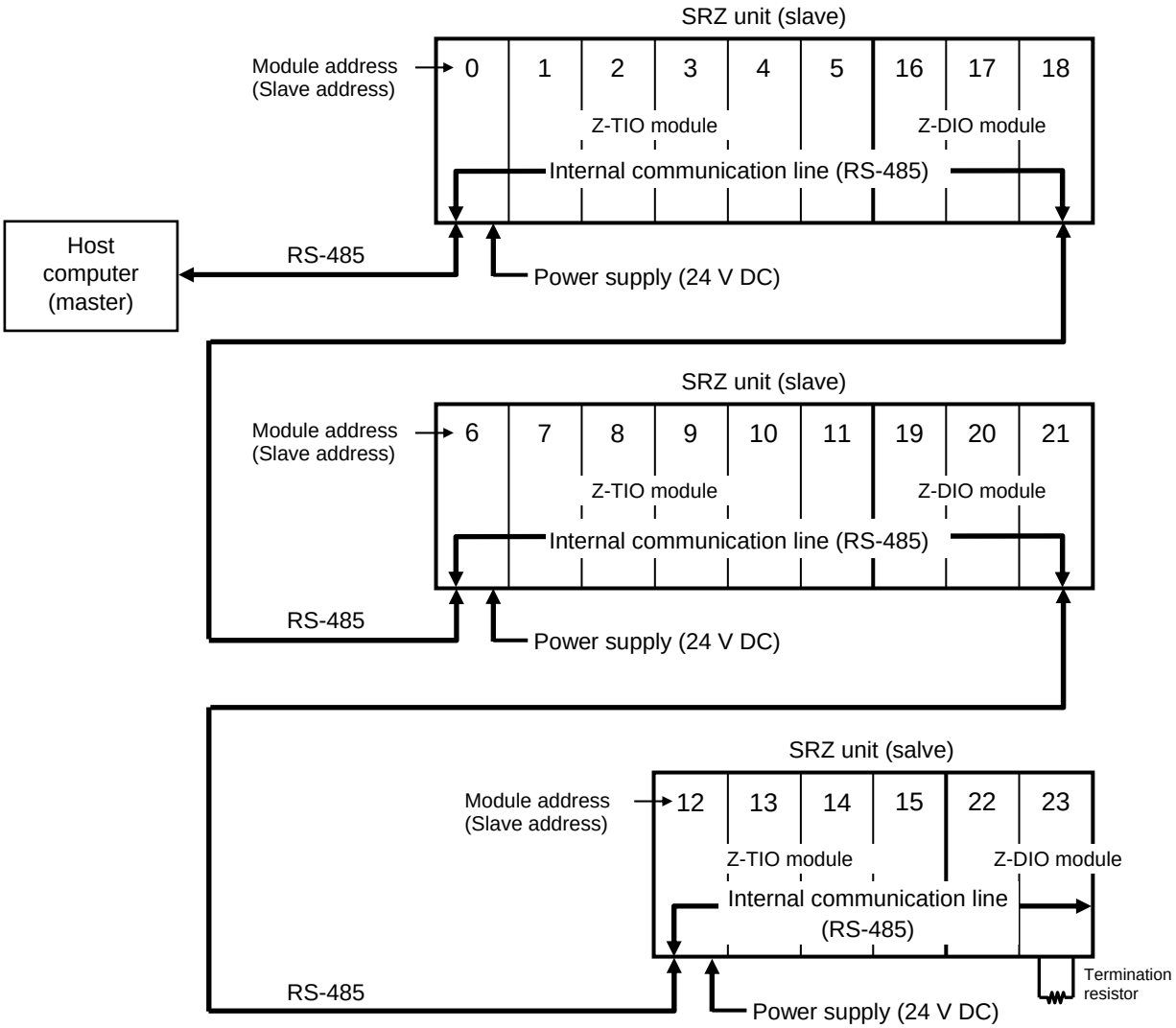
📖 Up to 16 Z-DIO modules can be connected.
The maximum number of SRZ modules (including other function modules) on the same communication line is 31.

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

☞ For the module address settings, refer to **3. COMMUNICATION SETTINGS (P. 3-1)**.

☞ For the procedure for connecting modules, refer to **4. MOUNTING (P. 4-1).**

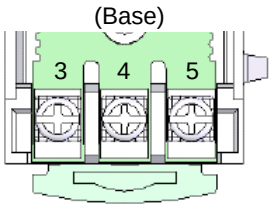
- **When two or more SRZ units are connected (distributed arrangement)**



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 and Z-CT), is 31.

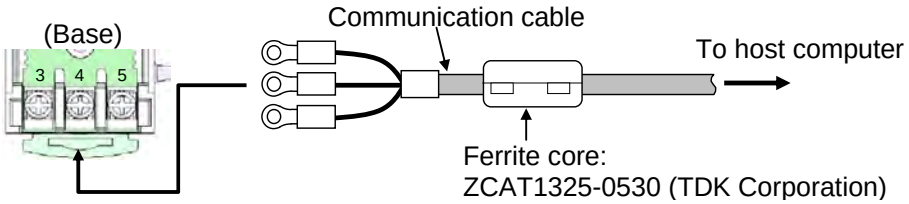
Function modules (Z-TIO, Z-DIO and Z-CT) connected inside the same unit can be placed in any position.

■ Terminal number and signal details



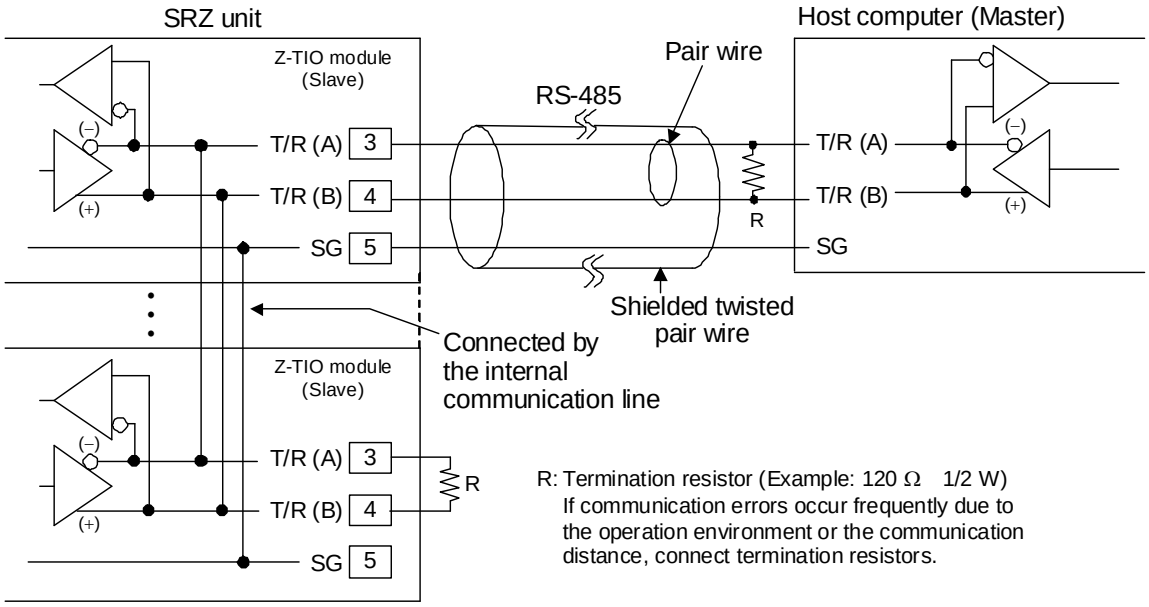
Terminal No.	Signal name	Symbol
3	Send data/Receive data	T/R (A)
4	Send data/Receive data	T/R (B)
5	Signal ground	SG

Install a ferrite core on the communication cable close to the Z-TIO-G.
Recommended ferrite core: ZCAT1325-0530 (TDK Corporation)



■ Wiring figure

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



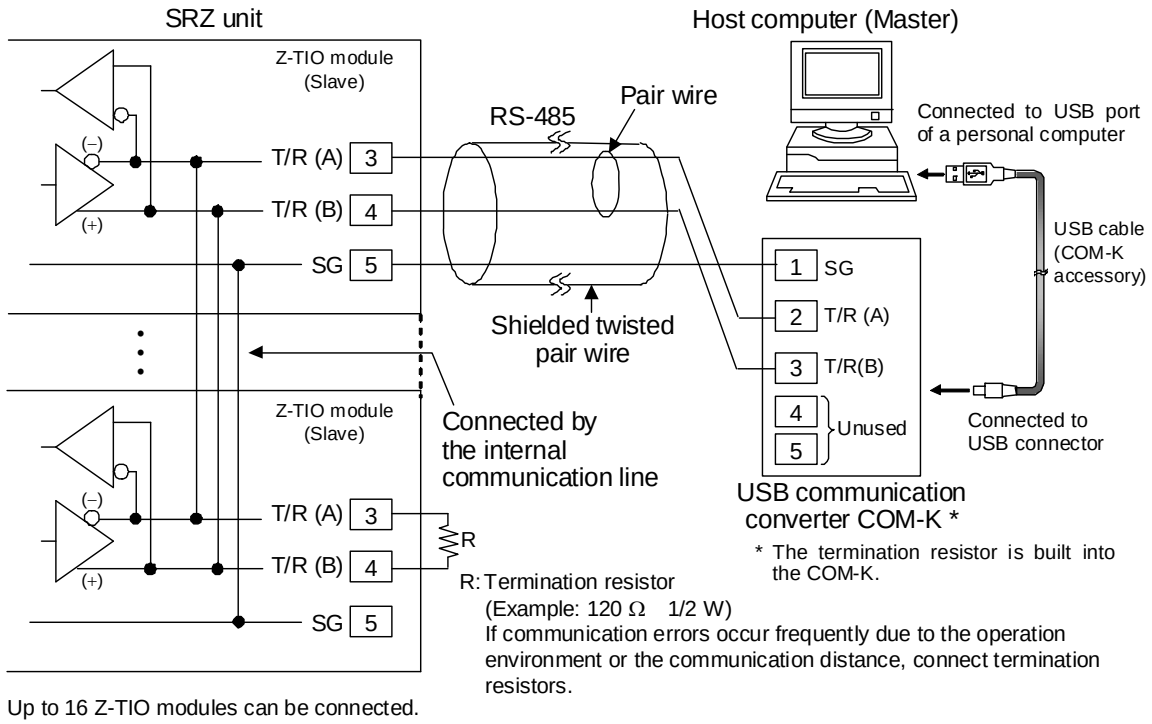
Up to 16 Z-TIO modules can be connected.
The maximum number of SRZ modules (including other function modules) on the same communication line is 31.

The cable and termination resistors must be provided by the customer.

For installation method of termination resistor of the SRZ side, refer to **5.5 Installation of Termination Resistor (P. 5-11)**.

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

When the host computer (OS: Windows 98SE or higher) 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, refer to **COM-K Instruction Manual (IMR01Z01-E□)**.

The cable and termination resistors must be provided by the customer.

For installation method of termination resistor of the SRZ side, refer to **5.5 Installation of Termination Resistor (P. 5-11)**.

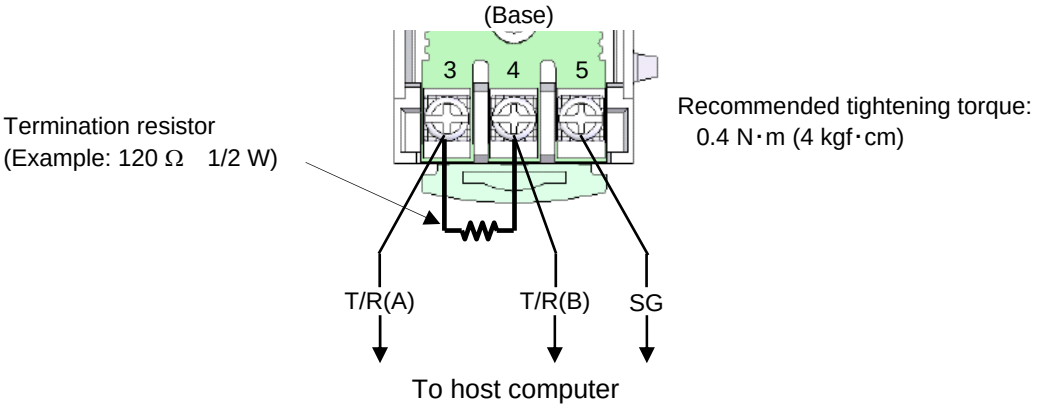
5.5 Installation of Termination Resistor

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.

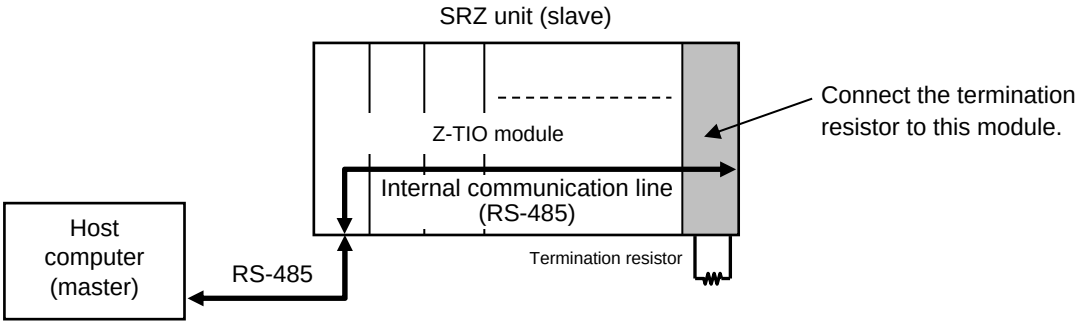
For the termination resistor on the host computer side, connect it so as to satisfy the host computer used.

■ Mounting position

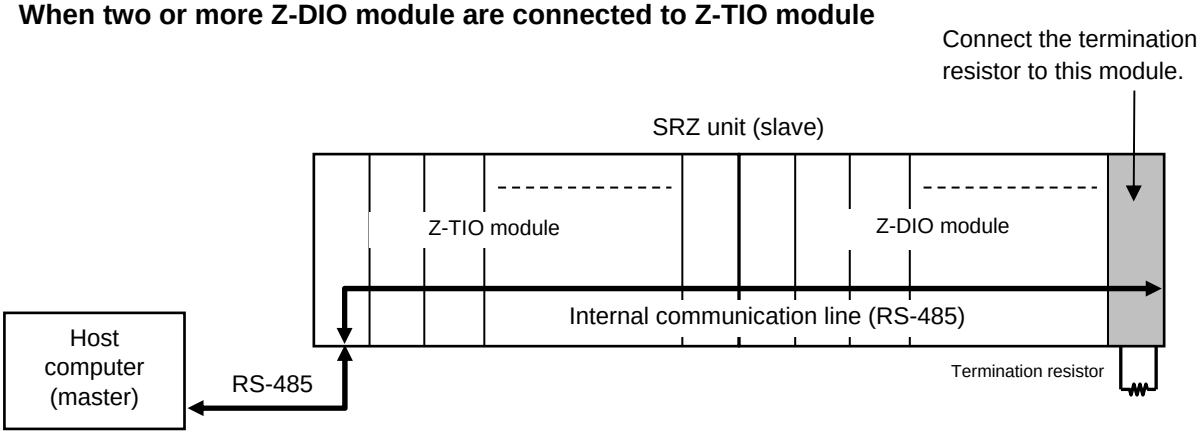
Connect a termination resistor between the communication terminals (No. 3 and 4) of the module at the end of the communication line from the host computer.



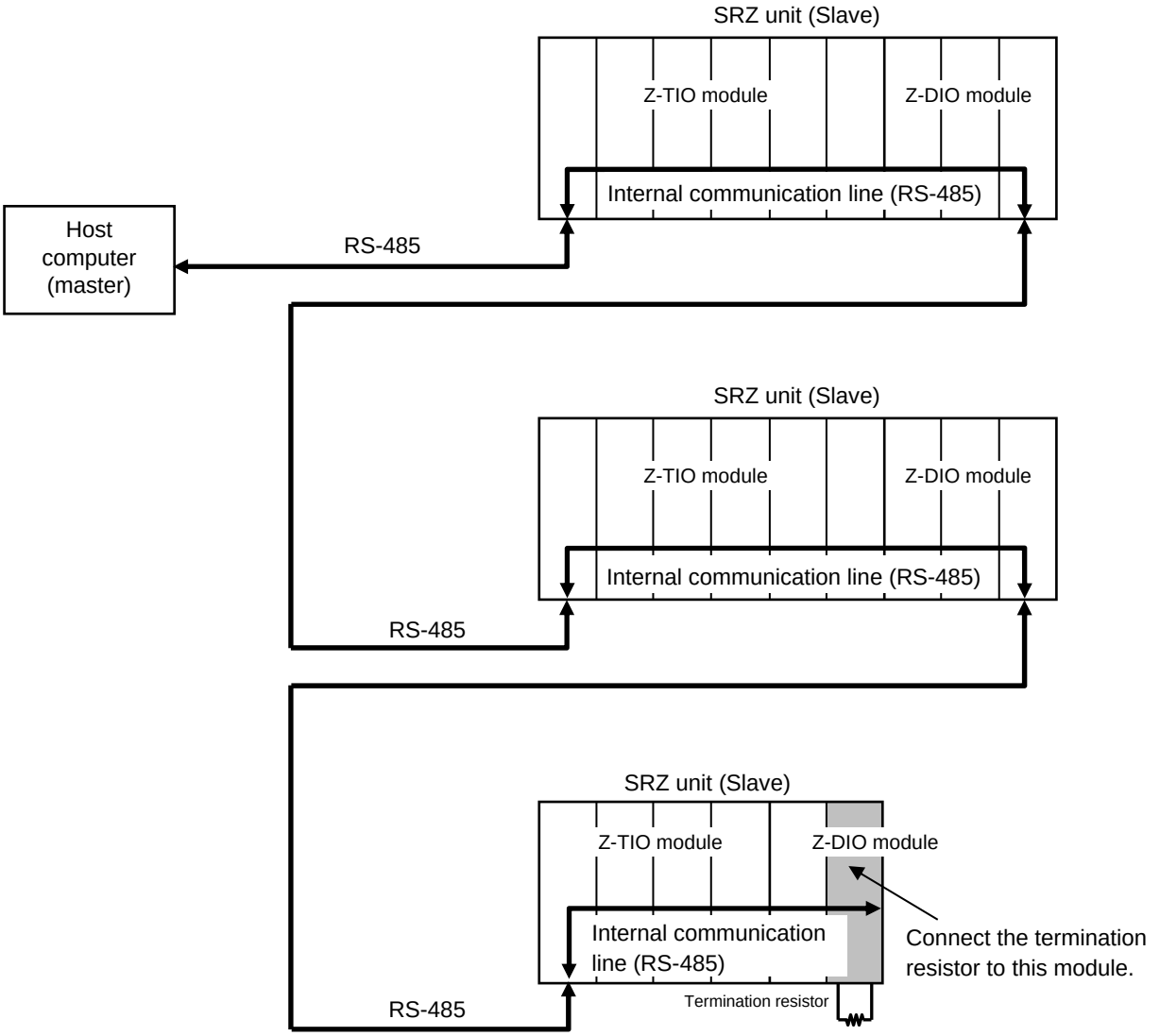
- **When two or more Z-TIO module are connected**



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



- **When two or more SRZ units are connected (distributed arrangement)**



5.6 Connections for Loader Communication

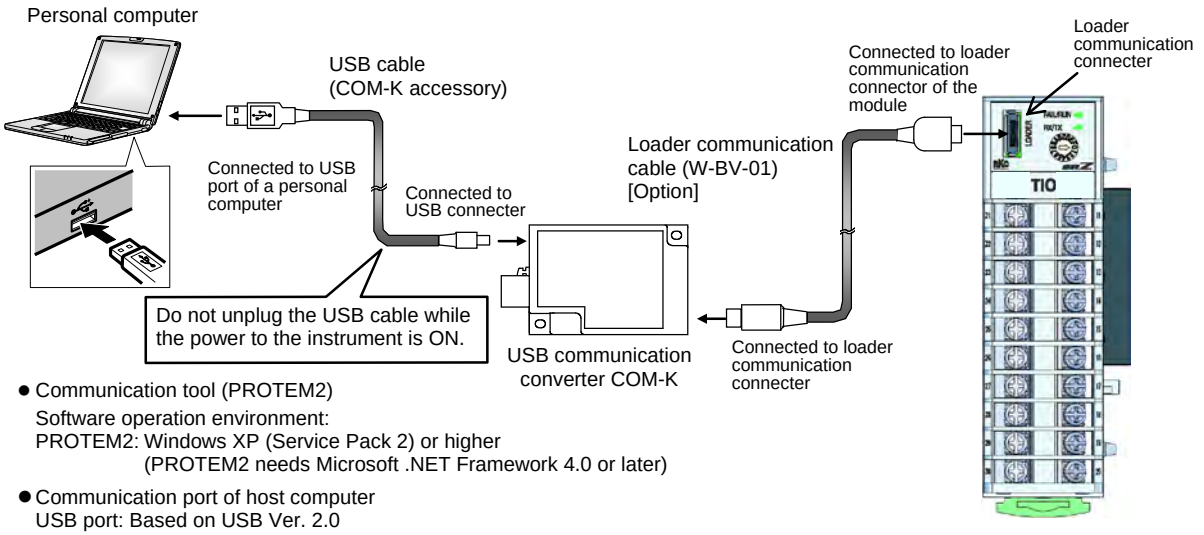
Each function module (Z-TIO, Z-DIO and Z-CT) is equipped standard with a Loader communication connector.

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 communication tool (PROTEM2) [2] can be installed on the computer, to enable data management monitoring and settings from the computer.

The only data that can be communicated by Loader communication is data of a module that is connected by a Loader communication cable. (Data of other joined modules cannot be communicated.)

[1] A loader communication cable (optional) 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] The communication tool (PROTEM2) can be downloaded from the RKC official website: https://www.rkcinst.com/.



- Communication tool (PROTEM2)
  Software operation environment:
  PROTEM2: Windows XP (Service Pack 2) or higher
  (PROTEM2 needs Microsoft .NET Framework 4.0 or later)
- Communication port of host computer
  USB port: Based on USB Ver. 2.0
- Communication settings on the computer
  (Values other than the communication port are fixed.)

Communication speed:	38400 bps
Start bit:	1
Data bit:	8
Parity bit:	Without
Stop bit:	1
Communication port:	0 to 255

The module address for Loader communication is fixed at "0." The setting of the address setting switch is disregarded.

The Loader port is only for parameter setup.

The Loader communication corresponds to the RKC communication protocol "Based on ANSI X3.28-1976 subcategories 2.5 and B1."

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

MEMO

6 RKC COMMUNICATION

6.1 Polling

RKC communication uses the Polling/Selecting method to establish a data link. The basic procedure follows ANSI X3.28-1976 subcategories 2.5 and B1 basic mode data transmission control procedure (Fast selecting is the selecting method used in SRZ).

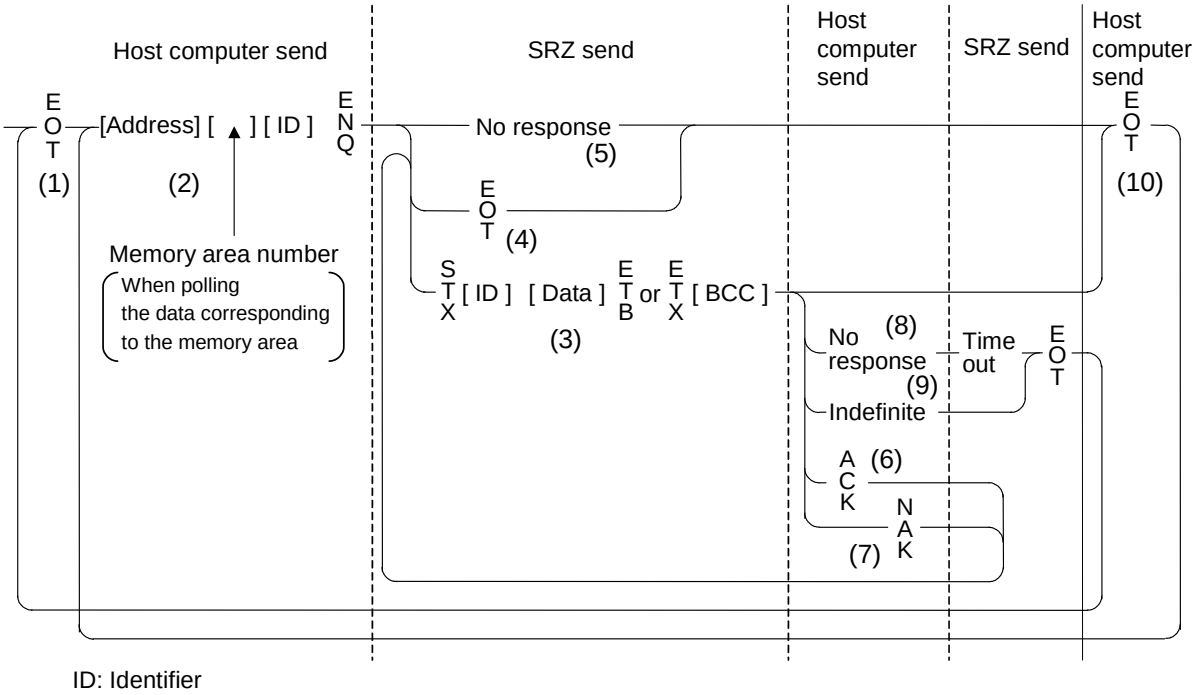
- The Polling/Selecting procedures are a centralized control method where the host computer controls the entire process. The host computer initiates all communication so the controller responds according to queries and commands from the host.

- The code used 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

Data send/receive state can be monitored by using our communication tool (PROTEM2).
The communication tool (PROTEM2) can be downloaded from the RKC official website:
https://www.rkcinst.com/.

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.

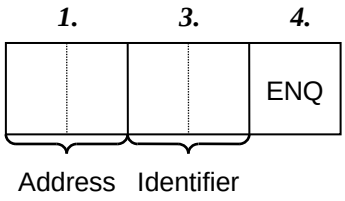
(2) Data sent from host computer - Polling sequence

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.

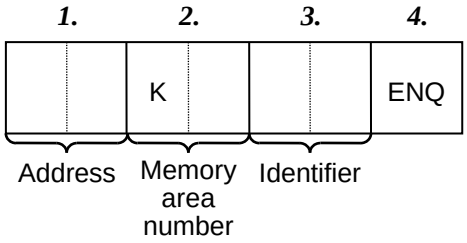


Example:

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.



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 **3.1 Module Address Setting (P. 3-2)**.


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.

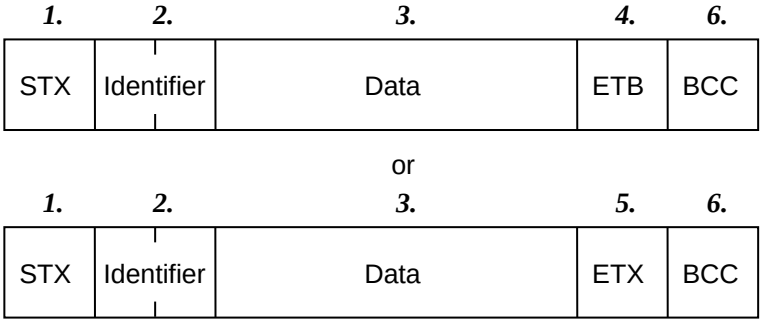
3. Identifier (2 digits)
The identifier specifies the type of data that is requested from the SRZ. Always attach the ENQ code to the end of the identifier.


Refer to **8. COMMUNICATION DATA LIST (P. 8-1)**.

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:



If the length of send data (from STX to BCC) exceeds 136 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.

Refer to **8. COMMUNICATION DATA LIST (P. 8-1)**.

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 (2CH).

- 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 by using 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 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

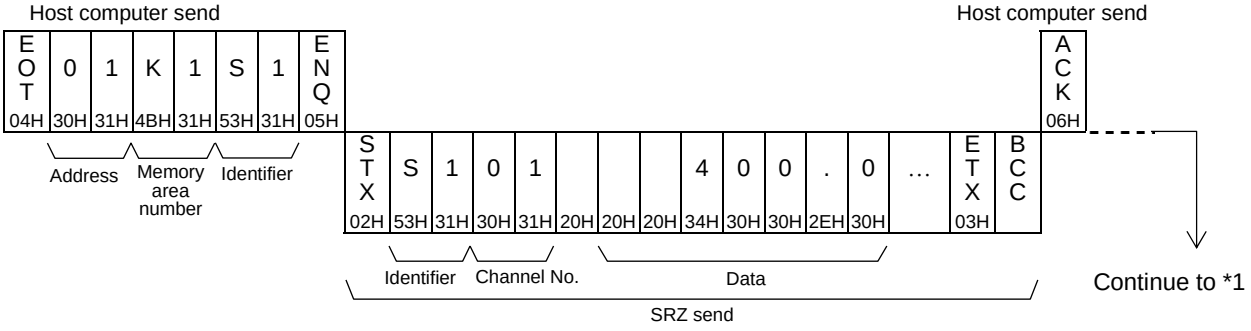
The SRZ sends EOT to terminate the data link when the host computer response is indefinite.

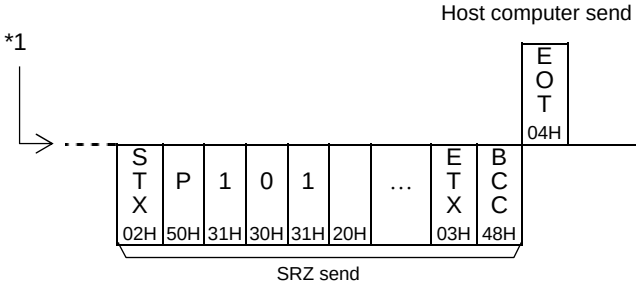
(10) EOT (Data link termination)

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.

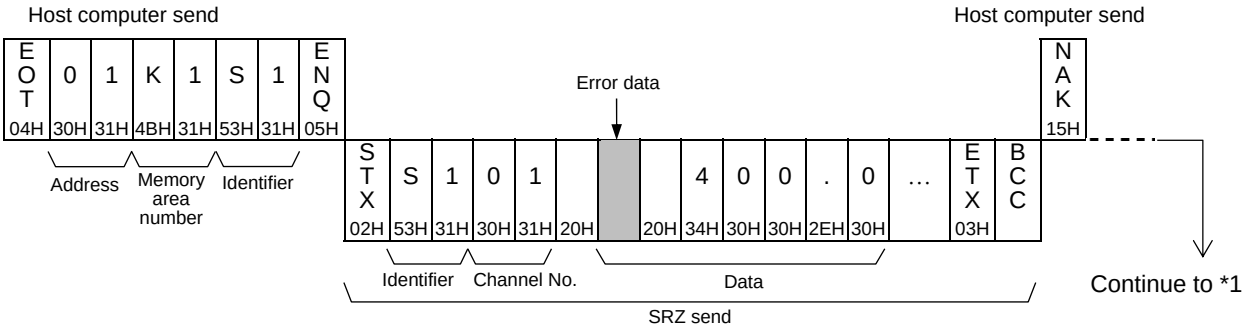
6.1.2 Polling procedure example (when the host computer requests data)

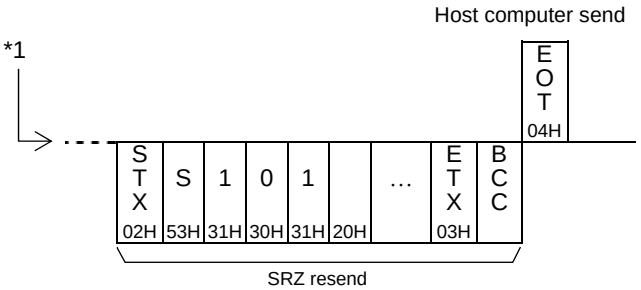
■ Normal transmission





■ Error transmission

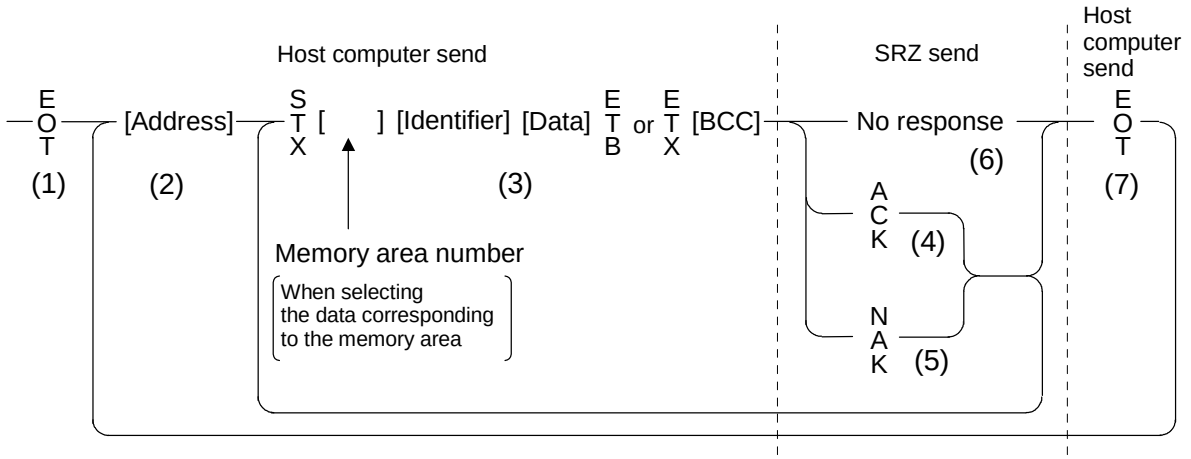




6.2 Selecting

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.

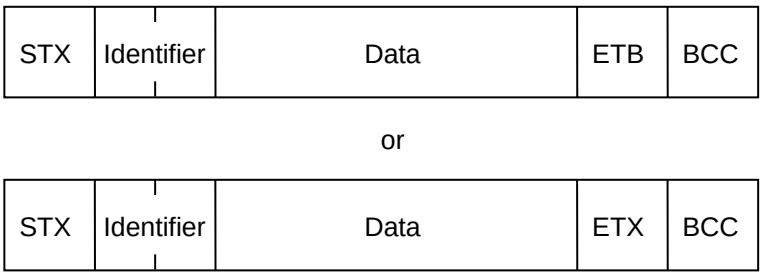
Address (2 digits):
This data is a module address of the SRZ to be selected and must be the same as the module address set value in item **3.1 Module Address Setting (P. 3-2)**.

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



- 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, refer to **6.1 Polling (P. 6-2)**.

📖 If the length of send data (from STX to BCC) exceeds 136 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:

Receivable data

- The SRZ can receive zero-suppressed data and whole number data (data without decimal fraction). (Number of digits: Within 7 digits)

  <Example> For example, even if the data −1.5 is sent by the host as −001.5, −01.5, −1.5, −1.50, −1.500, the SRZ receives the data as −1.5.

- When the host computer sends data with decimal point to the item without a decimal point, the SRZ receives a message with the value that is 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 a value truncated to a specified number of decimal places. The digits smaller than that will be 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

Unreceivable data

The SRZ sends NAK when received a following data.

+	Plus sign and data with a plus sing
−	Only minus sign (without a number)
−.	Only minus sign and a decimal point

(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

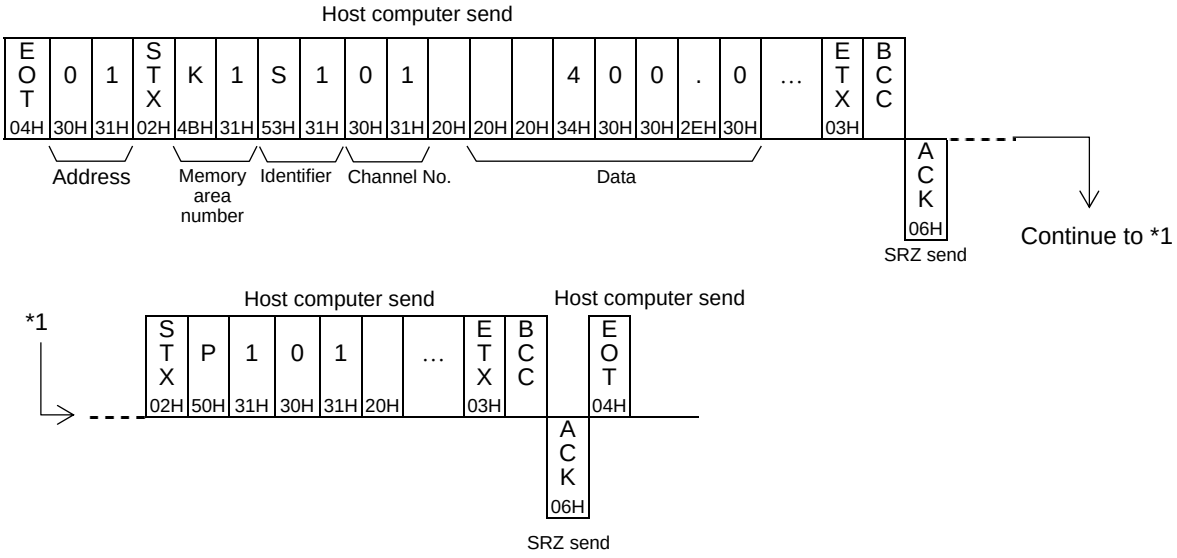
The SRZ does not respond when it can not receive the selecting address, STX, ETB, ETX or BCC.

(7) EOT (Data link termination)

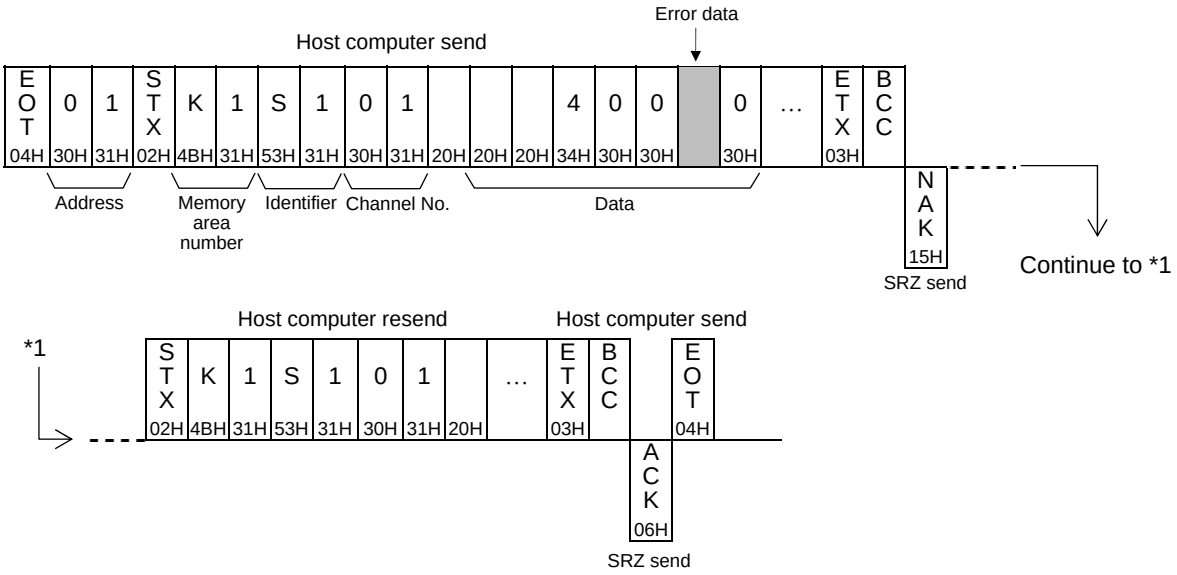
The host computer sends EOT when there is no more data to be sent from the host computer or there is no response from the SRZ.

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

■ Normal transmission



■ Error transmission



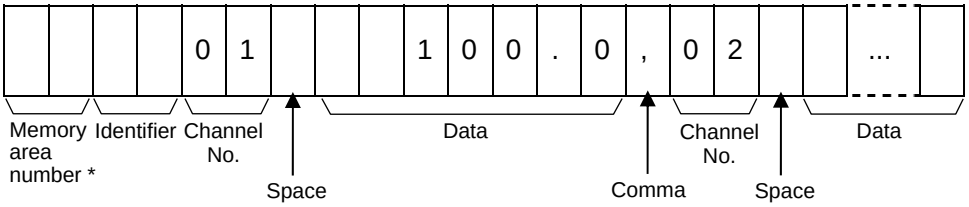
6.3 Communication Data Structure

■ Data description (Transmission/Receive data structure)

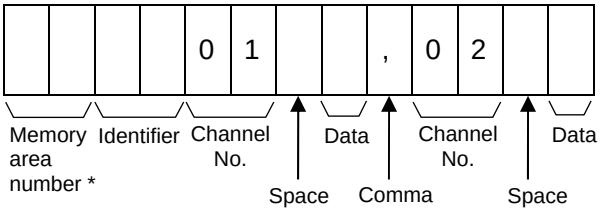
Part of the data above is shown below.

● Data for each channel

Data length 7 digits



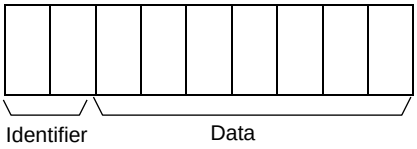
Data length 1 digit



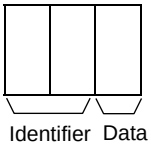
* To select data corresponding to a memory area, specify the number of the appropriate memory area.
If a Memory area number is specified for data that does not correspond to a memory area, the specification will be invalid.

● Data for each module address (Without channel)

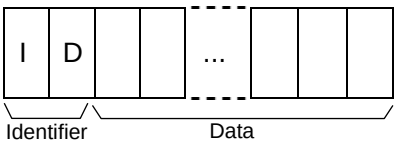
Data length 7 digits



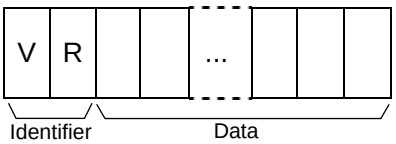
Data length 1 digit



Data length 32 digits (Model code)



Data length 8 digits (ROM version)



7 MODBUS

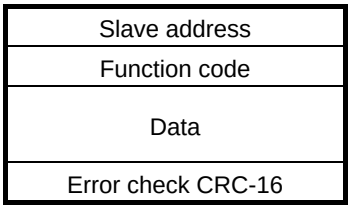
7.1 Communication Protocol

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 (SRZ). 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.

Data send/receive state can be monitored by using our communication tool (PROTEM2). The communication tool (PROTEM2) can be downloaded from the RKC official website: https://www.rkcinst.com/.

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.



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 and Z-DIO).

For details, refer to **3.1 Module Address Setting (P. 3-2).**

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, refer to **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, refer to **7.2 Register Read and Write (P. 7-8), 7.3 Data Processing Precautions (P. 7-12)** and **8. COMMUNICATION DATA LIST (P. 8-1).**

■ Error check

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

For details, refer to **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, Manipulated output 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	Refer to **7.1.2 Function code**
Data time interval	Less than 24-bit 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-bit time. If time intervals become time longer than the 24-bit 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 • When the data written exceeds the setting range
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 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 match, a communication error has occurred and the slave does not respond.

The CRC code is formed in the following sequence:

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

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 hex and return the result to the CRC register. If the carry flag is 0, repeat step ***3***.

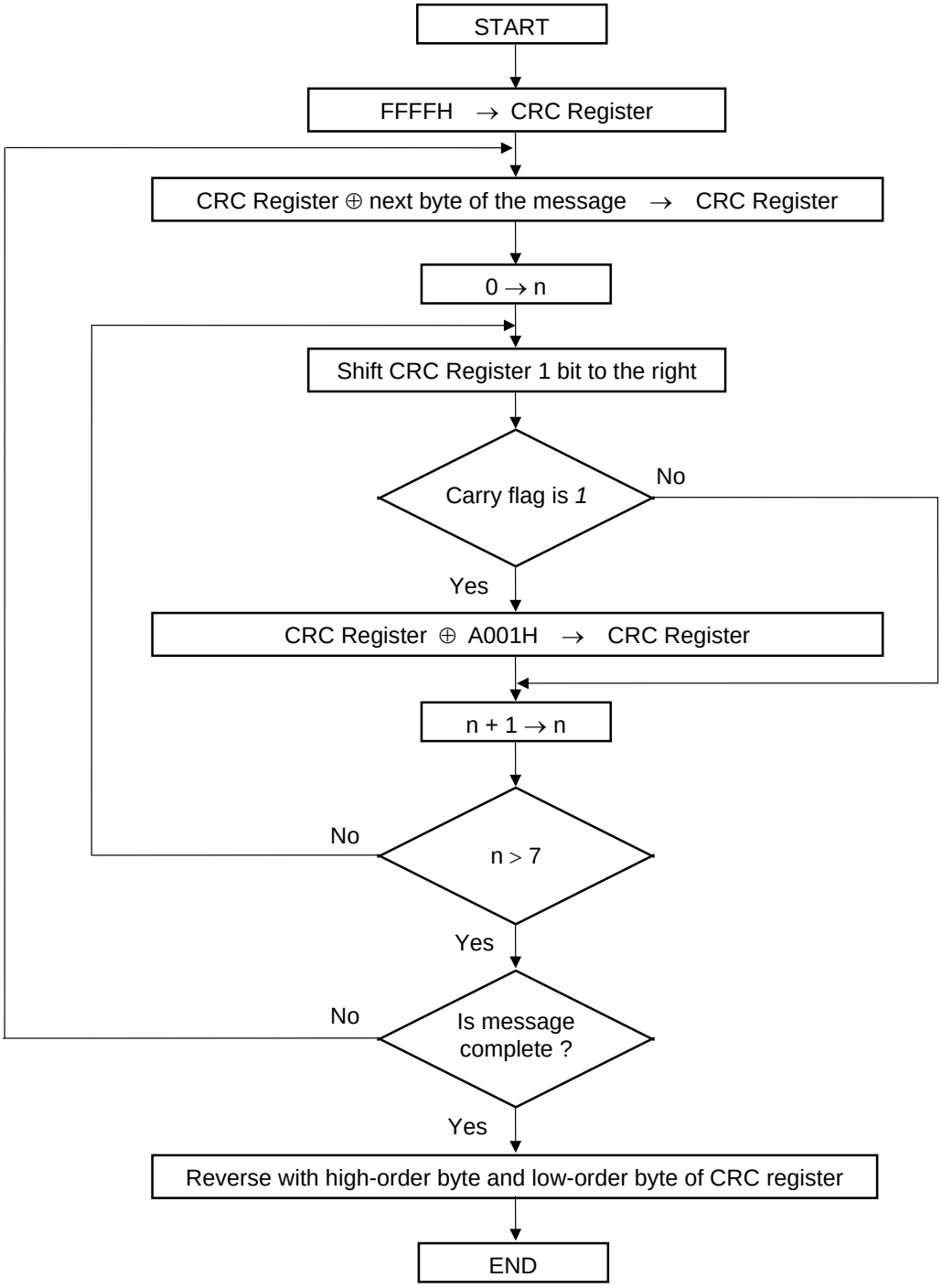
5. Repeat step ***3*** and ***4*** until there have been 8 shifts.

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 Register Read and Write

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 two holding registers from 0000H to 0001H 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	02H	
CRC-16	High	C4H	
	Low	38H	

Normal response message

Slave address		02H	
Function code		03H	
Number of data		04H	→ 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	C9H	
	Low	5FH	

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	
Function code		08H	
Test code	High	00H	Contents will be the same as query message data.
	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 Processing Precautions

- 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.

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

  Example1: When Output limiter high set value is 85.0 %, 85.0 is processed as 850,
  850 = 0352H

Output limiter high	High	03H
	Low	52H

  Example2: 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

- 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 cannot be written into an unused item.
- If an error (data range error or address error) is detected in the data writing process, an error is returned. Writing is aborted at and after the addresses where an error occurred. After having completed the setting, check to see if the data was properly written.
- An attribute of the item for functions which are not in the controller is RO (read only). If read action to this item is performed, the read data will be “0.” If write action to this item is performed, no error message is indicated and no data is written.

  ☞ For details, refer to **8. COMMUNICATION DATA LIST (P. 8-1)**.

- Commands should be sent at time intervals of 24 bits after the master receives the response message.

7.4 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

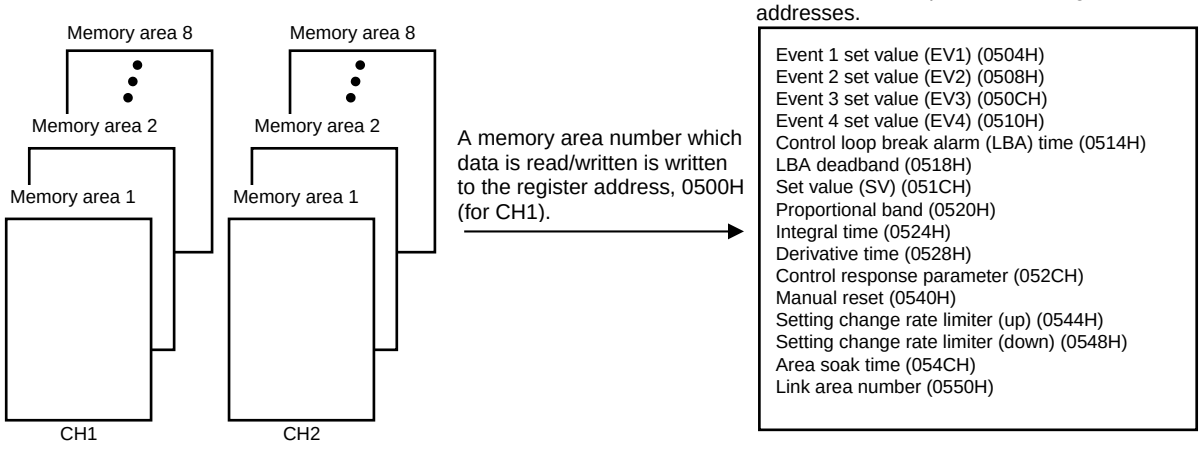
If any Memory area number to perform data read and write is specified by the Setting memory area number (0500H and 0501H), data corresponding to the specified memory area number is called up to the register addresses from 0504H to 0551H. By using these register addresses from 0504H to 0551H, it becomes possible to read and write data in any memory area.

	Register address	
	CH1	CH2
Setting memory area number	0500H	0501H
Event 1 set value (EV1)	0504H	0505H
Event 2 set value (EV2)	0508H	0509H
Event 3 set value (EV3)	050CH	050DH
Event 4 set value (EV4)	0510H	0511H
Control loop break alarm (LBA) time	0514H	0515H
LBA deadband	0518H	0519H
Set value (SV)	051CH	051DH
Proportional band	0520H	0521H
Integral time	0524H	0525H
Derivative time	0528H	0529H
Control response parameter	052CH	052DH
Manual reset	0540H	0541H
Setting change rate limiter (up)	0544H	0545H
Setting change rate limiter (down)	0548H	0549H
Area soak time	054CH	054DH
Link area number	0550H	0551H

← Register address to specify memory area

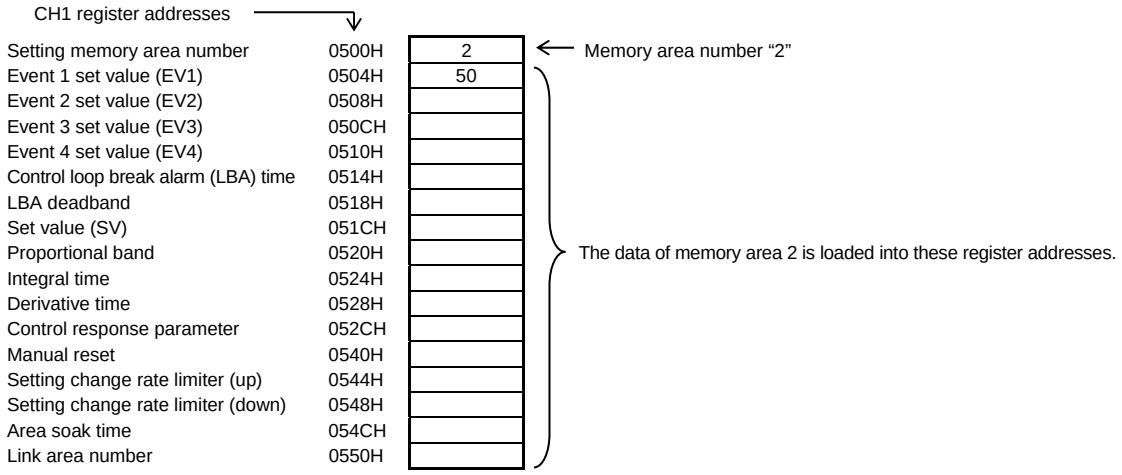
Register address of memory area data

☞ For the Memory area data list, refer to the **8.4 Memory Area Data Address (P. 8-22)**.



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

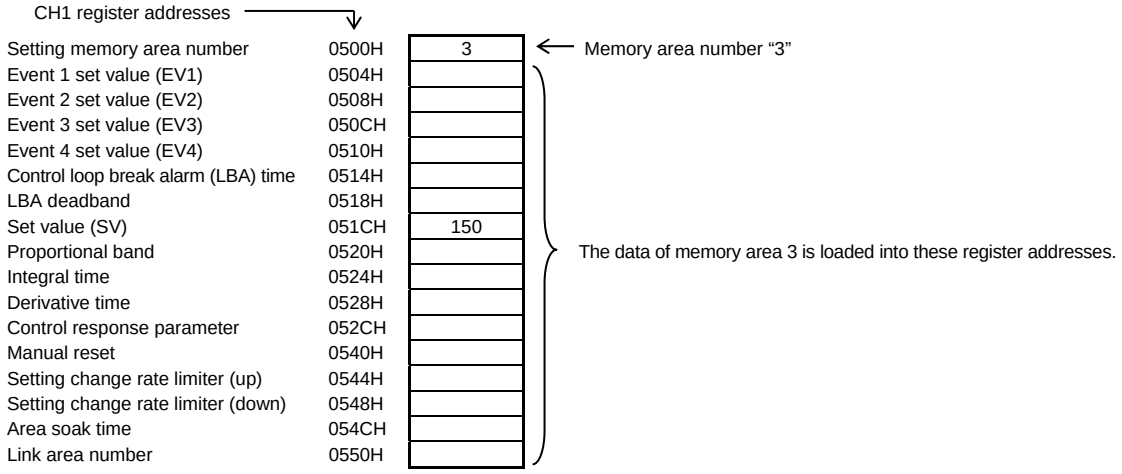
1. The Memory area number, “2” is written to the CH1 Setting memory area number (0500H). Data in Memory area 2 is called up to the CH1 register addresses.



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.



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

■ Control area transfer

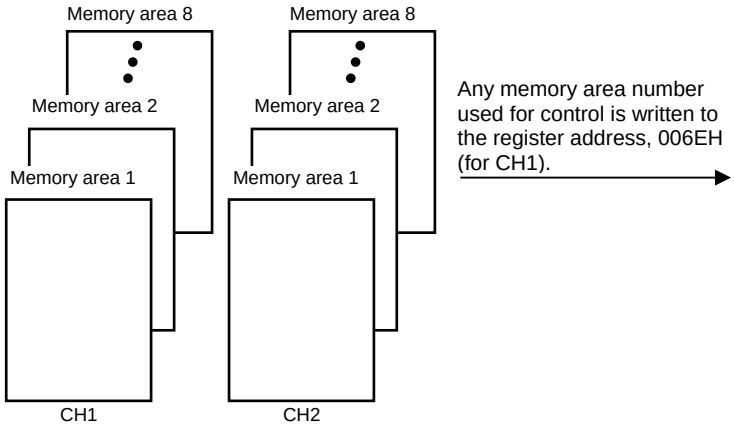
Any memory area used for control is specified by the Memory area transfer (006EH and 006FH). The area (0076H to 00C3H) now used for control is called Control area.

The Memory area number (Control area) can be changed at either RUN or STOP.

	Register address	
	CH1	CH2
Memory area transfer	006EH	006FH
Event 1 set value (EV1)	0076H	0077H
Event 2 set value (EV2)	007AH	007BH
Event 3 set value (EV3)	007EH	007FH
Event 4 set value (EV4)	0082H	0083H
Control loop break alarm (LBA) time	0086H	0087H
LBA deadband	008AH	008BH
Set value (SV)	008EH	008FH
Proportional band	0092H	0093H
Integral time	0096H	0097H
Derivative time	009AH	009BH
Control response parameter	009EH	009FH
Manual reset	00B2H	00B3H
Setting change rate limiter (up)	00B6H	00B7H
Setting change rate limiter (down)	00BAH	00BBH
Area soak time	00BEH	00BFH
Link area number	00C2H	00C3H

← Register address to specify Control area

Register address of memory area data

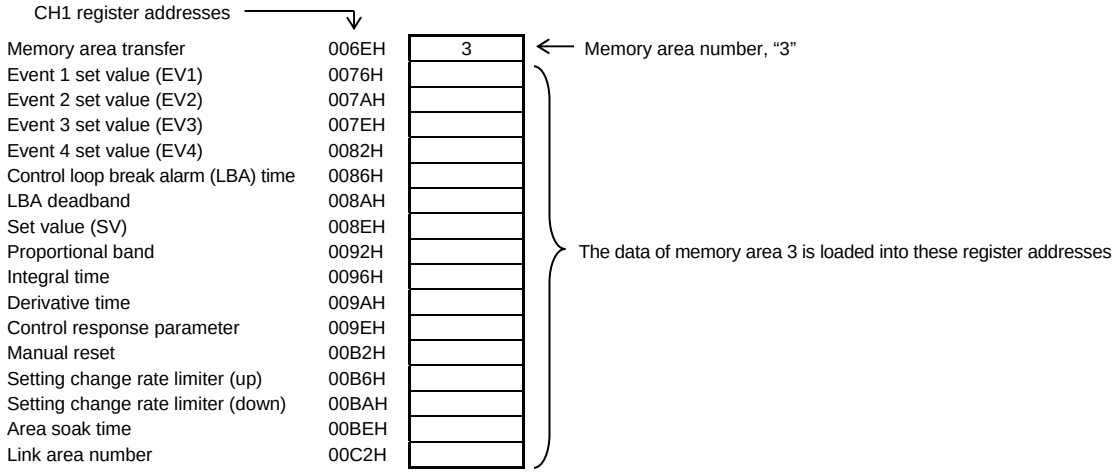


Data corresponding to a specified Memory area number is called up to the CH1 register addresses.

－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 (0092H)
Integral time (0096H)
Derivative time (009AH)
Control response parameter (009EH)
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.



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

If the Memory area transfer (006EH and 006FH) and the Setting memory area number (0500H and 0501H) are set to the same Memory area number, the respective data can be synchronized.

- Values in the Control areas (0076H to 00C3H) become the same as those in the memory areas (0504H to 0551H).
- 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.

7.5 How to Use Data Mapping

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

	Data range
Register address to specify mapping data	1000H to 100FH
Register address to actually read/write data	1500H to 150FH
Register address of data which can be mapped	Refer to **8.2 Normal Setting Data (P.8-3)** and **8.3 Engineering Setting Data (P. 8-9).**

☞ For the data mapping address list, refer to the **8.5 Data Mapping Address (P. 8-24)**.

[Example]
Mapping the CH1 data "Measured value (PV), Manipulated output value (MV) monitor, 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	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 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
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.

MEMO

COMMUNICATION DATA LIST

8

8.1 Reference to Communication Data List

(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)	(9)
No.	Name	Iden-tifier	Chan-nel	Register address		Digits	Attri-bute	Struc-ture	Data range	Factory set value
				HEX	DEC					
1	Model code	ID	—	—	—	32	RO	M	Model code (character)	—
2	ROM version	VR	—	—	—	8	RO	M	ROM version	—
3	Measured value (PV)	M1	CH1 CH2	0000 0001	0 1	7	RO	C	Input scale low to Input scale high Varies with the setting of the decimal point position.	—

(1) Name: Communication data name

(2) Identifier: Communication identifier of RKC communication

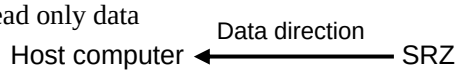
(3) Channel: Channel numbers of each Z-TIO module

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

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

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

RO: Read only data

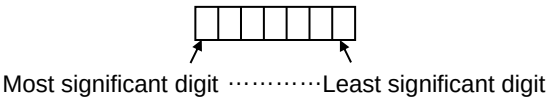


R/W: Read and write data

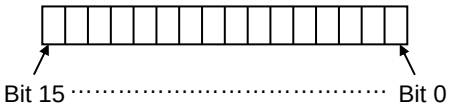
(7) Structure: C: Data for each channel
M: Data for each module

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

- ASCII code data (Example: 7 digits)



- 16-bit data (bit image)



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

Communication data includes both Normal setting data and Engineering setting data.

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, no further changes need to be made to parameters 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.

8.2 Normal Setting Data

No.	Name	Identifier	Channel	Register address HEX	Register address DEC	Digits	Attribute	Structure	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	CH1 CH2	0000 0001	0 1	7	RO	C	Input scale low to Input scale high Varies with the setting of the decimal point position. However, in case of MODBUS single word, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.	—
4	Comprehensive event state	AJ	CH1 CH2	0004 0005	4 5	7	RO	C	• RKC communication Least significant digit: Event 1 2nd digit: Event 2 3rd digit: Event 3 4th digit: Event 4 5th digit: Unused 6th digit: Unused Most significant digit: Burnout Data 0: OFF 1: ON • Modbus Bit data Bit 0: Event 1 Bit 1: Event 2 Bit 2: Event 3 Bit 3: Event 4 Bit 4: Unused Bit 5: Unused Bit 6: Burnout Bit 7 to Bit 15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 79]	—
5	Operation mode state monitor	L0	CH1 CH2	0008 0009	8 9	7	RO	C	• RKC communication 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 • Modbus Bit data Bit 0: Control STOP Bit 1: Control RUN Bit 2: Manual mode Bit 3: Remote mode Bit 4 to Bit 15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 15]	—
6	Error code	ER	CH1	000C	12	7	RO	M	• RKC communication 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. • Modbus Bit data 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 Data 0: OFF 1: ON [Decimal number: 0 to 63]	—

Continued on the next page.

Continued from the previous page.

No.	Name	Identifier	Channel	Register address HEX	Register address DEC	Digits	Attribute	Structure	Data range	Factory set value
7	Manipulated output value (MV) monitor	O1	CH1 CH2	000D 000E	13 14	7	RO	C	–5.0 to +105.0 %	—
8	Reserved	—	—	0015 0016	21 22	—	—	—	—	—
9	Set value (SV) monitor	MS	CH1 CH2	0019 001A	25 26	7	RO	C	Setting limiter low to Setting limiter high Varies with the setting of the decimal point position.	—
10	Remote setting (RS) input value monitor	S2	CH1 CH2	001D 001E	29 30	7	RO	C	Setting limiter low to Setting limiter high Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.	—
11	Burnout state monitor	B1	CH1 CH2	0021 0022	33 34	1	RO	C	0: OFF 1: ON	—
12	Event 1 state monitor	AA	CH1 CH2	0025 0026	37 38	1	RO	C	0: OFF 1: ON	—
13	Event 2 state monitor	AB	CH1 CH2	0029 002A	41 42	1	RO	C	0: OFF 1: ON	—
14	Event 3 state monitor	AC	CH1 CH2	002D 002E	45 46	1	RO	C	0: OFF 1: ON	—
15	Event 4 state monitor	AD	CH1 CH2	0031 0032	49 50	1	RO	C	0: OFF 1: ON	—
16	Reserved	—	—	0035 0036	53 54	—	—	—	—	—
17	Output state monitor	Q1	CH1	0039	57	7	RO	M	• RKC communication Least significant digit: OUT1 2nd digit: OUT2 3th digit to Most significant digit: Unused Data 0: OFF 1: ON • Modbus Bit data Bit 0: OUT1 Bit 1: OUT2 Bit 2 to Bit 15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 3] Valid only for time-proportional control output.	—
18	Memory area soak time monitor	TR	CH1 CH2	003A 003B	58 59	7	RO	C	0 minutes 00 seconds to 199 minutes 59 seconds: RKC communication: 0:00 to 199:59 (min:sec) Modbus: 0 to 11999 seconds 0 hours 00 minutes to 99 hours 59 minutes: RKC communication: 0:00 to 99:59 (hrs:min) Modbus: 0 to 5999 minutes Data range of Area soak time can be selected on the Soak time unit.	—
19	Integrated operating time monitor	UT	CH1	003E	62	7	RO	M	0 to 19999 hours	—
20	Reserved	—	—	003F 0040	63 64	—	—	—	—	—
21	Backup memory state monitor	EM	CH1	0043	67	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.	—

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No.	Name	Identifier	Channel	Register address HEX	Register address DEC	Digits	Attribute	Structure	Data range	Factory set value
22	Logic output monitor 1	ED	CH1	0044	68	7	RO	M	• RKC communication 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 • Modbus Bit data 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 to Bit 15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 63]	—
23	Logic output monitor 2	EE	CH1	—	—	7	RO	M	Least significant digit: Logic output 5 2nt digit: Logic output 6 3th digit to Most significant digit: Unused Data 0: OFF 1: ON	—
24	PID/AT transfer	G1	CH1 CH2	0061 0062	97 98	1	R/W	C	0: PID control 1: Autotuning (AT) When the Autotuning (AT) is finished, the control will automatically returns to 0: PID control.	0
25	Auto/Manual transfer	J1	CH1 CH2	0065 0066	101 102	1	R/W	C	0: Auto mode 1: Manual mode	0
26	Remote/Local transfer	C1	CH1 CH2	0069 006A	105 106	1	R/W	C	0: Local mode 1: Remote mode When performing remote control by Remote setting input and also performing Cascade control, transfer to the Remote mode.	0
27	RUN/STOP transfer	SR	CH1	006D	109	1	R/W	M	0: STOP (Control stop) 1: RUN (Control start)	0
28	Memory area transfer	ZA	CH1 CH2	006E 006F	110 111	7	R/W	C	1 to 8	1
29	Interlock release	AR	CH1 CH2	0072 0073	114 115	1	R/W	C	0: Normal state 1: Interlock release execution	0
30	Event 1 set value (EV1) ★	A1	CH1 CH2	0076 0077	118 119	7	R/W	C	Deviation action, Deviation action between channels: –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). If Event 4 corresponds to “9: Control loop break alarm (LBA),” the Event 4 set value becomes RO (Only reading data is possible). * Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.	50.00
31	Event 2 set value (EV2) ★	A2	CH1 CH2	007A 007B	122 123	7	R/W	C		50.00
32	Event 3 set value (EV3) ★	A3	CH1 CH2	007E 007F	126 127	7	R/W	C		50.00
33	Event 4 set value (EV4) ★	A4	CH1 CH2	0082 0083	130 131	7	R/W	C		50.00

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

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No.	Name	Identifier	Channel	Register address HEX	Register address DEC	Digits	Attribute	Structure	Data range	Factory set value
34	Control loop break alarm (LBA) time ★	A5	CH1 CH2	0086 0087	134 135	7	R/W	C	0 to 7200 seconds (0: Unused)	480
35	LBA deadband ★	N1	CH1 CH2	008A 008B	138 139	7	R/W	C	0 (0.0, 0.00) to Input span Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.	0.00
36	Set value (SV) ★	S1	CH1 CH2	008E 008F	142 143	7	R/W	C	Setting limiter low to Setting limiter high Varies with the setting of the decimal point position. However, in case of MODBUS single word, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.	RTD input: 0.00 (0.000) V input: 0.000
37	Proportional band ★	P1	CH1 CH2	0092 0093	146 147	7	R/W	C	RTD input: 0 (0.0, 0.00) to Input span (Unit: °C) Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2. Voltage (V) input: 0.00 to 300.00 % of input span 0 (0.0, 0.00): ON/OFF action	30.00
38	Integral time ★	I1	CH1 CH2	0096 0097	150 151	7	R/W	C	0.0 to 3000.0 seconds (0.0: PD action)	240.0
39	Derivative time ★	D1	CH1 CH2	009A 009B	154 155	7	R/W	C	0.0 to 3000.0 seconds (0.0: PI action)	60.0
40	Control response parameter ★	CA	CH1 CH2	009E 009F	158 159	1	R/W	C	0: Slow 1: Medium 2: Fast [Internally fixed to Fast in case of P and PD actions.]	0
41	Manual reset ★	MR	CH1 CH2	00B2 00B3	178 179	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 time is zero, manual reset value is added to the control output.	0.0
42	Setting change rate limiter (up) ★	HH	CH1 CH2	00B6 00B7	182 183	7	R/W	C	0 (0.0, 0.00) to Input span/unit time * 0 (0.0, 0.00): Unused Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2. * Unit time: 60 seconds (factory set value)	0.00
43	Setting change rate limiter (down) ★	HL	CH1 CH2	00BA 00BB	186 187	7	R/W	C		0.00
44	Area soak time ★	TM	CH1 CH2	00BE 00BF	190 191	7	R/W	C	0 minutes 00 seconds to 199 minutes 59 seconds: RKC communication: 0:00 to 199:59 (min:sec) Modbus: 0 to 11999 seconds 0 hours 00 minutes to 99 hours 59 minutes: RKC communication: 0:00 to 99:59 (hrs:min) Modbus: 0 to 5999 minutes Data range of Area soak time can be selected on the Soak time unit.	RKC communication: 0:00 Modbus: 0
45	Link area number ★	LP	CH1 CH2	00C2 00C3	194 195	7	R/W	C	0 to 8 (0: No link)	0
46	Reserved	—	—	00C6 00C7	198 199	—	—	—	—	—
47	Reserved	—	—	00CA 00CB	202 203	—	—	—	—	—

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

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No.	Name	Iden-tifier	Chan-nel	Register address		Digits	Attri-bute	Struc-ture	Data range	Factory set value
				HEX	DEC					
48	Reserved	—	—	00CE 00CF	206 207	—	—	—	—	—
49	PV bias	PB	CH1 CH2	00D2 00D3	210 211	7	R/W	C	–Input span to +Input span Varies with the setting of the decimal point position. For the 1/1000 °C unit, the minimum value is limited to "–99.999."	0.00 (0.000)
50	PV digital filter	F1	CH1 CH2	00D6 00D7	214 215	7	R/W	C	0.0 to 100.0 seconds (0.0: Unused)	0.0
51	PV ratio	PR	CH1 CH2	00DA 00DB	218 219	7	R/W	C	0.500 to 1.500	1.000
52	PV low input cut-off	DP	CH1 CH2	00DE 00DF	222 223	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
53	RS (cascade) bias	RB	CH1 CH2	00E2 00E3	226 227	7	R/W	C	–Input span to +Input span Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.	0.00
54	RS (cascade) digital filter	F2	CH1 CH2	00E6 00E7	230 231	7	R/W	C	0.0 to 100.0 seconds (0.0: Unused)	0.0
55	RS (cascade) ratio	RR	CH1 CH2	00EA 00EB	234 235	7	R/W	C	0.001 to 9.999	1.000
56	Output distribution selection	DV	CH1 CH2	00EE 00EF	238 239	1	R/W	C	0: Control output 1: Distribution output	0
57	Output distribution bias	DW	CH1 CH2	00F2 00F3	242 243	7	R/W	C	–100.0 to +100.0 %	0.0
58	Output distribution ratio	DQ	CH1 CH2	00F6 00F7	246 247	7	R/W	C	–9.999 to +9.999	1.000
59	Proportional cycle time	T0	CH1 CH2	00FA 00FB	250 251	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. 10 "Output assignment" (P. 8-9).	Relay contact output: 20.0 Voltage pulse output, Triac output and Open collector output: 2.0
60	Minimum ON/OFF time of proportioning cycle	VI	CH1 CH2	00FE 00FF	254 255	7	R/W	C	0 to 1000 ms This item becomes RO (Only reading data is possible) for the Voltage/Current output specification.	0
61	Manual manipulated output value	ON	CH1 CH2	0102 0103	258 259	7	R/W	C	Output limiter low to Output limiter high	0.0
62	Area soak time stop function	RV	CH1 CH2	0106 0107	262 263	1	R/W	C	0: No function 1: Event 1 2: Event 2 3: Event 3 4: Event 4	0
63	Operation mode	EI	CH1 CH2	0142 0143	322 323	1	R/W	C	0: Unused 1: Monitor 2: Monitor + Event function 3: Control	3

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No.	Name	Identifier	Channel	Register address		Digits	Attribute	Structure	Data range	Factory set value
				HEX	DEC					
64	Communication switch for logic	EF	CH1	014E	334	7	R/W	M	• RKC communication Least significant digit: Communication switch 1 2nd digit:Communication switch 2 3th digit to Most significant digit: Unused Data 0: OFF 1: ON • Modbus Bit data Bit 0: Communication switch 1 Bit 1: Communication switch 2 Bit 2 to Bit 15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 3]	0

8.3 Engineering Setting Data

There are two types of Engineering setting data; those common to other types of Z-TIO modules and those exclusive to Z-TIO-G.

8.3.1 Setting data common to Z-TIO-A/B/C/D/G

No.	Name	Identifier	Channel	Register address HEX	Register address DEC	Digits	Attribute	Structure	Data range	Factory set value
1	Input type	XI	CH1 CH2	0176 0177	374 375	7	R/W *	C	RTD input Pt100 30: –50.000 to +150.000 °C 31: –50.00 to +250.00 °C 32: –150.00 to +150.00 °C Voltage (V) input 19: 0 to 1 V DC	Based on model code When not specifying: 30
2	Display unit	PU	CH1 CH2	017A 017B	378 379	7	R/W *	C	0: °C Use to select the temperature unit for RTD input.	0
3	Decimal point position	XU	CH1 CH2	017E 017F	382 383	7	R/W *	C	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places RTD input: From 0 to 3 can be set. V/I inputs: Only 3 can be set (fixed).	Based on model code When not specifying: 3
4	Input scale high	XV	CH1 CH2	0182 0183	386 387	7	R/W *	C	RTD input: Input scale low to Maximum value of the selected input range Voltage (V) input: –99.99 to +300.00 (However, a span is 200.00 or less.) Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.	RTD input: Maximum value of the selected input range V input: 100.00
5	Input scale low	XW	CH1 CH2	0186 0187	390 391	7	R/W *	C	RTD input: Minimum value of the selected input range to Input scale high Voltage (V) input: –99.99 to +300.00 (However, a span is 200.00 or less.) Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.	RTD input: Minimum value of the selected input range V input: 0.00
6	Input error determination point (high)	AV	CH1 CH2	018A 018B	394 395	7	R/W *	C	Input error determination point (low) to (Input range high + 5 % of input span) Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.	Input range high + (5 % of input span)
7	Input error determination point (low)	AW	CH1 CH2	018E 018F	398 399	7	R/W *	C	(Input range low – 5 % of input span) to Input error determination point (high) Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.	Input range low – (5 % of input span)
8	Burnout direction	BS	CH1 CH2	0192 0193	402 403	1	R/W *	C	0: Upscale Valid only when the Voltage (V) input are selected.	0
9	Square root extraction	XH	CH1 CH2	0196 0197	406 407	1	R/W *	C	0: Unused 1: Used	0
10	Output assignment (Logic output selection function)	E0	CH1 CH2	019A 019B	410 411	1	R/W *	C	0: Control output 1: Logic output result 2: FAIL output	0
11	Energized/De-energized (Logic output selection function)	NA	CH1 CH2	019E 019F	414 415	1	R/W *	C	0: Energized 1: De-energized	0

* 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).

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No.	Name	Identifier	Channel	Register address HEX	Register address DEC	Digits	Attribute	Structure	Data range	Factory set value
12	Event 1 type	XA	CH1 CH2	01A2 01A3	418 419	7	R/W [1]	C	0: None 1: Deviation high (Using SV monitor value) * 2: Deviation low (Using SV monitor value) * 3: Deviation high/low (Using SV monitor value) * 4: Band (Using SV monitor value) * 5: Process high * 6: Process low * 7: SV high 8: SV low 9: Unused 10: MV high * 11: MV low * 12: Unused 13: Unused 14: Deviation high (Using local SV) * 15: Deviation low (Using local SV) * 16: Deviation high/low (Using local SV) * 17: Band (Using local SV) * 18: Deviation between channels high * 19: Deviation between channels low * 20: Deviation between channels high/low * 21: Deviation between channels band * * Event hold action is available.	Based on model code When not specifying: 0
13	Event 1 channel setting	FA	CH1 CH2	01A6 01A7	422 423	1	R/W [1]	C	1: Channel 1 2: Channel 2 This function is valid when “Deviation between channels” is selected.	1
14	Event 1 hold action	WA	CH1 CH2	01AA 01AB	426 427	1	R/W [1]	C	0: OFF 1: Hold action ON (when power turned on; when transferred from STOP to RUN) 2: Re-hold action ON (when power turned on; when transferred from STOP to RUN; 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.	Based on model code When not specifying: 0
15	Event 1 interlock	LF	CH1 CH2	01AE 01AF	430 431	1	R/W [1]	C	0: Unused 1: Used	0
16	Event 1 differential gap	HA	CH1 CH2	01B2 01B3	434 435	7	R/W [1]	C	① Deviation, Process, Set value, or Deviation action between channels: 0 (0.0, 0.00) to Input span (Unit: °C) Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2. ② MV: 0.0 to 110.0 %	①: 1.00 ②: 1.0
17	Event 1 delay timer	TD	CH1 CH2	01B6 01B7	438 439	7	R/W [1]	C	0 to 18000 seconds	0

[1] 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).

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No.	Name	Identifier	Channel	Register address HEX	Register address DEC	Digits	Attribute	Structure	Data range	Factory set value
18	Force ON of Event 1 action	OA	CH1 CH2	01BA 01BB	442 443	7	R/W [1]	C	• RKC communication 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 • Modbus Bit data 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 b15: Unused Data 0: Invalid 1: Valid [Decimal number: 0 to 15]	0
19	Event 2 type	XB	CH1 CH2	01BE 01BF	446 447	7	R/W [1]	C	0: None 1: Deviation high (Using SV monitor value) * 2: Deviation low (Using SV monitor value) * 3: Deviation high/low (Using SV monitor value) * 4: Band (Using SV monitor value) * 5: Process high * 6: Process low * 7: SV high 8: SV low 9: Unused 10: MV high * 11: MV low * 12: Unused 13: Unused 14: Deviation high (Using local SV) * 15: Deviation low (Using local SV) * 16: Deviation high/low (Using local SV) * 17: Band (Using local SV) * 18: Deviation between channels high * 19: Deviation between channels low * 20: Deviation between channels high/low * 21: Deviation between channels band * * Event hold action is available.	Based on model code When not specifying: 0

[1] 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).

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No.	Name	Iden-tifier	Chan-nel	Register address		Digits	Attri-bute	Struc-ture	Data range	Factory set value
				HEX	DEC					
20	Event 2 channel setting	FB	CH1 CH2	01C2 01C3	450 451	1	R/W *	C	1: Channel 1 2: Channel 2 This function is valid when “Deviation between channels” is selected.	1
21	Event 2 hold action	WB	CH1 CH2	01C6 01C7	454 455	1	R/W *	C	0: OFF 1: Hold action ON (when power turned on; when transferred from STOP to RUN) 2: Re-hold action ON (when power turned on; when transferred from STOP to RUN; 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.	Based on model code When not specifying: 0
22	Event 2 interlock	LG	CH1 CH2	01CA 01CB	458 459	1	R/W *	C	0: Unused 1: Used	0
23	Event 2 differential gap	HB	CH1 CH2	01CE 01CF	462 463	7	R/W *	C	① Deviation, Process, Set value, or Deviation action between channels: 0 (0.0, 0.00) to Input span (Unit: °C) Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2. ② MV: 0.0 to 110.0 %	①: 1.00 ②: 1.0
24	Event 2 delay timer	TG	CH1 CH2	01D2 01D3	466 467	7	R/W *	C	0 to 18000 seconds	0
25	Force ON of Event 2 action	OB	CH1 CH2	01D6 01D7	470 471	7	R/W *	C	• RKC communication 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 • Modbus Bit data 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 b15: Unused Data 0: Invalid 1: Valid [Decimal number: 0 to 15]	0

* 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).

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No.	Name	Identifier	Channel	Register address HEX	Register address DEC	Digits	Attribute	Structure	Data range	Factory set value
26	Event 3 type	XC	CH1 CH2	01DA 01DB	474 475	7	R/W [1]	C	0: None 1: Deviation high (Using SV monitor value) * 2: Deviation low (Using SV monitor value) * 3: Deviation high/low (Using SV monitor value) * 4: Band (Using SV monitor value) * 5: Process high * 6: Process low * 7: SV high 8: SV low 9: Unused 10: MV high * 11: MV low * 12: Unused 13: Unused 14: Deviation high (Using local SV) * 15: Deviation low (Using local SV) * 16: Deviation high/low (Using local SV) * 17: Band (Using local SV) * 18: Deviation between channels high * 19: Deviation between channels low * 20: Deviation between channels high/low * 21: Deviation between channels band * * Event hold action is available.	Based on model code When not specifying: 0
27	Event 3 channel setting	FC	CH1 CH2	01DE 01DF	478 479	1	R/W [1]	C	1: Channel 1 2: Channel 2 This function is valid when “Deviation between channels” is selected.	1
28	Event 3 hold action	WC	CH1 CH2	01E2 01E3	482 483	1	R/W [1]	C	0: OFF 1: Hold action ON (when power turned on; when transferred from STOP to RUN) 2: Re-hold action ON (when power turned on; when transferred from STOP to RUN; 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.	Based on model code When not specifying: 0
29	Event 3 interlock	LH	CH1 CH2	01E6 01E7	486 487	1	R/W [1]	C	0: Unused 1: Used	0
30	Event 3 differential gap	HC	CH1 CH2	01EA 01EB	490 491	7	R/W [1]	C	① Deviation, Process, Set value, or Deviation action between channels: 0 (0.0, 0.00) to Input span (Unit: °C) Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2. ② MV: 0.0 to 110.0 %	①: 1.00 ②: 1.0
31	Event 3 delay timer	TE	CH1 CH2	01EE 01EF	494 495	7	R/W [1]	C	0 to 18000 seconds	0

[1] 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).

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No.	Name	Identifier	Channel	Register address HEX	Register address DEC	Digits	Attribute	Structure	Data range	Factory set value
32	Force ON of Event 3 action	OC	CH1 CH2	01F2 01F3	498 499	7	R/W [1]	C	• RKC communication 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 • Modbus Bit data 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 b15: Unused Data 0: Invalid 1: Valid [Decimal number: 0 to 15]	0
33	Event 4 type	XD	CH1 CH2	01F6 01F7	502 503	7	R/W [1]	C	0: None 1: Deviation high (Using SV monitor value) * 2: Deviation low (Using SV monitor value) * 3: Deviation high/low (Using SV monitor value) * 4: Band (Using SV monitor value) * 5: Process high * 6: Process low * 7: SV high 8: SV low 9: Control loop break alarm (LBA) 10: MV high * 11: MV low * 12: Unused 13: Unused 14: Deviation high (Using local SV) * 15: Deviation low (Using local SV) * 16: Deviation high/low (Using local SV) * 17: Band (Using local SV) * 18: Deviation between channels high * 19: Deviation between channels low * 20: Deviation between channels high/low * 21: Deviation between channels band * * Event hold action is available.	Based on model code When not specifying: 0

[1] 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).

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No.	Name	Identifier	Channel	Register address HEX	Register address DEC	Digits	Attribute	Structure	Data range	Factory set value
34	Event 4 channel setting	FD	CH1 CH2	01FA 01FB	506 507	1	R/W *	C	1: Channel 1 2: Channel 2 This function is valid when “Deviation between channels” is selected.	1
35	Event 4 hold action	WD	CH1 CH2	01FE 01FF	510 511	1	R/W *	C	0: OFF 1: Hold action ON (when power turned on; when transferred from STOP to RUN) 2: Re-hold action ON (when power turned on; when transferred from STOP to RUN; 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.	Based on model code When not specifying: 0
36	Event 4 interlock	LI	CH1 CH2	0202 0203	514 515	1	R/W *	C	0: Unused 1: Used	0
37	Event 4 differential gap	HD	CH1 CH2	0206 0207	518 519	7	R/W *	C	① Deviation, Process, Set value, or Deviation action between channels: 0 (0.0, 0.00) to Input span (Unit: °C) Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2. ② MV: 0.0 to 110.0 %	①: 1.00 ②: 1.0
38	Event 4 delay timer	TF	CH1 CH2	020A 020B	522 523	7	R/W *	C	0 to 18000 seconds	0
39	Force ON of Event 4 action	OD	CH1 CH2	020E 020F	526 527	7	R/W *	C	• RKC communication 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 • Modbus Bit data 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 b15: Unused Data 0: Invalid 1: Valid [Decimal number: 0 to 15]	0

* 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).

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No.	Name	Iden-tifier	Chan-nel	Register address HEX	Register address DEC	Digits	Attri-bute	Struc-ture	Data range	Factory set value
40	Reserved	—	—	0212 0213	530 531	—	—	—	—	—
41	Reserved	—	—	0216 0217	534 535	—	—	—	—	—
42	Reserved	—	—	021A 021B	538 539	—	—	—	—	—
43	Reserved	—	—	021E 021F	542 543	—	—	—	—	—
44	Hot/Cold start	XN	CH1 CH2	0222 0223	546 547	1	R/W *	C	0: Hot start 1 1: Hot start 2 2: Cold start	0
45	Start determination point	SX	CH1 CH2	0226 0227	550 551	7	R/W *	C	0 (0.0, 0.00) to Input span (The unit is the same as input value.) 0 (0.0, 0.00): Action depending on the Hot/Cold start selection Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.	Based on specification (value equivalent to 3% of the input span)
46	SV tracking	XL	CH1 CH2	022A 022B	554 555	1	R/W *	C	0: Unused 1: Used	1
47	MV transfer function [Action taken when changed to Manual mode from Auto mode]	OT	CH1 CH2	022E 022F	558 559	1	R/W *	C	0: MV in Auto mode is used. [Balanceless-bumpless function] 1: MV in previous Manual mode is used.	0
48	Control action	XE	CH1 CH2	0232 0233	562 563	1	R/W *	C	0: Brilliant II PID control (Direct action) 1: Brilliant II PID control (Reverse action)	Based on model code When not specifying: 1
49	Integral/Derivative time decimal point position	PK	CH1 CH2	0236 0237	566 567	1	R/W *	C	1: 0.1 seconds setting (One decimal place)	1
50	Derivative action	KA	CH1 CH2	023A 023B	570 571	1	R/W *	C	0: Measured value derivative 1: Deviation derivative	0

* 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).

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No.	Name	Iden-tifier	Chan-nel	Register address HEX	Register address DEC	Digits	Attri-bute	Struc-ture	Data range	Factory set value
51	Derivative gain	DG	CH1 CH2	0242 0243	578 579	7	R/W *	C	0.1 to 10.0	6.0
52	ON/OFF action differential gap (upper)	IV	CH1 CH2	0246 0247	582 583	7	R/W *	C	RTD input: 0 (0.0, 0.00) to Input span (Unit: °C) Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2. Voltage (V) input: 0.00 to 100.00 % of input span	RTD input: 1.00 V input: 1.00
53	ON/OFF action differential gap (lower)	IW	CH1 CH2	024A 024B	586 587	7	R/W *	C		RTD input: 1.00 V input: 1.00
54	Action (high) at input error	WH	CH1 CH2	024E 024F	590 591	1	R/W *	C	0: Normal control 1: Manipulated output value at input error	0
55	Action (low) at input error	WL	CH1 CH2	0252 0253	594 595	1	R/W *	C		0
56	Manipulated output value at input error	OE	CH1 CH2	0256 0257	598 599	7	R/W *	C	−105.0 to +105.0 % Actual output values become those restricted by the output limiter.	0.0
57	Manipulated output value at STOP mode	OF	CH1 CH2	025A 025B	602 603	7	R/W *	C	−5.0 to +105.0 %	−5.0
58	Output change rate limiter (up)	PH	CH1 CH2	0262 0263	610 611	7	R/W *	C	0.0 to 100.0 % of manipulated output/seconds (0.0: OFF)	0.0
59	Output change rate limiter (down)	PL	CH1 CH2	0266 0267	614 615	7	R/W *	C		0.0
60	Output limiter high	OH	CH1 CH2	026A 026B	618 619	7	R/W	C	Output limiter low to 105.0 %	105.0
61	Output limiter low	OL	CH1 CH2	026E 026F	622 623	7	R/W	C	−5.0 % to Output limiter high	−5.0
62	AT bias	GB	CH1 CH2	0282 0283	642 643	7	R/W *	C	−Input span to +Input span Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2. When the AT point exceeds the setting range, high (or low) limit of the setting range becomes the AT point.	0.00
63	AT cycles	G3	CH1 CH2	0286 0287	646 647	1	R/W *	C	0: 1.5 cycles 1: 2.0 cycles 2: 2.5 cycles 3: 3.0 cycles	1
64	Output value with AT turned on	OP	CH1 CH2	028A 028B	650 651	7	R/W *	C	Output value with AT turned off to +105.0 % Actual output values become those restricted by the output limiter.	105.0
65	Output value with AT turned off	OQ	CH1 CH2	028E 028F	654 655	7	R/W *	C	−105.0 % to Output value with AT turned on Actual output values become those restricted by the output limiter.	−105.0
66	AT differential gap time	GH	CH1 CH2	0292 0293	658 659	7	R/W *	C	0.0 to 50.0 seconds	10.0
67	Proportional band adjusting factor	KC	CH1 CH2	0296 0297	662 663	7	R/W *	C	0.01 to 10.00 times	1.00
68	Integral time adjusting factor	KD	CH1 CH2	029A 029B	666 667	7	R/W *	C	0.01 to 10.00 times	1.00
69	Derivative time adjusting factor	KE	CH1 CH2	029E 029F	670 671	7	R/W *	C	0.01 to 10.00 times	1.00

* 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).

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No.	Name	Iden-tifier	Chan-nel	Register address HEX	Register address DEC	Digits	Attri-bute	Struc-ture	Data range	Factory set value
70	Proportional band limiter (high)	P6	CH1 CH2	02AE 02AF	686 687	7	R/W *	C	RTD input: 0 (0.0, 0.00) to Input span (Unit: °C) Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2. Voltage (V) input: 0.00 to 300.00 % of input span 0 (0.0, 0.00): ON/OFF action	RTD input: Input span V input: 300.00
71	Proportional band limiter (low)	P7	CH1 CH2	02B2 02B3	690 691	7	R/W *	C		RTD input: 0.00 V input: 0.00
72	Integral time limiter (high)	I6	CH1 CH2	02B6 02B7	694 695	7	R/W *	C	0.0 to 3000.0 seconds (0.0: PD action)	3000.0
73	Integral time limiter (low)	I7	CH1 CH2	02BA 02BB	698 699	7	R/W *	C	0.0 to 3000.0 seconds (0.0: PD action)	0.0
74	Derivative time limiter (high)	D6	CH1 CH2	02BE 02BF	702 703	7	R/W *	C	0.0 to 3000.0 seconds (0.0: PI action)	3000.0
75	Derivative time limiter (low)	D7	CH1 CH2	02C2 02C3	706 707	7	R/W *	C	0.0 to 3000.0 seconds (0.0: PI action)	0.0
76	Setting change rate limiter unit time	HU	CH1 CH2	031E 031F	798 799	7	R/W *	C	1 to 3600 seconds	60
77	Soak time unit	RU	CH1 CH2	0322 0323	802 803	1	R/W *	C	• RKC communication 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] • Modbus 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
78	Setting limiter high	SH	CH1 CH2	0326 0327	806 807	7	R/W *	C	Setting limiter low to Input scale high Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.	Input scale high
79	Setting limiter low	SL	CH1 CH2	032A 032B	810 811	7	R/W *	C	Input scale low to Setting limiter high Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.	Input scale low
80	PV transfer function	TS	CH1 CH2	032E 032F	814 815	1	R/W *	C	0: Unused 1: Used	0
81	Operation mode assignment 1 (Logic output selection function) Logic output 1 to 4	EA	CH1 CH2	0332 0333	818 819	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: Unused (Do not set this one.)	0

* 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).

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No.	Name	Iden-tifier	Chan-nel	Register address HEX	Register address DEC	Digits	Attri-bute	Struc-ture	Data range	Factory set value
82	Operation mode assignment 2 (Logic output selection function) Logic output 5 to 6	EB	CH1 CH2	0336 0337	822 823	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: Unused (Do not set this one)	0
83	SV select function	KM	CH1 CH2	033A 033B	826 827	1	R/W *	C	0: Remote SV function 1: Cascade control function	0
84	Remote SV function master channel module address	MC	CH1 CH2	033E 033F	830 831	7	R/W *	C	–1 (Master channel is selected from itself) 0 to 99 (Master channel is selected from other modules)	–1
85	Remote SV function master channel selection	MN	CH1 CH2	0342 0343	834 835	7	R/W *	C	1 to 99	1
86	Output distribution master channel module address	DY	CH1 CH2	0346 0347	838 839	7	R/W *	C	–1 (Master channel is selected from itself) 0 to 99 (Master channel is selected from other modules)	–1
87	Output distribution master channel selection	DZ	CH1 CH2	034A 034B	842 843	7	R/W *	C	1 to 99	1
88	Address of interacting modules	RL	CH1 CH2	034E 034F	846 847	7	R/W *	C	–1 (Interact with its own module address) 0 to 99 (Interact with the addresses of other modules)	–1
89	Channel selection of interacting modules	RM	CH1 CH2	0352 0353	850 851	7	R/W *	C	1 to 99 Becomes valid when the selected module is “Z-TIO module.”	1
90	Selection switch of interacting modules	RN	CH1 CH2	0356 0357	854 855	7	R/W *	C	• RKC communication Least significant digit: Memory area number 2nd digit: Operation mode 3rd digit: Auto/Manual 4th digit: Remote/Local 5th digit Unused 6th digit Interlock release Most significant digit: Suspension of area soak time Data 0: No interaction 1: Interact with other channels • Modbus Bit data Bit 0: Memory area number Bit 1: Operation mode Bit 2: Auto/Manual Bit 3: Remote/Local Bit 4: Unused Bit 5: Interlock release Bit 6: Suspension of area soak time Bit 7 to Bit 15: Unused Data 0: No interaction 1: Interact with other channels [Decimal number: 0 to 111]	0

* 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).

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No.	Name	Iden-tifier	Chan-nel	Register address		Digits	Attri-bute	Struc-ture	Data range	Factory set value
				HEX	DEC					
91	Control RUN/STOP holding setting	X1	CH1	035A	858	1	R/W *	M	0: Not holding (STOP start) 1: Holding (RUN/STOP hold)	1
92	Interval time	ZX	CH1	035B	859	7	R/W *	M	0 to 250 ms	10

* 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).

8.3.2 Setting parameters exclusive to Z-TIO-G module

No.	Name	Identifier	Channel	Register address HEX	Register address DEC	Digits	Attribute	Structure	Data range	Factory set value
1	Sensor bias	JI	CH1 CH2	0422 0423	1058 1059	7	R/W	C	–3.0000 to +3.0000 Ω	0.0000
2	PFF power supply frequency	JJ	CH1	0424	1060	7	R/W	M	0: 50 Hz 1: 60 Hz 2: Automatic setting	2
3	Power feed forward (PFF) selection	JK	CH1 CH2	0425 0426	1061 1062	7	R/W	C	0: Unused 1: Used	0
4	Measurement power supply frequency	JL	CH1	0427	1063	7	RO	M	0.0 to 100.0 Hz	—
5	PFF input voltage	JM	CH1	0428	1064	7	RO	M	0.0 to 600.0 V	—
6	Reserved	—	—	0429 042A	1065 1066	—	—	—	—	—
7	PFF reference voltage	JP	CH1	042B	1067	7	R/W	M	0.0 to 300.0 V Reference voltage is taken in at RUN.	0.0
8	Output compensation factor for PFF reference voltage	JQ	CH1 CH2	042C 042D	1068 1069	7	R/W	C	0.00 to 99.99	1.00
9	Output compensation captured value for PFF reference voltage	JR	CH1 CH2	042E 042F	1070 1071	7	R/W	C	0.00 to 9.99	0.00
10	PFF gain	JS	CH1 CH2	0430 0431	1072 1073	7	R/W	C	0.000 to 10.000	1.000
11	RTD input, 3-wire/4-wire systems selectable	X0	CH1 CH2	0432 0433	1074 1075	7	R/W	C	0: 3-wire system 1: 4-wire system	0
12	Modbus high/low order bit conversion	MX	CH1	045E	1118	1	R/W	M	0: high order → low order (big endian) 1: low order → high order (little endian) Valid for double word type item.	1
13	Output adjustment mode	bs	CH1 CH2	—	—	7	R/W *	C	0: Normal operation 1: Output adjustment 5 % 2: Output adjustment 100 % Valid at STOP Applicable to continuous voltage/current outputs only.	0
14	Output adjustment value 5 %	bt	CH1 CH2	—	—	7	R/W *	C	0 to 10000 Output is adjusted to 5 %. Settable except at STOP and except when output adjustment mode is other than zero.	2195
15	Output adjustment value 100 %	bu	CH1 CH2	—	—	7	R/W *	C	0 to 10000 Output is adjusted to 100 %. Settable except at STOP and except when output adjustment mode is other than zero.	8405

* 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).

8.4 Memory Area Data Address

☞ For data operation, refer to **7.4 How to Use Memory Area Data (P.7-13)**.

No.	Name	Chan-nel	Register address		Attri-bute	Struc-ture	Data range	Factory set value
			HEX	DEC				
1	Setting memory area number	CH1 CH2	0500 0501	1280 1281	R/W	C	1 to 8	1
2	Event 1 set value (EV1)	CH1 CH2	0504 0505	1284 1285	R/W	C	Deviation action, Deviation action between channels: –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). If Event 4 corresponds to "9: Control loop break alarm (LBA)," the Event 4 set value becomes RO (Only reading data is possible). * Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.	50.00
3	Event 2 set value (EV2)	CH1 CH2	0508 0509	1288 1289	R/W	C		50.00
4	Event 3 set value (EV3)	CH1 CH2	050C 050D	1292 1293	R/W	C		50.00
5	Event 4 set value (EV4)	CH1 CH2	0510 0511	1296 1297	R/W	C		50.00
6	Control loop break alarm (LBA) time	CH1 CH2	0514 0515	1300 1301	R/W	C	0 to 7200 seconds (0: Unused)	480
7	LBA deadband	CH1 CH2	0518 0519	1304 1305	R/W	C	0 (0.0, 0.00) to Input span Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.	0.00
8	Set value (SV)	CH1 CH2	051C 051D	1308 1309	R/W	C	Setting limiter low to Setting limiter high Varies with the setting of the decimal point position.	RTD input: 0.00 (0.000) V input: 0.000
9	Proportional band [heat-side]	CH1 CH2	0520 0521	1312 1313	R/W	C	RTD input: 0 (0.0, 0.00) to Input span (Unit: °C) Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2. Voltage (V) input: 0.00 to 300.00 % of input span 0 (0.0, 0.00): ON/OFF action	30.00
10	Integral time [heat-side]	CH1 CH2	0524 0525	1316 1317	R/W	C	0.0 to 3000.0 seconds (0.0: PD action)	240.0
11	Derivative time [heat-side]	CH1 CH2	0528 0529	1320 1321	R/W	C	0.0 to 3000.0 seconds (0.0: PI action)	60.0
12	Control response parameter	CH1 CH2	052C 052D	1324 1325	R/W	C	0: Slow 1: Medium 2: Fast [Internally fixed to Fast in case of P and PD actions.]	0
13	Manual reset	CH1 CH2	0540 0541	1344 1345	R/W	C	–100.0 to +100.0 % If the Integral function is valid, set to RO (Only reading data is possible). When Integral time is zero, manual reset value is added to the control output.	0.0
14	Setting change rate limiter (up)	CH1 CH2	0544 0545	1348 1349	R/W	C	0 (0.0, 0.00) to Input span/unit time * 0 (0.0, 0.00): Unused Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2. * Unit time: 60 seconds (factory set value)	0.00
15	Setting change rate limiter (down)	CH1 CH2	0548 0549	1352 1353	R/W	C		0.00

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No.	Name	Chan-nel	Register address		Attri-bute	Struc-ture	Data range	Factory set value
			HEX	DEC				
16	Area soak time	CH1 CH2	054C 054D	1356 1357	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 Data range of Area soak time can be selected on the Soak time unit.	0
17	Link area number	CH1 CH2	0550 0551	1360 1361	R/W	C	0 to 8 (0: No link)	0

8.5 Data Mapping Address

☞ For data operation, refer to **7.5 How to Use Data Mapping (P.7-17)**.

8.5.1 Register address for data mapping

No.	Name	Register address		Number of data items	Attribute	Data range	Factory set value
		HEX	DEC				
1	Register address setting 1 Read/write address: 1500H	1000	4096	1	R/W	Decimal: –1 to 8207 (–1: No mapping) Hexadecimal: FFFFH to 200FH (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

8.5.2 Register address for data read/writes

No.	Name	Register address		Number of data items	Attri-bute	Data range	Factory set value
		HEX	DEC				
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			

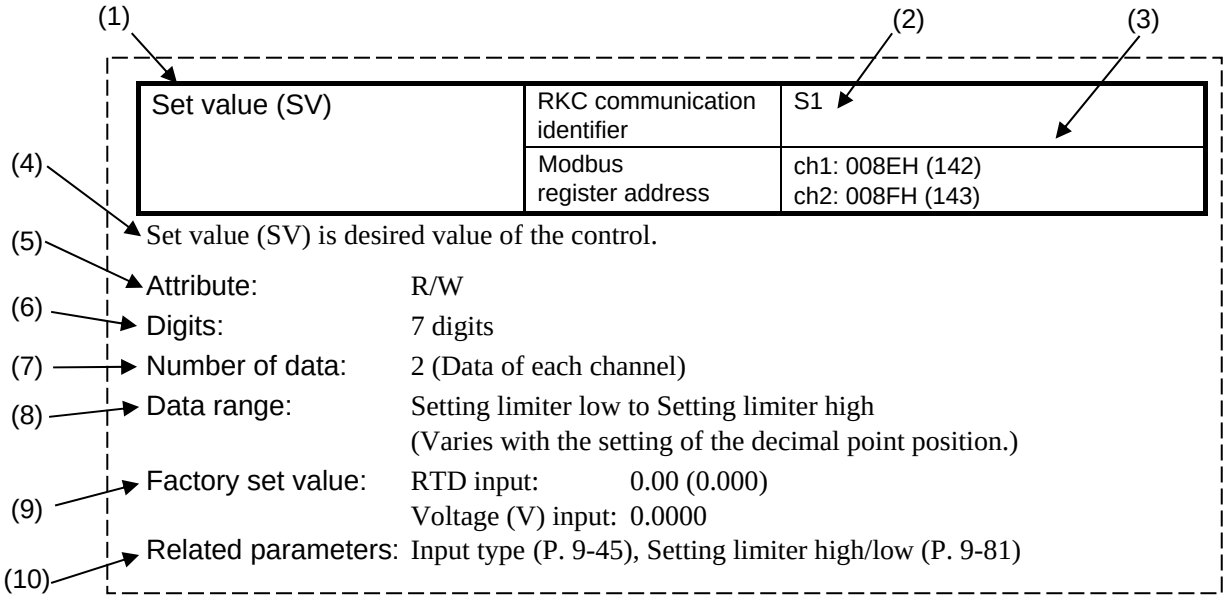
8.6 Double Word Data

No.	Name	Iden-tifier	Chan-nel	Register address		Digits	Attri-bute	Struc-ture	Data range	Factory set value
				HEX	DEC					
1	Measured value (PV)	M1	CH1	2000 2001	8192 8193	7	RO	C	Input scale low to Input scale high Varies with the setting of the decimal point position. Modbus double word type	—
			CH2	2002 2003	8194 8195					
2	Set value (SV)	S1	CH1	2004 2005	8196 8197	7	R/W	C	Setting limiter low to Setting limiter high Varies with the setting of the decimal point position. Modbus double word type	0
			CH2	2006 2007	8198 8199					
3	Reserved	—	—	2008 2009 200A 200B	8200 8201 8202 8203	—	—	—	—	—
4	PV bias	PB	CH1	200C 200D	8204 8205	7	R/W	C	−Input span to +Input span Varies with the setting of the decimal point position. For the 1/1000 °C unit, the minimum value is limited to "–99.999." Modbus double word type	0.000
			CH2	200E 200F	8206 8207					

COMMUNICATION DATA DESCRIPTION

9

9.1 Reference to Communication Data Contents



(1) Name: Communication data name

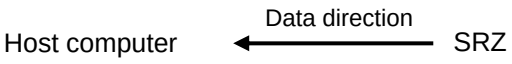
(2) RKC communication identifier:
Communication identifier of RKC communication

(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.

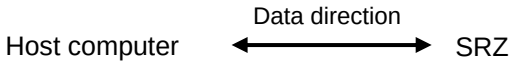
(4) Description: A short description of the communication data item

(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



R/W: Read and Write data



(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: 2
Number of each module data: 1

(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.

9.2 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: 1 (Data of each module)
Data range: Based on model code
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: 1 (Data of each module)
Data range: The version of loading software
Factory set value: —

Measured value (PV)	RKC communication identifier	M1
	Modbus register address	Single word : ch1: 0000H (0) ch2: 0001H (1)
		Double word : ch1: Lower word 2000H (8192) Upper word 2001H (8193) ch2: Lower word 2002H (8194) Upper word 2003H (8195)

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

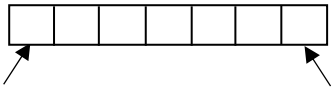
Attribute: RO
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: Input scale low to Input scale high
(Varies with the setting of the decimal point position. However, in case of MODBUS single word, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)
Factory set value: —

Comprehensive event state	RKC communication identifier	AJ
	Modbus register address	ch1: 0004H (4) ch2: 0005H (5)

Each event state such as Event 1 to Event 4 or Burnout is expressed in bit data items.

Attribute: RO
Digits: 7 digits
Number of data: 2 (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
2nd digit:	Event 2
3rd digit:	Event 3
4th digit:	Event 4
5th digit:	Unused
6th digit:	Unused
Most significant digit:	Burnout

Modbus: 0 to 79 (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
Bit 1:	Event 2
Bit 2:	Event 3
Bit 3:	Event 4
Bit 4:	Unused
Bit 5:	Unused
Bit 6:	Burnout
Bit 7 to Bit 15:	Unused

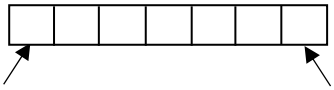
Factory set value: —
Related parameters: Event set value (EV) (P. 9-19), Burnout direction (P. 9-49), Event type (P. 9-52), Event hold action (P. 9-55), Event interlock (P. 9-57), Event differential gap (P. 9-58), Event delay timer (P. 9-59)

Operation mode state monitor	RKC communication identifier	L0
	Modbus register address	ch1: 0008H (8) ch2: 0009H (9)

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

Attribute: RO
Digits: 7 digits
Number of data: 2 (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
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
Bit 3: Remote mode
Bit 4 to Bit 15: Unused

Factory set value: —
Related parameters: Auto/Manual transfer (P. 9-15), Remote/Local transfer (P. 9-16), RUN/STOP transfer (P. 9-16), Operation mode (P. 9-37)

When the **Operation mode (P. 9-37)** is "0: Unused," all operation mode state monitor data is "0: OFF."

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: RKC communication:
Transmission data from the SRZ is replaced with ASCII code in decimal number.
1: Adjustment data error
2: Data back-up error
4: A/D conversion error
32: Logic output data error
When two or more errors occur, the error code is the sum of the generated errors.

Modbus: 0 to 63 (bit data)
Error status is assigned to each bit in the binary number.

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	RKC communication identifier	O1
	Modbus register address	ch1: 000DH (13) ch2: 000EH (14)

Manipulation output for PID control.

Attribute: RO
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: –5.0 to +105.0 %
Factory set value: —

Set value (SV) monitor	RKC communication identifier	MS
	Modbus register address	ch1: 0019H (25) ch2: 001AH (26)

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: 2 (Data of each channel)
Data range: Setting limiter low to Setting limiter high
(Varies with the setting of the decimal point position.)
Factory set value: —
Related parameters: Input type (P. 9-45), Decimal point position (P. 9-46)

Remote setting (RS) input value monitor	RKC communication identifier	S2
	Modbus register address	ch1: 001DH (29) ch2: 001EH (30)

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

Attribute: RO
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: Setting limiter low to Setting limiter high
(Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)
Factory set value: —
Related parameters: RS bias (P. 9-30), RS ratio (P. 9-31), RS digital filter (P. 9-31),
SV select function (P. 9-83),
Remote SV function master channel module address (P. 9-87),
Remote SV function master channel selection (P. 9-88)

Burnout state monitor	RKC communication identifier	B1
	Modbus register address	ch1: 0021H (33) ch2: 0022H (34)

Monitor a state in input break.

Attribute: RO
Digits: 1 digit
Number of data: 2 (Data of each channel)
Data range: 0: OFF
1: ON
Factory set value: —
Related parameters: Burnout direction (P. 9-49)

Event 1 state monitor	RKC communication identifier	AA
	Modbus register address	ch1: 0025H (37) ch2: 0026H (38)
Event 2 state monitor	RKC communication identifier	AB
	Modbus register address	ch1: 0029H (41) ch2: 002AH (42)
Event 3 state monitor	RKC communication identifier	AC
	Modbus register address	ch1: 002DH (45) ch2: 002EH (46)
Event 4 state monitor	RKC communication identifier	AD
	Modbus register address	ch1: 0031H (49) ch2: 0032H (50)

Monitor an ON/OFF state of the event.

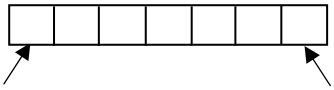
Attribute: RO
Digits: 1 digit
Number of data: 2 (Data of each channel)
Data range: 0: OFF
1: ON
Factory set value: —
Related parameters: Event set value (P. 9-19), Event type (P. 9-52), Event channel setting (P. 9-54), Event hold action (P. 9-55), Event interlock (P. 9-57), Event differential gap (P. 9-58), Event delay timer (P. 9-59)

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

ON/OFF state of output (OUT1 and OUT2) 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 to Most significant digit: Unused

Modbus: 0 to 3 (bit data)
The output state is assigned as a bit image in binary numbers.

Bit image: 0000000000000000

Bit 15 ····· Bit 0

Bit 0: OUT1
Bit 1: OUT2
Bit 2 to Bit 15: Unused

Bit data: 0: OFF 1: ON

Factory set value: —
Related parameters: Output assignment (P. 9-50)

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

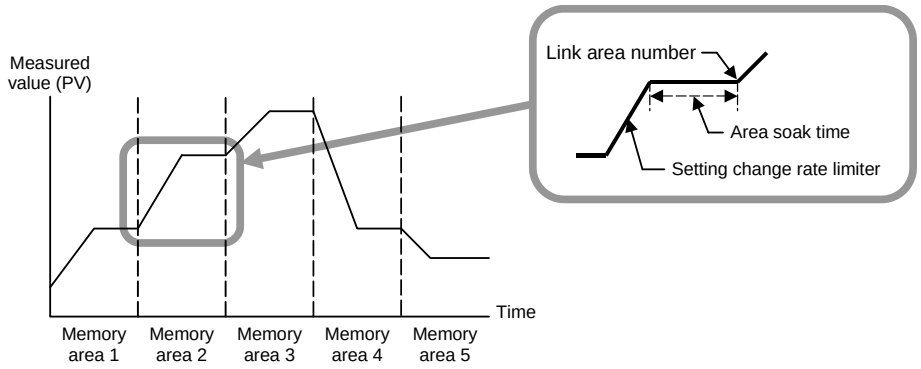
Memory area soak time monitor	RKC communication identifier	TR
	Modbus register address	ch1: 003AH (58) ch2: 003BH (59)

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: 2 (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. 9-27), Link area number (P. 9-28), Soak time unit (P. 9-80)

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: —

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.

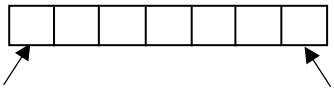
Attribute: RO
Digits: 1 digit
Number of data: 1 (Data of each module)
Data range: 0: The content of the backup memory does not coincide with that of the RAM.
1: The content of the backup memory coincides with that of the RAM.
Factory set value: —

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
3th digit to Most significant digit: Unused

Modbus: 0 to 63 (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 to Bit 15: Unused

Factory set value: —
Related parameters: Communication switch for logic (P. 9-38), Output assignment (P. 9-50), Operation mode assignment (P. 9-82)

PID/AT transfer	RKC communication identifier	G1
	Modbus register address	ch1: 0061H (97) ch2: 0062H (98)

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

Attribute: R/W
Digits: 1 digit
Number of data: 2 (Data of each channel)
Data range: 0: PID control
1: Autotuning (AT)
Factory set value: 0
Related parameters: AT bias (P. 9-74), AT cycles (P. 9-75), Output value with AT turned on (P. 9-76), Output value with AT turned off (P. 9-76), AT differential gap time (P. 9-77), Proportional band adjusting factor (P. 9-78), Integral time adjusting factor (P. 9-78), Derivative time adjusting factor (P. 9-78), Proportional band limiter (high/low) (P. 9-79), Integral time limiter (high/low) (P. 9-79), Derivative time limiter (high/low) (P. 9-80),

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).
When the Autotuning (AT) is finished, the control will automatically returns to 0: PID 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 not be finished normally. In that case, adjust the PID values manually. Manual setting of PID values may also be necessary if the set value is around the ambient temperature or is close to the maximum temperature achieved by the load.
  - If the output change rate limiter is set, the optimum PID values may not be computed 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 a rise in temperature or in stable control.

Operation 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 over-scale.
		Input error determination point (high) ≥ Measured value (PV) ≥ Input error determination point (low)
Operation mode [Identifier: EI] (P. 9-37)		Control

Continued on the next page.

Continued from the previous page.

- **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 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] (P. 9-37)	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 high or low output limit value 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) and Derivative time limiter (high).

For PI control:
Set “0” to Derivative time limiter (high).

For PD control:
Set “0” to Integral time limiter (high).

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

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.

Auto/Manual transfer	RKC communication identifier	J1
	Modbus register address	ch1: 0065H (101) ch2: 0066H (102)

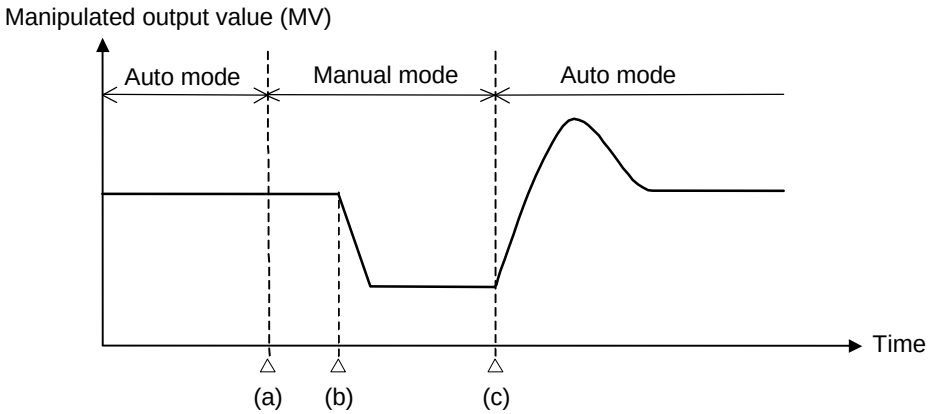
Use to transfer the Auto mode or Manual mode.

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: 2 (Data of each channel)
Data range: 0: Auto mode
1: Manual mode
Factory set value: 0
Related parameters: Operation mode state monitor (P. 9-5), MV transfer function (P. 9-66)
PV transfer function (P. 9-81)
Function: The manipulated output value when changed to the Manual mode from the Auto mode differs depending on the MV transfer function (P. 9-66) 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.
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.

Link Z-TIO module and Z-DIO module to switch Auto/Manual by using Digital input (DI). For details, refer to following items:
- **Address of interacting modules (P. 9-91)**
- **Selection switch of interacting modules (P. 9-92)**
- **SRZ Instruction Manual (IMS01T04-E□)**

Regardless of whether the mode is Auto mode or Manual mode, the ON/OFF action remains effective.

Remote/Local transfer	RKC communication identifier	C1
	Modbus register address	ch1: 0069H (105) ch2: 006AH (106)

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 or Cascade control.

Attribute: R/W
Digits: 1 digit
Number of data: 2 (Data of each channel)
Data range: 0: Local mode
1: Remote mode
Factory set value: 0
Related parameters: Operation mode state monitor (P. 9-5), SV tracking (P. 9-65)

When the cascade control is performed, the adjustment gauge on the slave must be switched to Remote mode.

Link Z-TIO module and Z-DIO module to switch Remote/Local by using Digital input (DI). For details, refer to following items:
- **Address of interacting modules (P. 9-91)**
- **Selection switch of interacting modules (P. 9-92)**
- **SRZ Instruction Manual (IMS01T04-E□)**

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
Related parameters: Operation mode state monitor (P. 9-5), Operation mode (P. 9-37),
Control RUN/STOP holding setting (P. 9-94)

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).

Switch RUN/STOP by using Digital input (DI) of Z-DIO module. All modules connected to the Z-DIO transfer RUN/STOP at the same time.
For details, refer to **SRZ Instruction Manual (IMS01T04-E□).**

Memory area transfer	RKC communication identifier	ZA
	Modbus register address	ch1: 006EH (110) ch2: 006FH (111)

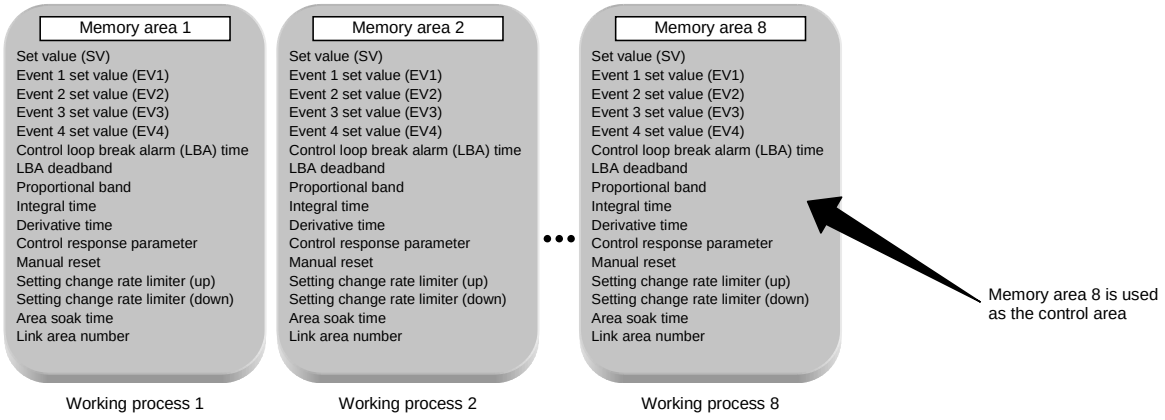
This item selects the memory area (Control area) to use for control.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 1 to 8
Factory set value: 1

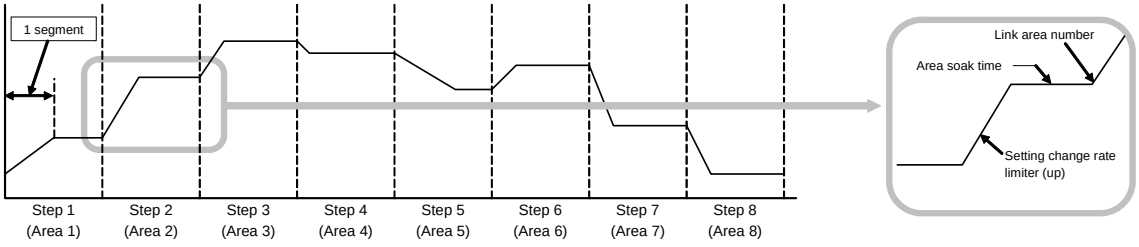
● Multi-memory area function

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.



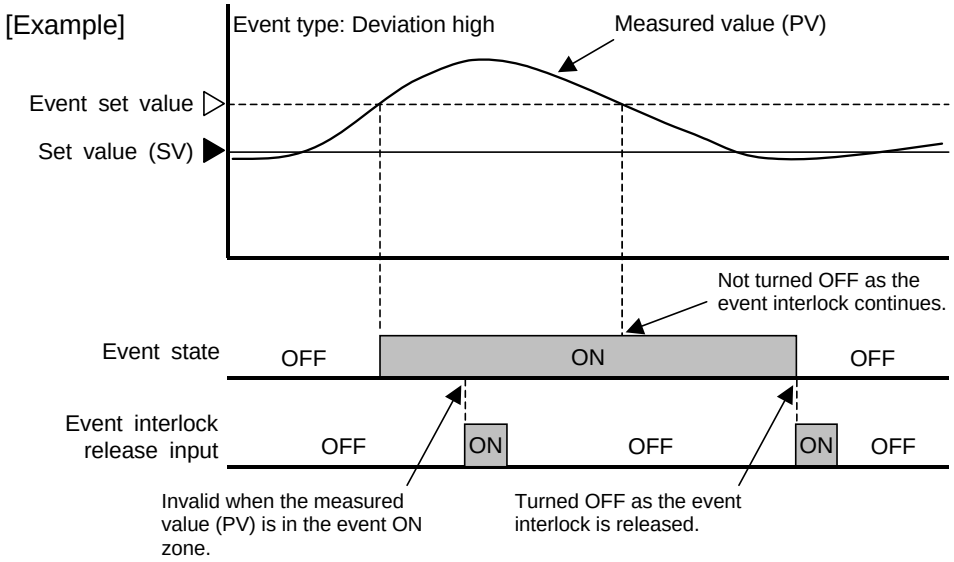
Link Z-TIO module and Z-DIO module to switch Memory area by using Digital input (DI). For details, refer to following items:

- **Address of interacting modules (P. 9-91)**
- **Selection switch of interacting modules (P. 9-92)**
- **SRZ Instruction Manual (IMS01T04-E☐)**

Interlock release	RKC communication identifier	AR
	Modbus register address	ch1: 0072H (114) ch2: 0073H (115)

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: 2 (Data of each channel)
Data range: 0: Normal state
1: Interlock release execution
Related parameters: Event interlock (P. 9-57)
Factory set value: 0
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."

Link Z-TIO module and Z-DIO module to release Interlock by using Digital input (DI). For details, refer to following items:

- **Address of interacting modules (P. 9-91)**
- **Selection switch of interacting modules (P. 9-92)**
- **SRZ Instruction Manual (IMS01T04-E☐)**

Event 1 set value (EV1)	RKC communication identifier	A1
	Modbus register address	ch1: 0076H (118) ch2: 0077H (119)
Event 2 set value (EV2)	RKC communication identifier	A2
	Modbus register address	ch1: 007AH (122) ch2: 007BH (123)
Event 3 set value (EV3)	RKC communication identifier	A3
	Modbus register address	ch1: 007EH (126) ch2: 007FH (127)
Event 4 set value (EV4)	RKC communication identifier	A4
	Modbus register address	ch1: 0082H (130) ch2: 0083H (131)

EV1 through EV4 are set values of the event action.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: Deviation action [1] and Deviation action between channels [1]:
–Input span to +Input span
(Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)
Process action [2] and SV action [2]:
Input scale low to Input scale high
(Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)
MV action [2]: –5.0 to +105.0 %

[1] Deviation high, Deviation low, Deviation high/low, Band
[2] high, low

Factory set value: 50.00
Related parameters: Event type (P. 9-52), Event hold action (P. 9-55), Event differential gap (P. 9-58), Event delay timer (P. 9-59), Force ON of Event action (P. 9-61)

When the Event type is “0: None,” this parameter is RO (Read Only).

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) ch2: 0087H (135)

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: 2 (Data of each channel)
Data range: 0 to 7200 seconds (0: Unused)
Related parameters: LBA deadband (P. 9-21), Event 4 type (P. 9-52)
Factory set value: 480
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. When the LBA time has elapsed and the PV is still within the alarm determination range, the LBA will be ON.

[Alarm action]
LBA determination range: RTD input: 2 °C (fixed)
Voltage input: 0.2 % of input span (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.

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.

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, the controller is in STOP mode, the LBA time is set to 0 or the LBA function is not assigned to Event 4, the LBA function is not activated.

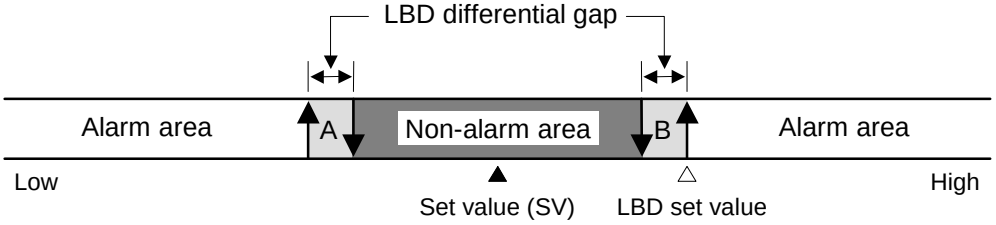
If the LBA setting time does not match the controlled object requirements, the LBA setting time should be lengthened. If setting time is not correct, the LBA will malfunction by turning on or off at inappropriate time or not turning on at all.

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.

LBA deadband	RKC communication identifier	N1
	Modbus register address	ch1: 008AH (138) ch2: 008BH (139)

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: 2 (Data of each channel)
Data range: 0 (0.0, 0.00) to Input span
(Varies with the setting of the decimal point position.
However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)
Related parameters: Control loop break alarm (LBA) time (P. 9-20), Event 4 type (P. 9-52)
Factory set value: 0.00
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: RTD input: 0.8 °C
Voltage input: 0.8 % of input 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, the controller is in STOP mode, the LBA time is set to 0 or the LBA function is not assigned to Event 4, the LBA function is not activated.

If the LBA setting time does not match the controlled object requirements, the LBA setting time should be lengthened. 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)	RKC communication identifier	S1
	Modbus register address	Single word : ch1: 008EH (142) ch2: 008FH (143)
		Double word : ch1: Lower word 2004H (8196) Upper word 2005H (8197) ch2: Lower word 2006H (8198) Upper word 2007H (8199)

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

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: Setting limiter low to Setting limiter high
(Varies with the setting of the decimal point position. However, in case of MODBUS single word, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)
Factory set value: RTD input: 0.00 (0.000)
Voltage (V) input: 0.000
Related parameters: Input type (P. 9-45), Setting limiter high/low (P. 9-81)

Proportional band	RKC communication identifier	P1
	Modbus register address	ch1: 0092H (146) ch2: 0093H (147)

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

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: RTD input: 0 (0.0, 0.00) to Input span (Unit: °C)
(Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)
Voltage (V) input: 0.00 to 300.00 % of input span
0 (0.0, 0.00): ON/OFF action

Regardless of whether the mode is Auto mode or Manual mode, the ON/OFF action remains effective.

Factory set value: 30.00
Related parameters: Decimal point position (P. 9-46), Control action (P. 9-66), ON/OFF action differential gap (upper/lower) (P. 9-69)

Integral time	RKC communication identifier	I1
	Modbus register address	ch1: 0096H (150) ch2: 0097H (151)

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: 2 (Data of each channel)
Data range: 0.0 to 3000.0 seconds
0.0: Integral time OFF (PD action)
Factory set value: 240.0
Related parameters: Control action (P. 9-66), Integral/Derivative time decimal point position (P. 9-68)

Derivative time	RKC communication identifier	D1
	Modbus register address	ch1: 009AH (154) ch2: 009BH (155)

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.

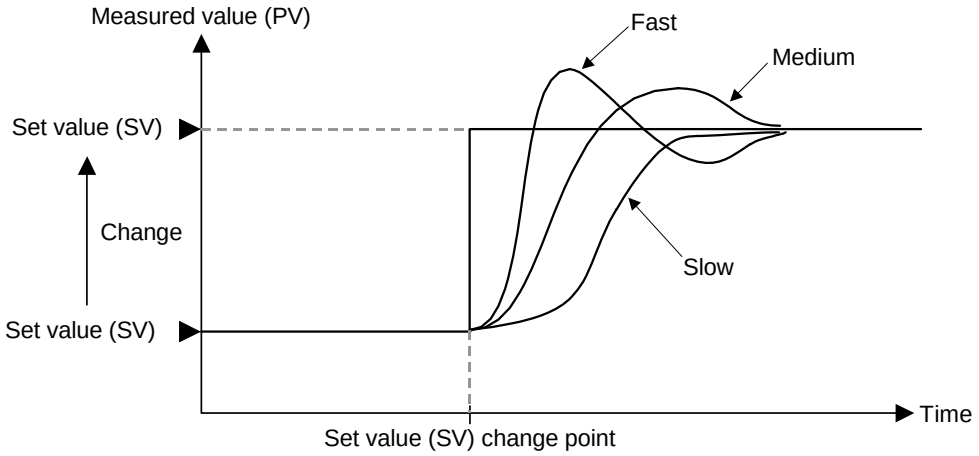
Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0.0 to 3000.0 seconds
0.0: Derivative time OFF (PI action)
Factory set value: 60.0
Related parameters: Control action (P. 9-66), Integral/Derivative time decimal point position (P. 9-68), Derivative gain (P. 9-69)

Control response parameter	RKC communication identifier	CA
	Modbus register address	ch1: 009EH (158) ch2: 009FH (159)

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

Attribute: R/W
Digits: 1 digit
Number of data: 2 (Data of each channel)
Data range: 0: Slow
1: Medium
2: Fast
Factory set value: 0
Related parameters: Control action (P. 9-66)
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.



When the P or PD action is selected, this setting becomes invalid.

Manual reset	RKC communication identifier	MR
	Modbus register address	ch1: 00B2H (178) ch2: 00B3H (179)

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

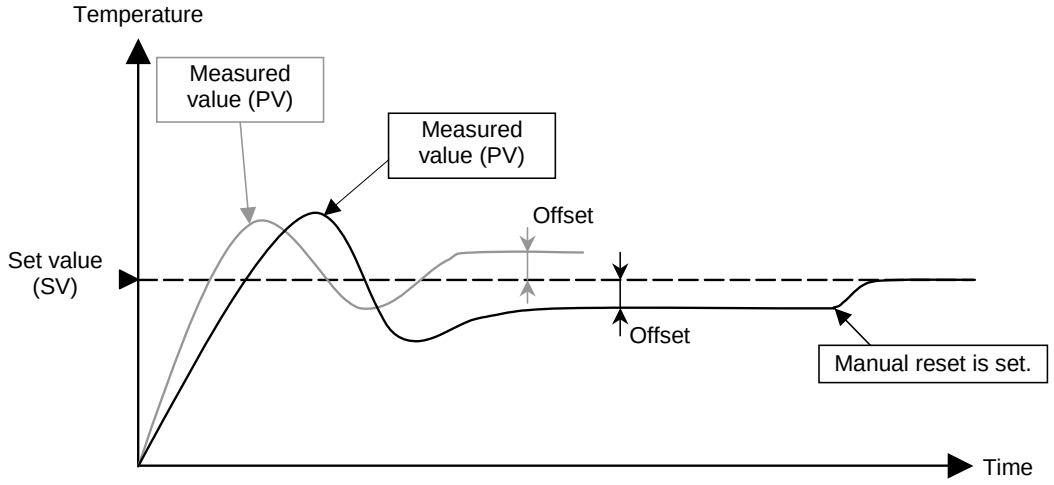
Number of data: 2 (Data of each channel)

Data range: –100.0 to +100.0 %

Factory set value: 0.0

Related parameters: Integral time (P. 9-23)

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 must be set to zero.

Setting change rate limiter (up)	RKC communication identifier	HH
	Modbus register address	ch1: 00B6H (182) ch2: 00B7H (183)
Setting change rate limiter (down)	RKC communication identifier	HL
	Modbus register address	ch1: 00BAH (186) ch2: 00BBH (187)

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

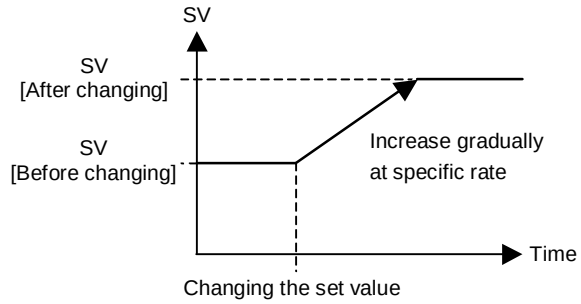
Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0 (0.0, 0.00) to Input span/unit time *
0 (0.0, 0.00): Unused
(Varies with the setting of the decimal point position.
However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)
* Unit time: 60 seconds (Factory set value)
Factory set value: Setting change rate limiter (up): 0.00
Setting change rate limiter (down): 0.00
Related parameters: Setting change rate limiter unit time (P. 9-80)

● Setting change rate limiter

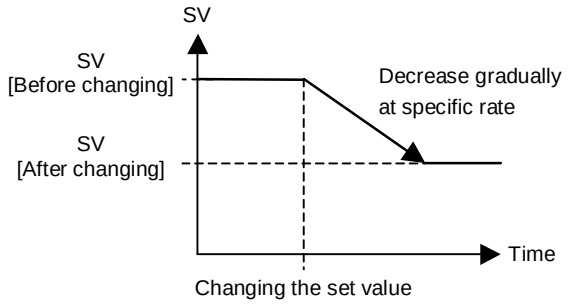
This function is to allow the Set value (SV) to be automatically changed at specific rates when a new Set value (SV). Setting change rate limiter (up) is used when the SV is changed to a higher SV. Setting change rate limiter (down) is used when the SV is changed to a lower SV.

[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.

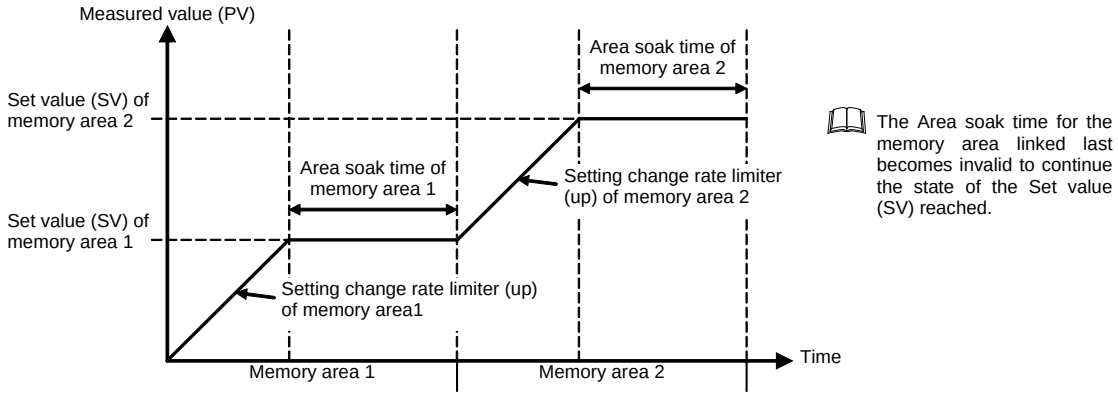
If the rate of setting change limiter is set to any value other than “0 (0.0, 0.00): Unused,” the event re-hold action to be taken by a Set value (SV) change becomes invalid.

Area soak time	RKC communication identifier	TM
	Modbus register address	ch1: 00BEH (190) ch2: 00BFH (191)

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

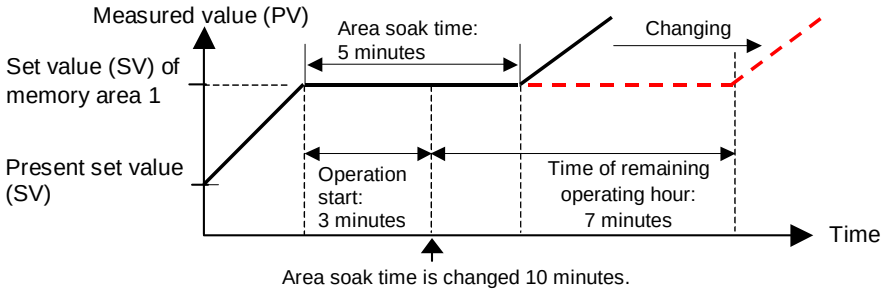
Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: RKC communication:
0 minutes 00 seconds to 199 minutes 59 seconds: 0:00 to 199:59 (min:sec)
0 hours 00 minutes to 99 hours 59 minutes: 0:00 to 99:59 (hrs:min)
Modbus:
0 minutes 00 seconds to 199 minutes 59 seconds: 0 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. 9-80)
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]



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

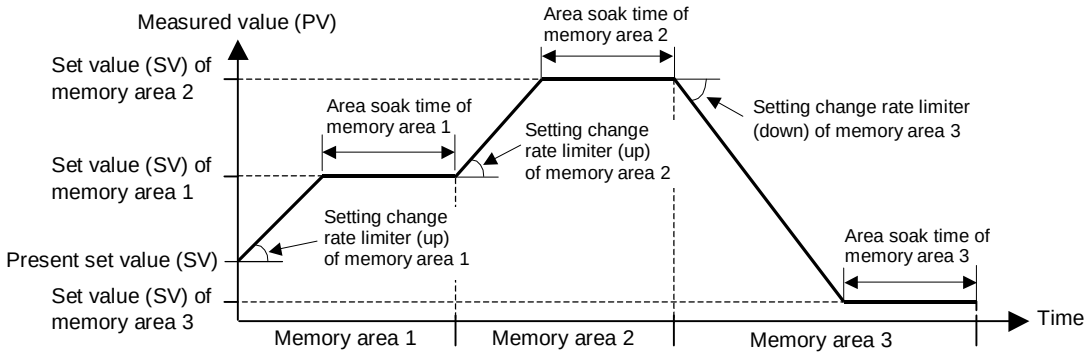
The Area soak time can be changed during normal operation with Ramp/Soak control function, but Read the following example carefully how the time change affects Ramp/Soak control time.
For example, the Memory area which has 5-minute soak time is executed.
When 3 minutes passed, the Area soak time is changed from 5 minutes to 10 minutes.
The remaining time of the currently executed Memory area is computed 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) ch2: 00C3H (195)

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: 2 (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.

PV bias	RKC communication identifier	PB
	Modbus register address	ch1: 00D2H (210) ch2: 00D3H (211)

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: 2 (Data of each channel)
Data range: –Input span to +Input span
(Varies with the setting of the decimal point position.)
For the 1/1000 °C unit, the minimum value limited to "–99.999."
Factory set value: 0.00 (0.000)

PV digital filter	RKC communication identifier	F1
	Modbus register address	ch1: 00D6H (214) ch2: 00D7H (215)

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

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0.0 to 100.0 seconds
(0.0: Unused)
Factory set value: 0.0

PV ratio	RKC communication identifier	PR
	Modbus register address	ch1: 00DAH (218) ch2: 00DBH (219)

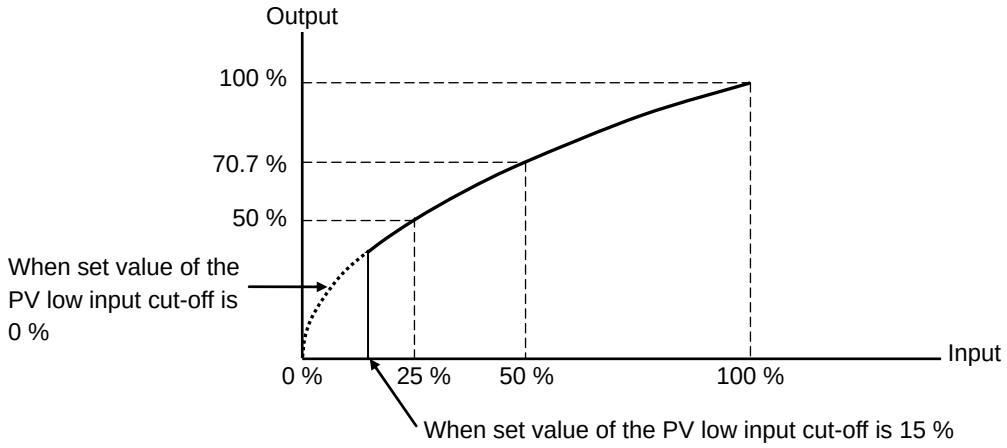
PV ratio is a multiplier to be applied to the Measured value (PV). The PV ratio is used to compensate the individual variations of the sensors or correct the difference between the Measured value (PV) of other instruments.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (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) ch2: 00DFH (223)

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.
Digits: 7 digits
Number of data: 2 (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. 9-49)
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 compute control output in order to prevent control disturbance caused by input variation at low measured value range.



RS bias (Cascade bias)	RKC communication identifier	RB
	Modbus register address	ch1: 00E2H (226) ch2: 00E3H (227)

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

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: –Input span to +Input span
(Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)
Factory set value: 0.00
Related parameters: Remote/Local transfer (P. 9-16), SV select function (P. 9-83), Remote SV function master channel module address (P. 9-87), Remote SV function master channel selection (P. 9-88)

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

RS digital filter (Cascade digital filter)	RKC communication identifier	F2
	Modbus register address	ch1: 00E6H (230) ch2: 00E7H (231)

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

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0.0 to 100.0 seconds
(0.0: Unused)
Factory set value: 0.0
Related parameters: Remote/Local transfer (P. 9-16), SV select function (P. 9-83),
Remote SV function master channel module address (P. 9-87),
Remote SV function master channel selection (P. 9-88)

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

RS ratio (Cascade ratio)	RKC communication identifier	RR
	Modbus register address	ch1: 00EAH (234) ch2: 00EBH (235)

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

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0.001 to 9.999
Factory set value: 1.000
Related parameters: Remote/Local transfer (P. 9-16), SV select function (P. 9-83),
Remote SV function master channel module address (P. 9-87),
Remote SV function master channel selection (P. 9-88)

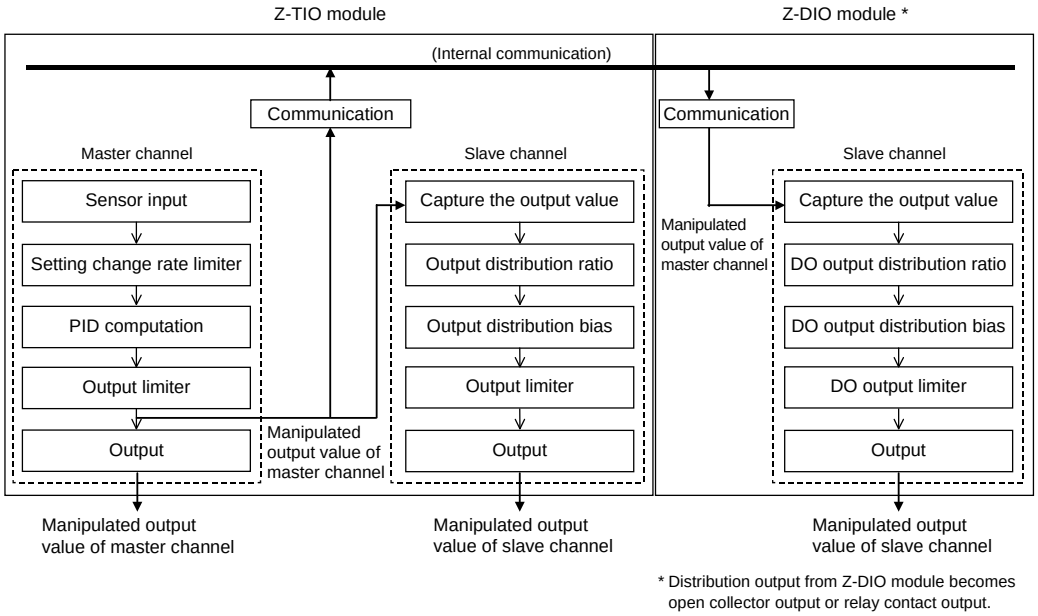
When the cascade control is selected, this is used as the cascade ratio.

Output distribution selection	RKC communication identifier	DV
	Modbus register address	ch1: 00EEH (238) ch2: 00EFH (239)

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

Attribute: R/W
Digits: 1 digit
Number of data: 2 (Data of each channel)
Data range: 0: Control output (master channel)
1: Distribution output (slave channel)
Factory set value: 0
Related parameters: Output distribution bias (P. 9-34), Output distribution ratio (P. 9-34), Output distribution master channel module address (P. 9-89), Output distribution master channel selection (P. 9-90)
Function: The output distribution function outputs the manipulated output value computed for the master channel as a manipulated output value from slave channels. Bias and ratio computations can also be applied to the manipulated output value computed 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).

Continued on the next page.

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● Operation flow

1. Set the Output distribution 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.

Output distribution master channel module address (P. 9-89):
–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 that will be the master in the master channel module. This setting is not required in the master channel.

Output distribution master channel selection (P. 9-90): 1 to 99

3. Output distribution selection

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

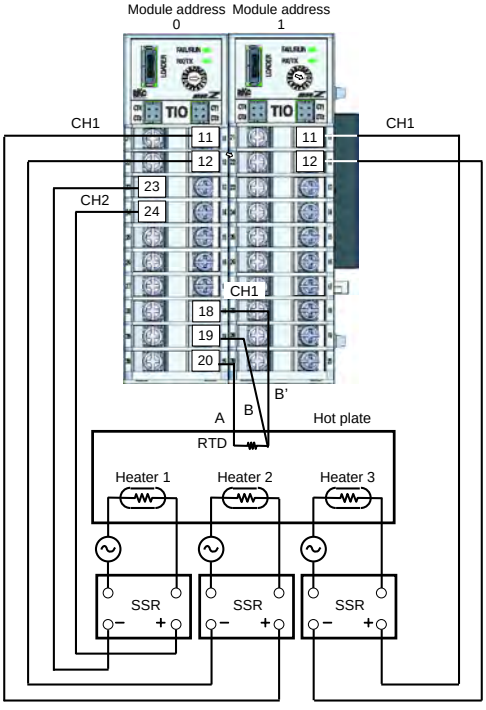
4. Control start

5. Adjust the Output distribution bias

6. Adjust the Output distribution ratio

In each slave, set the bias (P. 9-34) and ratio (P. 9-34) for the manipulated output value from the master. Select these settings as needed based on the actual operation state.

Example: Using two Z-TIO-G modules



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	CH2		Distribution output
Slave channel (Heater 3)	Module address 1	CH1		Distribution output

Setting:

Setting items	Module address 0		Module address 1
	CH1 (Master)	CH2 (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 (Control 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) ch2: 00F3H (243)

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: 2 (Data of each channel)
Data range: –100.0 to +100.0 %
Factory set value: 0.0
Related parameters: Output distribution selection (P. 9-32), Output distribution ratio (P. 9-34), Output distribution master channel module address (P. 9-89), Output distribution master channel selection (P. 9-90)

Output distribution ratio	RKC communication identifier	DQ
	Modbus register address	ch1: 00F6H (246) ch2: 00F7H (247)

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: 2 (Data of each channel)
Data range: –9.999 to +9.999
Factory set value: 1.000
Related parameters: Output distribution selection (P. 9-32), Output distribution bias (P. 9-34), Output distribution master channel module address (P. 9-89), Output distribution master channel selection (P. 9-90)

Proportional cycle time	RKC communication identifier	T0
	Modbus register address	ch1: 00FAH (250) ch2: 00FBH (251)

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: 2 (Data of each channel)
Data range: 0.1 to 100.0 seconds
Factory set value: Relay contact output: 20.0
Voltage pulse output (V), Triac output (T) and Open-collector output (D): 2.0
Related parameters: Output assignment (P. 9-50)

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

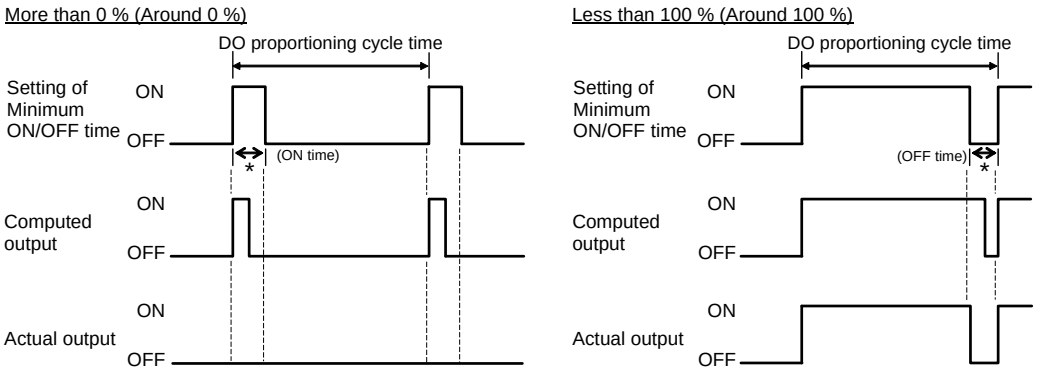
📖 This item becomes RO for the Voltage/Current output specification.

Minimum ON/OFF time of proportioning cycle	RKC communication identifier	VI
	Modbus register address	ch1: 00FEH (254) ch2: 00FFH (255)

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

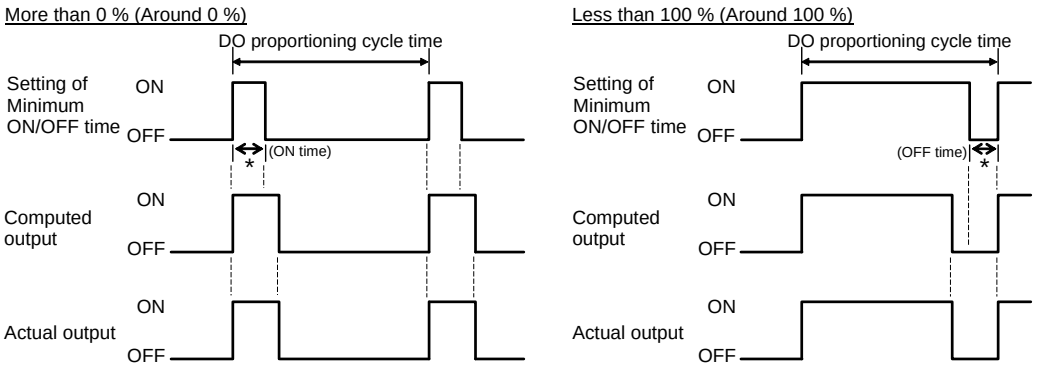
Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0 to 1000 ms
Factory set value: 0
Related parameters: Proportional cycle time (P. 9-34), Output assignment (P. 9-50)
Function: The minimum ON/OFF time of the proportioning cycle is used to prevent output ON or OFF when 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.

Example 1: Setting of Minimum ON/OFF time of proportioning cycle > Computed output



* When a long minimum ON/OFF time is required for the relay, set a time longer than that time.

Example 2: Setting of Minimum ON/OFF time of proportioning cycle ≤ Computed output



* When a long minimum ON/OFF time is required for the relay, set a time longer than that time.

This item becomes RO for the Voltage/Current output specification.

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) ch2: 0103H (259)

Use to set the output value in the Manual control.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: Output limiter low to Output limiter high
Factory set value: 0.0
Related parameters: Output limiter high/low (P. 9-73)

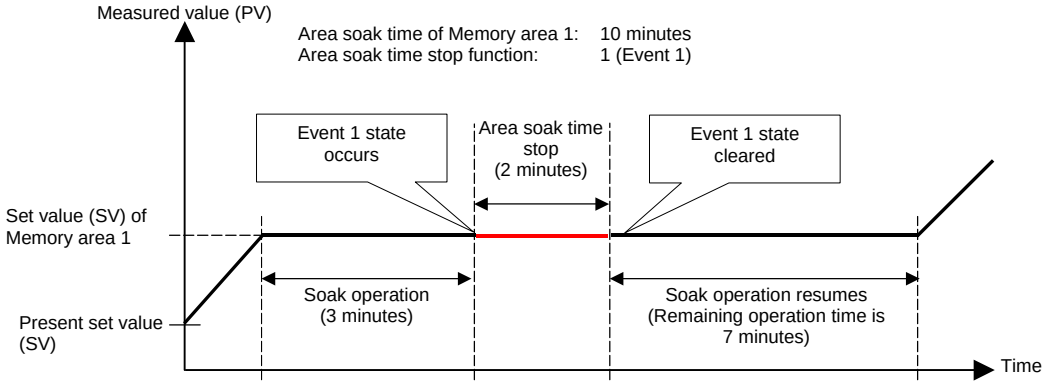
The output of the ON/OFF action in the Manual mode is as follows.
- When Manual manipulated output value ≤ Output limiter (low) (or 0.0 % or less)
  → Output limiter (low)
- When Manual manipulated output value > Output limiter (low) (or 0.0 % or less)
  → Output limiter (high)

Area soak time stop function	RKC communication identifier	RV
	Modbus register address	ch1: 0106H (262) ch2: 0107H (263)

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

Attribute: R/W
Digits: 1 digit
Number of data: 2 (Data of each channel)
Data range: 0: No function 3: Event 3
1: Event 1 4: Event 4
2: Event 2
Factory set value: 0
Related parameters: Area soak time (P. 9-27)
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:



Operation mode	RKC communication identifier	EI
	Modbus register address	ch1: 0142H (322) ch2: 0143H (323)

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: 2 (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 [including LBA] are performed)
3: Control (Control is performed)
Factory set value: 3
Related parameters: Operation mode state monitor (P. 9-5), RUN/STOP transfer (P. 9-16), Control RUN/STOP holding setting (P. 9-94)

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 %	Manipulated output value at STOP mode		
	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. 9-55).
Control state		Event function*	Action according to the selection in “Event Hold Action” (P. 9-55).
		Control	Action according to the settings in “Control RUN/STOP Hold Setting” (P. 9-94), “Hot/Cold Start” (P. 9-63), and “Start Determination Point” (P. 9-64).
Unused or Monitor ↓ Monitor + Event function	RUN state	Event function*	Action according to the selection in “Event Hold Action” (P. 9-55).
Unused or Monitor ↓ Control		Event function*	Action according to the selection in “Event Hold Action” (P. 9-55).
		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).

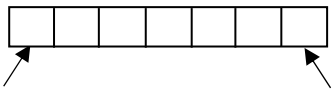
Link Z-TIO module and Z-DIO module to switch Operation mode by using Digital input (DI). For details, refer to **Address of interacting modules (P. 9-91), Selection switch of interacting modules (P. 9-92)** and **SRZ Instruction Manual (IMS01T04-E□)**.

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 computation 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 to Most significant digit: Unused

Modbus: 0 to 3 (bit data)
Communication switch for logic is assigned as a bit image in binary numbers.

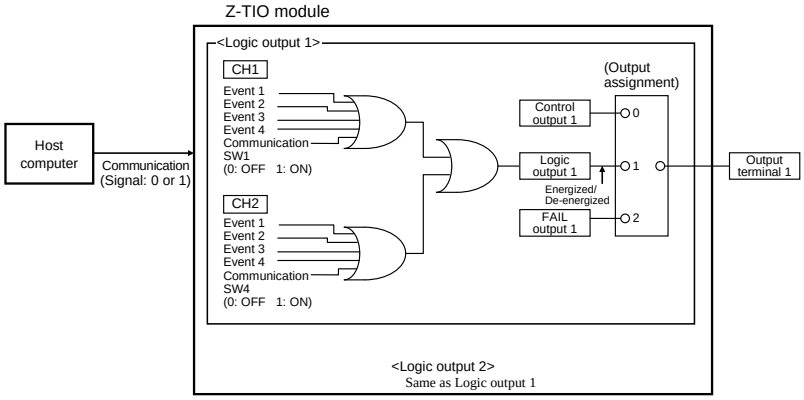
Bit image: 0000000000000000
Bit 15 ····· Bit 0

Bit 0: Communication switch 1
Bit 1: Communication switch 2
Bit 2 to Bit 15: Unused

Bit data: 0: OFF 1: ON

Factory set value: 0
Related parameters: Logic output monitor (P. 9-12), Output assignment (P. 9-50), Operation mode assignment (P. 9-82)

Example: Applying an event signal from a host computer to logic switch 1



☞ For a block diagram of the logic output selection function, refer to **12. APPENDIX (P. 12-5).**

9.3 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 Engineering setting data are set correctly, those data 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.

■ 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).

9.3.1 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 parameter is changed

When the input type is changed, all the setting in the following table will be changed. Reset the settings to the values that you wish to use.

Input type (RKC communication identifier: XI, Modbus address: 0176H to 0177H)

Items that are initialized:

Data type	Items	Default value
Engineering setting data	Decimal point position	RTD input: 2 or 3 Voltage (V) input: 3
	Input scale high	RTD input: Maximum value of the selected input range Voltage (V) input: 100.00
	Input scale low	RTD input: Minimum value of the selected input range Voltage (V) input: 0.00
	Input error determination point (high)	RTD input: Input range high + (5 % of Input span) Voltage (V) input: +105.00
	Input error determination point (low)	RTD input: Input range low – (5 % of Input span) Voltage (V) input: –5.00
	Burnout direction	0: Upscale

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Data type	Items	Default value
Engineering setting data	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	Deviation/Process/Set value/ Deviation action between channels: 1.00 Manipulated output value action: 1.0
	Event 2 differential gap	
	Event 3 differential gap	
	Event 4 differential gap	
	Event 1 delay timer	0
	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)	RTD input: 1.00 °C Voltage (V) input: 1.00 % of input span
	ON/OFF action differential gap (lower)	
	AT bias	0.00
	Proportional band limiter (high)	RTD input: Input span Voltage (V) input: 300.00 % of input span
	Proportional band limiter (low)	RTD input: 0.00 °C Voltage (V) input: 0.00 % of input span
	Integral time limiter (high)	3000.0 seconds
	Integral time limiter (low)	0.0 seconds
	Derivative time limiter (high)	3000.0 seconds
	Derivative time limiter (low)	0.0 seconds
	Setting limiter high	Input scale high
	Setting limiter low	Input scale low

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Data type	Items	Default value
Normal setting data	Event 1 set value (EV1)	50.00
	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	0.00
	Set value (SV)	RTD input: 0.00 (0.000) °C Voltage (V) input: 0.000
	Proportional band	RTD input: 30.00 °C Voltage (V) input: 30.00 % of input span
	Integral time	240.0 seconds
	Derivative time	60.0 seconds
	Control response parameter	0 (Slow)
	Setting change rate limiter (up)	0.00
	Setting change rate limiter (down)	0.00
	PV bias	0.00 (0.000)
	PV ratio	1.000
	RS bias	0.00
	RS ratio	1.000

- **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 01A3H)
Event 2 type (RKC communication identifier: XB, Modbus address: 01BEH to 01BFH)
Event 3 type (RKC communication identifier: XC, Modbus address: 01DAH to 01DBH)
Event 4 type (RKC communication identifier: XD, Modbus address: 01F6H to 01F7H)

Data type	Items	Default value
Engineering setting data	Event 1 hold action	0 (OFF)
	Event 2 hold action	
	Event 3 hold action	
	Event 4 hold action [1]	
	Event 1 interlock	0 (Unused)
	Event 2 interlock	
	Event 3 interlock	
	Event 4 interlock [1]	
	Event 1 differential gap	Deviation/Process/Set value/ Deviation action between channels: 1.00 Manipulated output value action: 1.0
	Event 2 differential gap	
	Event 3 differential gap	
	Event 4 differential gap [1]	

[1] Except when the Event 4 type is “Control loop break alarm (LBA).”

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Data type	Items	Default value
Engineering setting data	Event 1 delay timer	0
	Event 2 delay timer	
	Event 3 delay timer	
	Event 4 delay timer [1]	
	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 [1]	
Normal setting data	Event 1 set value (EV1)	50.00
	Event 2 set value (EV2)	
	Event 3 set value (EV3)	
	Event 4 set value (EV4) [1]	
	Control loop break alarm (LBA) time [2]	480 seconds
	LBA deadband [2]	0.00

[1] Except when the Event 4 type is "Control loop break alarm (LBA)."

[2] When the Event 4 type is changed to "Control loop break alarm (LBA)."

● When the Decimal point position parameter is changed

When the input decimal point position is changed (RKC communication identifier: XU, Modbus address: 017EH to 017FH), 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	Start determination point
	Input scale low	ON/OFF action differential gap (upper) [2]
	Input error determination point (high)	ON/OFF action differential gap (lower) [2]
	Input error determination point (low)	AT bias
	Event 1 differential gap [1]	Proportional band limiter (high) [2]
	Event 2 differential gap [1]	Proportional band limiter (low) [2]
	Event 3 differential gap [1]	Setting limiter high
	Event 4 differential gap [1]	Setting limiter low
Normal setting data	Measured value (PV)	LBA deadband
	SV monitor	Set value (SV)
	Remote setting (RS) input value monitor	Proportional band [2]
	Event 1 set value (EV1) [1]	Setting change rate limiter (up)
	Event 2 set value (EV2) [1]	Setting change rate limiter (down)
	Event 3 set value (EV3) [1]	PV bias
	Event 4 set value (EV4) [1]	RS bias

[1] Only for deviation, process, or set value.

[2] Only for RTD input.

● When the Input scale high/low 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 0183H)
Input scale low (RKC communication identifier: XW, Modbus address: 0186H to 0187H)

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]	ON/OFF action differential gap (upper) [2]
	Event 2 differential gap [1]	ON/OFF action differential gap (lower) [2]
	Event 3 differential gap [1]	AT bias
	Event 4 differential gap [1]	Proportional band limiter (high) [2]
	Start determination point	Proportional band limiter (low) [2]
Normal setting data	Event 1 set value (EV1) [1]	Proportional band [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
	Set value (SV)	

[1] Only for deviation, process, or set value.
[2] Only for RTD input.

● 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 0237H), 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)	Derivative time limiter (high)
	Integral time limiter (low)	Derivative time limiter (low)
Normal setting data	Integral time	Derivative time

● When the Output limiter high/low 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 (RKC communication identifier: OH, Modbus address: 026AH to 026BH)
Output limiter low (RKC communication identifier: OL, Modbus address: 026EH to 026FH)

Data type	Items
Normal setting data	Manual manipulated output value

● When the Soak time unit parameter is changed

When the soak time unit (RKC communication identifier: RU, Modbus address: 0322H to 0323H) 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/low 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 0327H)
Setting limiter low (RKC communication identifier: SL, Modbus address: 032AH to 032BH)

Data type	Items
Normal setting data	Set value (SV)

9.3.2 Setting data common to Z-TIO-A/B/C/D/G

Input type	RKC communication identifier	XI
	Modbus register address	ch1: 0176H (374) ch2: 0177H (375)

Input type number is a number to indicate an input type.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: RTD input [Pt100]:
30: −50.000 to +150.000 °C
31: −50.00 to +250.00 °C
32: −150.00 to +150.00 °C
Voltage (V) input:
19: 0 to 1 V DC
Factory set value: Based on model code
If input range code is not specified: 30

Do not set to any number which is not described in the input range 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 ● **When the Input type parameter is changed (P. 9-39)**.

Related parameters: Decimal point position (P. 9-46), Input scale high/low (P. 9-46)

Display unit	RKC communication identifier	PU
	Modbus register address	ch1: 017AH (378) ch2: 017BH (379)

Use to select the temperature unit for RTD input.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0: °C
Factory set value: 0

The invalidity in case of the Voltage (V) input.

Decimal point position	RKC communication identifier	XU
	Modbus register address	ch1: 017EH (382) ch2: 017FH (383)

Use to select the Decimal point position of the input range.

Attribute: R/W

Digits: 7 digits

Number of data: 2 (Data of each channel)

Data range: 0: No decimal place 2: Two decimal places
1: One decimal place 3: Three decimal places

RTD input: From 0 to 3 can be set.
Voltage (V) input: 3 (Fixed)

Factory set value: Based on model code
If input range code is not specified: 3

Related parameters: Proportional band (P. 9-22), Input type (P. 9-45), Input scale high/low (P. 9-46)

Input scale high	RKC communication identifier	XV
	Modbus register address	ch1: 0182H (386) ch2: 0183H (387)
Input scale low	RKC communication identifier	XW
	Modbus register address	ch1: 0186H (390) ch2: 0187H (391)

Use to set the high limit and low limit of the input scale range.

Attribute: R/W

Digits: 7 digits

Number of data: 2 (Data of each channel)

Data range: [Input scale high]
RTD input: Input scale low to Maximum value of the selected input range
Voltage (V) input: –99.99 to +300.00 [However, a span is 200.00 or less.]
(Varies with the setting of the decimal point position.
However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)
[Input scale low]
RTD input: Minimum value of the selected input range to Input scale high
Voltage (V) input: –99.99 to +300.00 [However, a span is 200.00 or less.]
(Varies with the setting of the decimal point position.
However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)

Factory set value: [Input scale high]
RTD input: Maximum value of the selected input range
Voltage (V) input: 100.00
[Input scale low]
RTD input: Minimum value of the selected input range
Voltage (V) input: 0.00

Related parameters: Input type (P. 9-45), Decimal point position (P. 9-46)

When a Voltage (V) input type is selected, the Input scale high can be set lower than the Input scale low. (Input scale high < Input scale low)

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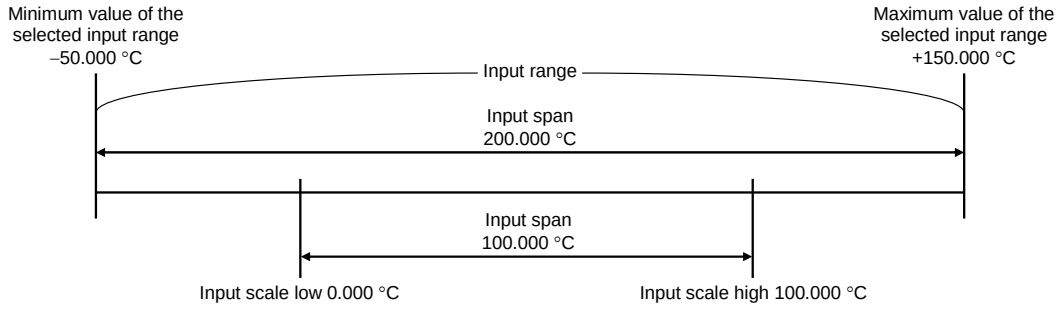
Function: The input range can be changed for RTD input.
For Voltage (V) input, display scaling can be made in the range of –99.99 to +300.00.

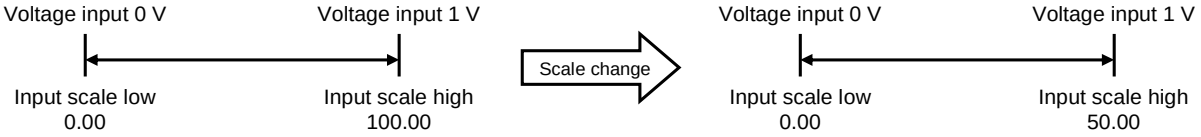
Example 1 [RTD input]:

When the range of –50.000 to +150.000 °C for RTD input is changed to 0.000 to 100.000 °C



Example 2 [Voltage (V) input]:

When the input scale is changed to “0.00 to 50.00” from “0.00 to 100.00” at a voltage input of 0 to 1 V DC



Input error determination point (high)	RKC communication identifier	AV
	Modbus register address	ch1: 018AH (394) ch2: 018BH (395)
Input error determination point (low)	RKC communication identifier	AW
	Modbus register address	ch1: 018EH (398) ch2: 018FH (399)

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: 2 (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)
(Varies with the setting of the decimal point position.
However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)

[Input error determination point (low)]
(Input range low – 5 % of Input span) to Input error determination point (high limit)
(Varies with the setting of the decimal point position.
However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)

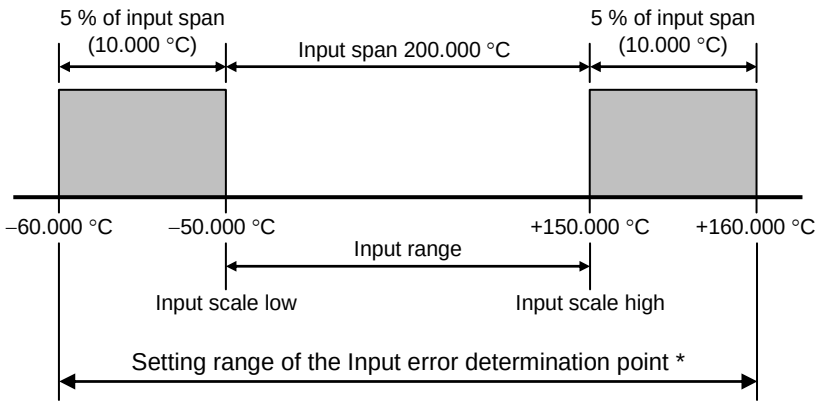
Factory set value: [Input error determination point (high)]
Input range high + (5 % of Input span)

[Input error determination point (low)]
Input range low – (5 % of Input span)

Related parameters: Action (high/low) at input error (P. 9-70),
Manipulated output value at input error (P. 9-71)

Example: When the input scale range is –50.000 to +150.000 °C

Input span: 200.000
5 % of input span: 10.000
Setting range: –60.000 to +160.000 °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) ch2: 0193H (403)

Use to select Burnout direction in input break.

Attribute: R/W
Digits: 1 digit
Number of data: 2 (Data of each channel)
Data range: 0: Upscale
Factory set value: 0

For RTD input, regardless of burnout setting, the instrument goes upscale at the time of input disconnection and the input short-circuit.

Square root extraction	RKC communication identifier	XH
	Modbus register address	ch1: 0196H (406) ch2: 0197H (407)

Use to select use/unuse of the Square root extraction for the measured value (PV).

Attribute: R/W
Digits: 1 digit
Number of data: 2 (Data of each channel)
Data range: 0: Unused
1: Used
Factory set value: 0
Related parameters: PV low input cut-off (P. 9-30)
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) ch2: 019BH (411)

This is used to assign the output function (control output, logic output result and FAIL output) for the output 1 (OUT1) and output 2 (OUT2).

Attribute: R/W

Digits: 1 digit

Number of data: 2 (Data of each channel)

Data range: 0: Control output
1: Logic output result
2: FAIL output

Factory set value: Output 1 (OUT1): 0
Output 2 (OUT2): 0

Related parameters: Energized/De-energized (P. 9-51), Event type (P. 9-52), Communication switch for logic (P. 9-38)

[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, refer to **12. APPENDIX (P. 12-5).**

Energized/De-energized (Logic output selection function)	RKC communication identifier	NA
	Modbus register address	ch1: 019EH (414) ch2: 019FH (415)

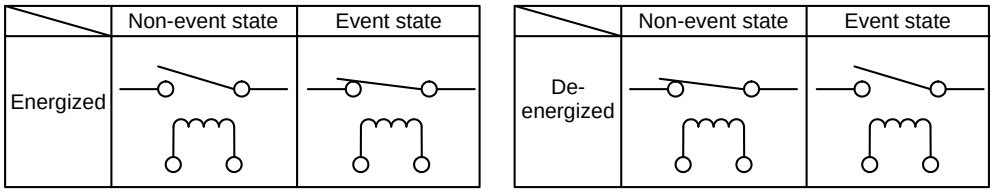
Energized/De-energized can be selected for any of outputs 1 (OUT1) and 2 (OUT2) that have an output function (logic output result) assigned.

Attribute: R/W
Digits: 1 digit
Number of data: 2 (Data of each channel)
Data range: 0: Energized
1: De-energized
Factory set value: 0
Related parameters: Output assignment (P. 9-50), Event type (P. 9-52), Communication switch for logic (P. 9-38)
Function: Action of Energized/De-energized

Energized/De-energized setting	Output state of OUT1 and OUT2	
	Non-event state	Event state
Energized	Event output OFF	Event output ON
De-energized	Event output ON	Event output OFF

Example: Relay contact output
Energized: Relay contact is closed under the event or alarm state.
De-energized: Relay contact opens under the event or alarm state.

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) ch2: 01A3H (419)
Event 2 type	RKC communication identifier	XB
	Modbus register address	ch1: 01BEH (446) ch2: 01BFH (447)
Event 3 type	RKC communication identifier	XC
	Modbus register address	ch1: 01DAH (474) ch2: 01DBH (475)
Event 4 type	RKC communication identifier	XD
	Modbus register address	ch1: 01F6H (502) ch2: 01F7H (503)

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: 2 (Data of each channel)
Data range: 0 to 21

Data range	Factory set value
0: None	Based 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 [1] 11: MV low [1] 12: Unused 13: Unused	
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, Event 2, and Event 3) 9: Control loop break alarm (LBA) (Only for Event 4)	

[1] Event hold action is available.

Related parameters: Comprehensive event state (P. 9-4), Event state monitor (P. 9-8), Event set value (P. 9-19), Output assignment (P. 9-50), Event interlock (P. 9-57), Event differential gap (P. 9-58), Event delay timer (P. 9-59)

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Funtion:

- **Event function**

Diagrams of the event action type are shown in the following.

ON: Event action turned on, OFF: Event action turned off

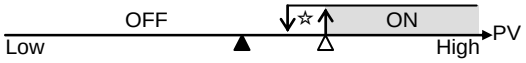
(▲: Set value (SV) △: Event set value ☆: Event differential gap)

Deviation action:

When 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.)

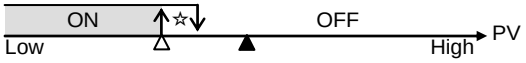


(Event set value is less than 0.)

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.)



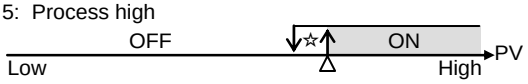
3: Deviation high/low (using SV monitor value)
16: Deviation high/low (using Local SV value)

4: Band (using SV monitor value)
17: Band (using Local SV value)

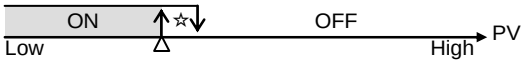
Input value action:

When the measured value (PV) reaches the event set value, event ON occurs.

5: Process high



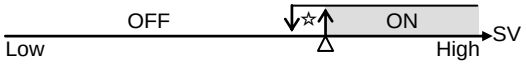
6: Process low



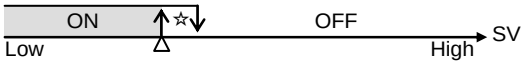
Set value action:

When the set value (SV) reaches the event set value, event ON occurs.

7: SV high:



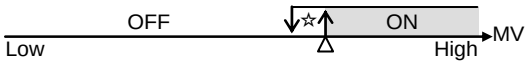
8: SV low:



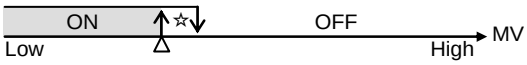
Manipulated output value action:

When the manipulated output value (MV) reaches the event set value, event ON occurs.

10: MV high



11: MV low



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")

- **Control loop break alarm (LBA) function**

☞ For LBA function, refer to **Control loop break alarm (LBA) time (P. 9-20).**

Event 1 channel setting	RKC communication identifier	FA
	Modbus register address	ch1: 01A6H (422) ch2: 01A7H (423)
Event 2 channel setting	RKC communication identifier	FB
	Modbus register address	ch1: 01C2H (450) ch2: 01C3H (451)
Event 3 channel setting	RKC communication identifier	FC
	Modbus register address	ch1: 01DEH (478) ch2: 01DFH (479)
Event 4 channel setting	RKC communication identifier	FD
	Modbus register address	ch1: 01FAH (506) ch2: 01FBH (507)

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: 2 (Data of each channel)
Data range: 1: Channel 1
2: Channel 2
Factory set value: 1
Related parameters: Event type (P. 9-52)

Event 1 hold action	RKC communication identifier	WA
	Modbus register address	ch1: 01AAH (426) ch2: 01ABH (427)
Event 2 hold action	RKC communication identifier	WB
	Modbus register address	ch1: 01C6H (454) ch2: 01C7H (455)
Event 3 hold action	RKC communication identifier	WC
	Modbus register address	ch1: 01E2H (482) ch2: 01E3H (483)
Event 4 hold action	RKC communication identifier	WD
	Modbus register address	ch1: 01FEH (510) ch2: 01FFH (511)

Use to set an event hold action for the Event.

Attribute: R/W

Digits: 1 digit

Number of data: 2 (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.	Based on model code When not specifying: 0

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

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. 9-4), Event state monitor (P. 9-8), Event set value (P. 9-19), Event type (P. 9-52), Event interlock (P. 9-57), Event differential gap (P. 9-58), Event delay timer (P. 9-59)

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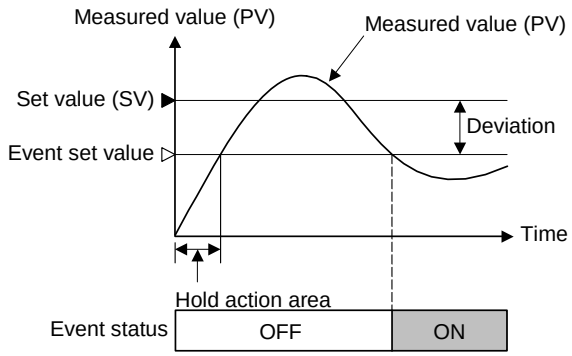
Function:

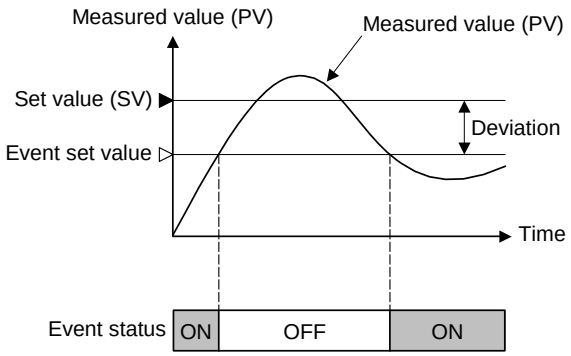
- **Hold action**

When hold action is ON, the Event action is suppressed at start-up or STOP to RUN until the Measured value (PV) has entered the non-event range.

[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 (PV) has entered the non-event range.

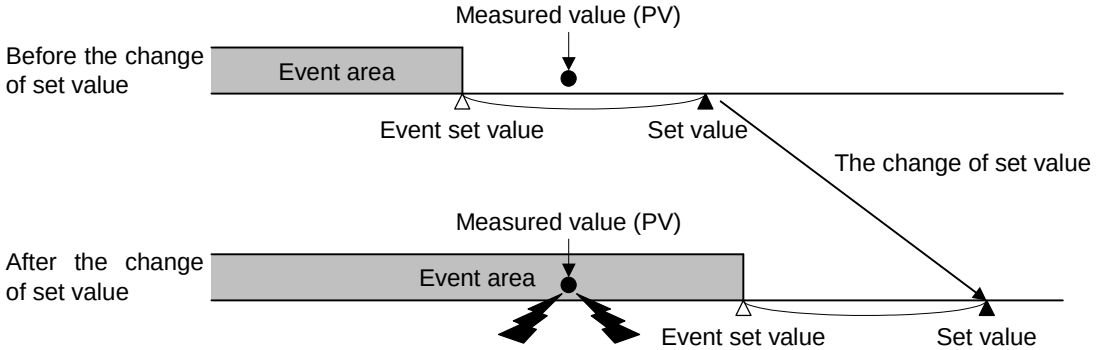
Action condition	1: Hold action ON (Only hold action)	2: Re-hold action ON (Hold and re-hold actions)
When the power is turned on	Hold action	Hold action
When transferred from STOP (control STOP) to RUN (control RUN)	Hold action	Hold action
When the Set value (SV) is changed	Without hold and re-hold 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 (PV) has entered the non-event range again.



Event 1 interlock	RKC communication identifier	LF
	Modbus register address	ch1: 01AEH (430) ch2: 01AFH (431)
Event 2 interlock	RKC communication identifier	LG
	Modbus register address	ch1: 01CAH (458) ch2: 01CBH (459)
Event 3 interlock	RKC communication identifier	LH
	Modbus register address	ch1: 01E6H (486) ch2: 01E7H (487)
Event 4 interlock	RKC communication identifier	LI
	Modbus register address	ch1: 0202H (514) ch2: 0203H (515)

Use to select the interlock function for the Event.

Attribute: R/W

Digits: 1 digit

Number of data: 2 (Data of each channel)

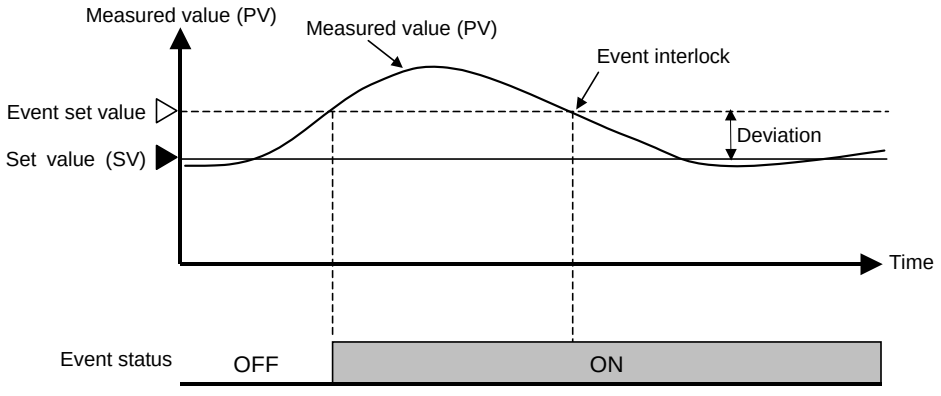
Data range: 0: Unused
1: Used

Factory set value: 0

Related parameters: Comprehensive event state (P. 9-4), Event state monitor (P. 9-8), Event set value (P. 9-19), Event type (P. 9-52), Event differential gap (P. 9-58), Event delay timer (P. 9-59), Force ON of Event action (P. 9-61)

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) ch2: 01B3H (435)
Event 2 differential gap	RKC communication identifier	HB
	Modbus register address	ch1: 01CEH (462) ch2: 01CFH (463)
Event 3 differential gap	RKC communication identifier	HC
	Modbus register address	ch1: 01EAH (490) ch2: 01EBH (491)
Event 4 differential gap	RKC communication identifier	HD
	Modbus register address	ch1: 0206H (518) ch2: 0207H (519)

Use to set a differential gap of the Event.

Attribute: R/W

Digits: 7 digits

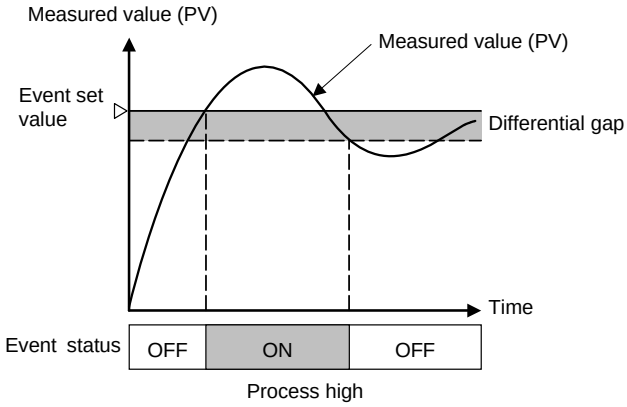
Number of data: 2 (Data of each channel)

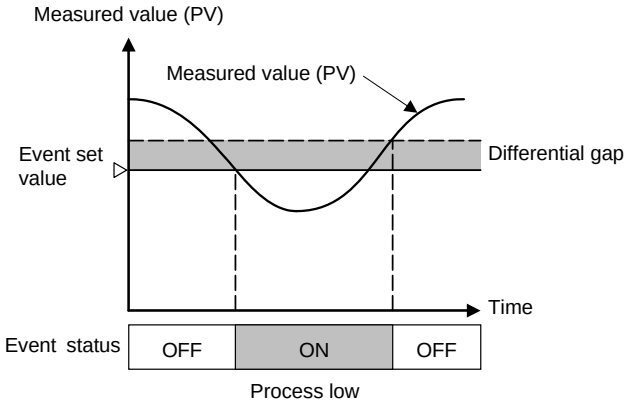
Data range: ① Deviation, Process, Set value, Deviation action between channels:
0 (0.0, 0.00) to Input span (Unit: °C)
(Varies with the setting of the decimal point position.
However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)
② MV: 0.0 to 110.0 %

Factory set value: ① Deviation, Process, Set value, Deviation action between channels:
1.00
② MV: 1.0

Related parameters: Comprehensive event state (P. 9-4), Event state monitor (P. 9-8), Event set value (P. 9-19), Event type (P. 9-52), Event interlock (P. 9-57), Event delay timer (P. 9-59), Force ON of Event action (P. 9-61)

Function: It prevents chattering of event output due to the Measured value (PV) fluctuation around the event set value.





When the Event 4 type is “9: Control loop break alarm (LBA),” the Event 4 differential gap setting is not effective.

Event 1 delay timer	RKC communication identifier	TD
	Modbus register address	ch1: 01B6H (438) ch2: 01B7H (439)
Event 2 delay timer	RKC communication identifier	TG
	Modbus register address	ch1: 01D2H (466) ch2: 01D3H (467)
Event 3 delay timer	RKC communication identifier	TE
	Modbus register address	ch1: 01EEH (494) ch2: 01EFH (495)
Event 4 delay timer	RKC communication identifier	TF
	Modbus register address	ch1: 020AH (522) ch2: 020BH (523)

Event delay timer is to set an output delay time for event outputs.

Attribute: R/W

Digits: 7 digits

Number of data: 2 (Data of each channel)

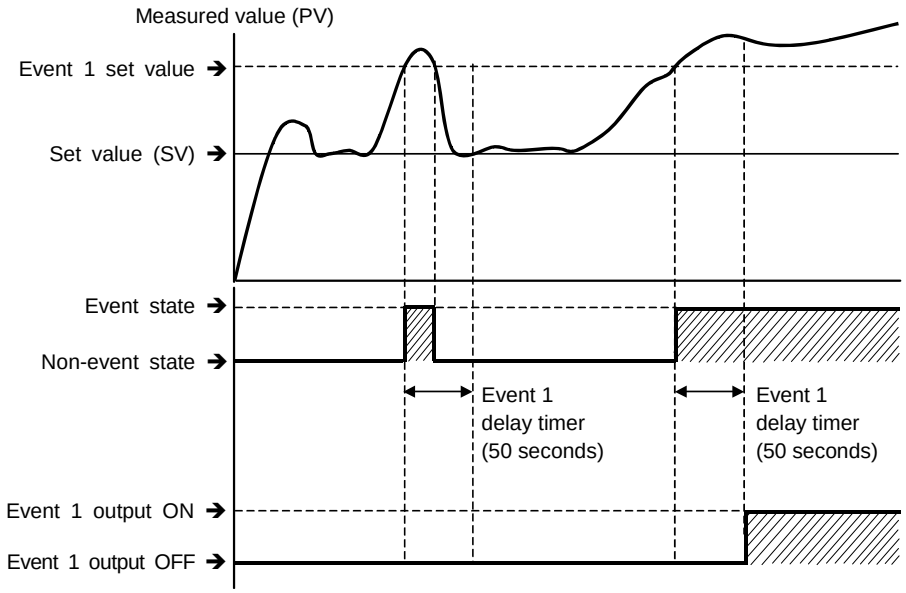
Data range: 0 to 18000 seconds

Factory set value: 0

Related parameters: Comprehensive event state (P. 9-4), Event state monitor (P. 9-8), Event set value (P. 9-19), Event type (P. 9-52), Event interlock (P. 9-57), Event differential gap (P. 9-58), Force ON of Event action (P. 9-61)

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.

Example: When the setting of Event 1 delay timer is 50 seconds



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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.

Force ON of Event 1 action	RKC communication identifier	OA
	Modbus register address	ch1: 01BAH (442) ch2: 01BBH (443)
Force ON of Event 2 action	RKC communication identifier	OB
	Modbus register address	ch1: 01D6H (470) ch2: 01D7H (471)
Force ON of Event 3 action	RKC communication identifier	OC
	Modbus register address	ch1: 01F2H (498) ch2: 01F3H (499)
Force ON of Event 4 action	RKC communication identifier	OD
	Modbus register address	ch1: 020EH (526) ch2: 020FH (527)

Select the operation state that is output (force ON) as the event action.

Attribute: R/W

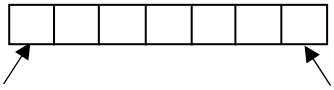
Digits: 7 digits

Number of data: 2 (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. 9-48),
Action (high/low) at input error (P. 9-70)

This setting is not effective when the event type is "0: None."

The Force ON of Event 4 action is not effective when the Event 4 type corresponds to "9: Control loop break alarm (LBA)."

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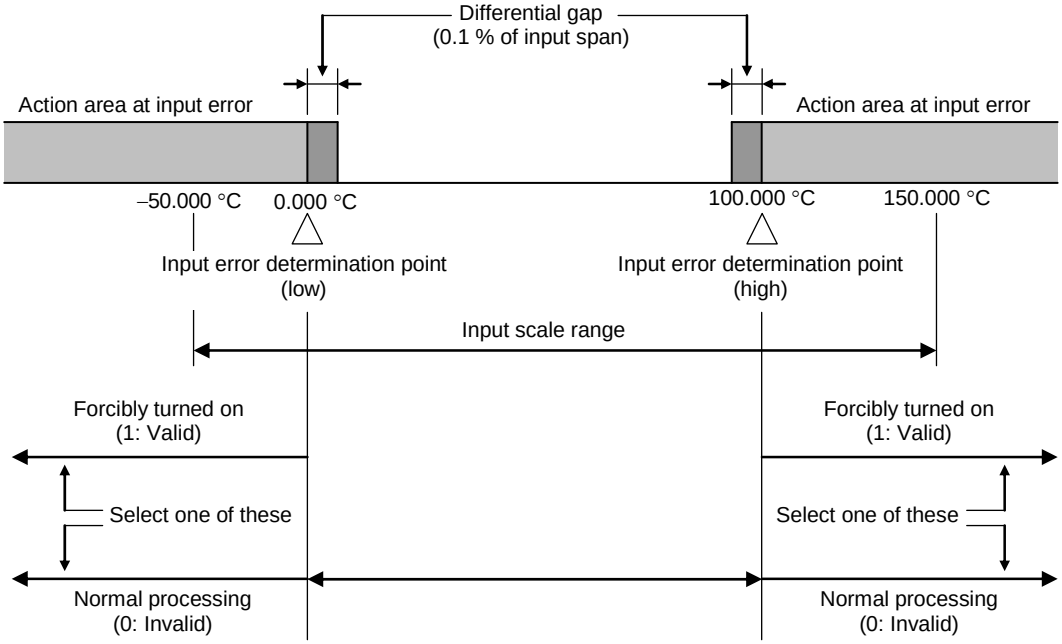
Example: When “0: Event output turned on at input error occurrence” is selected

Input range: –50.000 to +150.000 °C
Input error determination point (high): 100.000 °C
Input error determination point (low): 0.000 °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.

Hot/Cold start	RKC communication identifier	XN
	Modbus register address	ch1: 0222H (546) ch2: 0223H (547)

Use to select the start mode at power recovery.

Attribute: R/W

Digits: 1 digit

Number of data: 2 (Data of each channel)

Data range: 0: Hot start 1
1: Hot start 2
2: Cold start

Factory set value: 0

Related parameters: RUN/STOP transfer (P. 9-16), Operation mode (P. 9-37), Start determination point (P. 9-64)

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
Cold start	Manual	Output limiter low	

[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.

Start determination point	RKC communication identifier	SX
	Modbus register address	ch1: 0226H (550) ch2: 0227H (551)

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

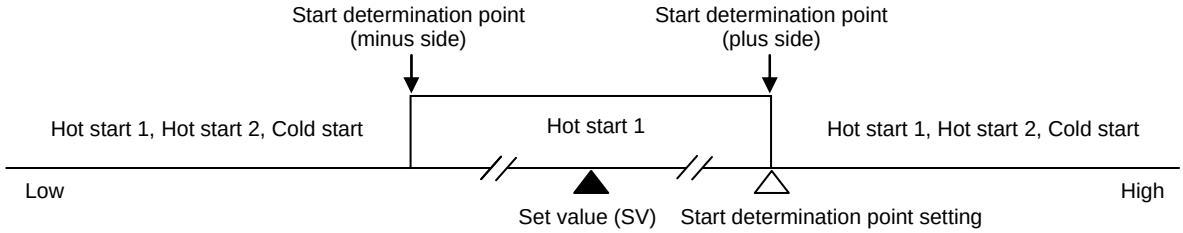
Number of data: 2 (Data of each channel)

Data range: 0 (0.0, 0.00) to Input span (The unit is the same as input value.)
0 (0.0, 0.00): Action depending on the Hot/Cold start selection
(Varies with the setting of the decimal point position.
However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)

Factory set value: Based on specification (value equivalent to 3% of input span)

Related parameters: RUN/STOP transfer (P. 9-16), Hot/Cold start (P. 9-63)

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.

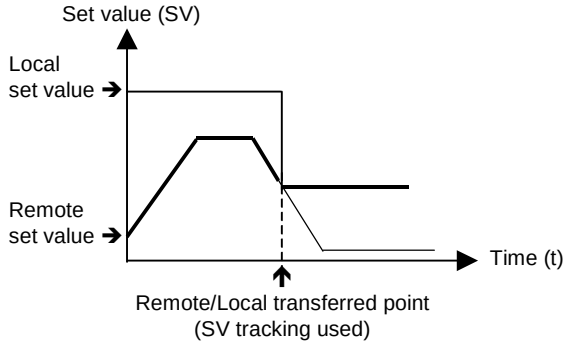


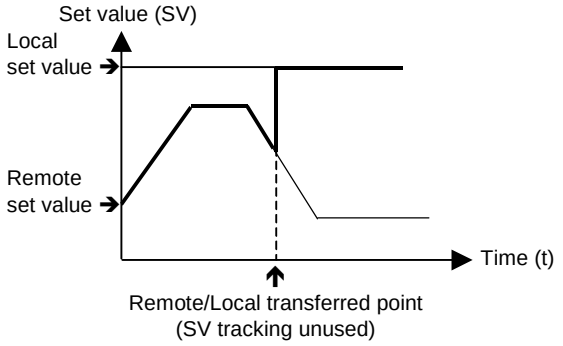
SV tracking	RKC communication identifier	XL
	Modbus register address	ch1: 022AH (554) ch2: 022BH (555)

To select Use/Unuse of SV tracking.

Attribute: R/W
Digits: 1 digit
Number of data: 2 (Data of each channel)
Data range: 0: Unused
1: Used
Factory set value: 1
Related parameters: Remote/Local transfer (P. 9-16)
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) ch2: 022FH (559)

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: 2 (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
Related parameters: Auto/Manual transfer (P. 9-15)
Function: For the Balanceless/Bumpless function, refer to **Auto/Manual transfer (P. 9-15)**.

Control action	RKC communication identifier	XE
	Modbus register address	ch1: 0232H (562) ch2: 0233H (563)

Use to select the control action type.

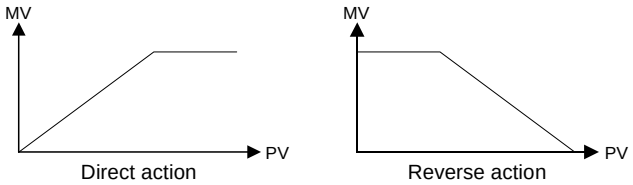
Attribute: R/W
Digits: 1 digit
Number of data: 2 (Data of each channel)
Data range: 0: Brilliant II PID control (Direct action)
1: Brilliant II PID control (Reverse action)
Factory set value: Based on model code
When not specifying: 1
Function:

- **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.



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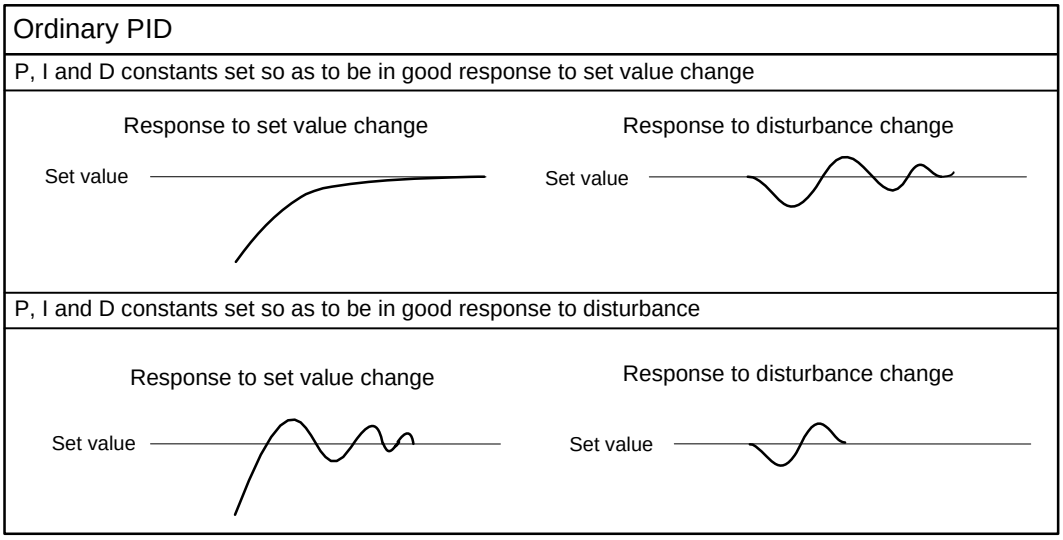
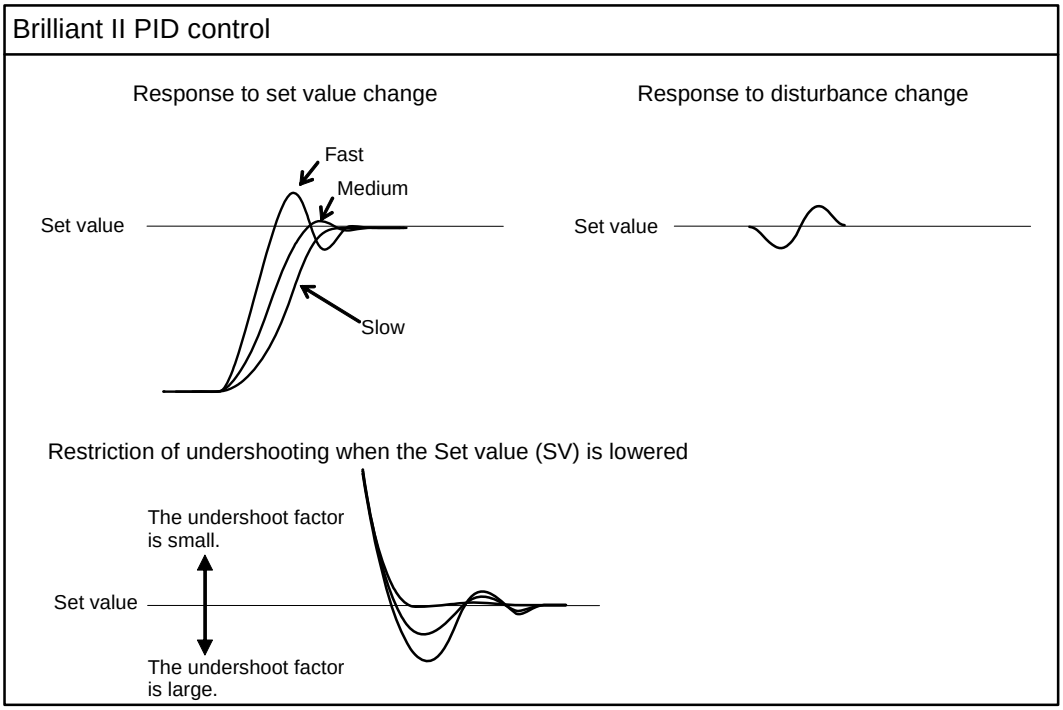
- **Brilliant II PID control**

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 Set value (SV) setting," "response to disturbances" deteriorates. In contrast, if PID constants are set so as to be in good "response to disturbances," "response to Set value (SV) setting" deteriorates. In brilliant II PID control a form of "response to Set value (SV) setting" can be selected from among Fast, Medium and Slow with PID constants remaining unchanged so as to be in good "response to disturbances."





Integral/Derivative time decimal point position	RKC communication identifier	PK
	Modbus register address	ch1: 0236H (566) ch2: 0237H (567)

Use to select a decimal point position of integral time and derivative time.

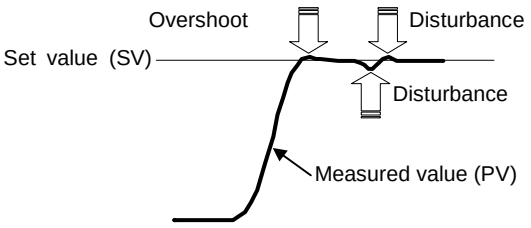
Attribute: R/W
Digits: 1 digit
Number of data: 2 (Data of each channel)
Data range: 1: 0.1 seconds setting (One decimal place)
Factory set value: 1
Related parameters: Integral time (P. 9-23), Derivative time (P. 9-23),
Integral time limiter (high/low) (P. 9-79),
Derivative time limiter (high/low) (P. 9-80)

Derivative action	RKC communication identifier	KA
	Modbus register address	ch1: 023AH (570) ch2: 023BH (571)

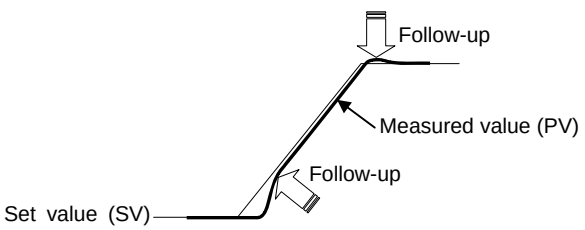
Use to select the derivative action.

Attribute: R/W
Digits: 1 digit
Number of data: 2 (Data of each channel)
Data range: 0: Measured value derivative
1: Deviation derivative
Factory set value: 0
Related parameters: PID/AT transfer (P. 9-13)
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 used to initiate follow-up upon start-up of load and to suppress overshooting when switching from ramp to soak.

Measured value derivative (PID control)



Deviation derivative (PID control)



Derivative gain	RKC communication identifier	DG
	Modbus register address	ch1: 0242H (578) ch2: 0243H (579)

Use to set a gain used for the derivative action in PID control. Derivative gain should not be changed under ordinary operation.

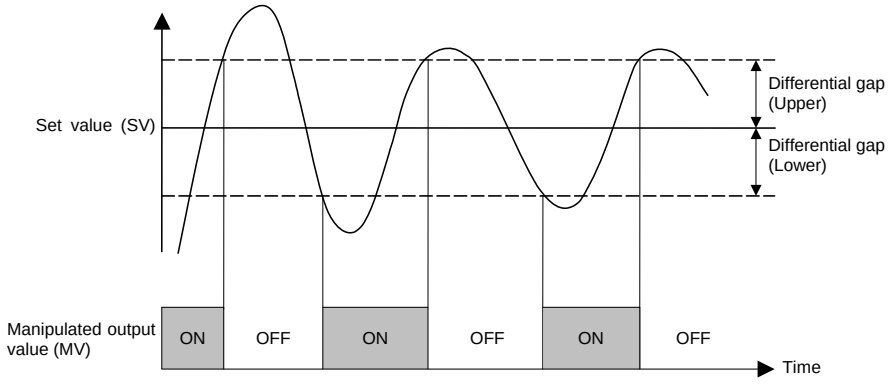
Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0.1 to 10.0
Factory set value: 6.0
Related parameters: Derivative time (P. 9-23)

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) ch2: 0247H (583)
ON/OFF action differential gap (lower)	RKC communication identifier	IW
	Modbus register address	ch1: 024AH (586) ch2: 024BH (587)

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: 2 (Data of each channel)
Data range: RTD input: 0 (0.0, 0.00) to Input span (Unit: °C)
(Varies with the setting of the decimal point position.
However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)
Voltage (V) input: 0.00 to 100.00 % of input span
Factory set value: RTD input: 1.00
Voltage (V) input: 1.00
Related parameters: Proportional band (P. 9-22)
Function: ON/OFF control is possible when the Proportional band is set to “0,” “0.0” or “0.00.” 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) ch2: 024FH (591)
Action (low) at input error	RKC communication identifier	WL
	Modbus register address	ch1: 0252H (594) ch2: 0253H (595)

Action (high) at input error:

Use to select the action when the Measured value (PV) reaches the Input error determination point (high).

Action (low) at input error:

Use to select the action when the Measured value (PV) reaches the Input error determination point (low).

Attribute: R/W

Digits: 1 digit

Number of data: 2 (Data of each channel)

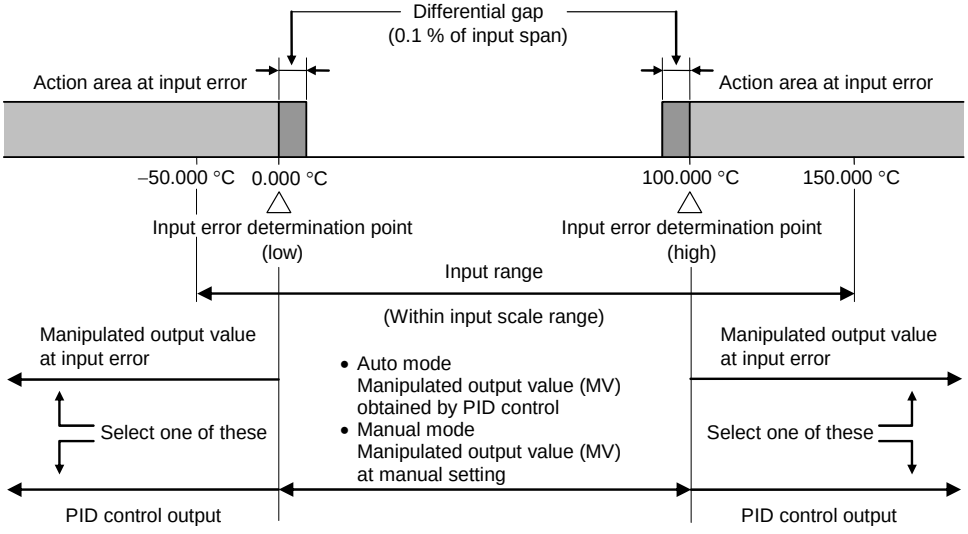
Data range: 0: Normal control (PID control output)
1: Manipulated output value at input error

Factory set value: Input error determination point (high): 0
Input error determination point (low): 0

Related parameters: Input error determination point (high/low) (P. 9-48),
Manipulated output value at input error (P. 9-71)

Function: Input Error Determination

Example: Input range: –50.000 to +150.000 °C
Input error determination point (high): 100.000 °C
Input error determination point (low): 0.000 °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.

Manipulated output value at input error	RKC communication identifier	OE
	Modbus register address	ch1: 0256H (598) ch2: 0257H (599)

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: 2 (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. 9-70), Output limiter high/low (P. 9-73)

The actual output value becomes the value restricted by the output limiter.

Manipulated output value at STOP mode	RKC communication identifier	OF
	Modbus register address	ch1: 025AH (602) ch2: 025BH (603)

Manipulated output value to be output at STOP (control stop).

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: –5.0 to +105.0 %
Factory set value: –5.0
Related parameters: RUN/STOP transfer (P. 9-16), Operation mode (P. 9-37)

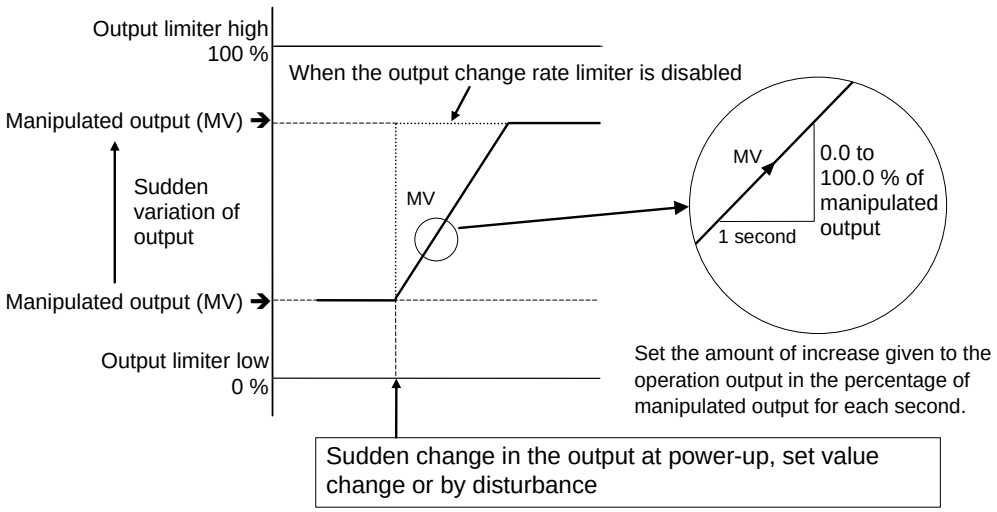
Output change rate limiter (up)	RKC communication identifier	PH
	Modbus register address	ch1: 0262H (610) ch2: 0263H (611)
Output change rate limiter (down)	RKC communication identifier	PL
	Modbus register address	ch1: 0266H (614) ch2: 0267H (615)

Set the Output change rate limiter (up, down) that limits change in the output.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0.0 to 100.0 % /second of manipulated output (0.0: OFF)
Factory set value: Output change rate limiter (up): 0.0
Output change rate limiter (down): 0.0
Related parameters: Output limiter high/low (P. 9-73)
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.

[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).

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	RKC communication identifier	OH
	Modbus register address	ch1: 026AH (618) ch2: 026BH (619)
Output limiter low	RKC communication identifier	OL
	Modbus register address	ch1: 026EH (622) ch2: 026FH (623)

Use to set the high limit value (low limit value) of Manipulated output value (MV).

Attribute: R/W

Digits: 7 digits

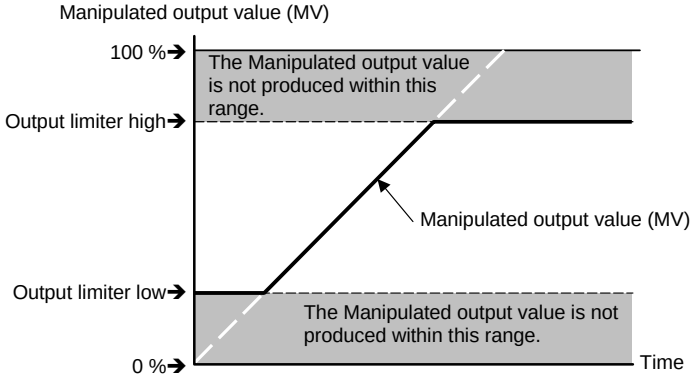
Number of data: 2 (Data of each channel)

Data range: Output limiter high: Output limiter low to 105.0 %
Output limiter low: –5.0 % to Output limiter high

Factory set value: Output limiter high: 105.0
Output limiter low: –5.0

Related parameters: Manipulated output value at input error (P. 9-71),
Output change rate limiter (up/down) (P. 9-72),
Output value with AT turned on (P. 9-76),
Output value with AT turned off (P. 9-76)

Function: This is the function which restricts the high and low limits of Manipulated output values (MV).



AT bias	RKC communication identifier	GB
	Modbus register address	ch1: 0282H (642) ch2: 0283H (643)

Use to set a bias to move the set value only when Autotuning is activated.

Attribute: R/W

Digits: 7 digits

Number of data: 2 (Data of each channel)

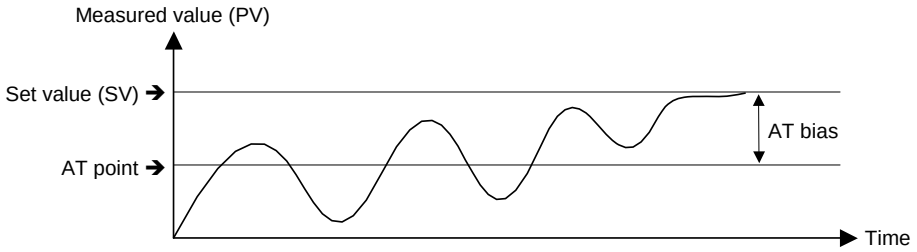
Data range: –Input span to +Input span
(Varies with the setting of the decimal point position.
However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)

Factory set value: 0.00

Related parameters: PID/AT transfer (P. 9-13)

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 compute 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] When AT bias is set to the minus (–) side.



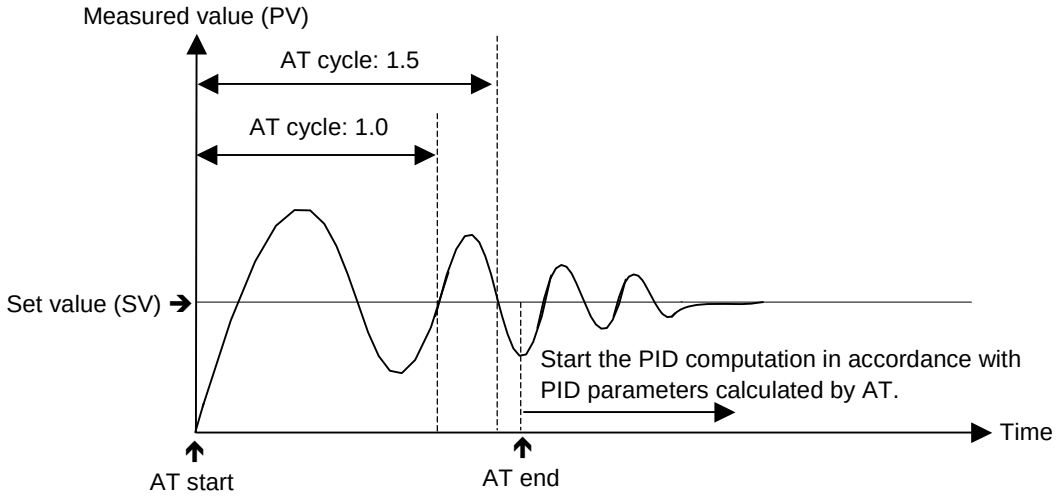
When the AT point exceeds the setting range, high (or low) limit of the setting range becomes the AT point.

AT cycles	RKC communication identifier	G3
	Modbus register address	ch1: 0286H (646) ch2: 0287H (647)

The number of ON/OFF cycles is selected when the Autotuning (AT) function is executed.

Attribute: R/W
Digits: 1 digit
Number of data: 2 (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
Related parameters: PID/AT transfer (P. 9-13)

[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) ch2: 028BH (651)
Output value with AT turned off	RKC communication identifier	OQ
	Modbus register address	ch1: 028EH (654) ch2: 028FH (655)

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: 2 (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. 9-13), Output limiter high/low (P. 9-73)

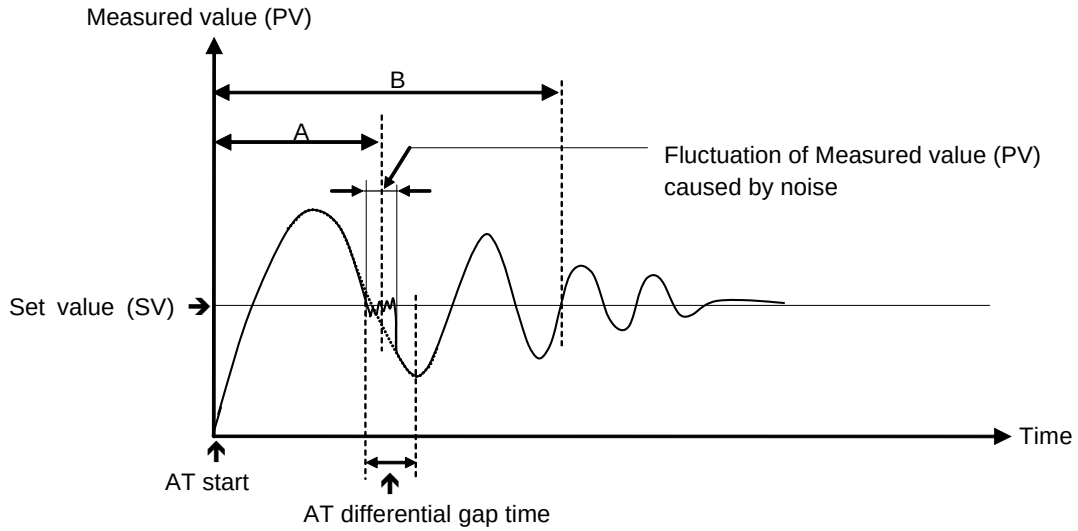
The actual output value becomes the value restricted by the output limiter.

AT differential gap time	RKC communication identifier	GH
	Modbus register address	ch1: 0292H (658) ch2: 0293H (659)

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: 2 (Data of each channel)
Data range: 0.0 to 50.0 seconds
Factory set value: 10.0
Related parameters: PID/AT transfer (P. 9-13)
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 when the AT differential gap time is set to 0.0 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 compute 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 compute suitable PID values.



The factory set value of the AT cycle is 2 cycles.

Proportional band adjusting factor	RKC communication identifier	KC
	Modbus register address	ch1: 0296H (662) ch2: 0297H (663)

This is a factor which is multiplied by the Proportional band computed by executing the Autotuning (AT) function.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0.01 to 10.00 times
Factory set value: 1.00
Related parameters: PID/AT transfer (P. 9-13), Proportional band (P. 9-22)

Integral time adjusting factor	RKC communication identifier	KD
	Modbus register address	ch1: 029AH (666) ch2: 029BH (661)

This is a factor which is multiplied by the Integral time computed by executing the Autotuning (AT) function.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0.01 to 10.00 times
Factory set value: 1.00
Related parameters: PID/AT transfer (P. 9-13), Integral time (P. 9-23)

Derivative time adjusting factor	RKC communication identifier	KE
	Modbus register address	ch1: 029EH (670) ch2: 029FH (671)

This is a factor which is multiplied by the Derivative time computed by executing the Autotuning (AT) function.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0.01 to 10.00 times
Factory set value: 1.00
Related parameters: PID/AT transfer (P. 9-13), Derivative time (P. 9-23)

Proportional band limiter (high)	RKC communication identifier	P6
	Modbus register address	ch1: 02AEH (686) ch2: 02AFH (687)
Proportional band limiter (low)	RKC communication identifier	P7
	Modbus register address	ch1: 02B2H (690) ch2: 02B3H (691)

Proportional band limiter (high): Use to set the high limit value of Proportional band.
Proportional band limiter (low): Use to set the low limit value of Proportional band.
(However, Proportional band limiter (high) ≥ Proportional band limiter (low))

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: RTD input: 0 (0.0, 0.00) to Input span (Unit: °C)
(Varies with the setting of the decimal point position.
However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)
Voltage (V) input: 0.00 to 300.00 % of input span
0 (0.0, 0.00): ON/OFF action
Factory set value: Proportional band limiter (high): RTD input: Input span
Voltage (V) input: 300.00
Proportional band limiter (low): RTD input: 0.00
Voltage (V) input: 0.00
Related parameters: PID/AT transfer (P. 9-13), Proportional band (P. 9-22), Decimal point position (P. 9-46)
Function: The Proportional band range is restricted while the Autotuning (AT) function is being executed.

Integral time limiter (high)	RKC communication identifier	I6
	Modbus register address	ch1: 02B6H (694) ch2: 02B7H (695)
Integral time limiter (low)	RKC communication identifier	I7
	Modbus register address	ch1: 02BAH (698) ch2: 02BBH (699)

Integral time limiter (high): Use to set the high limit value of Integral time.
Integral time limiter (low): Use to set the low limit value of Integral time.
(However, Integral time limiter (high) ≥ Integral time limiter (low))

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0.0 to 3000.0 seconds (0.0: PD action)
Factory set value: Integral time limiter (high): 3000.0
Integral time limiter (low): 0.0
Related parameters: PID/AT transfer (P. 9-13), Integral time (P. 9-23), Integral/Derivative time decimal point position (P. 9-68)
Function: The Integral time range is restricted while the Autotuning (AT) function is being executed.

If the Autotuning (AT) function is executed when the Integral time limiter (high) is set at “0.0,” P and D values suitable to PD control are computed.

Derivative time limiter (high)	RKC communication identifier	D6
	Modbus register address	ch1: 02BEH (702) ch2: 02BFH (703)
Derivative time limiter (low)	RKC communication identifier	D7
	Modbus register address	ch1: 02C2H (706) ch2: 02C3H (707)

Derivative time limiter (high): Use to set the high limit value of Derivative time.
Derivative time limiter (low): Use to set the low limit value of Derivative time.
(However, Derivative time limiter (high) ≥ Derivative time limiter (low))

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0.00 to 3000.0 seconds (0.0: PI action)
Factory set value: Derivative time limiter (high): 3000.0
Derivative time limiter (low): 0.0
Related parameters: PID/AT transfer (P. 9-13), Derivative time (P. 9-23),
Integral/Derivative time decimal point position (P. 9-68)
Function: The Derivative time range is restricted while the Autotuning (AT) function is being executed.

If the Autotuning (AT) function is executed when the Derivative time limiter (high) is set at "0.0," P and I values suitable to PI control are computed.

Setting change rate limiter unit time	RKC communication identifier	HU
	Modbus register address	ch1: 031EH (798) ch2: 031FH (799)

Set the time unit for Setting change rate limiter (UP/DOWN).

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 1 to 3600 seconds
Factory set value: 60
Related parameters: Setting change rate limiter (up) (P. 9-26), Setting change rate limiter (down) (P. 9-26)

Soak time unit	RKC communication identifier	RU
	Modbus register address	ch1: 0322H (802) ch2: 0323H (803)

Use to select the time unit for Area soak time.

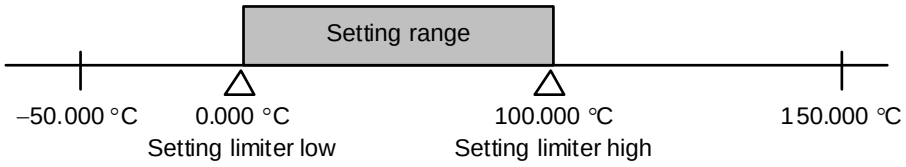
Attribute: R/W
Digits: 1 digit
Number of data: 2 (Data of each channel)
Data range: 0: 0 hours 00 minutes to 99 hours 59 minutes
RKC communication: 0 hours 00 minutes to 99 hours 59 minutes
Modbus: 0 to 5999 minutes
1: 0 minutes 00 seconds to 199 minutes 59 seconds
RKC communication: 0 minutes 00 seconds to 199 minutes 59 seconds
Modbus: 0 to 11999 seconds
Factory set value: RKC communication: 1
Modbus: 1
Related parameters: Memory area soak time monitor (P. 9-10), Area soak time (P. 9-27)

Setting limiter high	RKC communication identifier	SH
	Modbus register address	ch1: 0326H (806) ch2: 0327H (807)
Setting limiter low	RKC communication identifier	SL
	Modbus register address	ch1: 032AH (810) ch2: 032BH (811)

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: 2 (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
(Varies with the setting of the decimal point position.
However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)
Factory set value: Setting limiter high: Input scale high
Setting limiter low: Input scale low
Related parameters: Decimal point position (P. 9-46), Input scale high/low (P. 9-46)
Function: Setting limiter is to set the range of the Set value (SV).

[Example] The input range (input scale range) is from –50.000 to +150.000 °C, the setting limiter high is 100.000 °C, and the setting limiter low is 0.000 °C.



PV transfer function	RKC communication identifier	TS
	Modbus register address	ch1: 032EH (814) ch2: 032FH (815)

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: 2 (Data of each channel)
Data range: 0: Unused
1: Used
Factory set value: 0
Related parameters: Auto/Manual transfer (P. 9-15)

Operation mode assignment 1 (Logic output selection function) Logic output 1 to 4	RKC communication identifier	EA
	Modbus register address	ch1: 0332H (818) ch2: 0333H (819)
Operation mode assignment 2 (Logic output selection function) Logic output 5 to 6	RKC communication identifier	EB
	Modbus register address	ch1: 0336H (822) ch2: 0337H (823)

Assign operation modes to logic outputs 1 to 6.
Switch between the preset operation modes by turning on and off the logic output.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range:
0: No assignment
1: Operation mode (Monitor/Control)[0: Monitor, 1: Control]
2: Operation mode (Monitor + Event function/Control)
[0: Monitor + Event function, 1: Control]
3: Auto/Manual [0: Auto mode, 1: Manual mode]
4: Remote/Local [0: Local mode, 1: Remote mode]
5: Unused (Do not set this one)
Factory set value: Operation mode assignment 1: 0
Operation mode assignment 2: 0
Related parameters: Logic output monitor (P. 9-12), Output assignment (P. 9-50), Communication switch for logic (P. 9-38)

☞ For the block diagram of Logic output selection function, refer to **12. APPENDIX (P. 12-5).**

SV select function	RKC communication identifier	KM
	Modbus register address	ch1: 033AH (826) ch2: 033BH (827)

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: 2 (Data of each channel)
Data range: 0: Remote SV function
1: Cascade control function
Factory set value: 0
Related parameters: RS bias * (P. 9-30), RS ratio * (P. 9-31), RS digital filter * (P. 9-31), Remote SV function master channel module address * (P. 9-87), Remote SV function master channel selection * (P. 9-88)
* Common settings of the SV select function (Remote SV, Cascade control)

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.

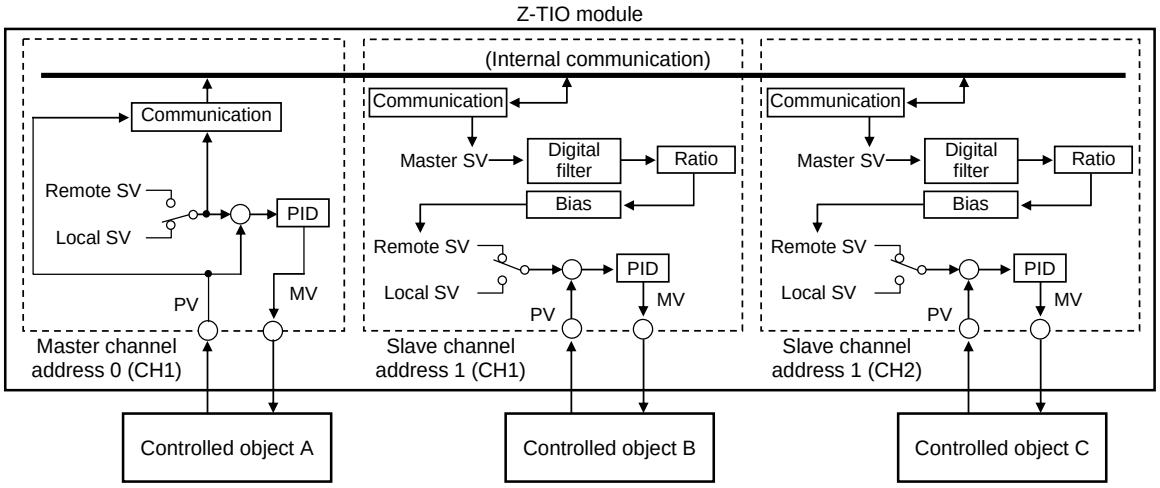
The SV select function only operates within connected modules (SRZ unit).

● Remote SV function

The Remote SV function controls the Measured value (PV) of the channel specified as the master as a remote SV.

Example: When two Z-TIO modules are used to control with a remote SV

Use CH1 at address 0 as the Master and use CH1 and CH2 at address 1 as slave channels. The Measured value (PV) of the master will be the Set value (SV) of the slaves.



Block diagram of Remote SV by internal communication

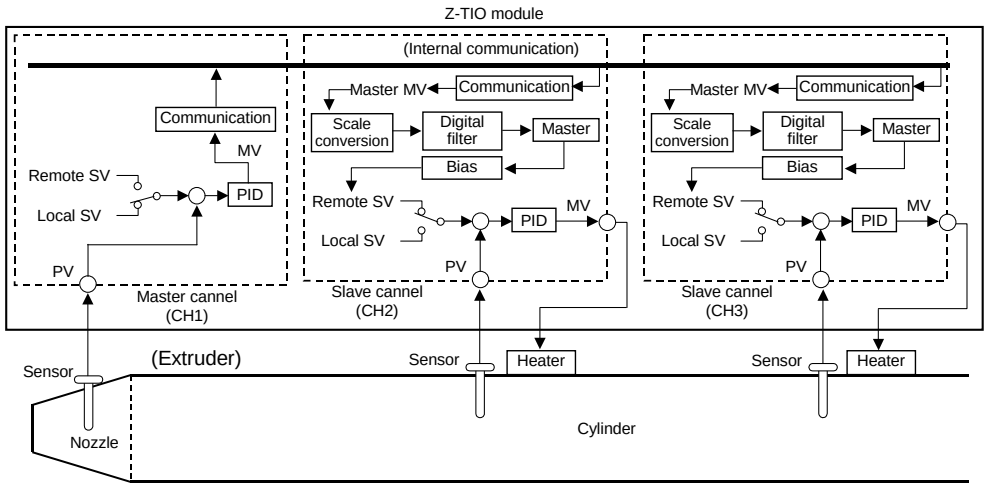
● Cascade control function

Cascade control 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.

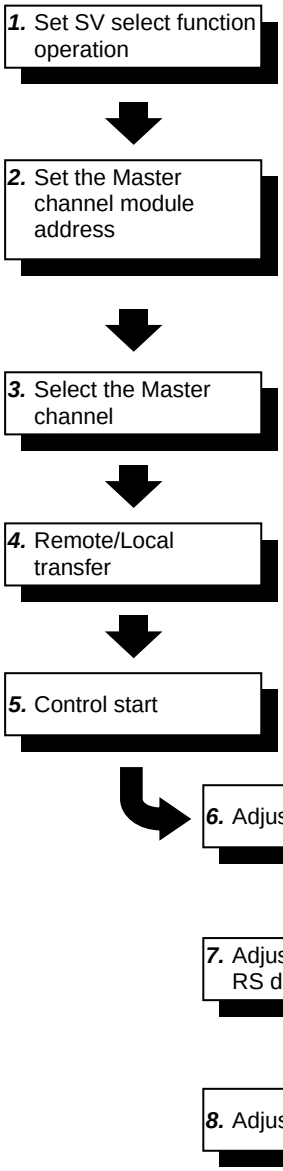
Example: When two Z-TIO modules are used for Cascade control

Address 0 (CH1) is set as the master channel and the Address 1 channels (CH1, CH2) 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.



Block diagram of Cascade control by internal communication

● Operation flow (common procedure for SV select function operation)



Set the function that you wish to have operate in the slave channel of the Z-TIO module (P. 9-83).

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 (P. 9-87):
−1 (Master channel is selected from itself)
0 to 99 (Master channel is selected from other modules)

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 (P. 9-88): 1 to 99

Change the slave channel to Remote mode (P. 9-16).

Perform adjustment after the start of control (P. 9-86) 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 (P. 9-30), RS digital filter (P. 9-31), and RS ratio (P. 9-31) 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**

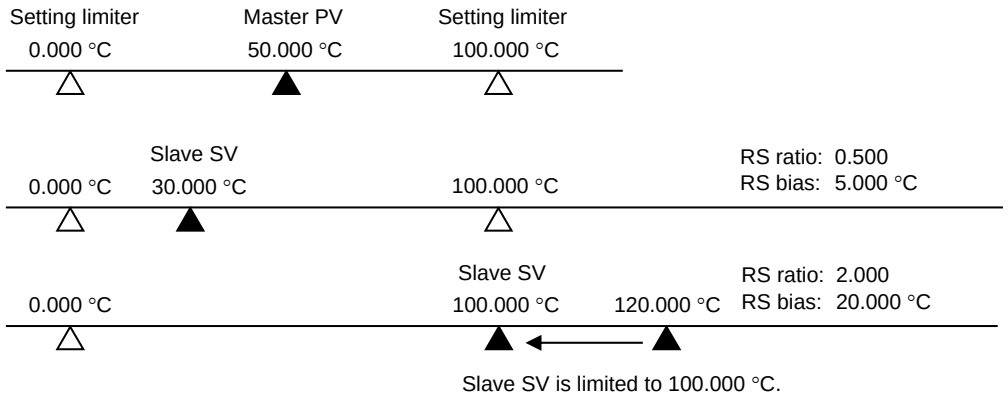
Examples of using the ratio and bias for each function are given below.

Example 1: Remote SV function

When the master and slave setting limiter range is 0.000 to 100.000 °C

- RS ratio of slave: 0.500, RS bias of slave: 5.000 °C
  Master measured value (PV): 50.000 °C → Slave set value (SV): 30.000 °C
- RS ratio of slave: 2.000, RS bias of slave: 20.000 °C
  Master measured value (PV): 50.000 °C → Slave set value (SV): 100.000 °C *

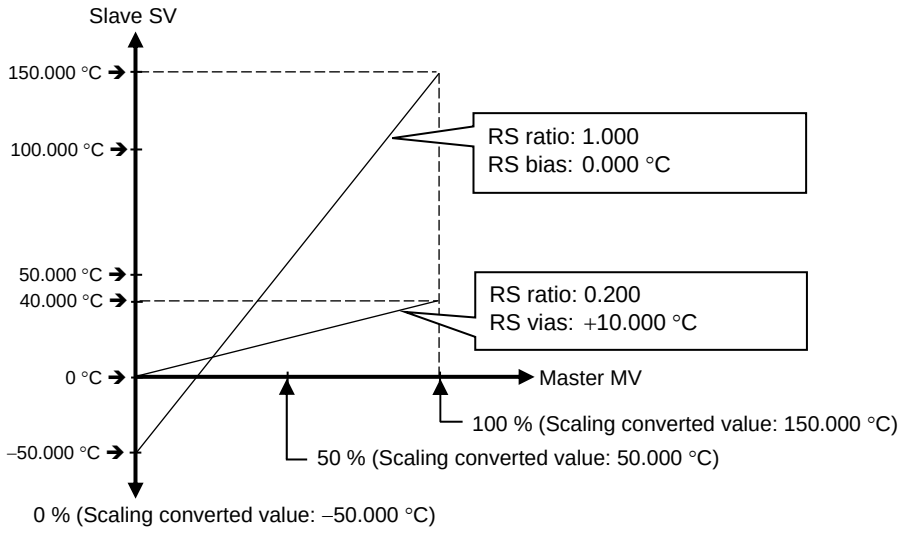
  * According to the computed value, the Slave set value (SV) becomes 120.000 °C but since the Setting limiter range is 0.000 to 100.000 °C, the Slave set value (SV) becomes the Setting limiter high: 100.000 °C



Example 2: Cascade control function

When the output scale of master is 0.0 to 100.0 % and the input scale of slave is –50.000 to +150.000 °C

- RS ratio of slave: 1.000, RS bias of slave: 0.000 °C
  Slave input scale for master output scale 0.0 to 100.0 % is –50.000 to +150.000 °C
- RS ratio of slave: 0.200, RS bias of slave: +10.000 °C
  Slave input scale for master output scale 0.0 to 100.0 % is 0.000 to 40.000 °C



Remote SV function master channel module address	RKC communication identifier	MC
	Modbus register address	ch1: 033EH (830) ch2: 033FH (831)

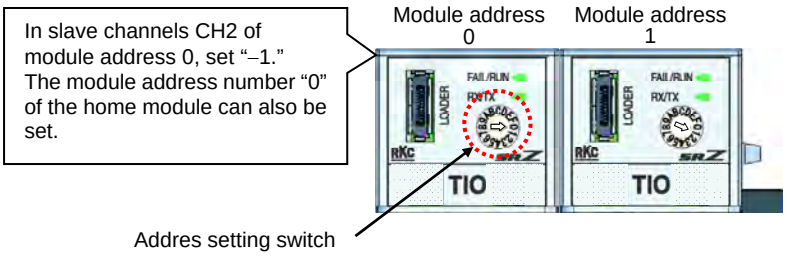
In the slave channel, set the module address number of the module that includes the channel to be specified as the master.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (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. 9-83),
Remote SV function master channel selection * (P. 9-88)

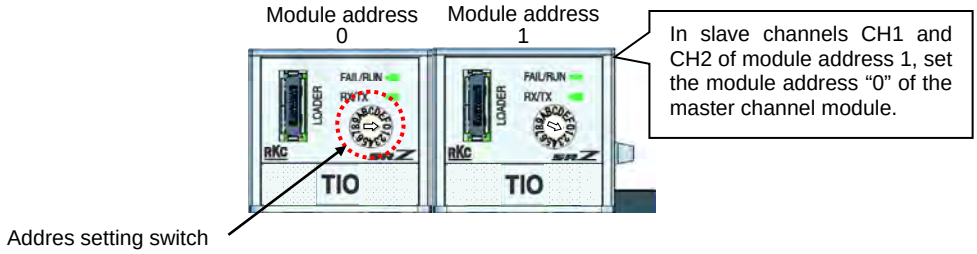
* Common settings of the SV select function (Remote SV, Cascade control)

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 of module address 0



Example 2: Selecting the master channel from other than the home module
Master channel: CH1 and CH2 of module address 0
Slave channel: CH1 and CH2 of module address 1



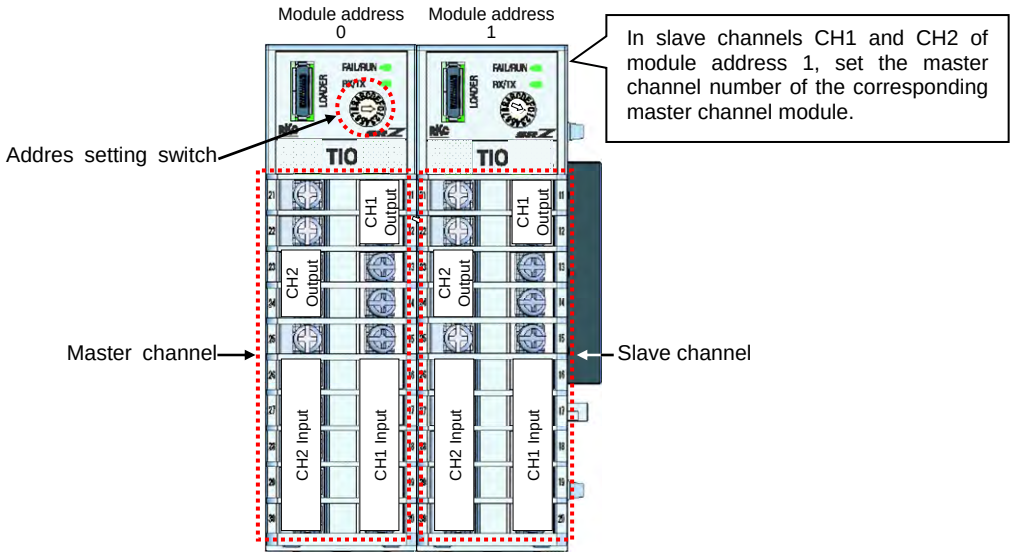
Remote SV function master channel selection	RKC communication identifier	MN
	Modbus register address	ch1: 0342H (834) ch2: 0343H (835)

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: 2 (Data of each channel)
Data range: 1 to 99
Factory set value: 1
Related parameters: SV select function (P. 9-83),
Remote SV function master channel module address (P. 9-87)

Example: Combining the master channel and slave channels as shown below

	Module address	CH	
Master channel	Module address 0	CH1	CH2
Slave channel	Module address 1	CH1	CH2



There is no need for this setting (selecting the master channel) in the master channel.

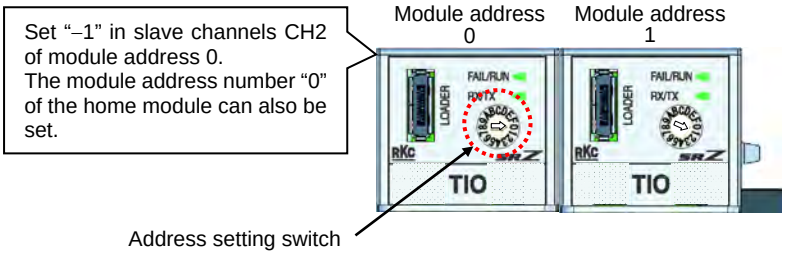
Output distribution master channel module address	RKC communication identifier	DY
	Modbus register address	ch1: 0346H (838) ch2: 0347H (839)

To output the manipulated output value computed 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.

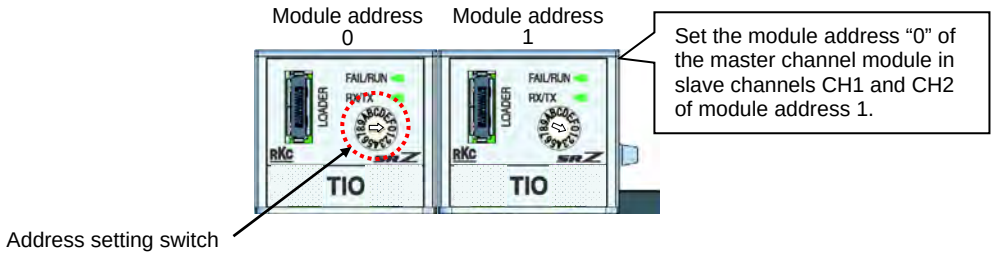
Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: –1 (Master channel is selected from itself)
0 to 99 (Master channel is selected from other modules)
Factory set value: –1
Related parameters: Output distribution selection (P. 9-32),
Output distribution master channel selection (P. 9-90)

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 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 CH2 of module address 1



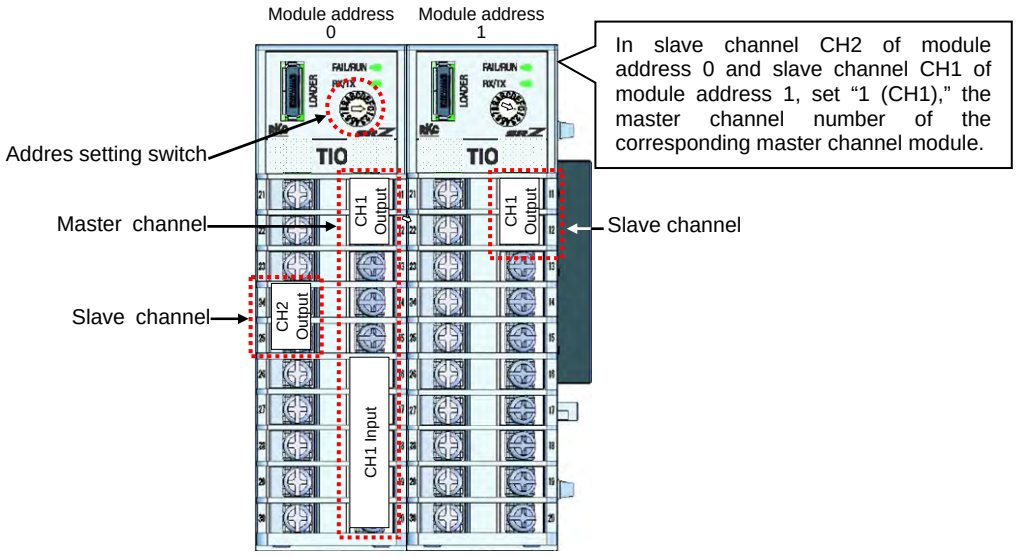
Output distribution master channel selection	RKC communication identifier	DZ
	Modbus register address	ch1: 034AH (842) ch2: 034BH (843)

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: 2 (Data of each channel)
Data range: 1 to 99
Factory set value: 1
Related parameters: Output distribution selection (P. 9-32),
Output distribution master channel module address (P. 9-89)

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	CH2		Distribution output
	Module address 1	CH1		Distribution output



There is no need for this setting (selecting the master channel) in the master channel.

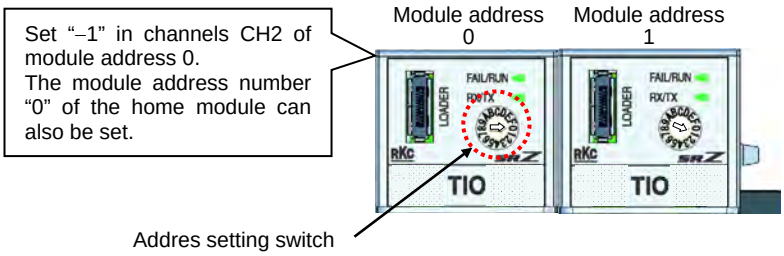
Address of interacting modules	RKC communication identifier	RL
	Modbus register address	ch1: 034EH (846) ch2: 034FH (847)

In the Z-TIO module, set the module address number of the module with the channel that you wish to link.

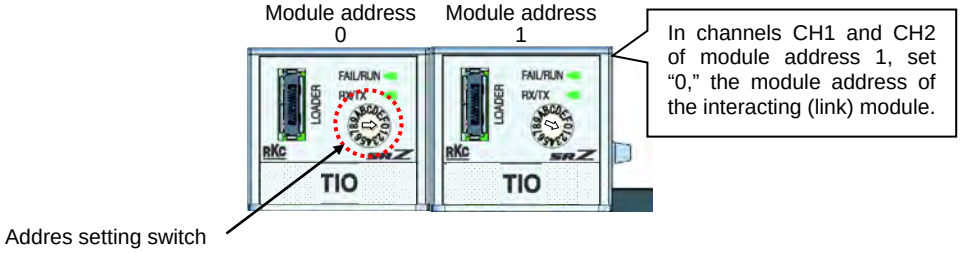
Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: –1 (Interact with its own module address)
0 to 99 (Interact with the addresses of other modules)
Factory set value: –1
Related parameters: Channel selection of interacting modules (P. 9-92),
Selection switch of interacting modules (P. 9-92)

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:
CH2 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 CH2 of module address 1



Channel selection of interacting modules	RKC communication identifier	RM
	Modbus register address	ch1: 0352H (850) ch2: 0353H (851)

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: 2 (Data of each channel)
Data range: 1 to 99
Factory set value: 1
Related parameters: Address of interacting modules (P. 9-91),
Selection switch of interacting modules (P. 9-92)

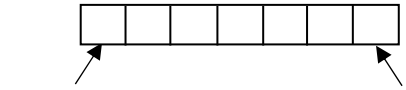
Becomes valid when the selected module is "Z-TIO module."

Selection switch of interacting modules	RKC communication identifier	RN
	Modbus register address	ch1: 0356H (854) ch2: 0357H (855)

Select the action that you wish to link.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (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: 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 Unused
6th digit Interlock release
Most significant digit: Suspension of area soak time

Modbus: 0 to 111 (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
Bit 3: Remote/Local
Bit 4: Unused
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. 9-91),
Channel selection of interacting modules (P. 9-92)

Settings by communication are disabled for functions for which "1: Interact with other channels" is set.

Continued on the next page.

Continued from the previous page.

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 of module address 0
CH1 and CH2 of module address 1

Z-TIO 1 (module address: 0)

CH1	Memory area transfer		Interacting *
	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

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

* 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.

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 and CH2 of module address 0
CH1 and CH2 of module address 1

Z-TIO 1 (module address: 0)

CH1	Memory area transfer		Interacting *
	Address of interacting modules	16	Specify the Z-DIO module address
	Channel selection of interacting modules	1	Factory set value (Setting is not effective because Z-DIO is selected)
	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	–1 or 0	Specify the home module
	Channel selection of interacting modules	1	Specify CH1 of the home module
	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		Interacting *
	Address of interacting modules	16	Specify the Z-DIO module address
	Channel selection of interacting modules	1	Factory set value (Setting is not effective because Z-DIO is selected)
	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	–1 or 1	Specify the home module
	Channel selection of interacting modules	1	Specify CH1 of the home module
	Selection switch of interacting modules	1	Specify 1(Interact with other channels) in the memory area number

Interacting*

Z-DIO 1 (module address: 16)

DI1	Memory area transfer (1 to 8)
DI2	
DI3	
DI4	Memory area setting signal
DI5	Operation mode
DI6	
DI7	Interlock release
DI8	Auto/Manual transfer

DI function assignment: 1
(See above for assignments)

* 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
Related parameters: RUN/STOP transfer (P. 9-16), Hot/Cold start (P. 9-63), Start determination point (P. 9-64)

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. *	Manipulated output value at STOP mode

* If changed to RUN from STOP by RUN/STOP selection after start, set to the operation mode before power failure occurs.

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

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.

9.3.3 Setting parameters exclusive to Z-TIO-G module

Sensor bias	RKC communication identifier	JI
	Modbus register address	ch1: 0422H (1058) ch2: 0423H (1059)

This is used to make a bias setting of the RTD input.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: –3.0000 to +3.0000 Ω
Factory set value: 0.0000
Related parameters: Input type (P. 9-45)

📖 This parameter is active when the instrument has RTD input.

PFF power supply frequency	RKC communication identifier	JJ
	Modbus register address	0424H (1060)

Set power supply frequency of the Power feed forward (PFF) input.

Attribute: R/W
Digits: 7 digits
Number of data: 1 (Data of each module)
Data range: 0: 50 Hz
1: 60 Hz
2: Automatic setting
Factory set value: 2
Related parameters: Power feed forward (PFF) selection (P. 9-96),
Measurement power supply frequency (P. 9-97)

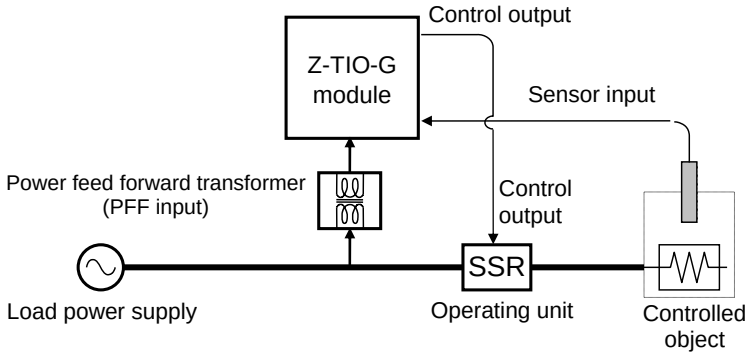
📖 This parameter is activated when the Power feed forward (PFF) input is used.

📖 The SRZ should be used with the default value “2: Automatic setting” in normal operations.

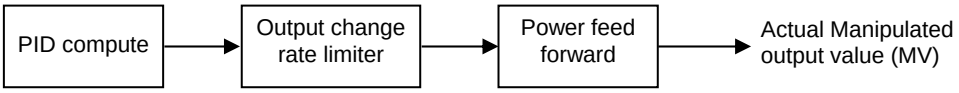
Power feed forward (PFF) selection	RKC communication identifier	JK
	Modbus register address	ch1: 0425H (1061) ch2: 0426H (1062)

Use to select Use/Unuse of the Power feed forward (PFF) function.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0: Unused
1: Used
Factory set value: 0
Related parameters: PFF power supply frequency (P. 9-95),
Measurement power supply frequency (P. 9-97), PFF input voltage (P. 9-97),
PFF reference voltage (P. 9-98),
Output compensation factor for PFF reference voltage (P. 9-98),
Output compensation captured value for PFF reference voltage (P. 9-99),
PFF gain (P. 9-99)
Function: The Power feed forward function monitors the electrical load through a dedicated transformer, and adjusts manipulated output to compensate power supply fluctuation. If the Power feed forward (PFF) input voltage is decreased to about 70 % or less of the rated value, the Power feed forward function is turned off. At this time, the control mode will return to the normal control (the same control as without the Power feed forward function).



The Power feed forward function is used together with the Output change rate limiter function, the Manipulated output value may exceed the limit of the Output change rate limiter.



Relationship between the Power feed forward and Output change rate limiter

When the Power feed forward function is set to "1: Used," the function is turned off under the following condition.

- **When no Power feed forward (PFF) input is used (no Power feed forward transformer is connected)**
- **When Power feed forward (PFF) input voltage is decreased to about 70 % or less of the rated value**

Always use the dedicated power feed transformer (PFT-02A) included.

Measurement power supply frequency	RKC communication identifier	JL
	Modbus register address	0427H (1063)

Power supply frequency of the power feed forward (PFF) input is displayed.

Attribute: RO
Digits: 7 digits
Number of data: 1 (Data of each module)
Data range: 0.0 to 100.0 Hz
Factory set value: —
Related parameters: PFF power supply frequency (P. 9-95),
Power feed forward (PFF) selection (P. 9-96)

 This parameter is activated when the Power feed forward (PFF) input is used.

PFF input voltage	RKC communication identifier	JM
	Modbus register address	0428H (1064)

Measurement input voltage of the Power feed forward (PFF) is displayed.

Attribute: RO
Digits: 7 digits
Number of data: 1 (Data of each module)
Data range: 0.0 to 600.0 V
Factory set value: —
Related parameters: PFF power supply frequency (P. 9-95),
Power feed forward (PFF) selection (P. 9-96),
Measurement power supply frequency (P. 9-97), PFF reference voltage (P. 9-98),
Output compensation factor for PFF reference voltage (P. 9-98),
Output compensation captured value for PFF reference voltage (P. 9-99),
PFF gain (P. 9-99)

 This parameter is activated when the Power feed forward (PFF) input is used.

PFF reference voltage	RKC communication identifier	JP
	Modbus register address	042BH (1067)

The reference voltage of the Power feed forward (PFF) is set here.

Attribute: R/W
Digits: 7 digits
Number of data: 1 (Data of each module)
Data range: 0.0 to 300.0 V
Factory set value: 0.0
Related parameters: PFF power supply frequency (P. 9-95),
Power feed forward (PFF) selection (P. 9-96),
Measurement power supply frequency (P. 9-97), PFF input voltage (P. 9-97),
Output compensation factor for PFF reference voltage (P. 9-98),
Output compensation captured value for PFF reference voltage (P. 9-99),
PFF gain (P. 9-99)
Function: Captures PFF input voltage as PFF reference voltage at the time of power-on, switching the mode from STOP (control stop) to RUN (control start), and changing the set value (SV).


This parameter is activated when the Power feed forward (PFF) input is used.


The PFF reference voltage is automatically taken in and set by the instrument under the normal operation. Users do not need to set this parameter by themselves.

Output compensation factor for PFF reference voltage	RKC communication identifier	JQ
	Modbus register address	ch1: 042CH (1068) ch2: 042DH (1069)

Set the output compensation factor of the Power feed forward reference voltage.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0.00 to 99.99
Factory set value: 1.00
Related parameters: PFF power supply frequency (P. 9-95),
Power feed forward (PFF) selection (P. 9-96),
Measurement power supply frequency (P. 9-97), PFF input voltage (P. 9-97),
PFF reference voltage (P. 9-98),
Output compensation captured value for PFF reference voltage (P. 9-99),
PFF gain (P. 9-99)


This parameter is activated when the Power feed forward (PFF) input is used.


There is no need to set this parameter in normal operations.

Output compensation captured value for PFF reference voltage	RKC communication identifier	JR
	Modbus register address	ch1: 042EH (1070) ch2: 042FH (1071)

Used to set the Output compensation captured value of the Power feed forward (PFF) reference voltage.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0.00 to 9.99
Factory set value: 0.00
Related parameters: PFF power supply frequency (P. 9-95),
Power feed forward (PFF) selection (P. 9-96),
Measurement power supply frequency (P. 9-97), PFF input voltage (P. 9-97),
PFF reference voltage (P. 9-98),
Output compensation factor for PFF reference voltage (P. 9-98), PFF gain (P. 9-99)

This parameter is activated when the Power feed forward (PFF) input is used.

There is no need to set this parameter in normal operations.

PFF gain	RKC communication identifier	JS
	Modbus register address	ch1: 0430H (1072) ch2: 0431H (1073)

Used to set the PFF gain for the output correction of the Power feed forward (PFF).

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0.000 to 10.000
Factory set value: 1.000
Related parameters: PFF power supply frequency (P. 9-95),
Power feed forward (PFF) selection (P. 9-96),
Measurement power supply frequency (P. 9-97), PFF input voltage (P. 9-97),
PFF reference voltage (P. 9-98),
Output compensation factor for PFF reference voltage (P. 9-98),
Output compensation captured value for PFF reference voltage (P. 9-99)

This parameter is activated when the Power feed forward (PFF) input is used.

RTD input, 3-wire/4-wire systems selectable	RKC communication identifier	X0
	Modbus register address	ch1: 0432H (1074) ch2: 0433H (1075)

Used to set the RTD input type (3-wire system or 4-wire system) which is used for measurement input.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0: 3-wire system
1: 4-wire system
Factory set value: 0
Related parameters: Input type (P. 9-45)

This parameter is active when the instrument has RTD input.

Modbus high/low order bit conversion	RKC communication identifier	MX
	Modbus register address	045EH (1118)

Used to set the order of data read (high or low) when double word data is used in Modbus communication.

Attribute: R/W
Digits: 1 digit
Number of data: 1 (Data of each module)
Data range: 0: high order → low order (big endian)
1: low order → high order (little endian)
Factory set value: 1

Output adjustment mode	RKC communication identifier	bs
	Modbus register address	—

Used to select the output accuracy for Voltage/Current outputs.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0: Normal operation
1: Output adjustment 5 %
2: Output adjustment 100 %
Factory set value: 0
Related parameters: Output adjustment value 5 % (P. 9-101), Output adjustment value 100 % (P. 9-102)
Function: The output accuracy at the time of shipment (without output adjustment) is ±3 % of the span. Output adjustment improves the accuracy to ±0.5 % of the span.

[Output adjustment procedure]

1. Connect a multimeter or equivalent so that the output from the Z-TIO-G can be measured.
2. Set the Output adjustment mode to "1: Output adjustment 5 %."
3. Change the output adjustment 5 % data so that the output from the Z-TIO-G becomes 5 %.
4. Set the Output adjustment mode to "2: Output adjustment 100 %."
5. Change the output adjustment 100 % data so that the output from the Z-TIO-G becomes 100 %.

This parameter is active when the control is stopped (STOP) and when the instrument has Voltage/Current output.

Output adjustment 5 %	RKC communication identifier	bt
	Modbus register address	—

This parameter is used to adjust the accuracy when the Voltage/Current output is 5 %.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0 to 10000
Factory set value: 2195
Related parameters: Output adjustment mode (P. 9-101), Output adjustment 100 % (P. 9-102)

This parameter is active when control is stopped (STOP), when output type is Voltage/Current, and when the Output adjustment mode is other than zero.

Output adjustment 100 %	RKC communication identifier	bu
	Modbus register address	—

This parameter is used to adjust the accuracy when the Voltage/Current output is 100 %.

Attribute: R/W
Digits: 7 digits
Number of data: 2 (Data of each channel)
Data range: 0 to 10000
Factory set value: 8405
Related parameters: Output adjustment mode (P. 9-101), Output adjustment 5 % (P. 9-101)

This parameter is active when control is stopped (STOP), when output type is Voltage/Current, and when the Output adjustment mode is other than zero.

TROUBLE SHOOTING

10

Solutions for Problems

This section explains possible 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 wiring is completed. Make sure that the wiring is correct before applying power to the instrument.
- To prevent electric shock or instrument failure, do not touch the inside of the instrument.
- All wiring must be performed by authorized personnel with electrical experience in this type of work.

CAUTION

All wiring must be completed before power is turned on to prevent electric shock, instrument failure, or incorrect action. The power must be turned off before repairing work for input break and output failure including replacement of sensor, contactor or SSR, and all wiring must be completed before power is turned on again.

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-G module

Problem	Possible 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-G 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-G module
The FAIL/RUN lamp is lit (red): FAIL status	CPU section or power section defect	Replace Z-TIO-G module

■ RKC communication

Problem	Possible 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 136 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	Possible 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 specified number of data items in the query message exceeds the maximum number of data items available • 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

11

■ Measured input

Number of inputs: 2 points (Isolated between each input)

Input type:
- Group 1

Voltage: 0 to 1 V DC

- Group 2

RTD: Pt100 (JIS-C1604-1997)
Selectable between 3-wire and 4-wire systems.

Input range:

RTD input

Input type	Measured range
Pt100	–50.000 to +150.000 °C
	–50.00 to +250.00 °C
	–150.00 to +150.00 °C

Voltage input

Input type		Measured range
Voltage (low)	0 to 1 V DC	Programmable range (–19999 to +19999) [However, a span is 20000 or less.]

Sampling cycle: 0.1 seconds

Influence of input lead: Approx. 0.02 %/Ω of PV (RTD input)
100 Ω or less per wire

Input impedance: Voltage input: 1 MΩ or more

Measuring current: Approx. 1 mA (RTD input)

Action at input break: RTD input: Upscale
Voltage input: Upscale

Action at input short circuit: Downscale (RTD 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
Select control action at input error:
Continue/Manipulated output at input error, whichever is specified.
Manipulated output value at input error:
–5.0 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):
Calculation method:
Measured value = √ (Input value × PV ratio + PV bias)
PV low input cut-off:
0.00 to 25.00 % of input span

■ Power feed forward (PFF) input [optional]

Input range: 0 to 10 V AC (50 Hz, 60Hz)
Power feed forward (PFF) input can be measured up to 240 V AC * using a PFF transformer [PFT-02A].
(Measurable low limit voltage: 35 V AC)
When connecting a PFF transformer, install it near the SRZ and connect the SRZ to the output terminals (6 and 7) of the PFF transformer with the minimum wiring length.

* OVERVOLTAGE CATEGORY II

■ Digital input (DI) [optional]

Number of inputs: 1 point

Input method: Voltage contact input (Sink type)

Open (OFF) state:	5.0 V DC or less
Close (ON) state:	17.5 V DC or more
Contact current:	3.0 mA or less
Allowable applied voltage:	26.4 V DC or less

Capture judgment time: Approx. 100 ms

■ Output (OUT1, OUT2)

Number of outputs: 2 points

Output contents: Output assignment

Output specification	OUT1	OUT2
Control output	×	×
Logic output	×	×

Function assignment

Function assignment	Control output	Logic output
Relay contact	×	×
Voltage pulse	×	×
4 to 20 mA DC 0 to 20 mA DC	×	—
0 to 1 V DC 1 to 5 V DC 0 to 5 V DC 0 to 10 V DC	×	—
Triac	×	×
Open collector	×	×

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 (When control output is selected.)
Minimum ON/OFF time:	0 to 1000 ms (Active only for Time proportioning output)

• Voltage pulse output

Output voltage:	0/12 V DC (Rating) ON voltage: 11.0 to 13.0 V OFF voltage: 0.2 V or less
Allowable load resistance:	600 Ω or more
Proportional cycle time:	0.1 to 100.0 seconds (When control output is selected.)
Minimum ON/OFF time:	0 to 1000 ms (Active only for Time proportioning output)

• Current output

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

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 AC (Ambient temperature 40 °C or less) Ambient temperature 50 °C: 0.3 A AC
Load voltage:	75 to 250 V AC
Minimum load current:	30 mA AC
ON voltage:	1.6 V AC or less (at maximum load current)
Proportional cycle time:	0.1 to 100.0 seconds (When control output is selected.)
Minimum ON/OFF time:	0 to 1000 ms

* The following standards do not apply to triac output type.
CE/UL/cUL/RCM

• Open collector output

Output method:	Sink type
Allowable load current:	100 mA DC
Load voltage:	30 V DC or less
Minimum load current:	0.5 mA
ON voltage:	2 V DC or less (at maximum load current)
Leakage current at OFF:	0.1 mA DC or less
Proportional cycle time:	0.1 to 100.0 seconds (When control output is selected.)
Minimum ON/OFF time:	0 to 1000 ms

Related function:

• Output logic selection
Selectable from Energized and De-energized outputs.
There is no relation to the Energized/De-energized actions of FAIL output.

■ Performance

Basic performance:

• Input accuracy:

Input type	Input range	Accuracy
Pt100	–50.000 to +150.000 °C	±0.050 °C
	–50.00 to +250.00 °C	±0.20 °C
	–150.00 to +150.00 °C	±0.20 °C
Voltage input	±0.05 % of input span	
PFF input	±5 % of input span	

• Noise rejection: Nomal mode: 60 dB or more (50/60 Hz)
Common mode: 120 dB or more (50/60 Hz)

• Input resolution: Approx. 1/1000000
(Pt100: –50.000 to +150.000 °C)

• Close horizontal mounting error:
±0.1 °C

• Output accuracy: Current output:
Without calibration: ±3 % of Output span
(factory shipment)
With calibration: ±0.5 % of Output span
Voltage output:
Without calibration: ±3 % of Output span
(factory shipment)
With calibration: ±0.5 % of Output span

• Output resolution: Approx. 1/4000

Operating influence:

• Influence ambient temperature:
RTD input: ±0.006 %/°C of input span
Voltage input: ±0.006 %/°C of input span
Voltage/Current outputs:
±0.05 %/°C of Output span

• Influence ambient humidity:
RTD input: ±0.006 %/% RH of input span
Voltage input: ±0.006 %/% RH of input span
Voltage/Current outputs:
±0.006 %/% RH of Output span

• Influence of power supply voltage:
RTD input: ±0.05 % of input span
Voltage input: ±0.05 % of input span
Voltage/Current outputs:
±0.05 % of Output span

• Influence vibration:
RTD input: ±0.05 % of input span
Voltage input: ±0.05 % of input span

• Influence of physical orientation:
RTD input: ±0.05 % of input span
Voltage input: ±0.05 % of input span

■ Indication lamp

Number of indicates: 2 points

Indication contents:

- Operation state indication (1 point)
  When normal (RUN): A green lamp is on
  Control is stopped due to the self-diagnosis (FAIL): A green lamp flashes
  Action is stopped due to the self-diagnosis (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: Brilliant II PID control (Direct action/Reverse action is selectable)

Autotuning (AT): Enhanced AT (Brilliant II PID control)

■ Brilliant II PID control

Overshoot suppression function: Reset feedback (RFB)

Setting range:

a) Proportional band (P) *
- RTD input: 0 (0.0, 0.00) to Input span (unit: °C)
  Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.
- Voltage input: 0.00 to 300.00 % of input span

* 0 (0.0, 0.00): ON/OFF action
ON/OFF action differential gap: RTD input: 0 (0.0, 0.00) to Input span (unit: °C) (Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.)
Voltage input: 0.00 to 100.00 % of input span

b) Integral time (I): 0.0 to 3000.0 seconds
(0.0: Integral action OFF)

c) Derivative time (D): 0.0 to 3000.0 seconds
(0.0: Derivative action OFF)

d) Control response parameter:
Slow, Medium and Fast (3-step selection)
Internally fixed to Fast in case of P and PD actions.

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 of manipulated output
(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 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:
1 (0.1 seconds setting)

■ Event function

Number of events: 4 points/channel

Event action:
Deviation high (SV monitor), Deviation low (SV monitor),
Deviation high/low (SV monitor), Band (SV monitor),
Process high, Process low, SV high, SV low, MV high, MV low,
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
Control loop break alarm (LBA) (Event 4 only)

Setting range:
• Deviation
Event setting*: −Input span to +Input span
Differential gap*: 0 to Input 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 Input span
Channel setting: Channel 1 to 4
• Temperature rise completion
Event setting*: −Input span to +Input span
Differential gap*: 0 to Input span
• Control loop break alarm (LBA)
LBA time: 0 to 7200 seconds (0: LBA function OFF)
LBA deadband (LBD) *:
0 to Input span
* Varies with the setting of the decimal point position. However, even if "3: Three decimal places" is set, the maximum settable decimal places are 2.

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 to 18000 seconds
Interlock: 0 (Unused), 1 (Used)
Force ON of Event action:
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

■ Multi-memory area function

Number of areas: 8 areas/channel

Stored parameters: Set value (SV), Event function 1 to 4, LBA time, LBA deadband, Proportional band, Integral time, Derivative time, Control response parameter, Manual reset, Setting change rate limiter (up), Setting change rate limiter (down), Soak time setting, Link area number

Method of area transfer: Communication function
Internal communication
Area soak time

Memory area link function: Link area number:
0 to 8 (0: No link)
Soak time: 0 minutes 00 seconds to 199 minutes 59 seconds or
0 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 to 4 (Event 1to 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 bit: RKC communication: 7 or 8
Modbus: 8
Parity bit: RKC communication: Without, Odd or Even
Modbus: Without
Stop bit: 1

Protocol: RKC communication (ANSI X3.28-1976 subcategories 2.5 and B1)
Modbus-RTU
(Selectable)

Error control: RKC communication: Vertical parity, Horizontal parity
Modbus: CRC-16

Termination resistor: Externally terminal connected (Example: 120 Ω, 1/2 W)

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

Connection method: 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
Data bit configuration is fixed to the above value.
Module address is fixed at 0.

Protocol: Based on ANSI X3.28-1976 subcategories 2.5 and B1

Maximum connections: 1 point

■ Logic output function

Number of logic output points: 6 points

Input: Event output 1 (CH1, CH2), Event output 2 (CH1, CH2),
Event output 3 (CH1, CH2), Event output 4 (CH1, CH2),
Communication switch for logic 1 and 2,
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 (Unused [Do not set this one])

Additional function: Energized/De-energized: 0 (Energized), 1 (De-energized)
Can be selected for each logic output 1 and 2 (OUT1, OUT2)

■ 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

● Cascade control

Setting range:

SV select function:	1 (Cascade control 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)

■ 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 coupled 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: Unused
Bit 5: Interlock release
Bit 6: Suspension of area soak time

■ Self-diagnostic function

Control stop:
Adjustment data error (Error code 1)
Data back-up error (Error code 2)
A/D conversion error (Error code 4)
Logic output data error (Error code 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 (Control is stopped due to the self-diagnosis)
A red lamp is on (Action is stopped due to the self-diagnosis)

■ 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):
120 mA max. (at 24 V DC)
Rush current: 10 A or less

■ General specifications

Insulation resistance:

Test voltage: 500 V DC	①	②	③	④
① Grounding terminal				
② Power terminal	20 MΩ or more			
③ Measured input terminal	20 MΩ or more	20 MΩ or more	20 MΩ or more	
④ Output terminal (Relay contact, Triac)	20 MΩ or more	20 MΩ or more	20 MΩ or more	20 MΩ or more
⑤ Communication, DI terminals	20 MΩ or more		20 MΩ or more	20 MΩ or more

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 Communication, DI terminals	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. ten billion times or more
Data storage period: Approx. 10 years

Power failure recovery: Hot start 1: Operation resumes with the operation condition before the power failure and from the output value before the power failure.
Hot start 2: Operation resumes with the operation mode before the power failure.
Manual mode: Operation starts from the value of the Output limiter low.
Cold start: Operation starts in the Manual mode regardless of the mode before the power failure. Output value is the low limit of the output limiter.

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:

Number of vibration Hz	Level		Attenuation slope dB/oct
	$(m/s^2)^2/Hz$	$[g^2/Hz]$ *	
3	0.048	(0.0005)	—
3 to 6	—	—	+13.75
6 to 18	1.15	(0.012)	
18 to 40	—	—	–9.34
40	0.096	(0.001)	
40 to 200	—	—	–1.29
200	0.048	(0.0005)	—

The effective value of the acceleration is 5.8 m/s^2 [0.59 g*] within the number of vibration.

* g = 9.806658 m/s^2

Shock: Height 800 mm or less

Temperature: –25 to +70 °C (At storage)
–40 to +70 °C (At transport)

Humidity: Less than 5 to 95 %RH (Non condensing)
Absolute humidity: MAX.W.C 35 g/m^3 dry air at 101.3 kPa

Mounting and Structure:

Mounting method: DIN rail mounting or Panel mounting
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.

Mounting orientation: Datum plane ± 10°

Case material: PPE [Flame retardancy: UL94 V-1]

Panel sheet material: Polyester

Weight: Approx. 160 g

■ Standard

Safety standards:

UL: UL61010-1

cUL: CAN/CSA-C22.2 No.61010-1

CE marking:

LVD: EN61010-1
OVERVOLTAGE CATEGORY II,
POLLUTION DEGREE 2,
Class II (Reinforced insulation)

EMC: EN61326-1

RCM: EN55011

The following standards do not apply to triac output type.

CE/UL/cUL/RCM

MEMO

APPENDIX 12

12.1 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

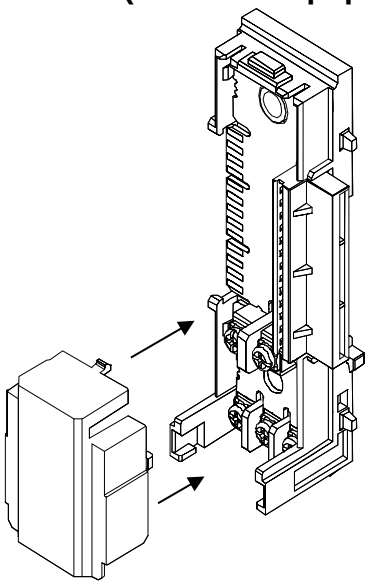
12.2 Cover

⚠ 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.

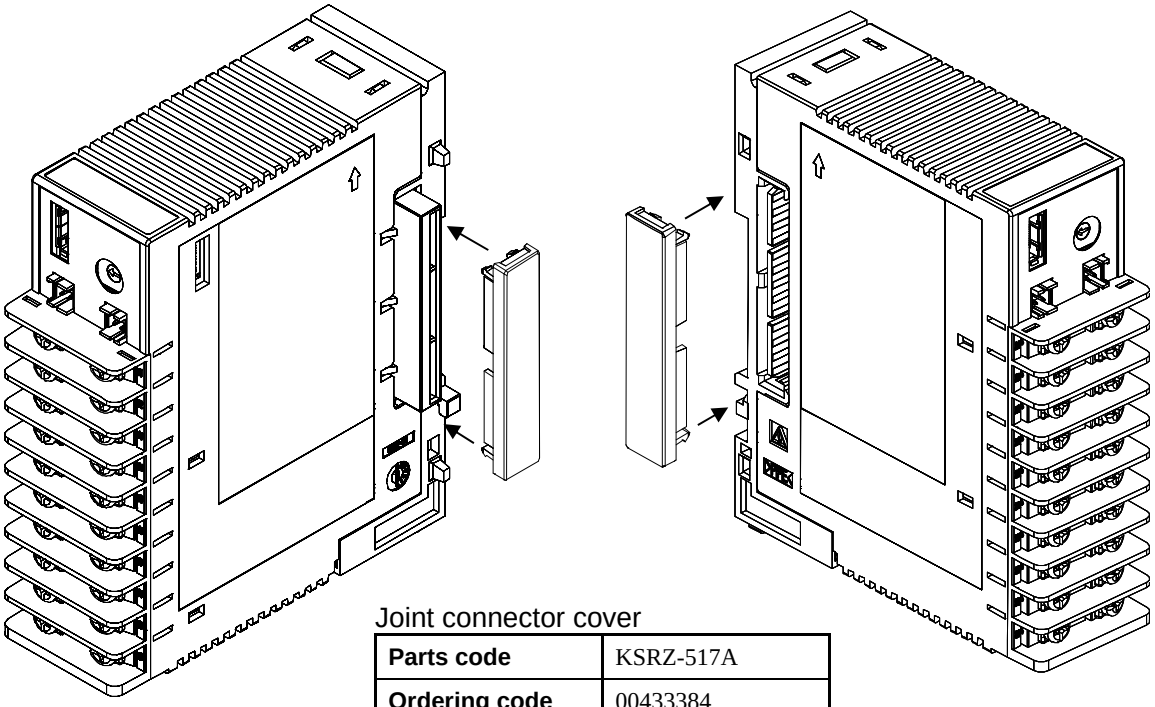
■ Power terminal cover (standard equipment)



Power terminal cover

Parts code	KSRZ-518A
Ordering code	00514689

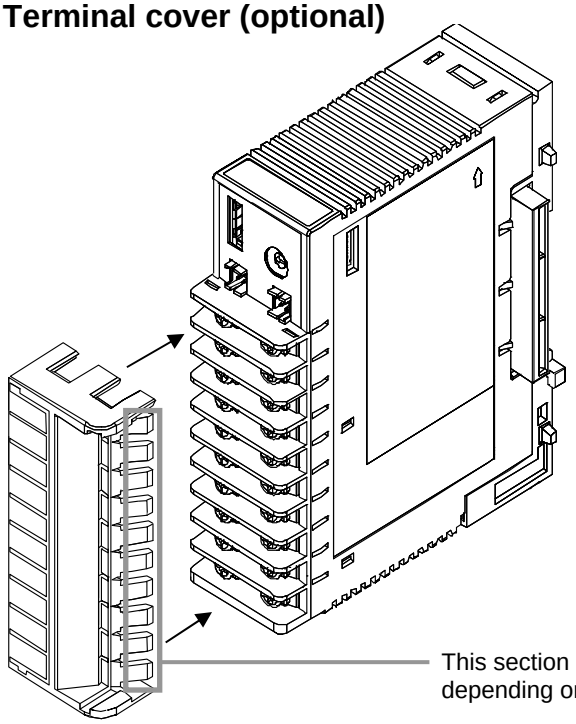
■ Joint connector cover (standard equipment)



Joint connector cover

Parts code	KSRZ-517A
Ordering code	00433384

■ Terminal cover (optional)



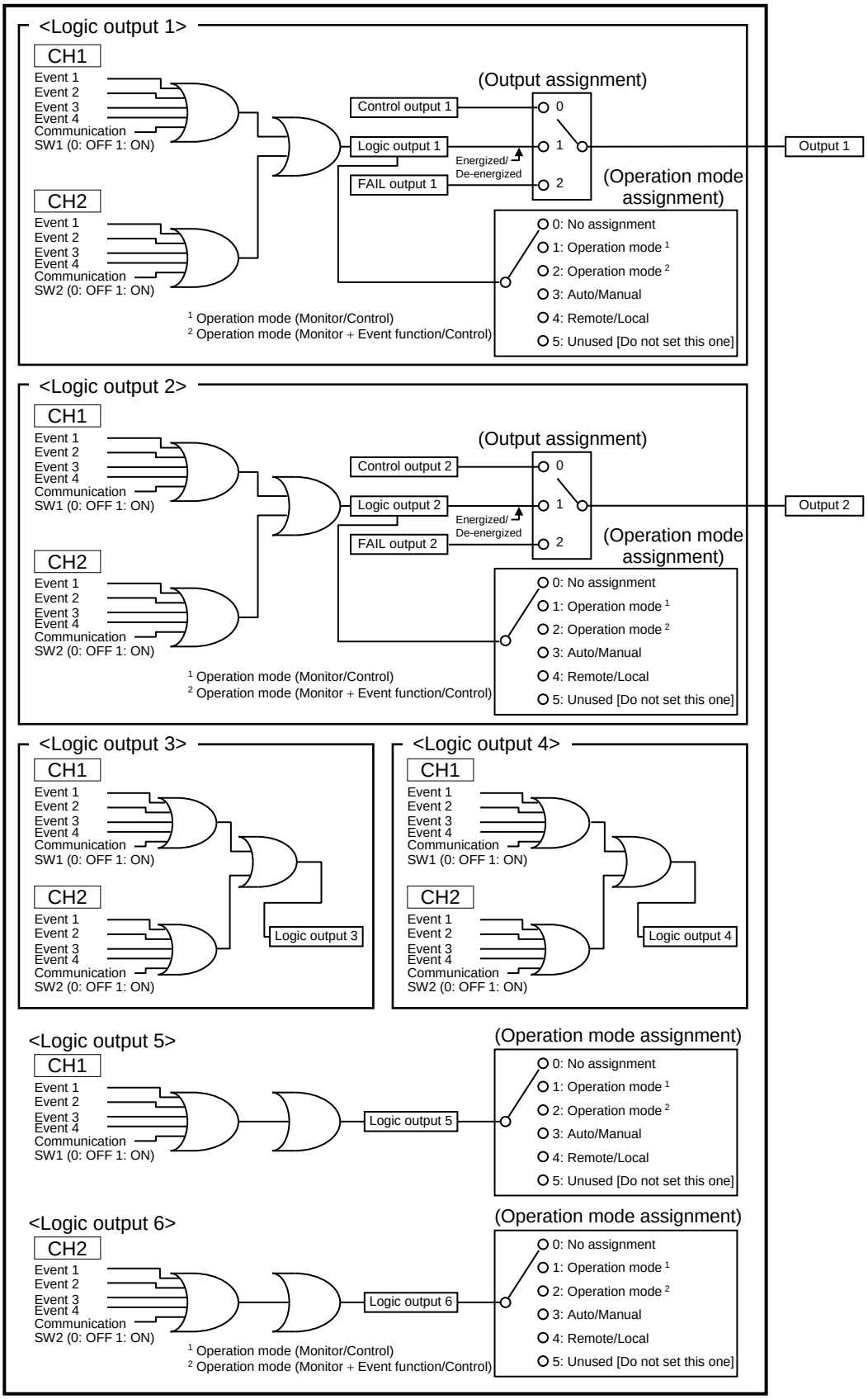
This section can be removed by bending it. Remove and then use it depending on the wiring condition.

Terminal cover

Parts code	KSRZ-510A(1)
Ordering code	00501925

12.3 Block Diagram of Logic Output Selection Function

Z-TIO-G module

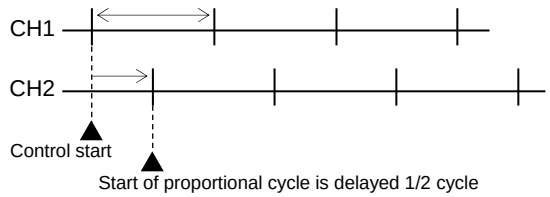


12.4 Peak Current Suppression Function

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. 9-34)** and the **Output limiter (P. 9-73)** must be set to the required conditions.

■ Action

Two-division setting:



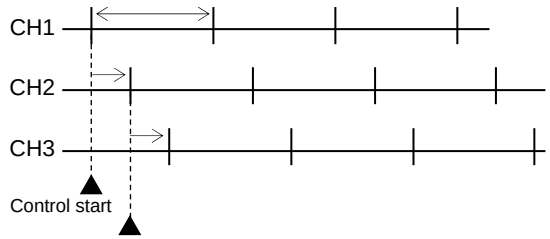
<Output limiter setting conditions>*

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:

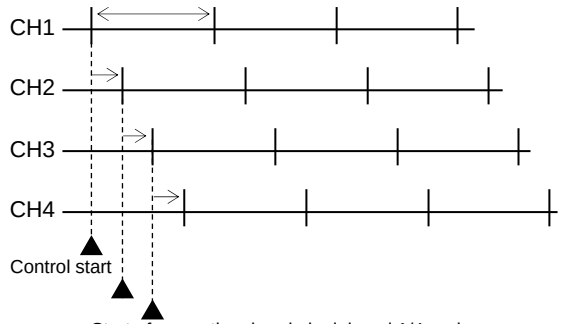


<Output limiter setting conditions>*

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

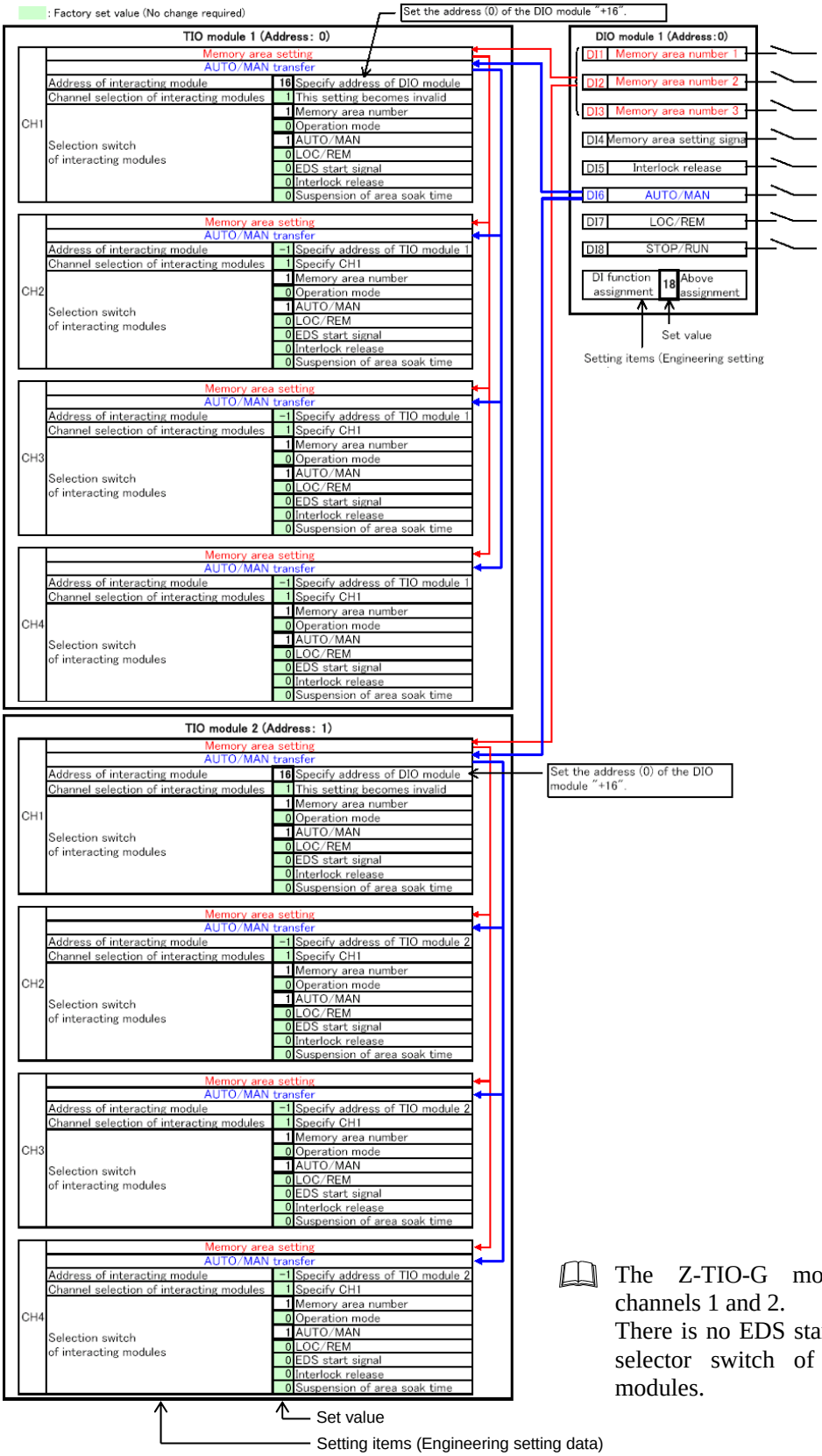
The use of peak current suppression function in the load used in the three phase power supply system may not suppress the peak current. This is because the peak current suppression function works on condition that the target (object) channels are time-proportionally controlled on the voltage with the same frequency. Because of this, if zero-crossing points of the frequency of each channel are different from one another, outputs of different channels may be overlapped and as a result the peak current suppression function may not work properly.

The Z-TIO-G module only uses channels 1 and 2.

12.5 Example of Using DI/DO

■ Example of using DI

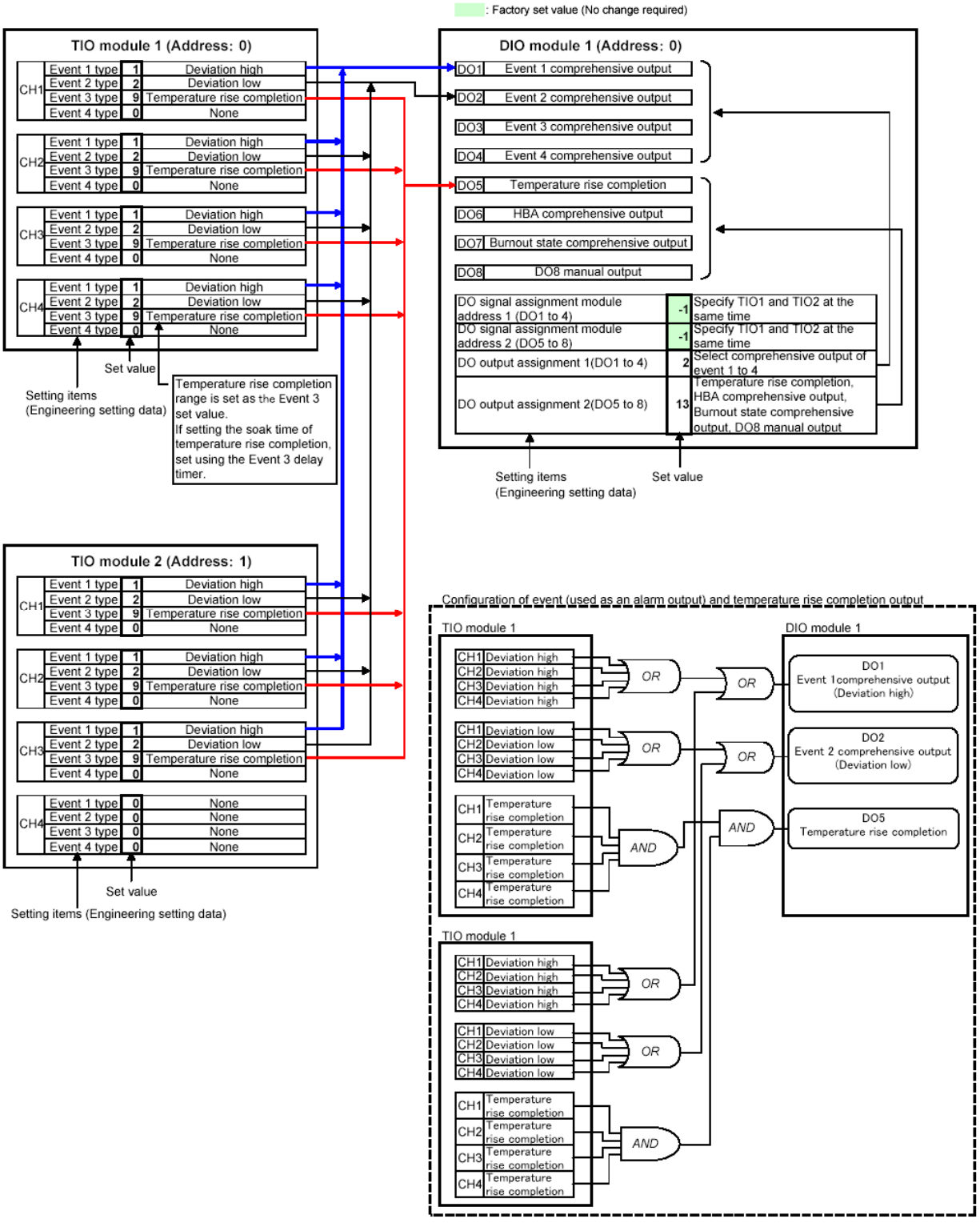
Using one Z-DIO module to configure memory area settings and perform AUTO/MAN switching in two Z-TIO modules



The Z-TIO-G module only uses channels 1 and 2.
There is no EDS starting signal in the selector switch of the interlocking modules.

■ Example of using DO

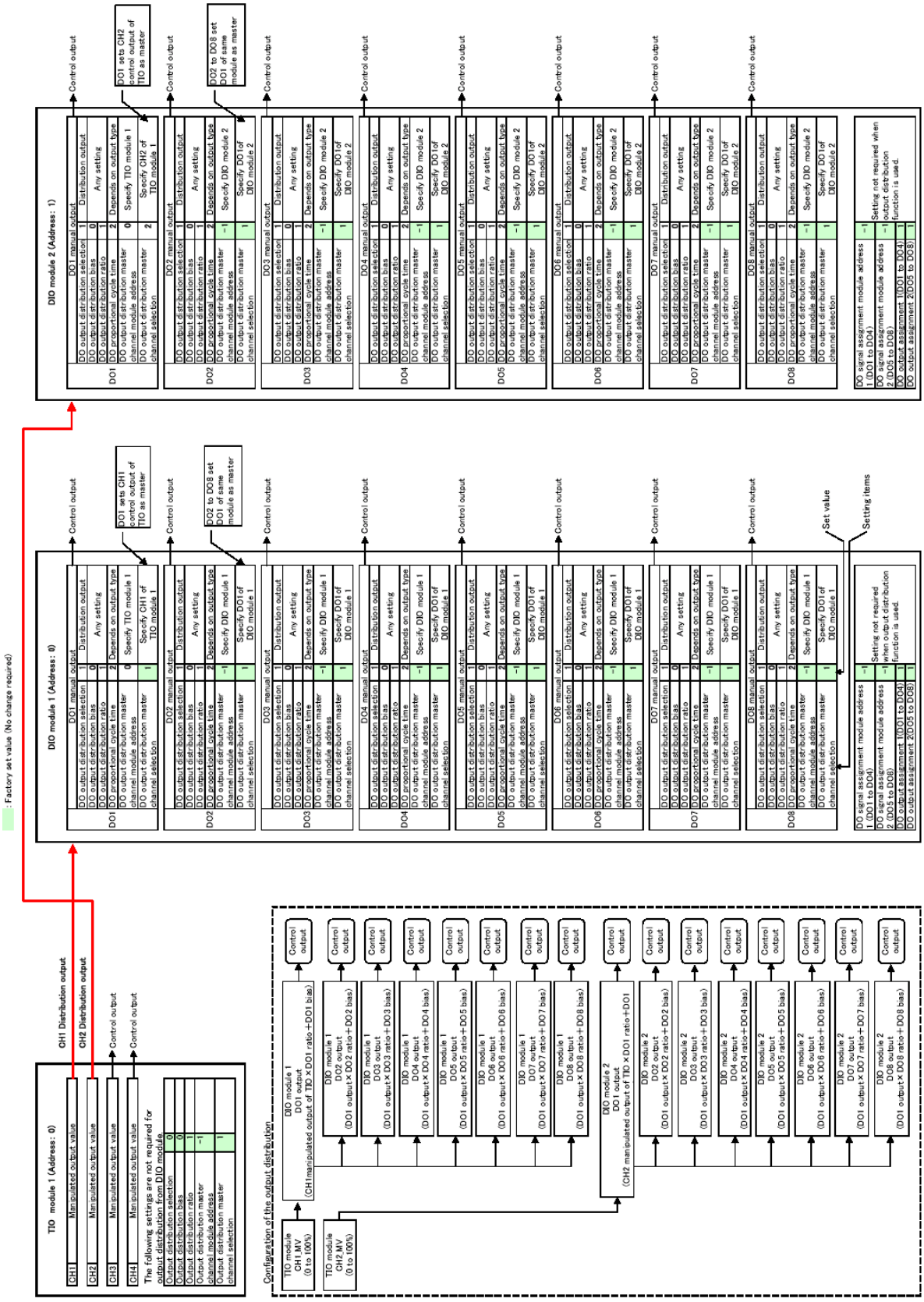
When outputting events (used as an alarm) and temperature rise completion of two Z-TIO modules from one Z-DIO module



The Z-TIO-G module only uses channels 1 and 2.
Temperature rise completion cannot be specified.

■ 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

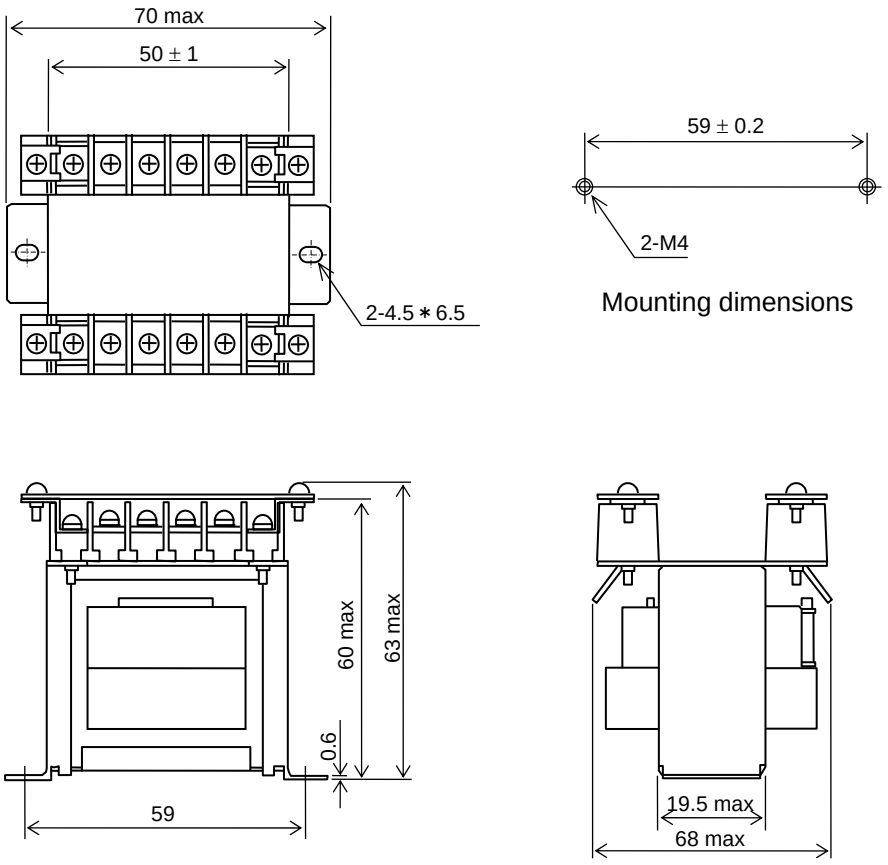


The Z-TIO-G module only uses channels 1 and 2.

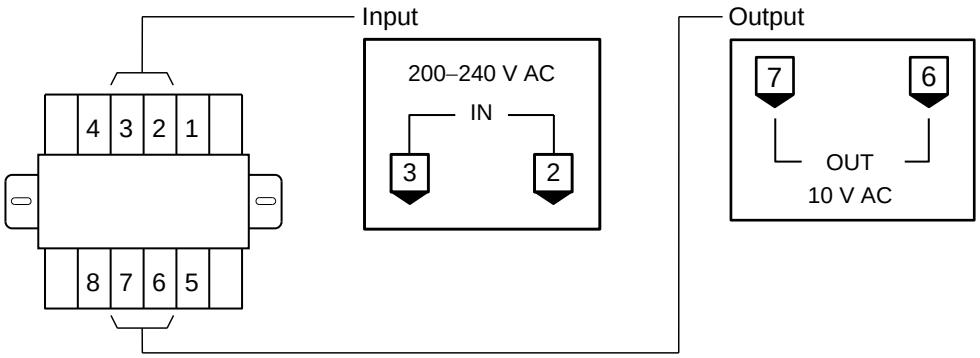
12.6 PFF Transformer PFT-02A

■ Dimensions

[Unit mm]



■ Terminal configuration



Alphabetical Order

H

I

L

M

O

P

R

S

MEMO

The first edition: SEP. 2012 [IMQ00]
The fourth edition: FEB. 2019 [IMQ00]

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