Module Type Controller SRZ

Current Transformer Input Module

Z-CT

Instruction Manual

[Detailed version]

RKC INSTRUMENT INC. IMS01T21-E5

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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.

⚠ WARNING

- To prevent injury to persons, damage to the instrument and the equipment, a suitable external protection device shall be required.
- All wiring must be completed before power is turned on to prevent electric shock, fire or damage to 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.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- All wiring must be in accordance with local codes and regulations.
- All wiring must be completed before power is turned on to prevent electric shock, instrument failure, or incorrect action. The power must be turned off before repairing work for input break and output failure including replacement of sensor, contactor or SSR, and all wiring must be completed before power is turned on again.
- To prevent instrument damage as a result of failure, protect the power line and the input/output lines from high currents with a suitable overcurrent protection device with adequate breaking capacity such as a fuse, circuit breaker, etc.
- A malfunction in this product may occasionally make control operations impossible or prevent alarm outputs, resulting in a possible hazard. Take appropriate measures in the end use to prevent hazards in the event of malfunction.
- 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.

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

The module type controller has the following features:

The current transformer input module Z-CT (hereafter called Z-CT module) has 12 current transformer (CT) inputs (hereafter called CT inputs), and is a function module that is used exclusively for the module type controller SRZ. Z-CT module interfaces with the host computer via Modbus or RKC communication protocols. The Z-CT module sets all of the data items via communication (The communication interface used for both protocols is RS-485). Therefore before operation, it is necessary to set value of each data item via communication.

■ Heater break alarm (HBA) and heater overcurrent alarm are possible

A Z-TIO module or Z-DIO module can be connected to a Z-CT module to enable the use of heater break alarm (HBA), heater melting alarm, and heater overcurrent alarm. (Time proportional output is supported.)
Both heater break alarm (HBA) and heater overcurrent alarm can be used with one CT input.
(Either alarm can also be used alone.)

- A Z-CT module can be connected to a Z-TIO module to enable heater break alarm (HBA) and heater overcurrent alarm for three-phase loads.
- When the output distribution function is used with a Z-DIO module, a Z-CT module can be connected to enable heater break alarm (HBA) and heater overcurrent alarm for distribution output.
- The Z-CT module can be connected to a Z-DIO module to output the heater break alarm (HBA) state from the digital output (DO) of the Z-DIO module.

  The heater overcurrent alarm state cannot be output from the digital output (DO) of the Z-DIO module.

■ Heater break alarm (HBA) and heater overcurrent can be set automatically

The heater break alarm (HBA) set value and heater overcurrent alarm set value can be automatically set using the push button on the front of the Z-CT module or by communication.

■ CTs other than the specified CTs can also be used

CTs other than the specified CTs can be used by changing the CT type and CT ratio settings. There are certain requirements for the CTs that can be used.

For details of CT condition, see on page 7-18.

Specified CTs

- CTL-6-P-Z (0.0 to 10.0 A)
- CTL-6-P-N (0.0 to 30.0 A)
- CTL-12-S56-10L-N (0.0 to 100.0 A)

■ 12-point current measurement is possible with a single module

Up to 12 current transformers can be connected to one Z-CT module.
Up to 16 Z-CT modules can be connected, enabling 192-point current measurement.
When used for current measurement applications, a Z-CT module can be used by itself.

Some usage conditions may prevent the current transformer (CT) input value monitor from showing the root mean squared current value. (See P. 7-4)

1.2 Checking the Product

Before using this product, check each of the following:

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

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

■ Package contents

Name	Q'TY	Remarks
☐ Z-CT module	1	————
☐ Z-CT Instruction Manual (IMS01T16-E☐)	1	Enclosed with instrument
☐ Joint connector cover KSRZ-517A	2	Enclosed with instrument
☐ Power terminal cover KSRZ-518A	1	Enclosed with instrument

■ Option (Sold separately)

Name	Q'TY	Remarks
☐ End plate DEP-01	2	————
☐ Connector SRZP-01 (front screw type)	2	For the connector type module
☐ Connector SRZP-02 (side screw type)	2	For the connector type module
☐ Terminal cover KSRZ-510A	1	For the terminal type module
☐ Current transformer CTL-6-P-Z	1	0.0 to 10.0 A
☐ Current transformer CTL-6-P-N	1	0.0 to 30.0 A
☐ Current transformer CTL-12-S56-10L-N	1	0.0 to 100.0 A
☐ Z-CT Instruction Manual [Detailed version] (IMS01T21-E5)	1	This manual (separately) * * This manual can be downloaded from our website: URL: http://www.rkcinst.com/english/manual_load.htm

1.3 Model Code

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

■ Suffix code

Z-CT-A□／□－□□
(1) (2) (3) (4)

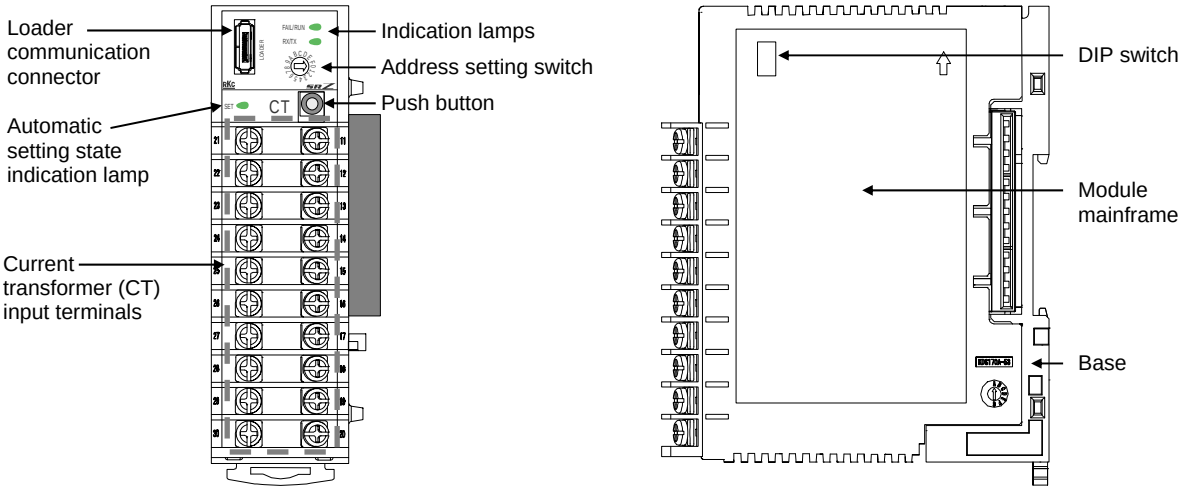
Specifications		Suffix code			
		Hardware coding only		Quick start code	
		(1)	(2)	(3)	(4)
Wiring type	Terminal type	T			
	Connector type	C			
Quick start code	No quick start code (Configured as factory default) *		N		
	Specify quick start code		1		
CT type	No specify quick start code			No code	
	CTL-6-P-N			P	
	CTL-12-S56-10L-N			S	
	CTL-6-P-Z			Z	
Communication protocol	No specify quick start code				No code
	RKC communication (ANSI X3.28-1976)				1
	Modbus				2

* Factory set value: CT type: P: CTL-6-P-N
Communication protocol: RKC communication (ANSI X3.28-1976)

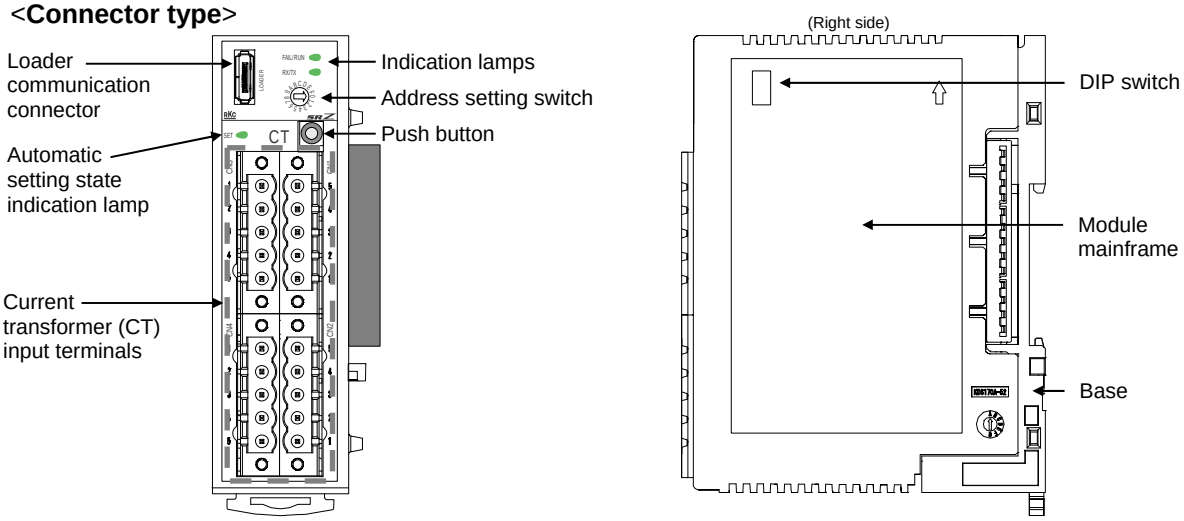
1.4 Parts Description

■ Module mainframe

<Terminal type>



<Connector type>



● Indication lamps

FAIL/RUN	[Green or Red]	When normal (RUN):	A green lamp is on
		Self-diagnostic error (FAIL):	A green lamp flashes
		Instrument abnormality (FAIL):	A red lamp is on
RX/TX	[Green]	During data send and receive:	A green lamp turns on
SET	[Green]	During automatic setting execution:	A green lamp is on
(Automatic setting state indication lamp)		Automatic setting failure:	A green lamp flashes *

* Flashes if automatic setting fails for even one channel among the CT input channels for which automatic setting is being executed.

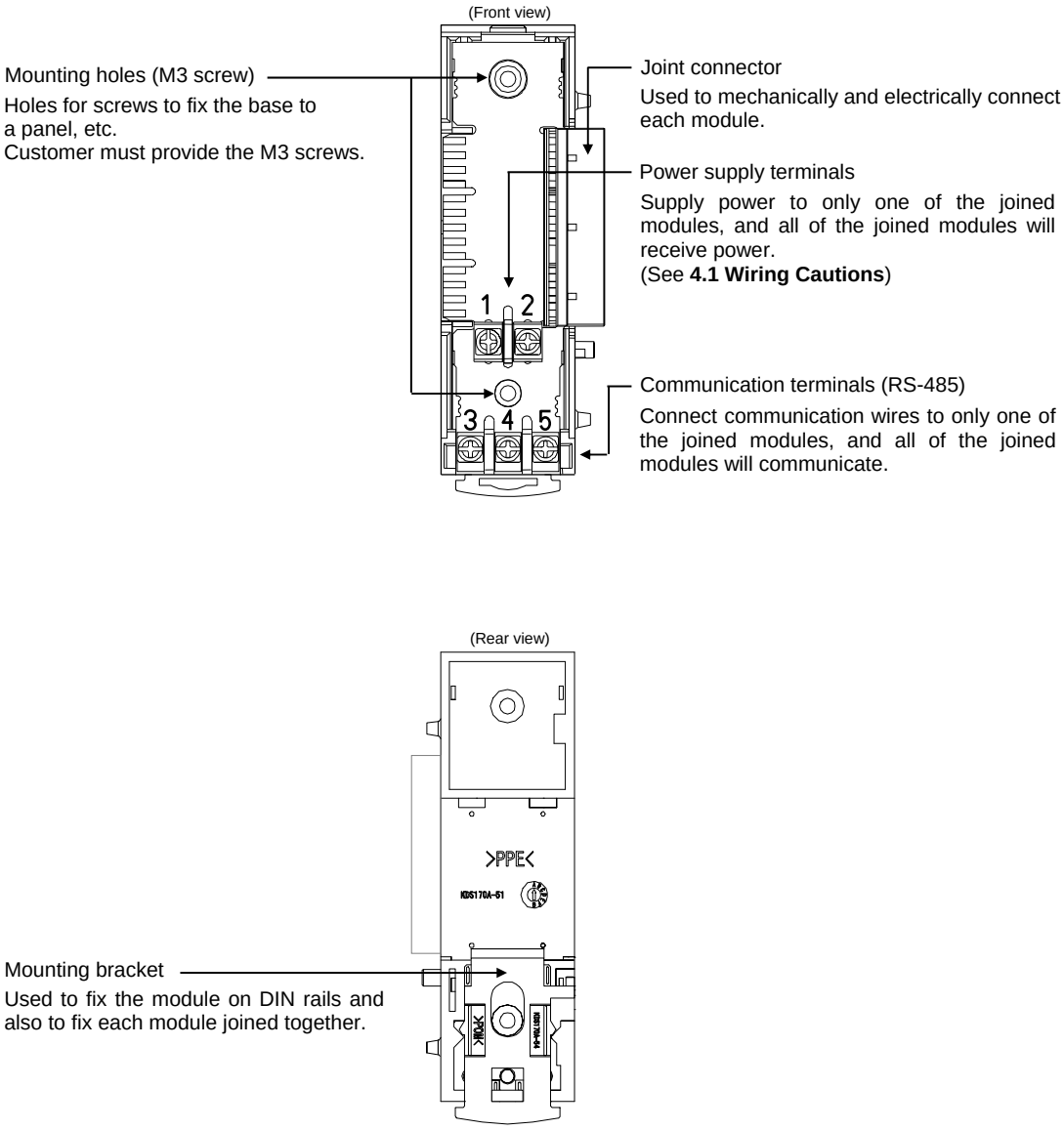
● Button

Push button	Use when the heater break alarm set value or heater overcurrent alarm set value should be automatically set.

● Switches

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

■ Base


(Front view)
Mounting holes (M3 screw)
Holes for screws to fix the base to a panel, etc.
Customer must provide the M3 screws.
Joint connector
Used to mechanically and electrically connect each module.
Power supply terminals
Supply power to only one of the joined modules, and all of the joined modules will receive power.
(See 4.1 Wiring Cautions)
Communication terminals (RS-485)
Connect communication wires to only one of the joined modules, and all of the joined modules will communicate.
1
2
3
4
5
(Rear view)
Mounting bracket
Used to fix the module on DIN rails and also to fix each module joined together.

1.5 Corresponding to the SRZ Modules and Communication Protocol

The Z-CT module can be connected to the following SRZ modules.
However, the communication protocol types that can be selected for each SRZ module vary, and some communication protocols are not compatible with the Z-CT module.
SRZ modules that can be connected to a Z-CT module and usable communication protocols are shown below.

Joinable modules		Communication protocol	Usable/ Not usable	Remarks
SRZ module name	Model			
Z-TIO module	Z-TIO-A/B	RKC communication (ANSI X3.28-1976)	Usable	—
		Modbus	Usable	—
	Z-TIO-C/D	RKC communication (ANSI X3.28-1976)	Usable	—
		Modbus	Usable	—
		PLC communication	Not usable	The Z-CT module does not support PLC communication.
	Z-TIO-E/F	RKC communication (ANSI X3.28-1976)	Usable	—
		Modbus	Usable	—
		PLC communication	Not usable	The Z-CT module does not support PLC communication.
Z-DIO module	Z-DIO-A	RKC communication (ANSI X3.28-1976)	Usable	—
		Modbus	Usable	—
Z-COM module *	Z-COM-A	RKC communication (ANSI X3.28-1976)	Usable	—
		Modbus	Usable	—
		PLC communication	Not usable	The Z-CT module does not support PLC communication.

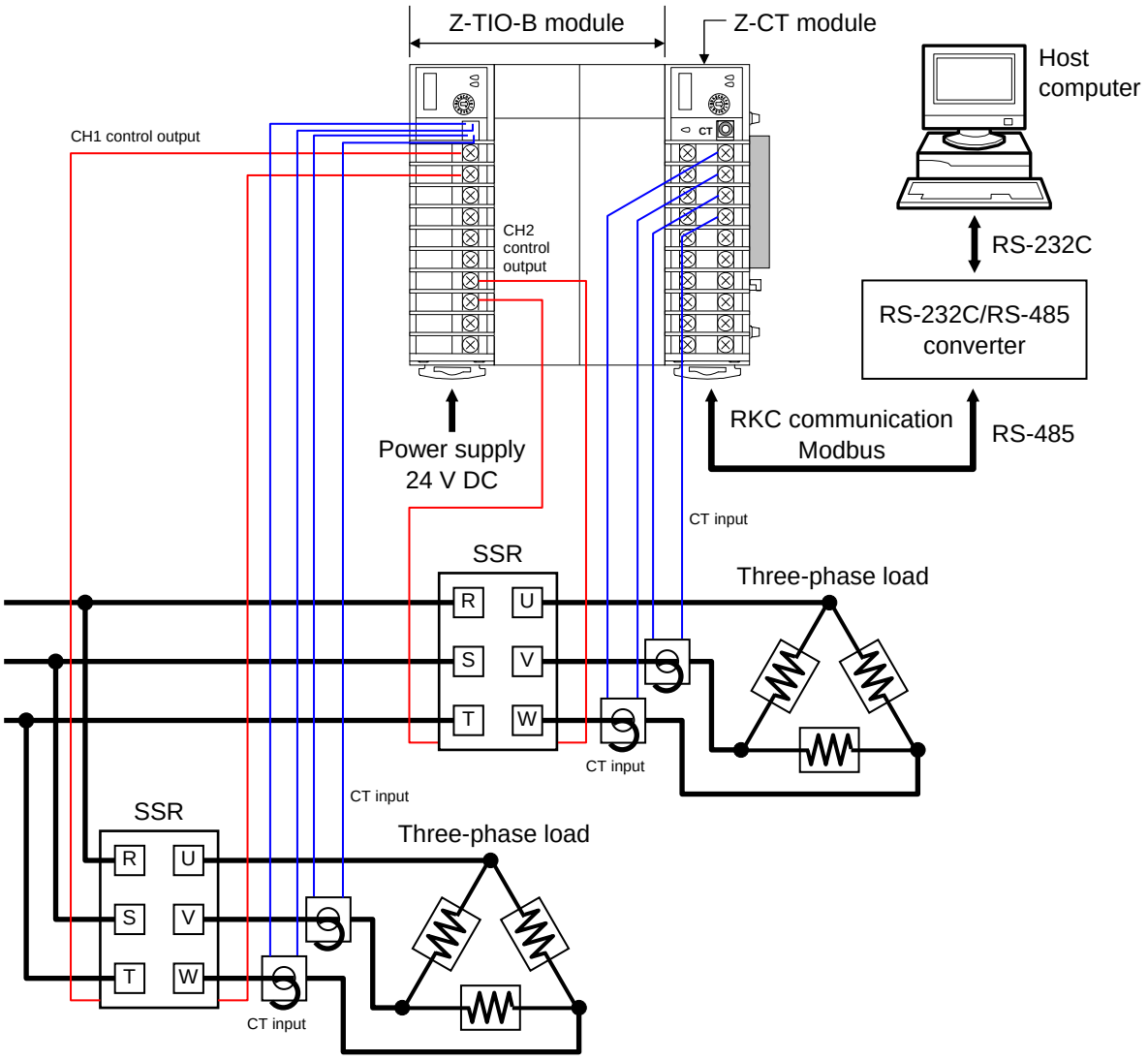
* A Z-COM module in which the ROM version is earlier than “PC0379-15” cannot be connected to a Z-CT module.

1.6 Application of Z-CT Module

■ For three-phase load alarm monitoring

For three-phase loads, two CT inputs are used for one control output.
When a Z-TIO module is connected to a three-phase load, the CT input (option) of the Z-TIO module does not allow heater break alarms (HBA) and heater overcurrent alarms to be added to all control outputs.
A Z-CT module can be connected to the Z-TIO module to add heater break alarms (HBA) and heater overcurrent alarms to the control outputs that could not be handled by the CT input (option) of the Z-TIO module.

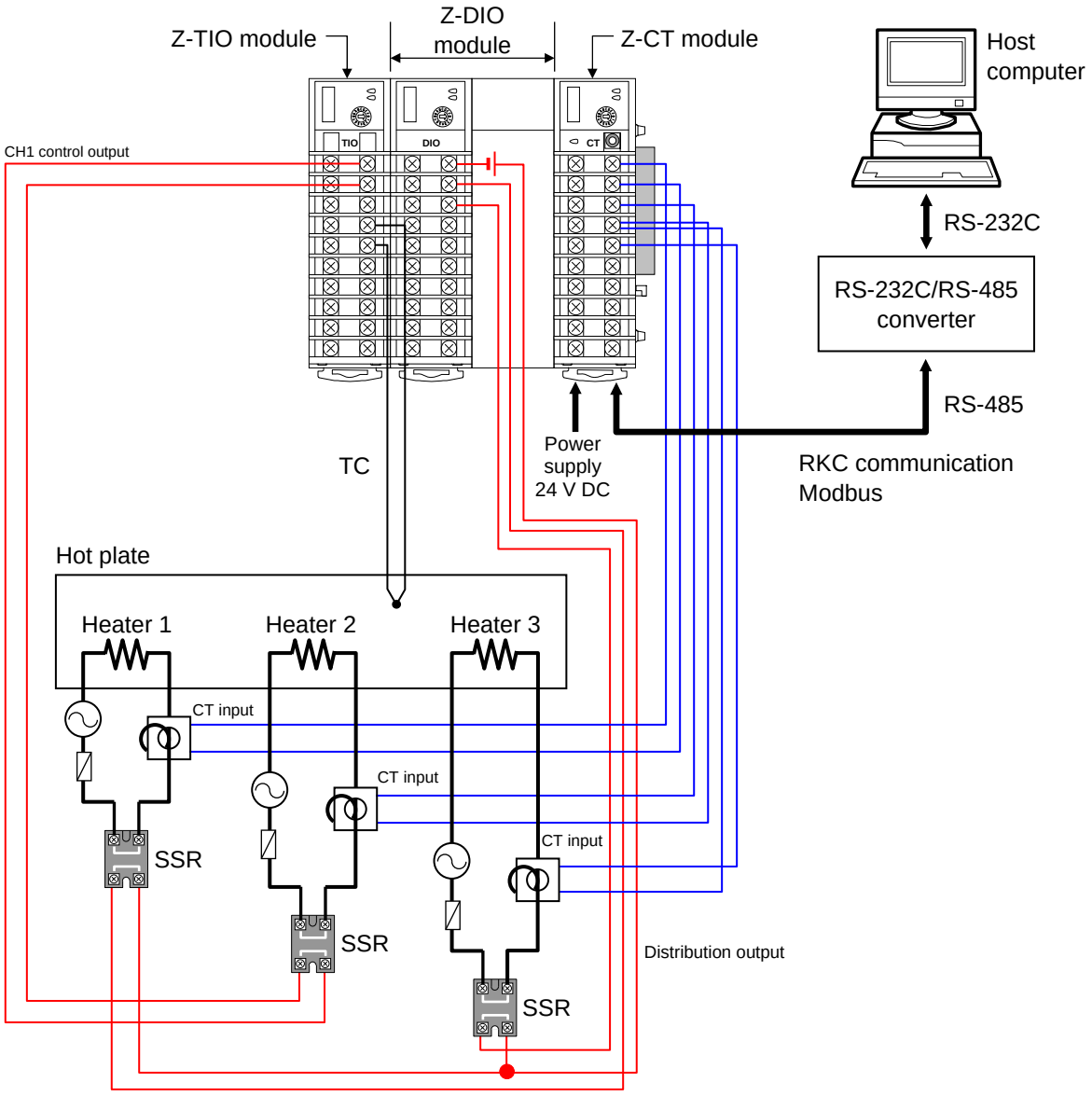
When the Z-TIO-B module (2-channel type) is used



The heater break-alarm (HBA) and heater overcurrent alarm of the Z-CT module corresponds to the time proportional output.

■ For alarm monitoring of distribution output

When the output distribution function is used with a Z-DIO module, a Z-CT module can be connected to enable detection of heater break and heater overcurrent in distribution output.



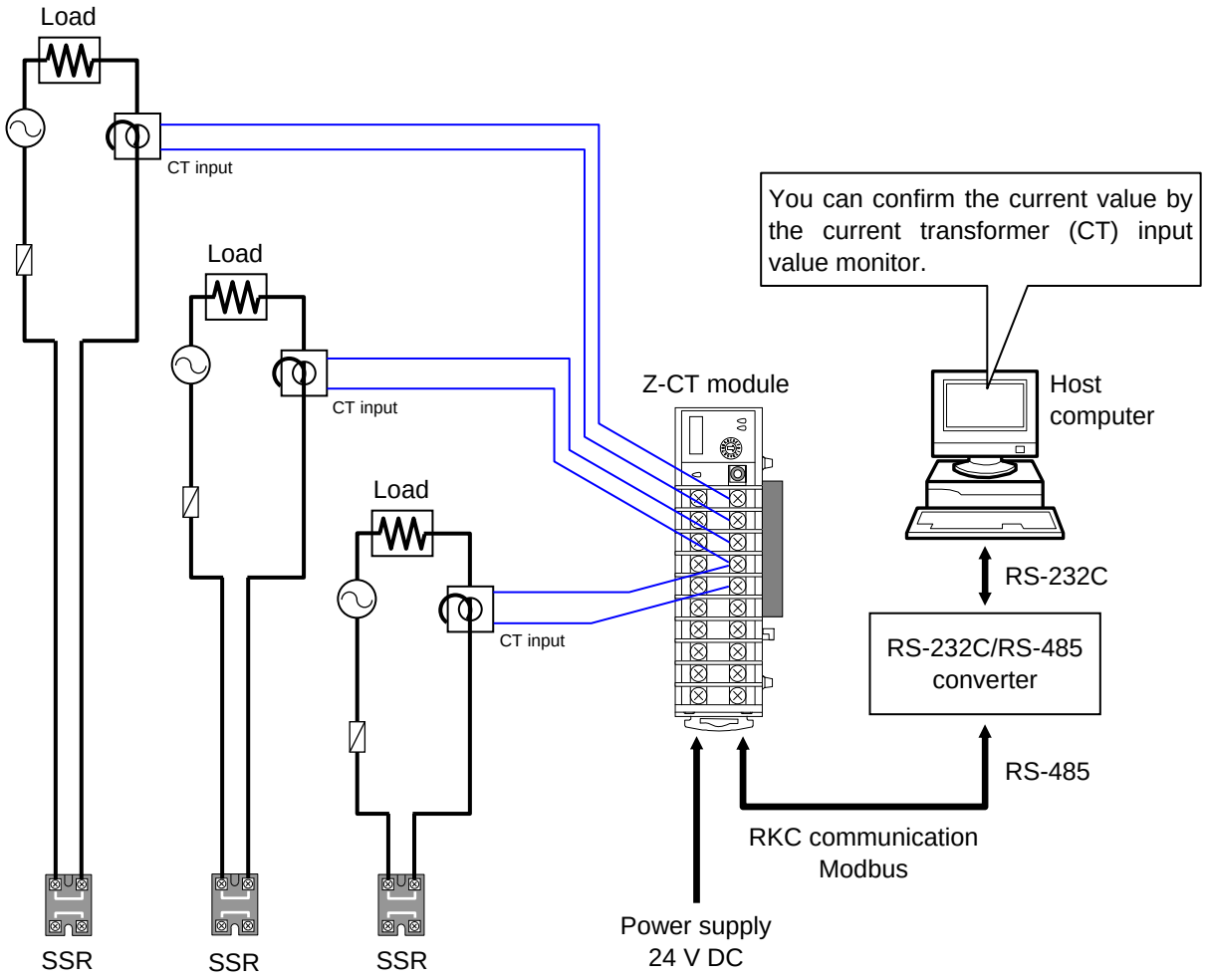
The heater break-alarm (HBA) and heater overcurrent alarm of the Z-CT module corresponds to the time proportional output.

For the output distribution function, see **SRZ Instruction Manual (IMS01T04-E☐)**.

■ For CT input value monitor

One Z-CT module is capable of monitoring 12 channels of current.
When only used for CT input value monitoring, the Z-CT module can be used by itself; connection to another SRZ function module (Z-TIO or Z-DIO module) is not necessary.

Some usage conditions may prevent the current transformer (CT) input value monitor from showing the root mean squared current value. (See P. 7-4)



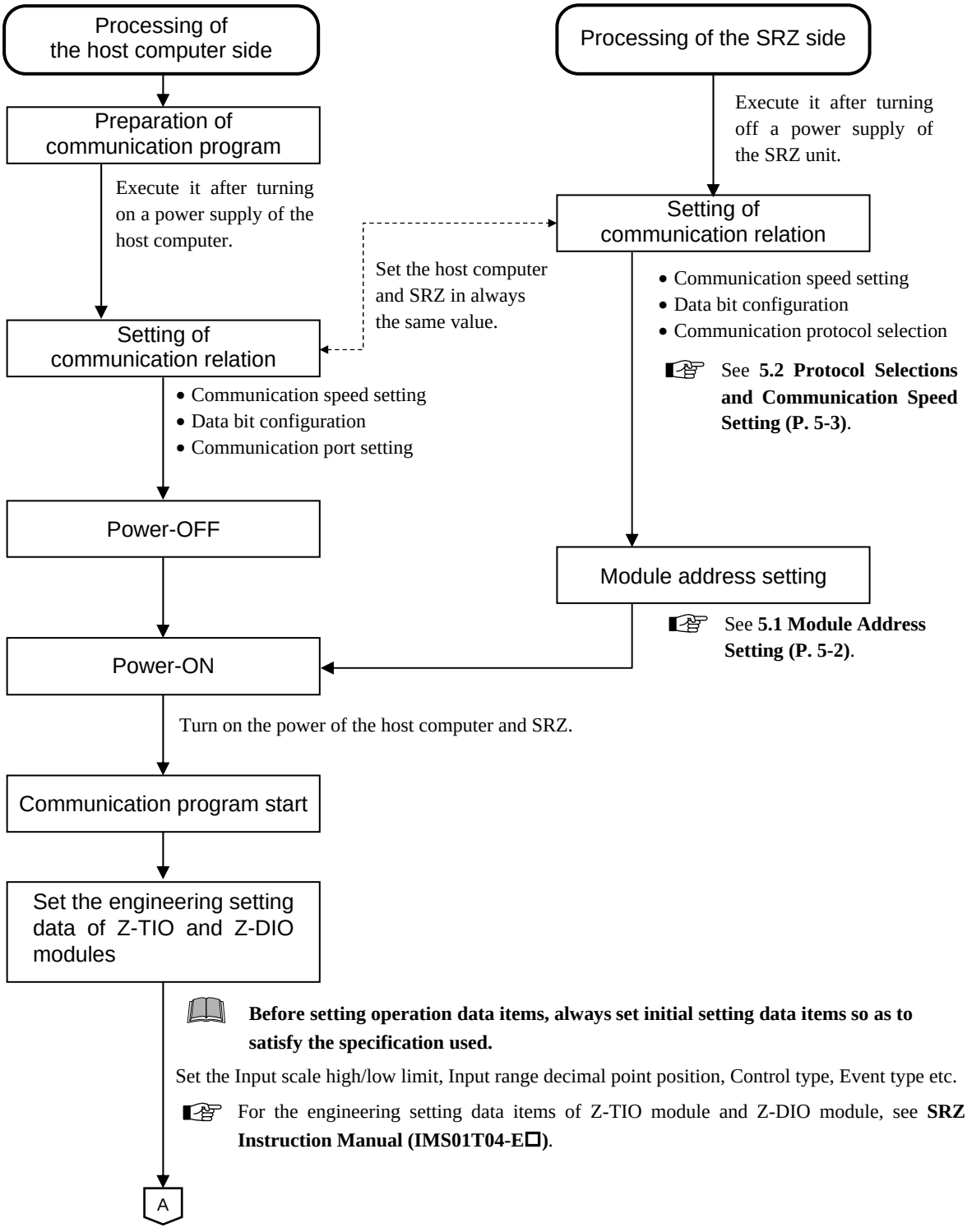
HANDLING PROCEDURE TO OPERATION

2

■ Procedure flow chart

Before configuring settings, complete installation of the SRZ and host computer and make all connections. Once installation and the connections are completed, follow the procedure below to configure settings required for operation.

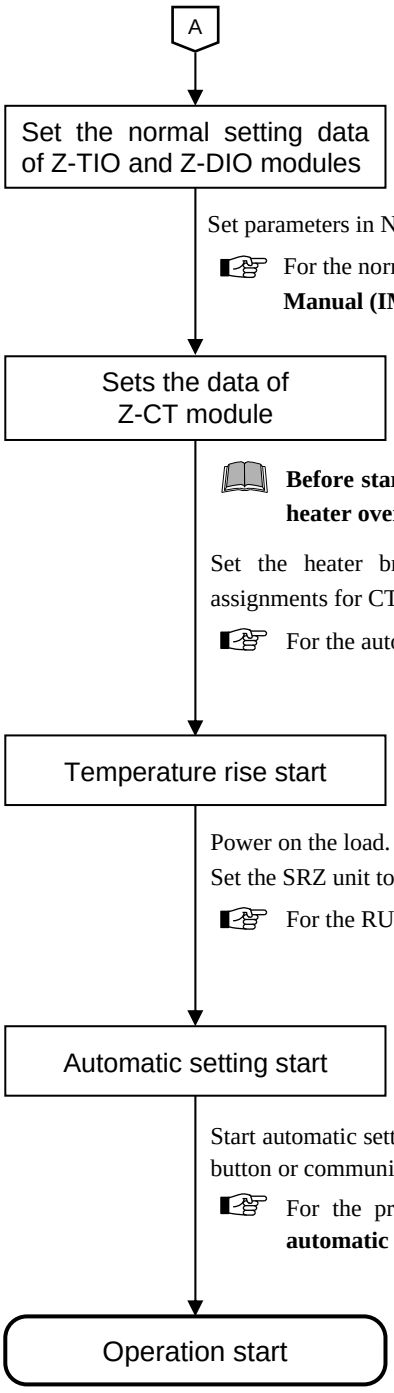
(1) When the Z-CT module is connected to a Z-TIO module or Z-DIO module



Before setting operation data items, always set initial setting data items so as to satisfy the specification used.

Set the Input scale high/low limit, Input range decimal point position, Control type, Event type etc.

☞ For the engineering setting data items of Z-TIO module and Z-DIO module, see **SRZ Instruction Manual (IMS01T04-E□)**.



Set parameters in Normal setting of data.

☞ For the normal setting data of Z-TIO module and Z-DIO module, see **SRZ Instruction Manual (IMS01T04-E□)**.

Before starting automatic setting, always set the data of heater break alarm (HBA) or heater overcurrent alarm.

Set the heater break/heater overcurrent alarm automatic setting selection, Module address assignments for CT input, Module channel assignments for CT input, etc.

☞ For the automatic setting, see **6.3 Automatic Setting Example (P. 6-14)**.

Power on the load.

Set the SRZ unit to RUN (start control).

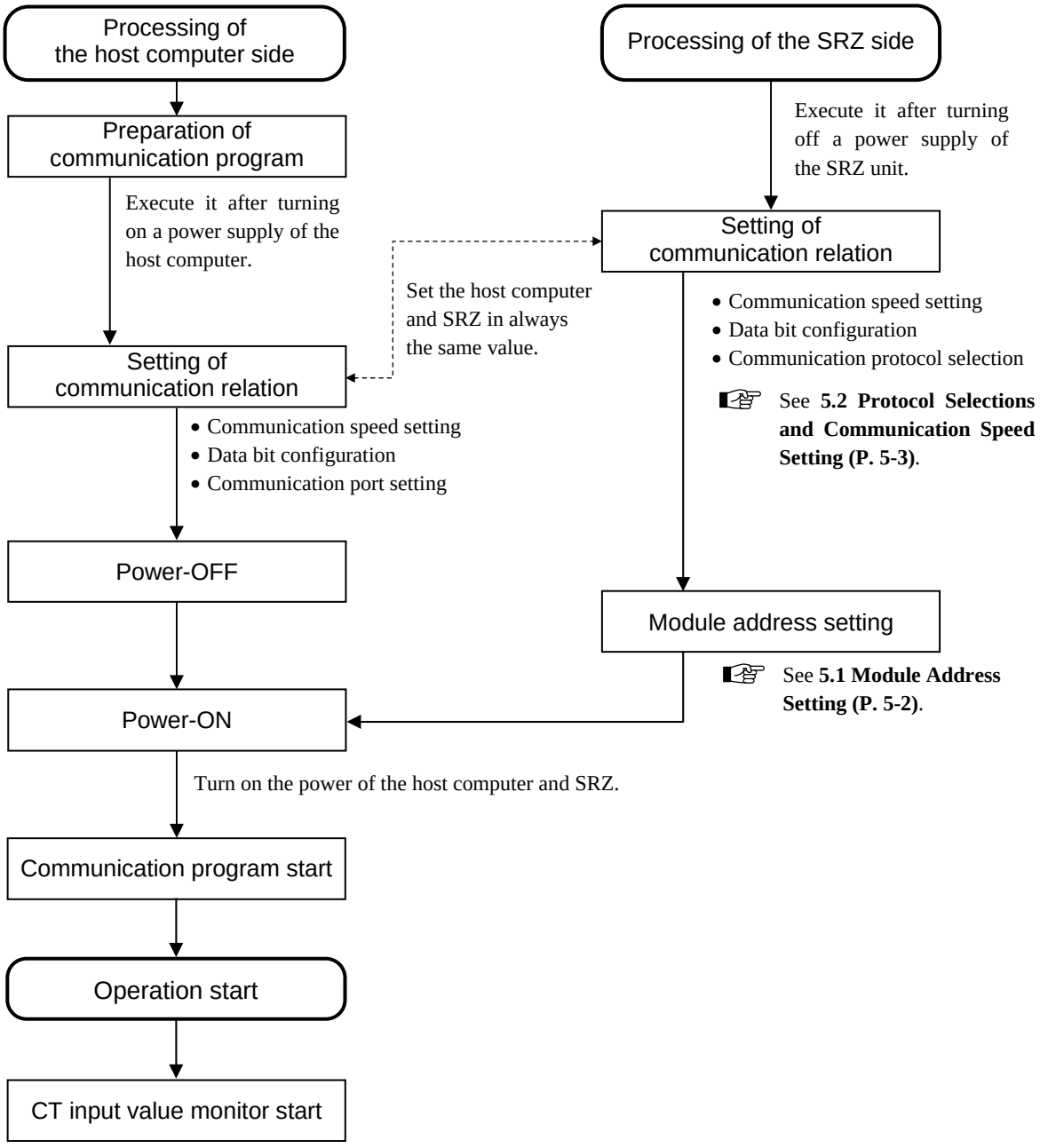
☞ For the RUN/STOP transfer of SRZ unit, see **SRZ instruction Manual (IMS01T04-E□)**.

Start automatic setting of the heater break alarm (HBA) or heater overcurrent alarm using the push button or communication.

☞ For the procedure for starting automatic setting, see **6.3.4 Procedure for executing automatic setting (P. 6-23)**.

(2) Using the Z-CT module by itself (using as a CT input monitor)

Some usage conditions may prevent the current transformer (CT) input value monitor from showing the root mean squared current value. (See P. 7-4)



(3) When the Z-CT module is connected to a Z-COM module

To connect a Z-COM module, see the instruction manual for the Z-COM module.

Z-COM Host Communication Instruction Manual (IMS01T23-E□)

Z-COM Instruction Manual (IMS01T22-E□)

3 MOUNTING

3.1 Mounting Cautions

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

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

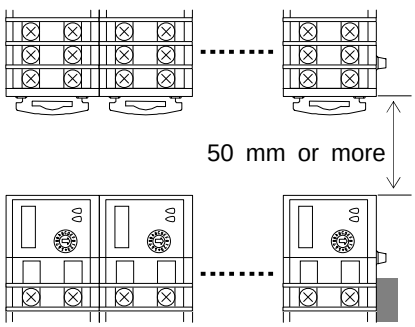
(1) This instrument is intended to be used under the following environmental conditions.
(IEC 61010-1) [OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2]

(2) Use this instrument within the following environment conditions.
- Allowable ambient temperature: −10 to +50 °C
- Allowable ambient humidity: 5 to 95 %RH
  (Absolute humidity: MAX.W.C 29.3 g/m^3 dry air at 101.3 kPa)
- Installation environment conditions: Indoor use
  Altitude up to 2000 m

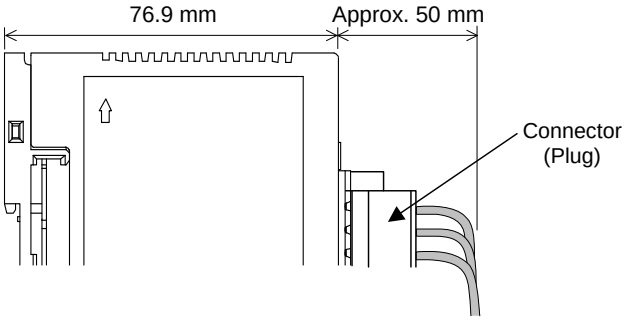
(3) Avoid the following conditions when selecting the mounting location:
- Rapid changes in ambient temperature which may cause condensation.
- Corrosive or inflammable gases.
- Direct vibration or shock to the mainframe.
- Water, oil, chemicals, vapor or steam splashes.
- Excessive dust, salt or iron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

(4) 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, or the like. 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

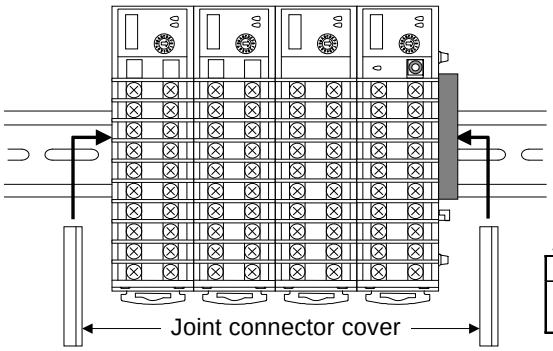
  When the module is mounted on the panel, allow a minimum of 50 mm at the top and bottom of the module to attach the module to the mainframe.



- Depth for connector mount type module (Connector type)
  Space for connectors and cables must be considered when installing.



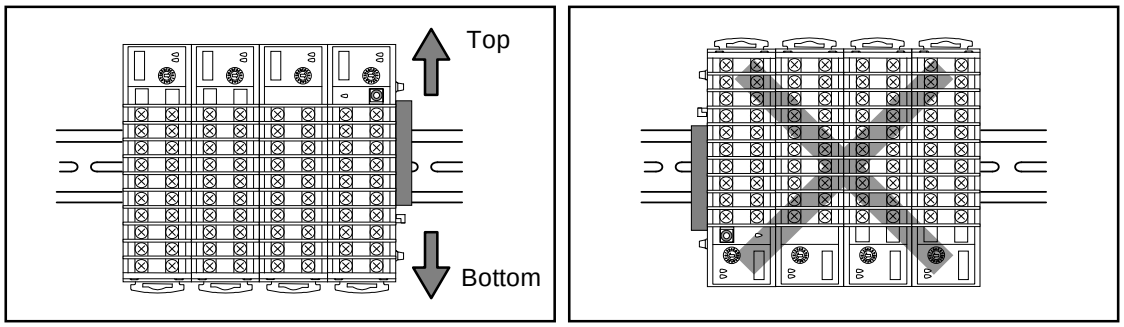
- Mounting the joint connector cover
  It is recommended to use a plastic cover on the connector on both sides of the mounted modules for protection of connectors.



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.

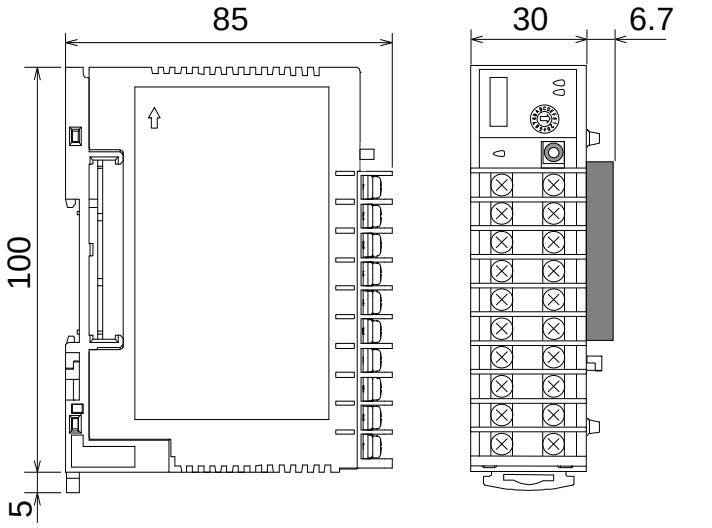


(5) If this instrument is permanently connected to equipment, it is important to include a switch or circuit-breaker into the installation. This should be in close proximity to the equipment and within the easy reach of the operator. It should be marked as the disconnecting device for the equipment.

3.2 Dimensions

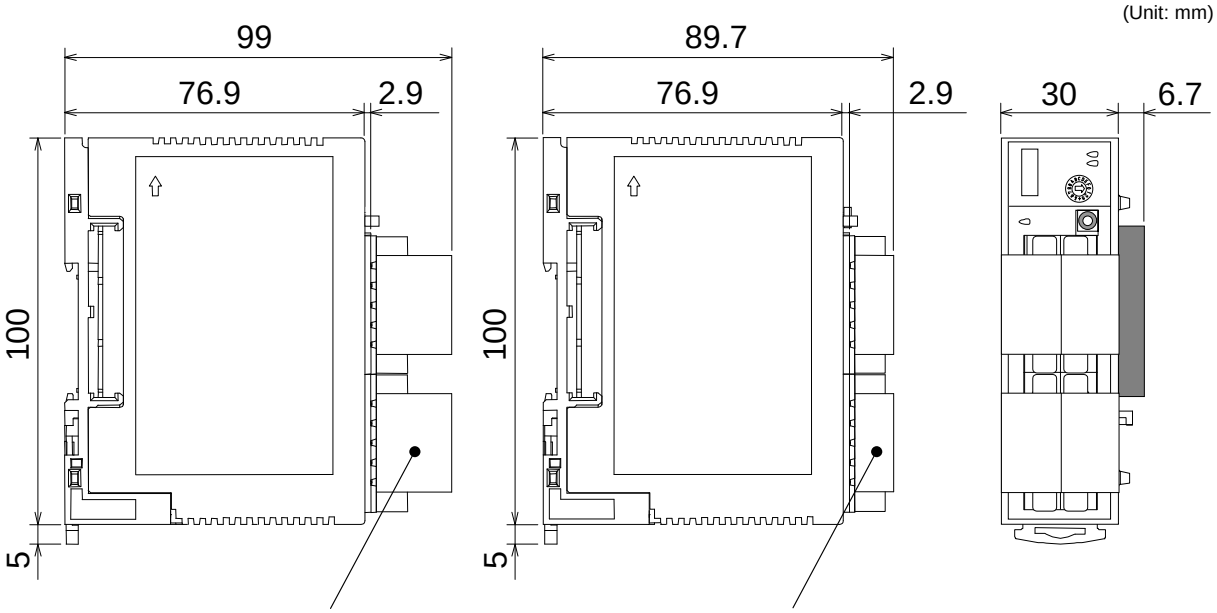
<Terminal type module>

(Unit: mm)



<Connector type module>

(Unit: mm)



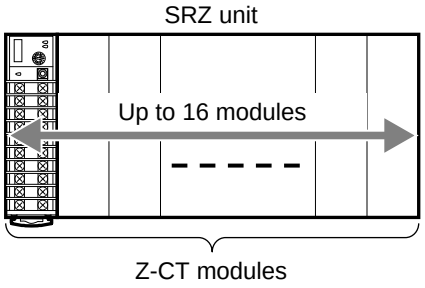
Connector type (sold separately):
SRZP-01 [Front-screw type]

Connector type (sold separately):
SRZP-02 [Side-screw type]

3.3 Joinable Number of Modules

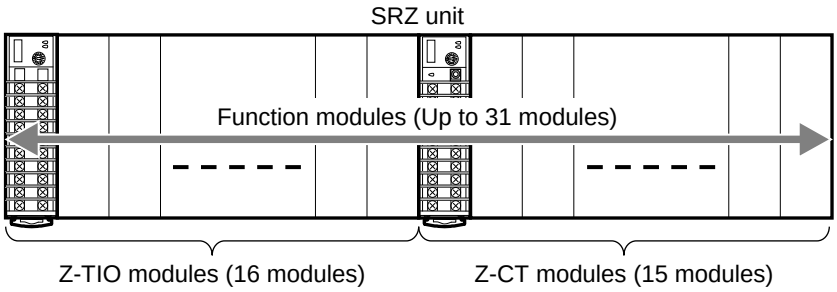
When joining a function module (Z-TIO module, Z-DIO module, or Z-CT module) or a Z-COM module, note the points below.

■ **When connecting only Z-CT modules: Up to 16 modules**

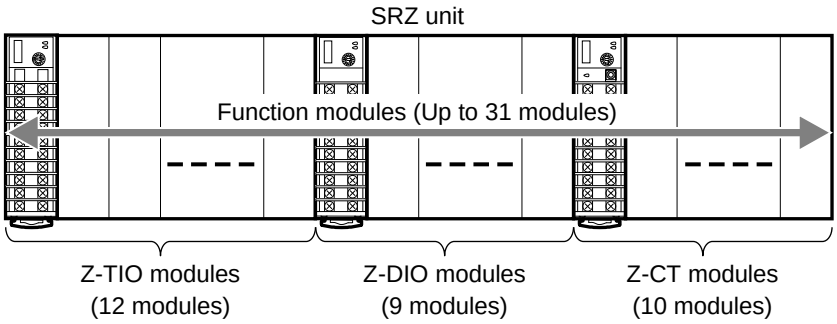


■ **When connecting two or more different types of function modules: Up to 31 modules**
(However, the number of connected function modules of the same type must not exceed the maximum)

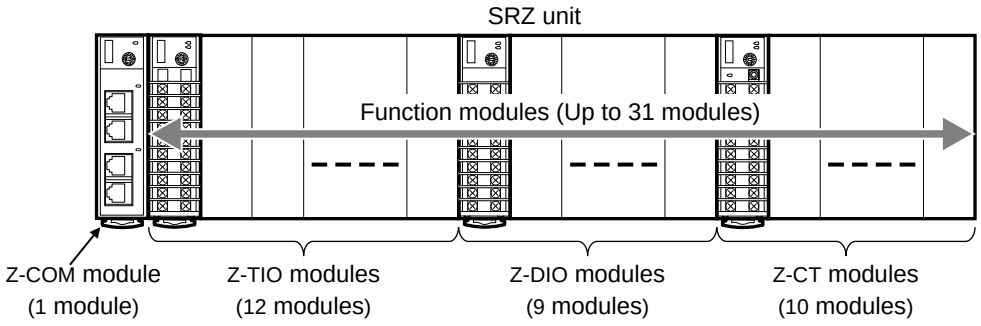
- When connecting Z-TIO-A modules and Z-CT modules



- When connecting Z-TIO-A, Z-DIO and Z-CT modules



- When connecting Z-COM, Z-TIO, Z-DIO and Z-CT modules

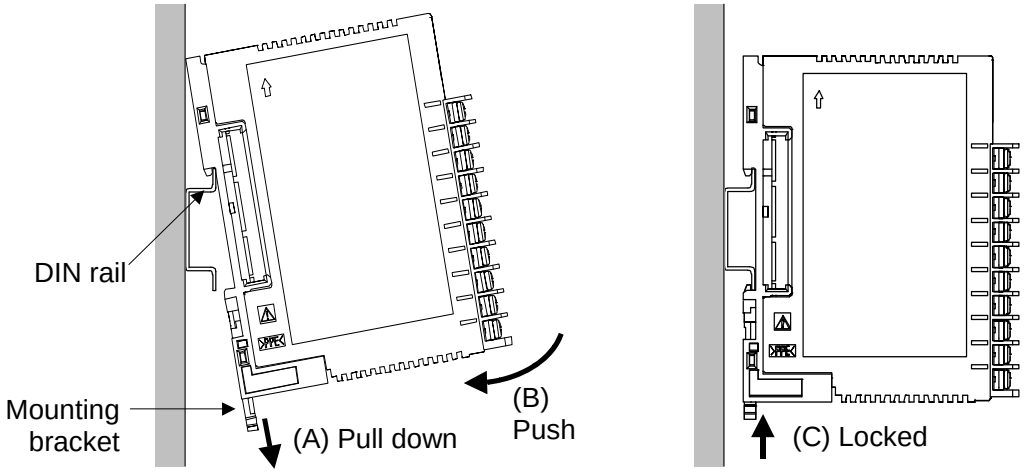


3.4 DIN Rail Mounting and Removing

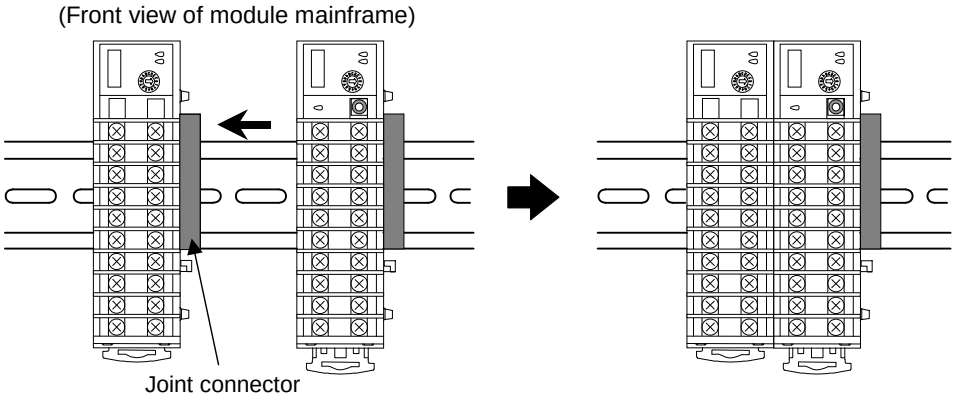
■ Mounting procedures

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).

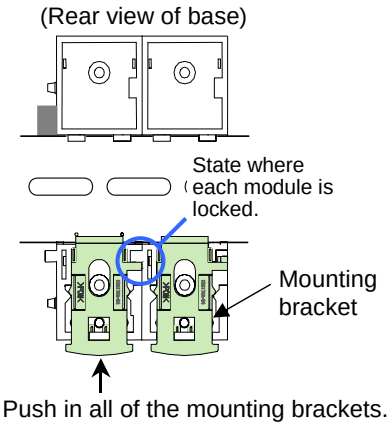
2. Slide the mounting bracket up to secure the module to the DIN rail (C).



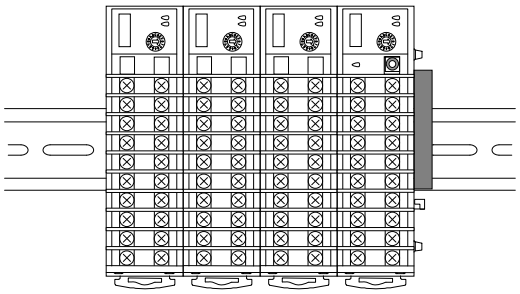
3. Mount the modules on the DIN rail. Slide the modules until the modules are closely joined together and the joint connectors are securely connected.



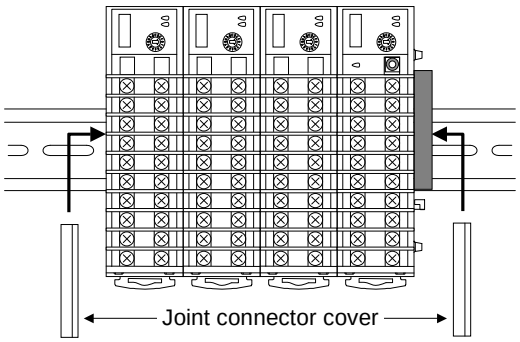
4. Push in the mounting brackets to lock the modules together and fix to the DIN rail.



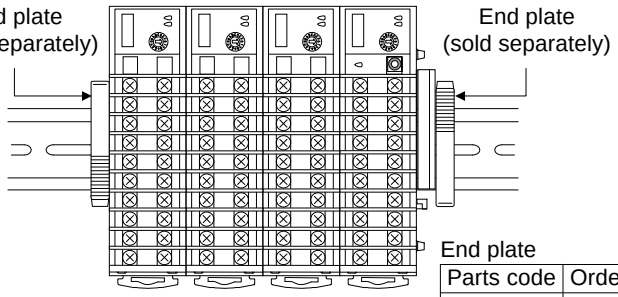
5. Connect the required number of function modules.



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.

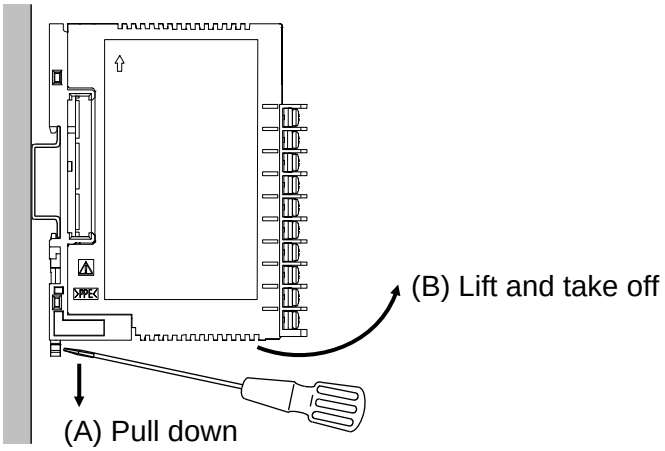


End plate

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

■ Removing procedures

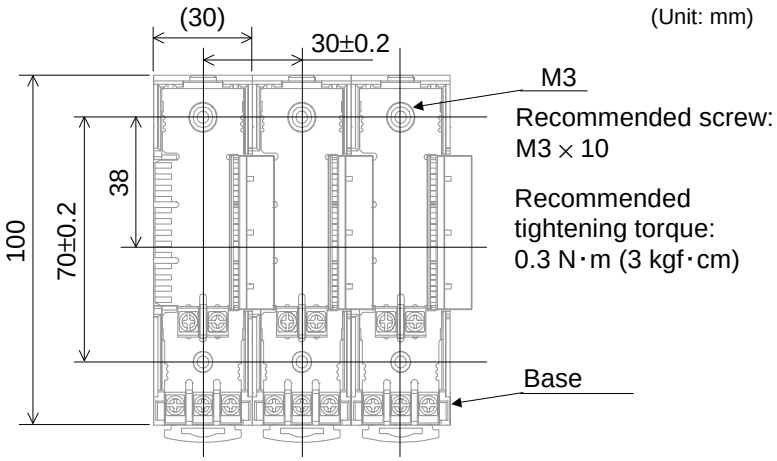
1. Pull down a mounting bracket with a blade screwdriver (A).
2. Lift the module from bottom, and take it off (B).



3.5 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)

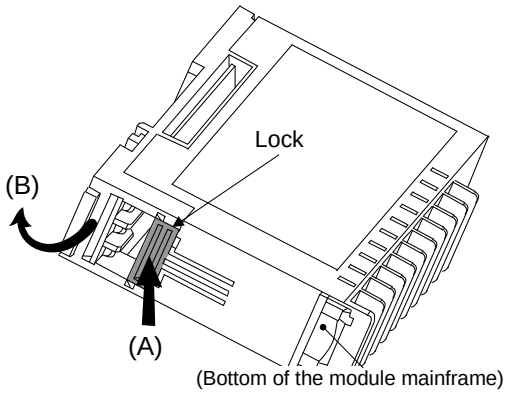


Fig. 1: Removing the base

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

☞ See the **3.4 DIN Rail Mounting and Removing (P. 3-6).**

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)

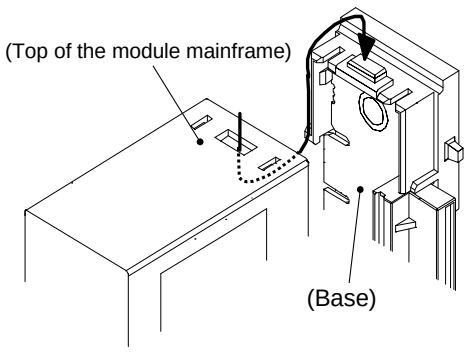


Fig. 2: Mounting the module mainframe

4 WIRING

4.1 Wiring Cautions

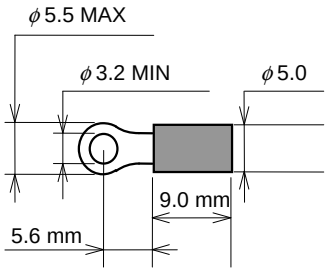
⚠ WARNING

To prevent electric shock or instrument failure, do not turn on the power until all the wiring is completed. Make sure that the wiring has been properly made 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.
- 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 the end-use equipment. The power supply must be in compliance with a limited-energy circuits (maximum available current of 8 A).
- Supply the power to only one of the joined modules. When power is supplied to any one of the joined modules, all of the joined modules will receive power.
- Select the power capacity which is appropriate for the total power consumption of all joined modules and the initial current surge when the power is turned on.

  Z-CT module power consumption (at maximum load): 35 mA max. (at 24 V DC)
  Rush current: 10 A or less
- For the power supply terminals and communication terminals, use the specified solderless terminals. Only these specified solderless terminals can be used due to the insulation between the terminals.

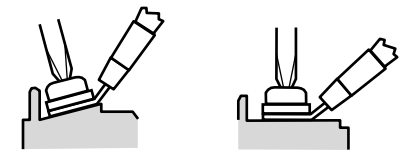
  Screw Size: M3 × 7 (with 5.8 × 5.8 square washer)
  Recommended tightening torque:
  0.4 N·m (4 kgf·cm)
  Applicable wire: Solid/twisted wire of 0.25 to 1.65 mm^2
  Specified solderless terminals:
  Manufactured by J.S.T MFG CO., LTD.
  Circular terminal with isolation V1.25–MS3
  (M3 screw, width 5.5 mm, hole diameter 3.2 mm)



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

📖 Connecting solderless terminals to CT input terminals (terminal type module)
When using a non-specified CT, use solderless terminals that are the same size as the above.
A spade terminal (Y type) can also be used if it is the same size.

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

  Connector type: SRZP-01 (Front-screw type)
  SRZP-02 (Side-screw type)
  Screw size: M2.5
  Recommended tightening torque:
  0.43 to 0.50 N·m (4.3 to 5.0 kgf·cm)
  Used cable specifications*:
  Lead wire type:
  Solid (AWG 28 [cross-section: 0.081 mm^2] to 12 [cross-section: 3.309 mm^2]) or
  Twisted wire (AWG 30 [cross-section: 0.051 mm^2] to 12 [cross-section: 3.309 mm^2])
  Stripping length: 9 to 10 mm (SRZP-01), 7 to 8 mm (SRZP-02)
  * Cables within the given ranges can be connected.
  If a cable is not connected to the CT, select a cable within these ranges.

- Isolation between Power supply, Communication and CT inputs

  Isolation between the Z-CT module terminals is as follows:

  ▬▬ : Isolated
  ——— : Not isolated

Power supply	
CT inputs (1 to 6CH)	
CT inputs (7 to 12CH)	
Communication	

4.2 Connecting Precautions

⚠ WARNING

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

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

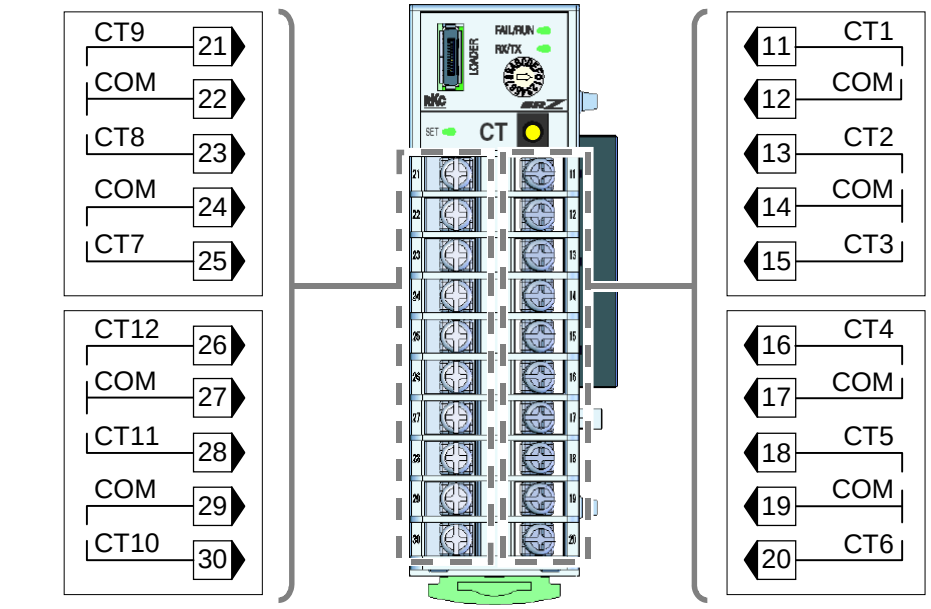
4.3 Terminal Configuration

4.3.1 CT input terminals

■ Terminal type module

Current transformer (CT) input [CT7 to CT12]

Current transformer (CT) input [CT1 to CT6]



COM: Common

■ Connecter type module

Current transformer (CT) input [CT7 to CT12]

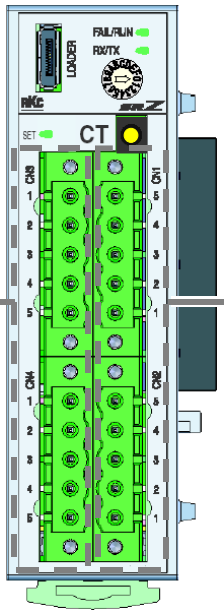
Current transformer (CT) input [CT1 to CT6]

CN3

Pin No.	Description
1	CT9
2	COM
3	CT8
4	COM
5	CT7

CN4

Pin No.	Description
1	CT12
2	COM
3	CT11
4	COM
5	CT10



CN1

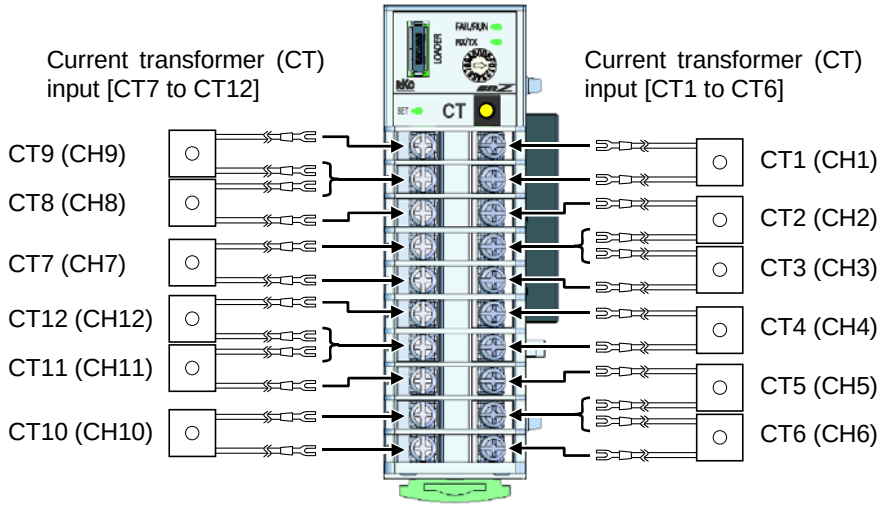
Pin No.	Description
5	CT1
4	COM
3	CT2
2	COM
1	CT3

CN2

Pin No.	Description
5	CT4
4	COM
3	CT5
2	COM
1	CT6

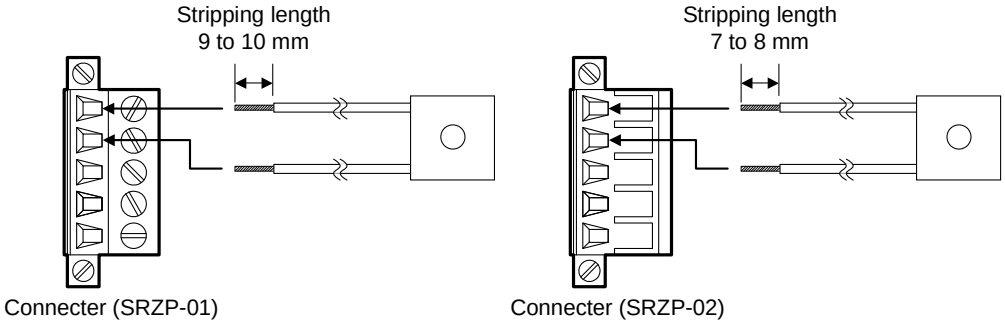
COM: Common

■ Connection example of CT (Terminal type module)

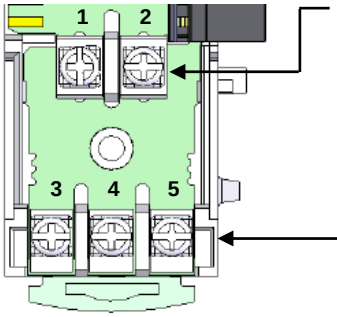


When use the connector type module

If the CT is to be connected to a connector, cut off the solderless terminal of the CT, strip off the indicated length of the jacket and connect to the connector.



4.3.2 Power supply terminals and communication terminals



Power supply terminals

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

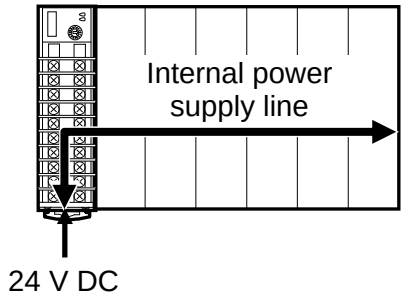
Communication terminals (RS-485)

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

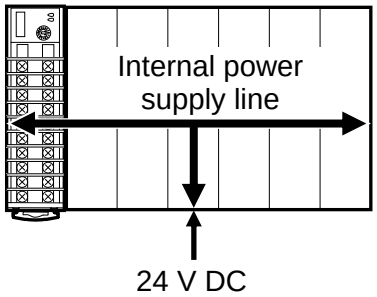
■ Connecting to the power supply terminals

When using the Z-CT module connected to function modules (Z-TIO, Z-DIO module) or Z-COM module, the power supply wiring is connected to any one of the modules. Power is supplied from the module with the power wiring to the other modules.

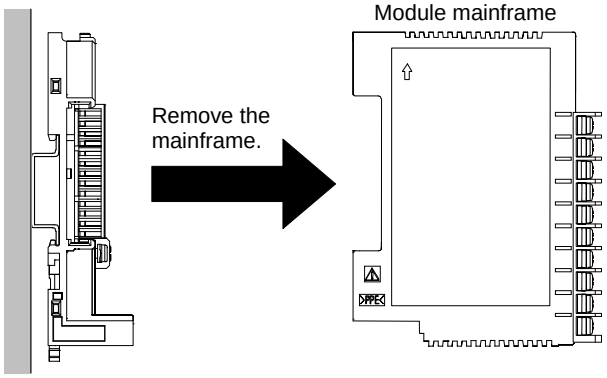
[Wiring example 1]



[Wiring example 2]



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



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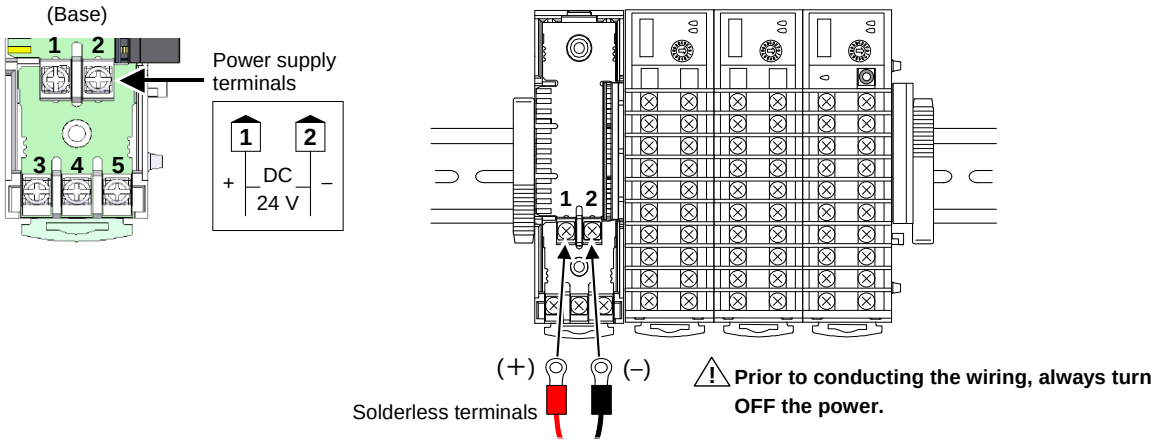
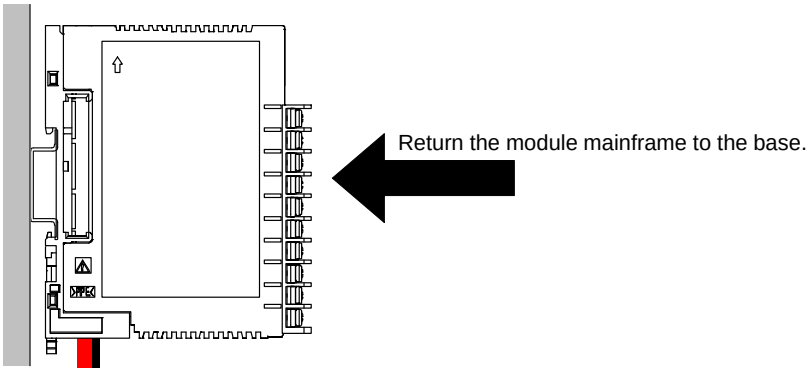
2. Attach the solderless terminals to the power terminals with a Phillips head screwdriver.



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.

4.4 Connection to Host Computer

WARNING

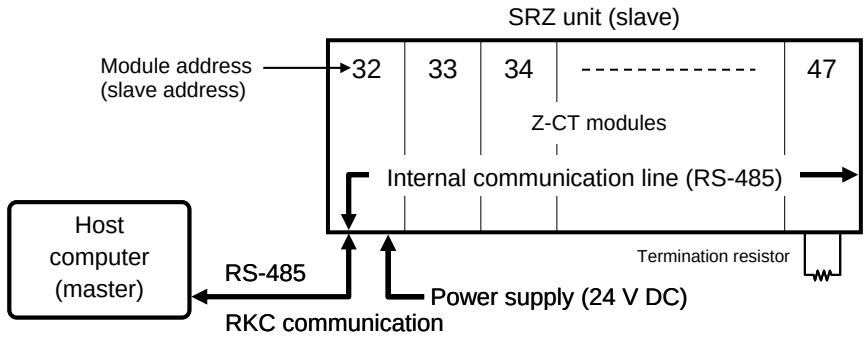
To prevent electric shock or instrument failure, turn off the power before connecting or disconnecting the instrument and peripheral equipment.

■ 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-CT modules, or a unit in which Z-CT modules are connected to several other function modules (Z-TIO module, Z-DIO module).

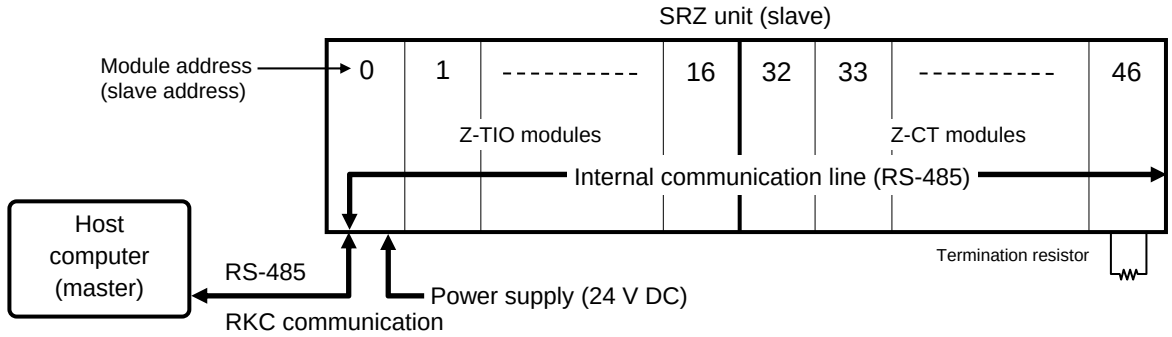
● When two or more Z-CT module are connected



Up to 16 Z-CT modules can be connected.

For the Z-CT module address, see **5.1 Module Address Setting (P. 5-2)**.

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



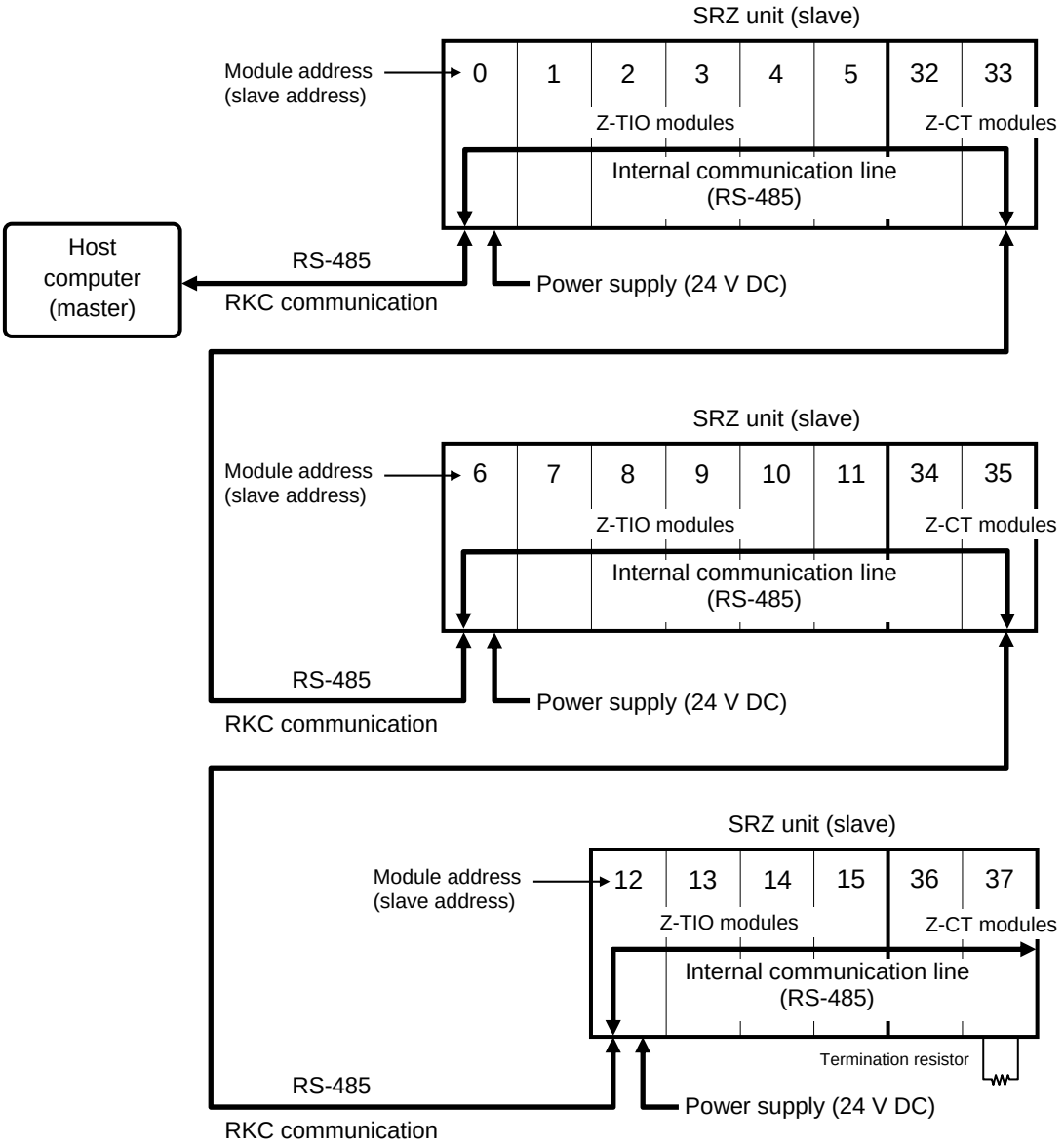
Up to 16 Z-CT modules can be connected.
The maximum number of SRZ modules (including other function modules) on the same communication line is 31.

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

For the procedure for connecting modules, see **3. MOUNTING (P. 3-1)**.

For the module address settings, see **5. SETTINGS BEFORE OPERATION (P. 5-1)**.

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



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

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

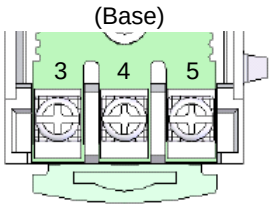
- **When using the Z-CT module connected to Z-COM module**

To connect a Z-COM module, see the instruction manual for the Z-COM module.

☞ **Z-COM Host Communication Instruction Manual (IMS01T23-E□)**

☞ **Z-COM Instruction Manual (IMS01T22-E□)**

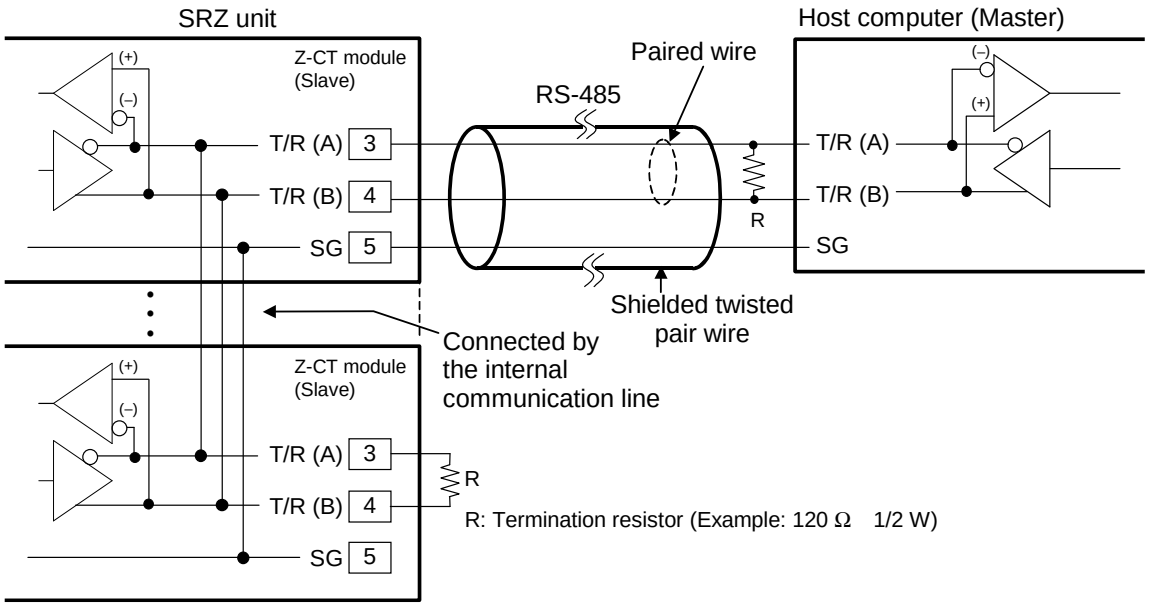
■ Terminal number and signal details



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

■ Wiring figure

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



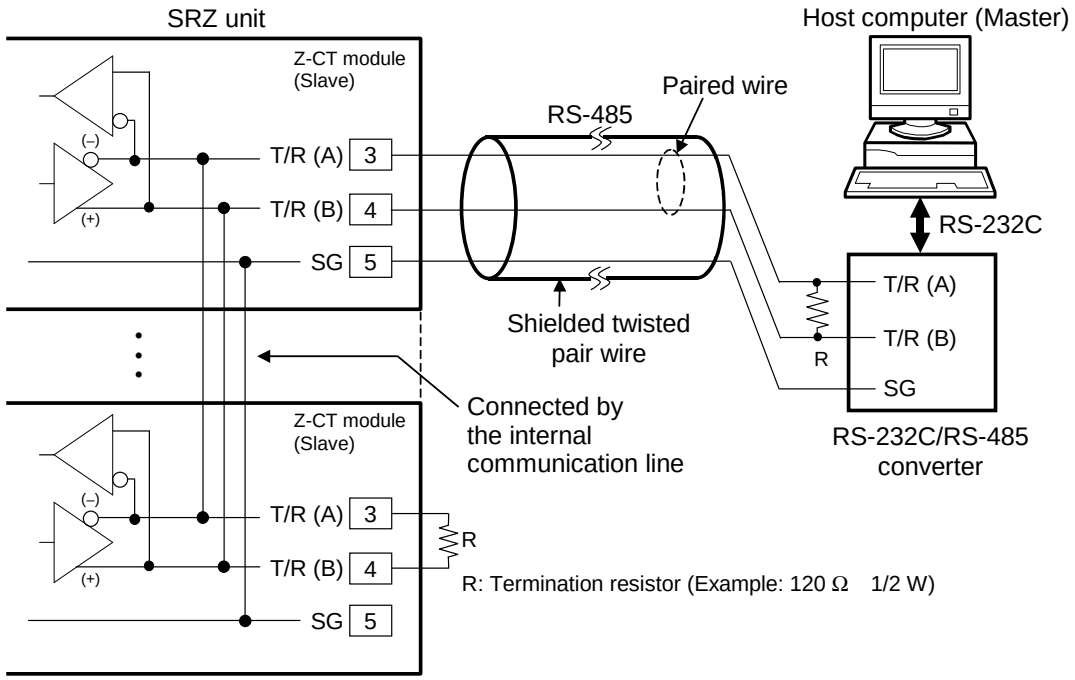
Up to 16 Z-CT modules can be connected.
The maximum number of SRZ modules (including other function modules) on the same communication line is 31.

The cable must be provided by the customer.

For installation method of termination resistor of the SRZ side, see **4.5 Installation of Termination Resistor (P. 4-14).**

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

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



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

When the host computer (master) uses Windows95/98/Me/NT/2000/XP, use a RS-232C/RS-485 converter with an automatic send/receive transfer function.

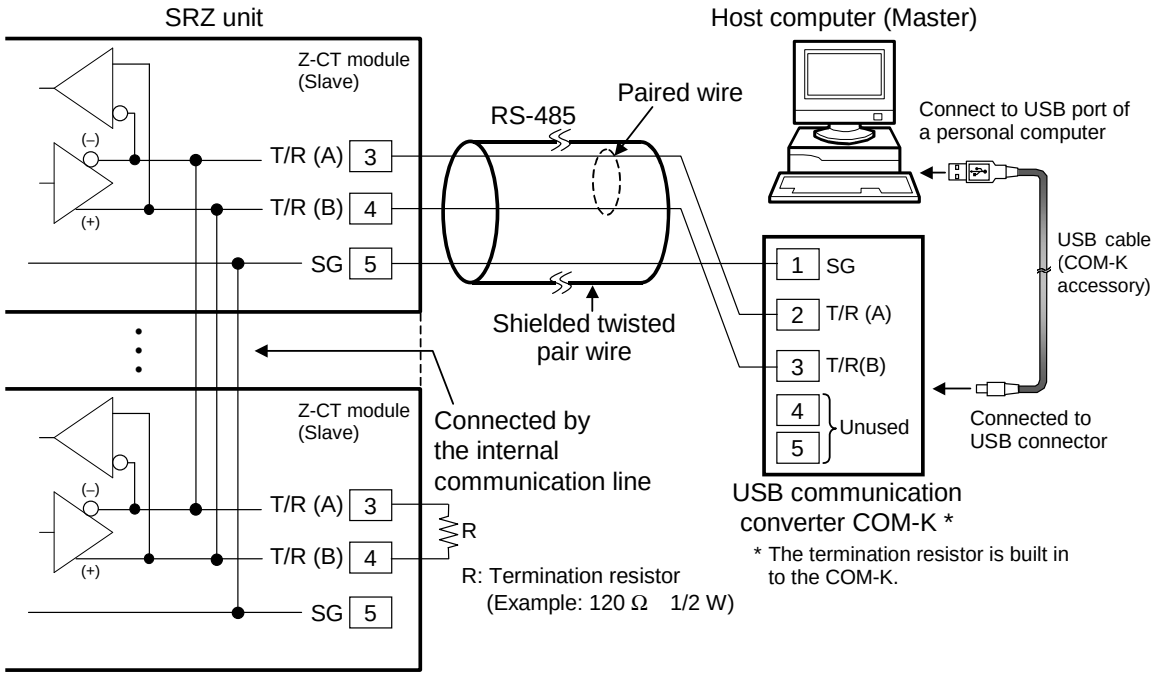
Recommended RS-232C/RS-485 converter:
CD485, CD485/Vmanufactured by Data Link, Inc. or equivalent

The cable must be provided by the customer.

For installation method of termination resistor of the SRZ side, see **4.5 Installation of Termination Resistor (P. 4-14).**

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

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



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

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

📖 The cable must be provided by the customer.

☞ For installation method of termination resistor of the SRZ side, see **4.5 Installation of Termination Resistor (P. 4-14).**

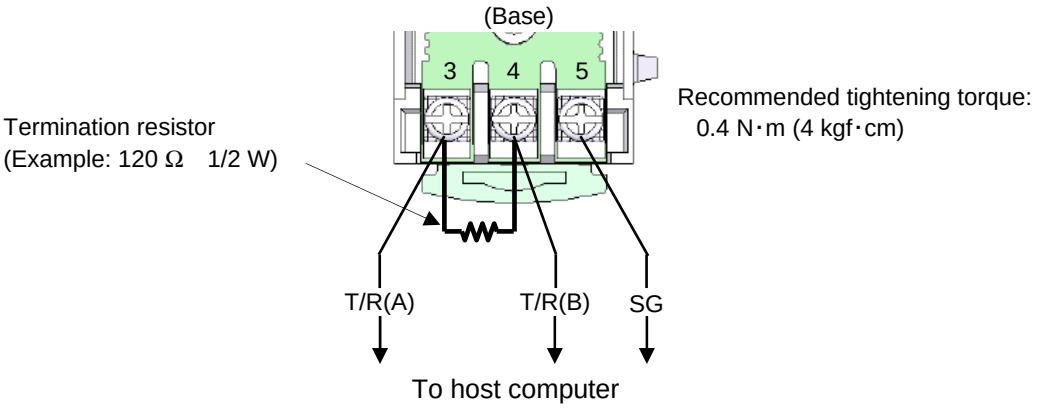
4.5 Installation of Termination Resistor

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.

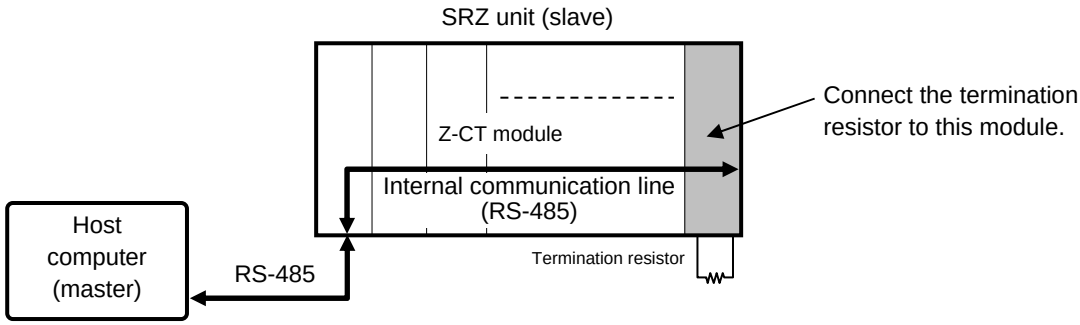
For the termination resistor on the host computer side, connect it so as to satisfy the host computer used.

■ Mounting position

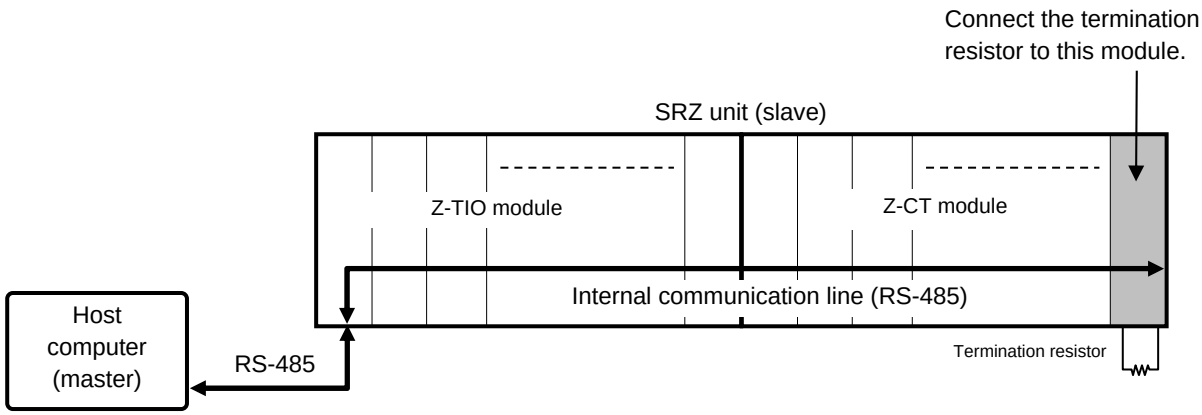
Connect a termination resistor between the communication terminals (No.3 and 4) of the module at the end of the communication line from the host computer.



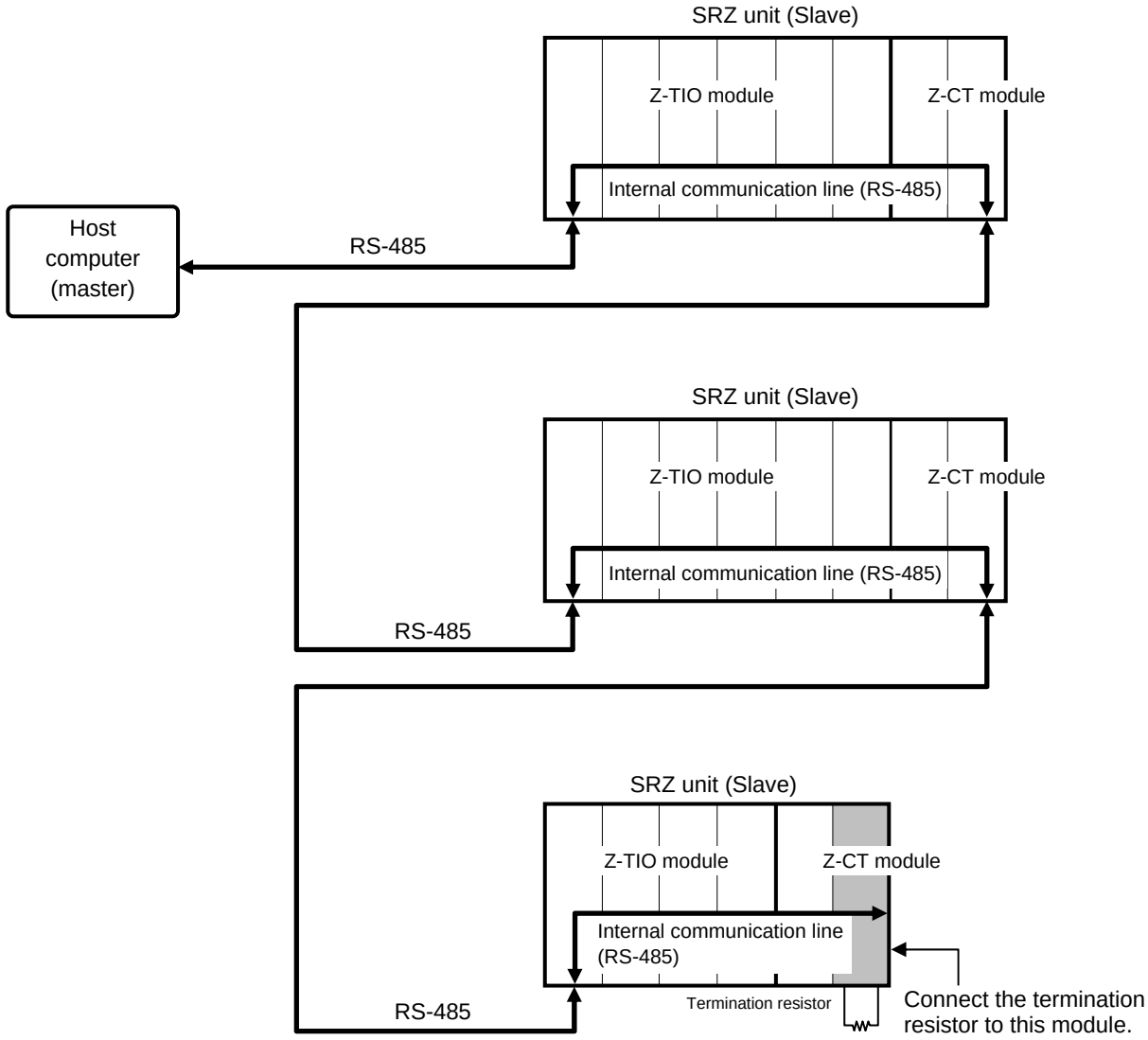
- **When two or more Z-CT module are connected**



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



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



4.6 Connections for Loader Communication

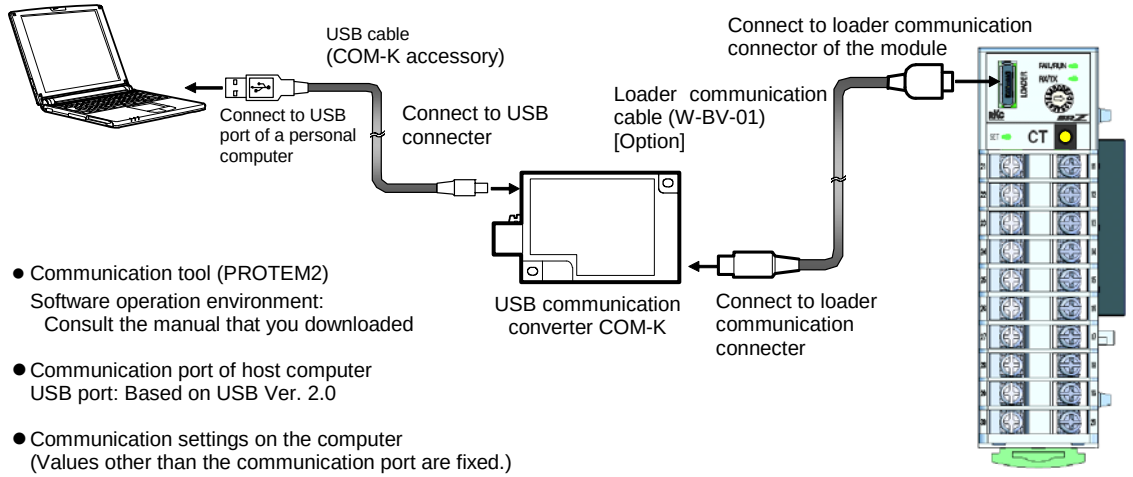
Z-CT module is equipped standard with a loader communication connector.

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 official RKC website: http://www.rkcinst.com/.



- Communication tool (PROTEM2)
  Software operation environment:
  Consult the manual that you downloaded
- 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, see the **COM-K Instruction Manual (IMR01Z01-E□).**

SETTINGS BEFORE OPERATION

5

5.1 Module Address Setting

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

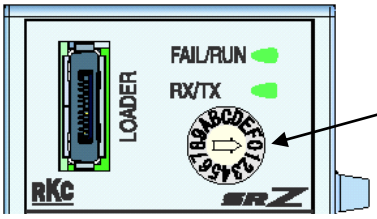
CAUTION

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

■ Address setting switch

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

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



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

Module address number of each module:

	RKC communication	Modbus
Z-CT module	32 to 47: Decimal The value obtained by adding “32” to the set address corresponds to the address used for the actual program.	33 to 48: Decimal The value obtained by adding “33” to the set address corresponds to the address used for the actual program.

☞ For details of Z-TIO-A/B and Z-DIO modules, see **SRZ Instruction Manual (IMS01T04-E□)**. The address setting method of Z-TIO-C/D and Z-TIO-E/F modules are the same as the setting method of the Z-TIO-A/B module.

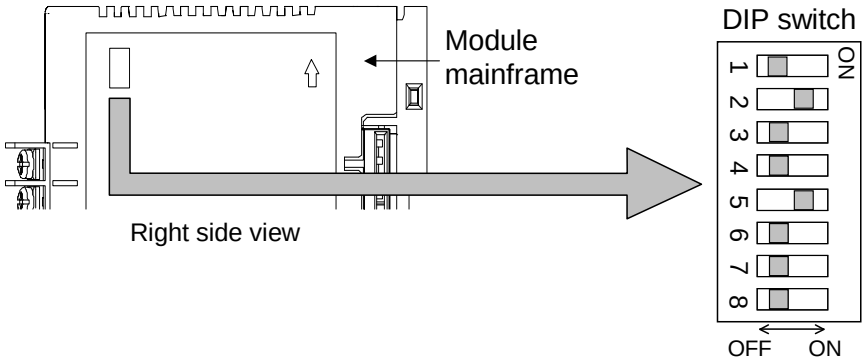
☞ For the address number of Z-COM module, see Z-COM module instruction manual.

Z-COM Host Communication Instruction Manual (IMS01T23-E□)
Z-COM Instruction Manual (IMS01T22-E□)

5.2 Protocol Selections and Communication Speed Setting

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

When two or more Z-CT 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.
The DIP switch settings (switches 1 to 8) of all modules must also be the same when a Z-TIO or Z-DIO module is connected.



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

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

Factory set value: 19200 bps

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

5.3 Operating Precautions

■ Power ON

● When a Z-CT module is used by itself

The Z-CT module does not have RUN/STOP transfer data, and thus when the power is turned on, it starts capturing the current values. When the power is turned on, the FAIL/RUN indication lamp lights green.

● When a Z-CT module is connected to Z-TIO module

When the power of the SRZ unit is turned on, it starts up with the operation mode set to "Control" and RUN/STOP transfer set to STOP (control is stopped). (The FAIL/RUN indication lamp lights green)
When the power of the Z-CT module is turned on, it starts capturing in the current value.
When the SRZ unit is switched from STOP to RUN, operation begins. [Factory set value: STOP]
When switched to RUN, the Z-CT module starts heater break alarm (HBA) and heater overcurrent alarm operation. The Z-CT module also starts monitoring the state of the operation mode of the Z-TIO module.
The heater break alarm (HBA) function and heater overcurrent alarm function do not operate for channels for which the operation mode of the Z-TIO module is set to "0: Unused" or "1: Monitor."


If a Z-COM module and Z-TIO module are connected to a Z-CT module, operation will be the same as described above.


Even if a heater break alarm (HBA) or heater overcurrent alarm occurs when the SRZ unit is set to STOP (control stop), an alarm state will not occur.


For details of RUN/STOP transfer, see following instruction manual.
SRZ Instruction Manual (IMS01T04-E□)
Z-COM Host Communication Instruction Manual (IMS01T23-E□)
Z-COM Instruction Manual (IMS01T22-E□)

■ Confirm the automatic setting data

Before switching the SRZ unit to RUN, verify that the communication data required for automatic setting of the heater break alarm (HBA) and heater overcurrent alarm have been set.


For details of each parameter, see **7. COMMUNICATION DATA DESCRIPTION (P. 7-1)**.

For the automatic setting, see **6.3 Automatic Setting Example (P. 6-14)**.

■ Execution of automatic setting

Before performing automatic setting of the heater break alarm (HBA) and heater overcurrent alarm, verify that installation has been completed, all connections have been made, and the required communication data have been set, so that the system is ready for operation.
Execute automatic setting when the load starts heating up.


For the procedure for starting automatic setting, see **6.3.4 Procedure for executing automatic setting (P. 6-23)**.

■ Checking the heater break alarm (HBA) and heater overcurrent alarm

The Z-CT module does not have a terminal that outputs alarm signals, and thus the alarm status must be checked using one of the methods below.

- Check the alarm status in the communication data (heater break alarm (HBA) state monitor, heater overcurrent alarm state monitor).
- Use a Z-DIO module to check the alarm status in the digital output (DO)*.

*The heater overcurrent alarm state cannot be output from the digital output (DO) of the Z-DIO module.


For the procedure for checking the alarm status using the digital output (DO), see **6.4 Digital Output (DO) of Heater Break Alarm (HBA) (P. 6-27)**.

6 HOST COMMUNICATION

6.1 RKC Communication

6.1.1 RKC communication protocol

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

For an explanation of RKC communication protocol, see the following instruction manual.
Instruction manual can be downloaded from the official RKC website.
(URL: http://www.rkcinst.com/english/manual_load.htm)

- **When using the Z-CT module connected to function modules (Z-TIO module, Z-DIO module)**
  ☞ **SRZ Instruction Manual (IMS01T04-E☐)**
- **When using the Z-CT module connected to Z-COM module**
  ☞ **Z-COM Instruction Manual (IMS01T22-E☐)**
  ☞ **Z-COM Host Communication Instruction Manual (IMS01T23-E☐)**

☞ For details of the "Processing times during data send/receive," "RS-485 (2-wire system) send/receive timing," "Fail-safe," see **SRZ Instruction Manual (IMS01T04-E☐)**.

6.1.2 RKC communication data list

■ Reference to communication data list

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

No.	Name	Iden-tifier	Digits	Attri-bute	Struc-ture	Data range	Factory set value
1	Model code	ID	32	RO	M	Model code (character)	—
2	ROM version	VR	8	RO	M	ROM version	—
3	Current transformer (CT) input value monitor	M4	7	RO	C	CTL-6-P-Z: 0.0 to 10.0 A CTL-6-P-N: 0.0 to 30.0 A CTL-12-S56-10L-N: 0.0 to 100.0 A	—

(1) Name: Communication data name

(2) Identifier: Communication identifier of RKC communication

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

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

RO: Read only data

Host computer ← Data direction — Z-CT module

R/W: Read and Write data

Host computer ←→ Data direction Z-CT module

(5) Structure: C: Data for each channel

M: Data for each module

For the data structure, the following instruction manual.

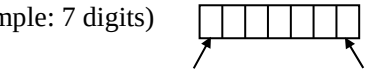
☞ **SRZ Instruction Manual (IMS01T04-E☐)**

☞ **Z-COM Instruction Manual (IMS01T22-E☐)**

☞ **Z-COM Host Communication Instruction Manual (IMS01T23-E☐)**

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

ASCII code data (Example: 7 digits)



Most significant digit ·····Least significant digit

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

Communication data includes both "Normal setting data" and "Engineering setting data." Engineering setting data can be written when the set lock (identifier: LK) is set to "0: Unlock."

Normal setting data: No. 1 to 19
Engineering setting data: No. 20 to 30

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 data 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.

When connected to a Z-COM module, the set lock (identifier: LK) state of the Z-CT module is linked to RUN/STOP transfer (identifier: SR) of the Z-COM module.
When the Z-COM module is transferred to STOP (control stop), the set lock (identifier: LK) of the Z-CT module changes to "0: Unlock."

■ Communication data list

No.	Name	Iden-tifier	Digits	Attri-bute	Struc-ture	Data range	Factory set value
1	Model code	ID	32	RO	M	Model code (character)	—
2	ROM version	VR	8	RO	M	ROM version	—
3	Current transformer (CT) input value monitor	M4	7	RO	C	CTL-6-P-Z: 0.0 to 10.0 A CTL-6-P-N: 0.0 to 30.0 A CTL-12-S56-10L-N: 0.0 to 100.0 A	—
4	Load factor conversion CT monitor	M5	7	RO	C	0.0 to 100.0 A	—
5	Heater break alarm (HBA) state monitor	AF	1	RO	C	0: Normal 1: Break 2: Melting	—
6	Heater overcurrent alarm state monitor	AG	1	RO	C	0: Normal 1: Heater overcurrent	—
7	Error code	ER	7	RO	M	1: Adjustment data error 2: Data back-up error 4: A/D conversion error	—
8	Integrated operating time monitor	UT	7	RO	M	0 to 19999 hours	—
9	Backup memory state monitor	EM	1	RO	M	0: The content of the backup memory does not coincide with that of the RAM. 1: The content of the backup memory coincides with that of the RAM.	—
10	Automatic setting state monitor [1]	CJ	1	RO	M	0: Normal state 1: Automatic setting execution 2: Automatic setting failure	—
11	Heater break/Heater overcurrent alarm automatic setting selection	BT	1	R/W	C	0: Automatic setting is disabled. (Alarm set value cannot be automatically set by the push button and communication.) 1: Automatic setting for heater break alarm is enabled. 2: Automatic setting for heater overcurrent alarm set value is enabled. 3: Automatic setting for heater break alarm (HBA) and heater overcurrent alarm set values are enabled.	1
12	Automatic setting transfer [2]	BU	1	R/W	C	0: Normal state 1: Automatic setting execution [3] 2: Automatic setting failure (RO)	0
13	Heater break alarm (HBA) set value	A8	7	R/W	C	0.0 to 100.0 A 0.0: Heater break alarm function (HBA) OFF (HBA function OFF: The current transformer (CT) input value monitoring is available.)	0.0
14	Heater break alarm (HBA) selection	BZ	1	R/W	C	0: Heater break alarm (HBA) unused 1: Heater break alarm (HBA) 2: Heater break alarm (HBA) (With alarm interlock function)	1
15	Heater overcurrent alarm set value	A6	7	R/W	C	0.0 to 105.0 A 0.0: Heater overcurrent alarm function OFF	0.0
16	Heater overcurrent alarm selection	BO	1	R/W	C	0: Heater overcurrent alarm unused 1: Heater overcurrent alarm 2: Heater overcurrent alarm (With alarm interlock function)	1
17	Heater break alarm (HBA) interlock release	CX	1	R/W	C	0: Normal state 1: Interlock release execution [4]	0
18	Heater overcurrent alarm interlock release	CY	1	R/W	C	0: Normal state 1: Interlock release execution [4]	0

[1] This is linked to the solid lighting or blinking state of the automatic setting state indication lamp (SET).
[2] Automatic setting is only possible for channels that have been set to other than "0: Automatic setting is disabled" in heater break/heater overcurrent alarm automatic setting selection.
[3] When automatic setting ends normally, this reverts to "0: Normal state."
[4] After the interlock is released, this automatically returns to "0."

Continued on the next page.

Continued from the previous page.

No.	Name	Iden-tifier	Digits	Attri-bute	Struc-ture	Data range	Factory set value
19	Set lock	LK	1	R/W	M	0: Unlock 1: Lock	0
Set data No. 20 or later are for engineering setting.							
20	CT type [1]	BV	1	R/W [2]	C	0: CTL-6-P-N (0.0 to 30.0 A) 1: CTL-12-S56-10L-N (0.0 to 100.0 A) 2: CTL-6-P-Z (0.0 to 10.0 A)	Depends on model code. When not specifying: 0
21	CT ratio [3] (CT number of winds)	XT	7	R/W [2]	C	0 to 9999	CTL-6-P-N, CTL-6-P-Z: 800 CTL-12-S56-10L-N: 1000
22	Number of heater break alarm (HBA) delay times	DI	7	R/W [2]	C	0 to 255 times	5
23	Automatic setting factor for heater break alarm (HBA)	BW	7	R/W [2]	C	1 to 100 %	75
24	Automatic setting factor for heater overcurrent alarm	B9	7	R/W [2]	C	100 to 1000 %	200
25	Determination current value for automatic setting	BP	7	R/W [2]	C	0.0 to 100.0 A	1.0
26	Automatic setting time	BQ	7	R/W [2]	C	10 to 250 seconds	60
27	Module address assignments for CT input	BX	7	R/W [2]	C	0 to 99	0
28	Module channel assignments for CT input	BY	7	R/W [2]	C	1 to 99	1
29	Load factor conversion method	IC	1	R/W [2]	C	0: Mean conversion 1: Root mean squared value conversion	0
30	Interval time	ZX	7	R/W [2]	M	0 to 250 ms	10

[1] When using a non-specified CT, set to "1: CTL-12-S56-10L-N (0.0 to 100.0 A)."
[2] When the set lock is set to "0: Unlock," writing data is possible.
[3] When using a non-specified CT, set the number of winds of the CT.
[4] For monitoring using "0: Mean conversion" or "1: Root mean squared value conversion," the following settings are required:

- Module address assignments for CT input must be set.
- Module channel assignments for CT input must be set.
- The heater break alarm (HBA) value must be set to other than "0.0."

6.2 Modbus

6.2.1 Modbus 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 (Z-CT module).
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.

For an explanation of Modbus communication protocol, see the following instruction manual. Instruction manual can be downloaded from the official RKC website.
(URL: http://www.rkcinst.com/english/manual_load.htm)

- **When using the Z-CT module connected to function modules (Z-TIO module, Z-DIO module)**
  ☞ **SRZ instruction manual (IMS01T04-E☐)**
- **When using the Z-CT module connected to Z-COM module**
  ☞ **Z-COM Instruction Manual (IMS01T22-E☐)**
  ☞ **Z-COM Host Communication Instruction Manual (IMS01T23-E☐)**

☞ For details of the "Processing times during data send/receive," "Fail-safe," see **SRZ Instruction Manual (IMS01T04-E☐)**.

6.2.2 Caution for handling communication data

- 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.

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

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

- If data (holding register) exceeding the accessible address range is accessed, an error response message is returned.
- Read data of unused item is a default value.
- Any attempt to write to an unused item is not processed as an error. Data can not be written into an unused item.
- If data range or address error occurs during data writing, it is not processed as an error. Except the data that error occurred, normal data is written in data register. Therefore, it is necessary to confirm data after the end of setting data.
- Some of the communication data becomes RO (read only) when set lock is used.
  If you attempt to write data to RO data, an error will not occur; however, the data will not be written.

  ☞ For details of set lock, see **6.2.3 Modbus communication data list (P. 6-7)**.

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

6.2.3 Modbus communication data list

■ Reference to communication data list

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

No.	Name	Chan-nel	Resister address		Attri-bute	Struc-ture	Data range	Factory set value
			HEX	DEC				
1	Current transformer (CT) input value monitor	CH1	0000	0	RO	C	CTL-6-P-Z: 0.0 to 10.0 A CTL-6-P-N: 0.0 to 30.0 A CTL-12-S56-10L-N: 0.0 to 100.0 A	—
		CH2	0001	1				
		CH3	0002	2				
		CH4	0003	3				
		CH5	0004	4				
		CH6	0005	5				
		CH7	0006	6				
		CH8	0007	7				
		CH9	0008	8				
		CH10	0009	9				
		CH11	000A	10				
		CH12	000B	11				
2	Load factor conversion CT monitor	CH1	000C	12	RO	C	0.0 to 100.0 A	—
		CH2	000D	13				
		CH3	000E	14				
		CH4	000F	15				
		CH5	0010	16				
		CH6	0011	17				
		CH7	0012	18				
		CH8	0013	19				
		CH9	0014	20				
		CH10	0015	21				
		CH11	0016	22				
		CH12	0017	23				

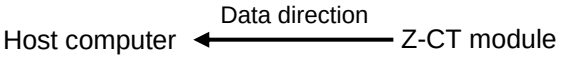
(1) Name: Communication data name

(2) Channel: Channel numbers of Z-CT module

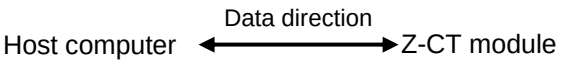
(3) Register address: Register addresses of each channel (HEX: Hexadecimal DEC: Decimal)

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

RO: Read only data

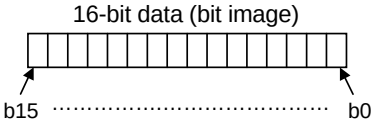


R/W: Read and write data



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

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



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

Communication data includes both "Normal setting data" and "Engineering setting data." Engineering setting data can be written when the set lock (address: 0178H) is set to "0: Unlock."

Normal setting data: No. 1 to 20
Engineering setting data: No. 21 to 31

The engineering setting data should be set according to the application before setting any parameter related to operation. Once the engineering setting data are set correctly, no further changes need to be made to data 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.

When connected to a Z-COM module, the set lock (address: 0178H) state of the Z-CT module is linked to RUN/STOP transfer (address: 0133H) of the Z-COM module.
When the Z-COM module is transferred to STOP (control stop), the set lock (address: 0178H) of the Z-CT module changes to "0: Unlock."

■ Communication data list

No.	Name	Chan-nel	Resister address		Attri-bute	Struc-ture	Data range	Factory set value
			HEX	DEC				
1	Current transformer (CT) input value monitor	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8 CH9 CH10 CH11 CH12	0000 0001 0002 0003 0004 0005 0006 0007 0008 0009 000A 000B	0 1 2 3 4 5 6 7 8 9 10 11	RO	C	CTL-6-P-Z: 0.0 to 10.0 A CTL-6-P-N: 0.0 to 30.0 A CTL-12-S56-10L-N: 0.0 to 100.0 A	—
2	Load factor conversion CT monitor	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8 CH9 CH10 CH11 CH12	000C 000D 000E 000F 0010 0011 0012 0013 0014 0015 0016 0017	12 13 14 15 16 17 18 19 20 21 22 23	RO	C	0.0 to 100.0 A	—
3	Heater break alarm (HBA) state monitor	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8 CH9 CH10 CH11 CH12	0018 0019 001A 001B 001C 001D 001E 001F 0020 0021 0022 0023	24 25 26 27 28 29 30 31 32 33 34 35	RO	C	0: Normal 1: Break 2: Melting	—
4	Heater overcurrent alarm state monitor	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8 CH9 CH10 CH11 CH12	0024 0025 0026 0027 0028 0029 002A 002B 002C 002D 002E 002F	36 37 38 39 40 41 42 43 44 45 46 47	RO	C	0: Normal 1: Heater overcurrent	—
5	Error code	—	0030	48	RO	M	b0: Adjustment data error b1: Data back-up error b2: A/D conversion error b3 to b15: Unused Data 0: OFF 1: ON [Decimal number: 0 to 7]	—
6	Integrated operating time monitor	—	0031	49	RO	M	0 to 19999 hours	—
7	Backup memory state monitor	—	0032	50	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.	—
8	Automatic setting state monitor*	—	0033	51	RO	M	0: Normal state 1: Automatic setting execution 2: Automatic setting failure	—

* This is linked to the solid lighting or blinking state of the automatic setting state indication lamp (SET).

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Continued from the previous page.

No.	Name	Chan-nel	Resister address HEX	Resister address DEC	Attri-bute	Struc-ture	Data range	Factory set value
9	Unused	—	0034	52	—	—	Do not use this register address as it is used for the internal processing.	—
10	Unused	—	0035 ⋮ 0093	53 ⋮ 147	—	—	—	—
11	Heater break/Heater overcurrent alarm automatic setting selection	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8 CH9 CH10 CH11 CH12	0094 0095 0096 0097 0098 0099 009A 009B 009C 009D 009E 009F	148 149 150 151 152 153 154 155 156 157 158 159	R/W	C	0: Automatic setting is disabled. (Alarm set value cannot be automatically set by the push button and communication.) 1: Automatic setting for heater break alarm is enabled. 2: Automatic setting for heater overcurrent alarm set value is enabled. 3: Automatic setting for heater break alarm (HBA) and heater overcurrent alarm set values are enabled.	1
12	Automatic setting transfer *	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8 CH9 CH10 CH11 CH12	00A0 00A1 00A2 00A3 00A4 00A5 00A6 00A7 00A8 00A9 00AA 00AB	160 161 162 163 164 165 166 167 168 169 170 171	R/W	C	0: Normal state 1: Automatic setting execution When automatic setting ends normally, this reverts to “0: Normal state.” 2: Automatic setting failure (RO)	0
13	Heater break alarm (HBA) set value	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8 CH9 CH10 CH11 CH12	00AC 00AD 00AE 00AF 00B0 00B1 00B2 00B3 00B4 00B5 00B6 00B7	172 173 174 175 176 177 178 179 180 181 182 183	R/W	C	0.0 to 100.0 A 0.0: Heater break alarm function (HBA) OFF (HBA function OFF: The current transformer (CT) input value monitoring is available.)	0.0
14	Heater break alarm (HBA) selection	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8 CH9 CH10 CH11 CH12	00B8 00B9 00BA 00BB 00BC 00BD 00BE 00BF 00C0 00C1 00C2 00C3	184 185 186 187 188 189 190 191 192 193 194 195	R/W	C	0: Heater break alarm (HBA) unused 1: Heater break alarm (HBA) 2: Heater break alarm (HBA) (With alarm interlock function)	1

* Automatic setting is only possible for channels that have been set to other than “0: Automatic setting is disabled” in heater break/heater overcurrent alarm automatic setting selection.

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No.	Name	Chan-nel	Resister address HEX	Resister address DEC	Attri-bute	Struc-ture	Data range	Factory set value
15	Heater overcurrent alarm set value	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8 CH9 CH10 CH11 CH12	00C4 00C5 00C6 00C7 00C8 00C9 00CA 00CB 00CC 00CD 00CE 00CF	196 197 198 199 200 201 202 203 204 205 206 207	R/W	C	0.0 to 105.0 A 0.0: Heater overcurrent alarm function OFF	0.0
16	Heater overcurrent alarm selection	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8 CH9 CH10 CH11 CH12	00D0 00D1 00D2 00D3 00D4 00D5 00D6 00D7 00D8 00D9 00DA 00DB	208 209 210 211 212 213 214 215 216 217 218 219	R/W	C	0: Heater overcurrent alarm unused 1: Heater overcurrent alarm 2: Heater overcurrent alarm (With alarm interlock function)	1
17	Heater break alarm (HBA) interlock release	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8 CH9 CH10 CH11 CH12	00DC 00DD 00DE 00DF 00E0 00E1 00E2 00E3 00E4 00E5 00E6 00E7	220 221 222 223 224 225 226 227 228 229 230 231	R/W	C	0: Normal state 1: Interlock release execution After the interlock is released, this automatically returns to “0.”	0
18	Heater overcurrent alarm interlock release	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8 CH9 CH10 CH11 CH12	00E8 00E9 00EA 00EB 00EC 00ED 00EE 00EF 00F0 00F1 00F2 00F3	232 233 234 235 236 237 238 239 240 241 242 243	R/W	C	0: Normal state 1: Interlock release execution After the interlock is released, this automatically returns to “0.”	0
19	Unused	—	00F4 ⋮ 0177	244 ⋮ 375	—	—	—	—
20	Set lock	—	0178	376	R/W	M	0: Unlock 1: Lock	0
Set data No. 21 or later are for engineering setting.								
21	CT type [1]	CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8 CH9 CH10 CH11 CH12	0179 017A 017B 017C 017D 017E 017F 0180 0181 0182 0183 0184	377 378 379 380 381 382 383 384 385 386 387 388	R/W [2]	C	0: CTL-6-P-N (0.0 to 30.0 A) 1: CTL-12-S56-10L-N (0.0 to 100.0 A) 2: CTL-6-P-Z (0.0 to 10.0 A)	Depends on model code. When not specifying: 0

[1] When using a non-specified CT, set to “1: CTL-12-S56-10L-N (0.0 to 100.0 A).”

[2] When the set lock is set to “0: Unlock,” writing data is possible.

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No.	Name	Chan-nel	Resister address		Attri-bute	Struc-ture	Data range	Factory set value
			HEX	DEC				
22	CT ratio [1] (CT number of winds)	CH1	0185	389	R/W [2]	C	0 to 9999	CTL-6-P-N, CTL-6-P-Z: 800 CTL-12-S56-10L-N: 1000
		CH2	0186	390				
		CH3	0187	391				
		CH4	0188	392				
		CH5	0189	393				
		CH6	018A	394				
		CH7	018B	395				
		CH8	018C	396				
		CH9	018D	397				
		CH10	018E	398				
		CH11	018F	399				
		CH12	0190	400				
23	Number of heater break alarm (HBA) delay times	CH1	0191	401	R/W [2]	C	0 to 255 times	5
		CH2	0192	402				
		CH3	0193	403				
		CH4	0194	404				
		CH5	0195	405				
		CH6	0196	406				
		CH7	0197	407				
		CH8	0198	408				
		CH9	0199	409				
		CH10	019A	410				
		CH11	019B	411				
		CH12	019C	412				
24	Automatic setting factor for heater break alarm (HBA)	CH1	019D	413	R/W [2]	C	1 to 100 %	75
		CH2	019E	414				
		CH3	019F	415				
		CH4	01A0	416				
		CH5	01A1	417				
		CH6	01A2	418				
		CH7	01A3	419				
		CH8	01A4	420				
		CH9	01A5	421				
		CH10	01A6	422				
		CH11	01A7	423				
		CH12	01A8	424				
25	Automatic setting factor for heater overcurrent alarm	CH1	01A9	425	R/W [2]	C	100 to 1000 %	200
		CH2	01AA	426				
		CH3	01AB	427				
		CH4	01AC	428				
		CH5	01AD	429				
		CH6	01AE	430				
		CH7	01AF	431				
		CH8	01B0	432				
		CH9	01B1	433				
		CH10	01B2	434				
		CH11	01B3	435				
		CH12	01B4	436				
26	Determination current value for automatic setting	CH1	01B5	437	R/W [2]	C	0.0 to 100.0 A	1.0
		CH2	01B6	438				
		CH3	01B7	439				
		CH4	01B8	440				
		CH5	01B9	441				
		CH6	01BA	442				
		CH7	01BB	443				
		CH8	01BC	444				
		CH9	01BD	445				
		CH10	01BE	446				
		CH11	01BF	447				
		CH12	01C0	448				

[1] When using a non-specified CT, set the number of winds of the CT.

[2] When the set lock is set to “0: Unlock,” writing data is possible.

Continued on the next page.

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No.	Name	Chan-nel	Resister address		Attri-bute	Struc-ture	Data range	Factory set value
			HEX	DEC				
27	Automatic setting time	CH1	01C1	449	R/W [1]	C	10 to 250 seconds	60
		CH2	01C2	450				
		CH3	01C3	451				
		CH4	01C4	452				
		CH5	01C5	453				
		CH6	01C6	454				
		CH7	01C7	455				
		CH8	01C8	456				
		CH9	01C9	457				
		CH10	01CA	458				
		CH11	01CB	459				
		CH12	01CC	460				
28	Module address assignments for CT input	CH1	01CD	461	R/W [1]	C	0 to 99	0
		CH2	01CE	462				
		CH3	01CF	463				
		CH4	01D0	464				
		CH5	01D1	465				
		CH6	01D2	466				
		CH7	01D3	467				
		CH8	01D4	468				
		CH9	01D5	469				
		CH10	01D6	470				
		CH11	01D7	471				
		CH12	01D8	472				
29	Module channel assignments for CT input	CH1	01D9	473	R/W [1]	C	1 to 99	1
		CH2	01DA	474				
		CH3	01DB	475				
		CH4	01DC	476				
		CH5	01DD	477				
		CH6	01DE	478				
		CH7	01DF	479				
		CH8	01E0	480				
		CH9	01E1	481				
		CH10	01E2	482				
		CH11	01E3	483				
		CH12	01E4	484				
30	Load factor conversion method [2]	CH1	01E5	485	R/W [1]	C	0: Mean conversion 1: Root mean squared value conversion	0
		CH2	01E6	486				
		CH3	01E7	487				
		CH4	01E8	488				
		CH5	01E9	489				
		CH6	01EA	490				
		CH7	01EB	491				
		CH8	01EC	492				
		CH9	01ED	493				
		CH10	01EE	494				
		CH11	01EF	495				
		CH12	01F0	496				
31	Interval time	—	01F1	497	R/W [1]	M	0 to 250 ms	10

[1] When the set lock is set to “0: Unlock,” writing data is possible.

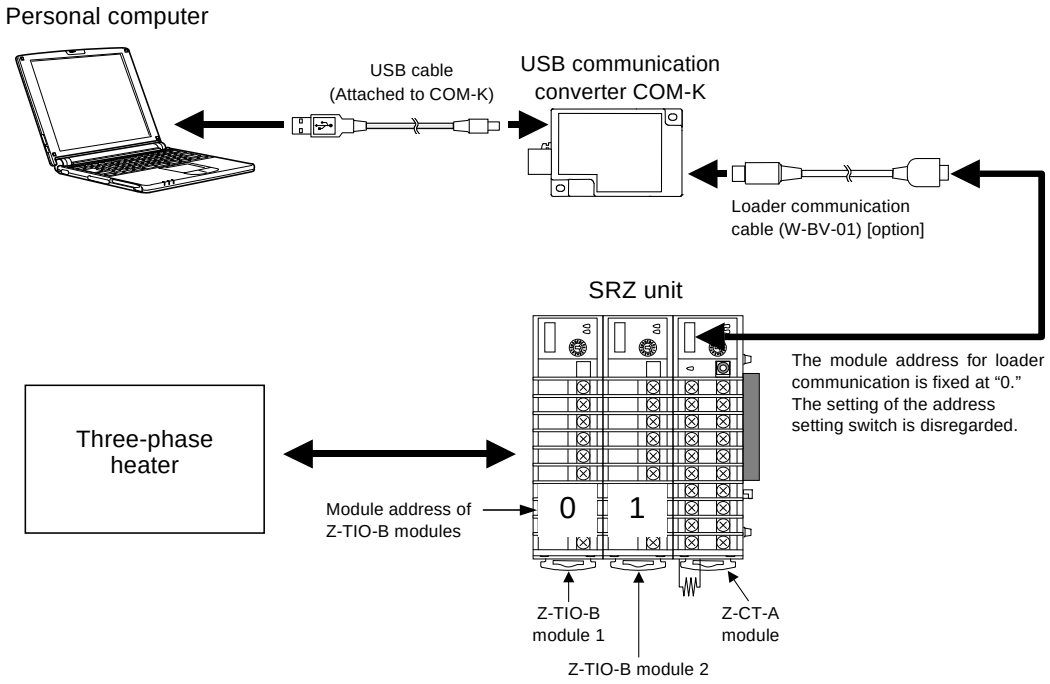
[2] For monitoring using “0: Mean conversion” or “1: Root mean squared value conversion,” the following settings are required:

- Module address assignments for CT input must be set.
- Module channel assignments for CT input must be set.
- The heater break alarm (HBA) value must be set to other than “0.0.”

6.3 Automatic Setting Example

The example of automatic setting of the heater break alarm (HBA) and heater overcurrent alarm when a Z-TIO-B module is connected to a Z-CT module is explained below.
Before executing automatic setting, install and connect all devices and complete the communication settings and initial settings of the Z-TIO-B module and the communication settings (address, communication speed, and data bit configuration) of the Z-CT module, so that the system is ready for operation.

■ System configuration



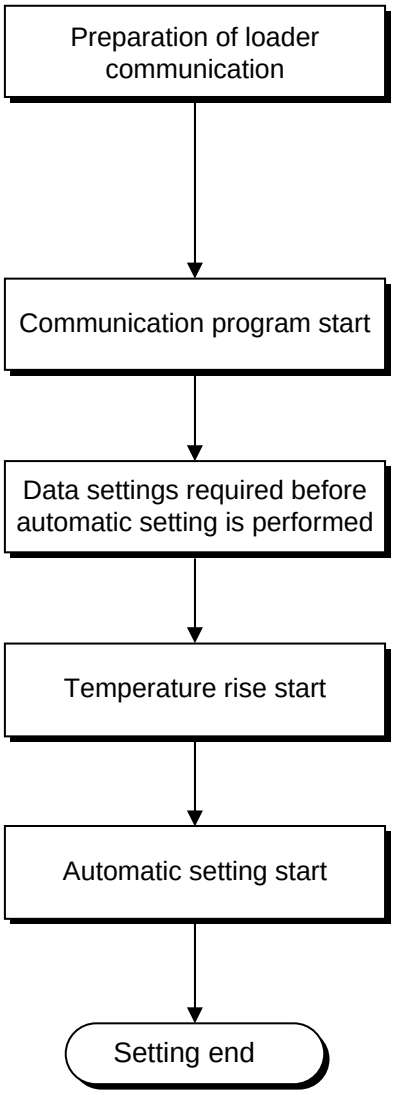
■ Use instruments

- **SRZ unit**
  Temperature control module Z-TIO-B (2 channel type: No CT input [option]): 2
  Current transformer module Z-CT-A: 1
- **Communication converter**
  USB communication converter COM-K (RKC product): 1
  Loader communication cable W-BV-01 [option]: 1
- **Personal computer:** 1 (Software operation environment: Consult the manual that you downloaded.)
- **Communication program:**
  The customer must provide the communication program.

■ Condition

Control output of Z-TIO-B module: Time proportioning output (Relay contact output, Voltage pulse output, Triac output or Open collector output)
CT input channel (CH1 to CH4): Used for detection of heater break and heater overcurrent in channel 1 and channel 2 of Z-TIO-B module 1 (address 0).
CT input channel (CH5 to CH8): Used for detection of heater break and heater overcurrent in channel 1 and channel 2 of Z-TIO-B module 2 (address 1).

6.3.1 Automatic setting procedure



Connect the communication converter, configure the communication settings of the personal computer, and prepare the communication program.

☞ See **6.3.2 Preparation of loader communication (P. 6-16).**

☞ To use the USB communication converter COM-K, the driver must be installed on the computer.
See **COM-K Instruction Manual (IMR01Z01-E□)**.

☞ See **6.3.3 Data settings before execution of automatic setting (P. 6-17)**.

Turn on the power of the heater.

Set the SRZ unit to RUN (start control).

☞ For the RUN/STOP transfer of SRZ unit, see **SRZ Instruction Manual (IMS01T04-E□)**.

Start the automatic setting of heater break alarm (HBA) and heater overcurrent alarm.

☞ For the procedure for starting automatic setting,
see **6.3.4 Procedure for executing automatic setting (P. 6-23)**.

6.3.2 Preparation of loader communication

(1) Preparation of communication program

The customer must provide the communication program.
In this example, the communication program that our company developed is used.

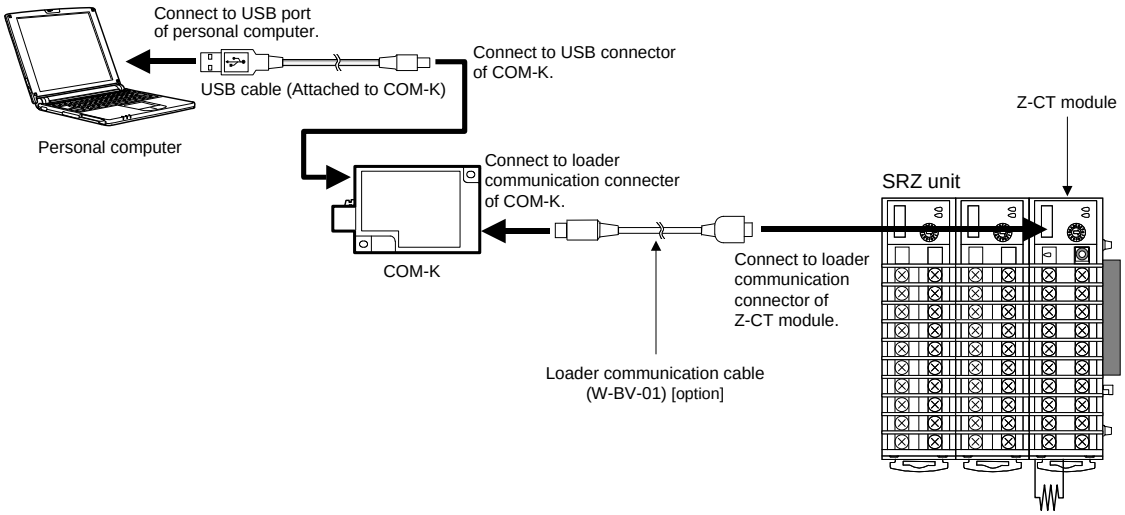
(2) Loader communication setting

The module address, communication speed, communication protocol and data bit configuration for loader communication are fixed at following values.
Set the communication port of the computer to the following values. There are no loader communication settings on the Z-CT module side.

Name	Data (fixed)
Z-CT module address	0
Communication speed	38400 bps
Communication protocol	RKC communication (ANSI X3.28-1976 subcategories 2.5 and B1)
Data bit configuration	Data bit: 8 Parity bit: Without parity Stop bit: 1

(3) Connection of loader communication

Connect a Z-CT module to converter COM-K and personal computer by connection cable.

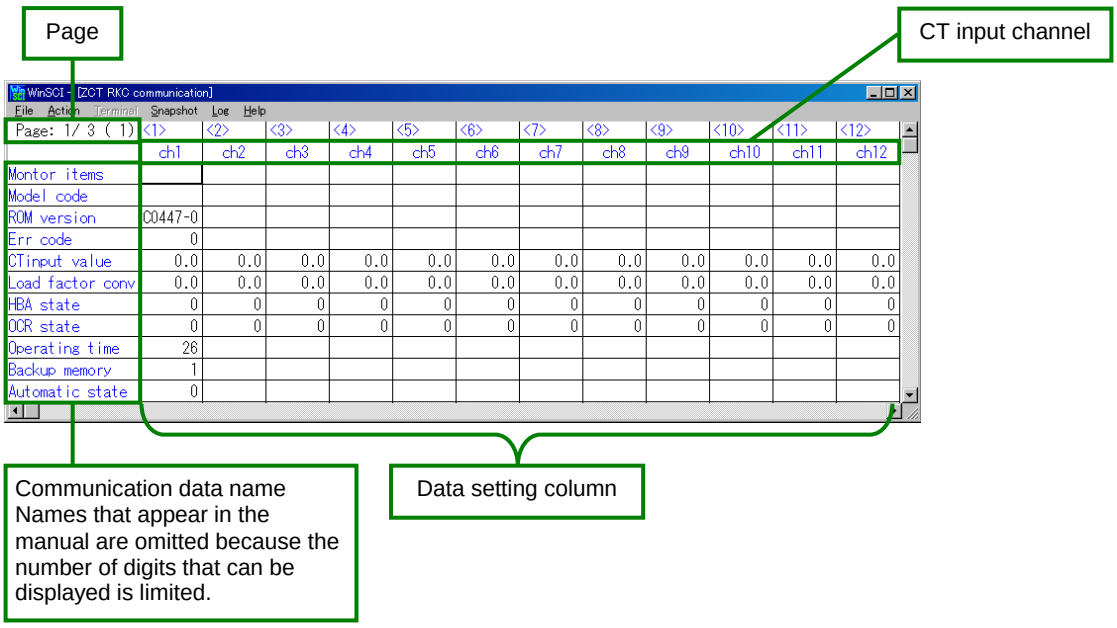


6.3.3 Data settings before execution of automatic setting

1. Turn on the power of the personal computer, and SRZ unit.

2. Start the communication program and display the communication screen of the host computer.

Screen example of communication program



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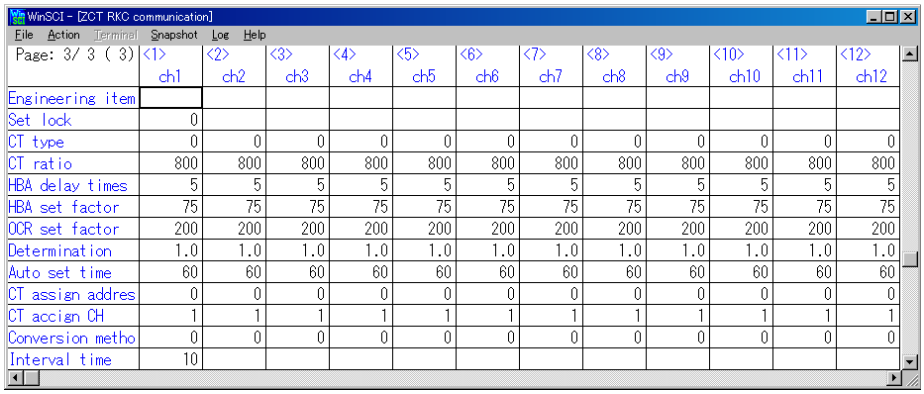
Montor items												
Model code												
ROM version	C0447-0											
Err code	0											
CTinput value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Load factor conv	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HBA state	0	0	0	0	0	0	0	0	0	0	0	0
OCR state	0	0	0	0	0	0	0	0	0	0	0	0
Operating time	26											
Backup memory	1											
Automatic state	0											

3. Go to the setting screen.

Setting screen



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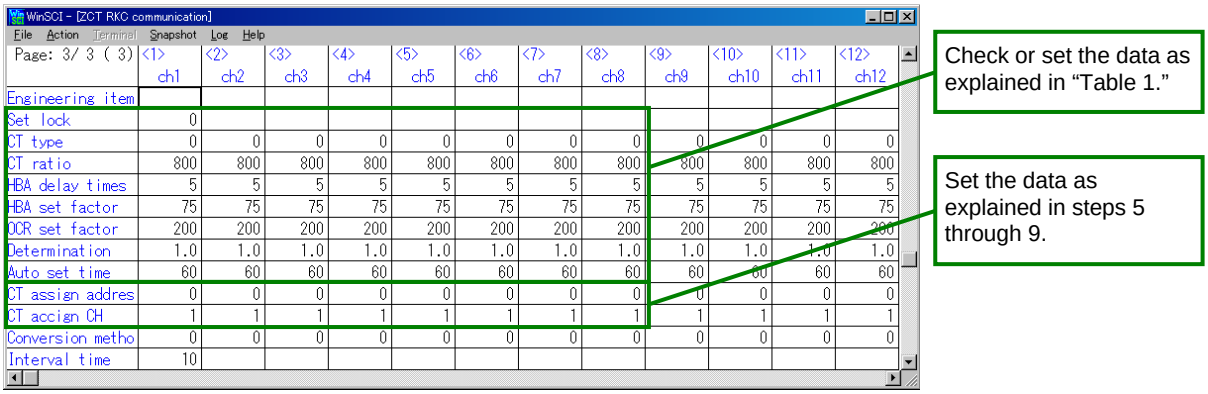
Engineering item												
Set lock	0											
CT type	0	0	0	0	0	0	0	0	0	0	0	0
CT ratio	800	800	800	800	800	800	800	800	800	800	800	800
HBA delay times	5	5	5	5	5	5	5	5	5	5	5	5
HBA set factor	75	75	75	75	75	75	75	75	75	75	75	75
OCR set factor	200	200	200	200	200	200	200	200	200	200	200	200
Determination	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Auto set time	60	60	60	60	60	60	60	60	60	60	60	60
CT assign addres	0	0	0	0	0	0	0	0	0	0	0	0
CT accign CH	1	1	1	1	1	1	1	1	1	1	1	1
Conversion metho	0	0	0	0	0	0	0	0	0	0	0	0
Interval time	10											

4. Check and set the communication data below. Configure settings for the CT input channels to be used. In this example, communication data for CT input channels 1 to 8 are set.
Set the data as explained below.



Check or set the data as explained in “Table 1.”

Set the data as explained in steps 5 through 9.

Table 1

Communication data name	Details of setting data	Communication data explanation
Set lock	If the set data is locked, set to “0: Unlock.”	P. 7-17
CT type	Verify that the CT type to be used is set. In the example, CT (CTL-6-P-N) for no specification at factory shipping is used, and thus “0” is set. Using a non-specified CT If a non-specified CT is used, set to “1.” There are certain requirements for non-specified CTs that can be used. See the explanation of the communication data.	P. 7-18
CT ratio	Set the number of winds of the CT. The number of winds of the CT (CTL-6-P-N) is 800; therefore, set to “800.” Using a non-specified CT If a non-specified CT is used, set the number of winds of that CT.	P. 7-19
HBA delay times [Number of heater break alarm (HBA) delay times] *	Set the number of heater break alarm (HBA) delay times. In this example, “5 times (factory set value)” is set.	P. 7-20
HBA set factor [Automatic setting factor for heater break alarm (HBA)] *	Set the automatic setting factor for heater break alarm (HBA). In this example, “75 % (factory set value)” is set.	P. 7-21
OCR set factor [Automatic setting factor for heater overcurrent alarm] *	Set the automatic setting factor for heater overcurrent alarm. In this example, “200 % (factory set value)” is set.	P. 7-22

* Names in brackets [ ] are names that appear in the manual.

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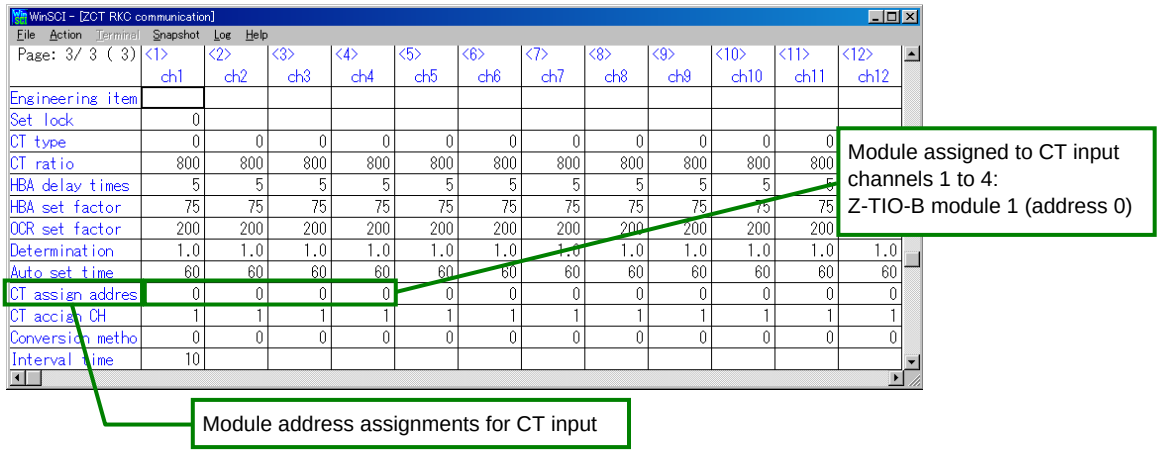
Table 1

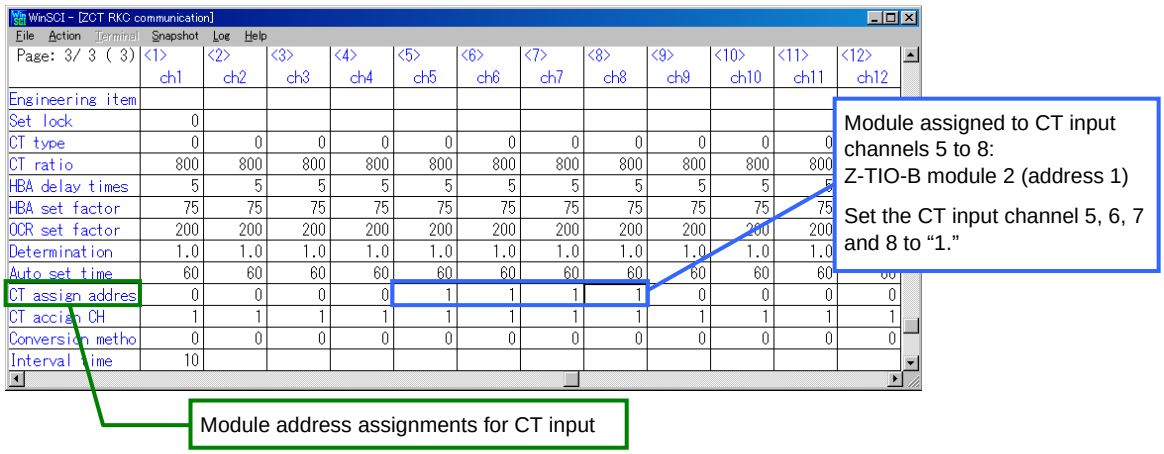
Communication data name	Details of setting data	Communication data explanation
Determination [Determination current value for automatic setting] *	Set the determination current value for automatic setting. In this example, “1.0 A (factory set value)” is set. If the current is less than 1.0 A during automatic setting, the set value of each alarm is not calculated.	P. 7-23
Auto set time [Automatic setting time] *	Set the calculation time for performing automatic setting. In this example, “60 seconds A (factory set value)” is set. If calculation of the alarm set values cannot be performed within 60 seconds, automatic setting will fail.	P. 7-24

* Names in brackets [ ] are names that appear in the manual.

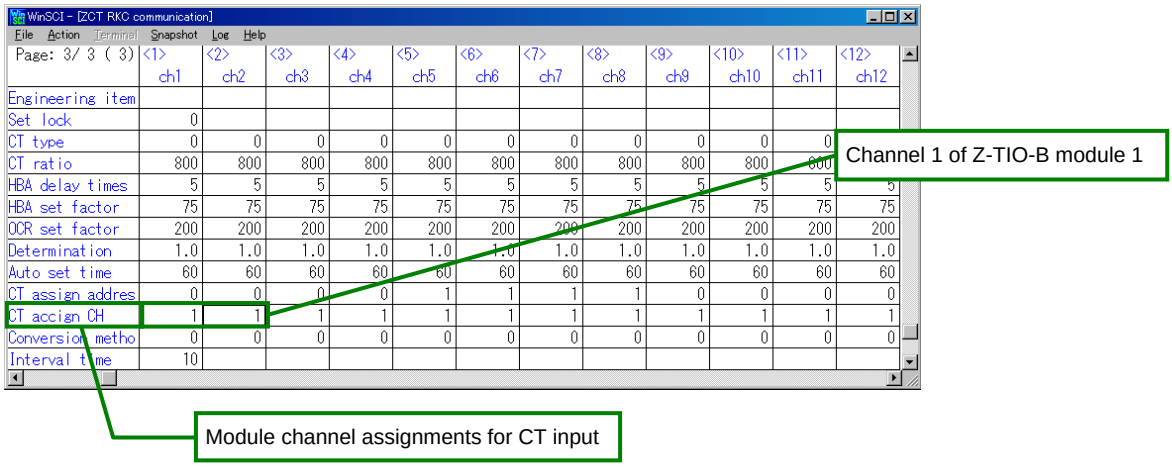
5. Set the address of the module to be assigned to the CT input channel.
The address number “0” of Z-TIO-B module 1 is to be assigned to CT input channels 1 to 4, and thus the data does not to be changed.



6. Set the address of the module to be assigned to the CT input channel 5 to 8.
The address number of Z-TIO-B module 2 is to be assigned to CT input channels 5 to 8. Set “1,” the address of Z-TIO-B module 2.



7. Set the channel of the module to be assigned to the CT input channel.
CT input channels 1 and 2 will be assigned to channel 1 of Z-TIO-B module 1 (address 0), and thus the data does not to be changed.



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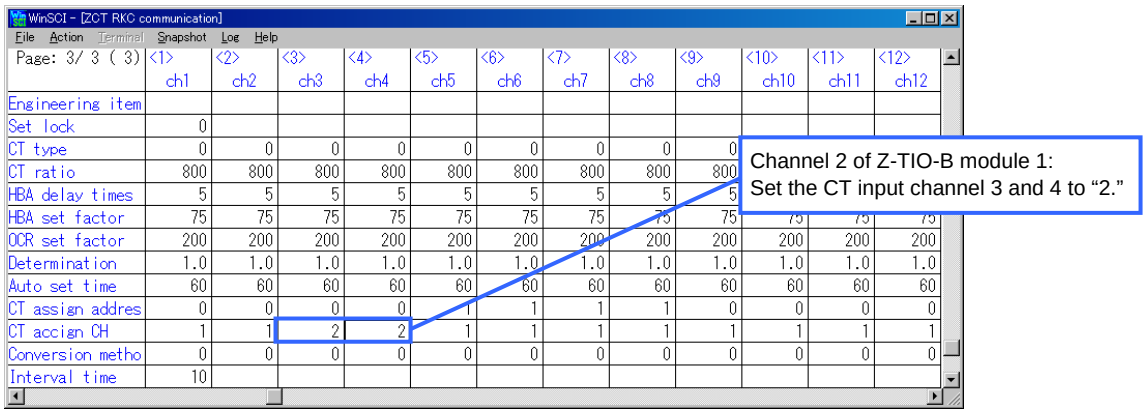
Engineering item												
Set lock	0											
CT type	0	0	0	0	0	0	0	0	0	0	0	0
CT ratio	800	800	800	800	800	800	800	800	800	800	800	800
HBA delay times	5	5	5	5	5	5	5	5	5	5	5	5
HBA set factor	75	75	75	75	75	75	75	75	75	75	75	75
OCR set factor	200	200	200	200	200	200	200	200	200	200	200	200
Determination	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Auto set time	60	60	60	60	60	60	60	60	60	60	60	60
CT assign addres	0	0	0	0	1	1	1	1	0	0	0	0
CT accign CH	1	1	1	1	1	1	1	1	1	1	1	1
Conversion metho	0	0	0	0	0	0	0	0	0	0	0	0
Interval time	10											

8. CT input channels 3 and 4 will be assigned to channel 2 of Z-TIO-B module 1 (address 0), and thus these are set to “2.”



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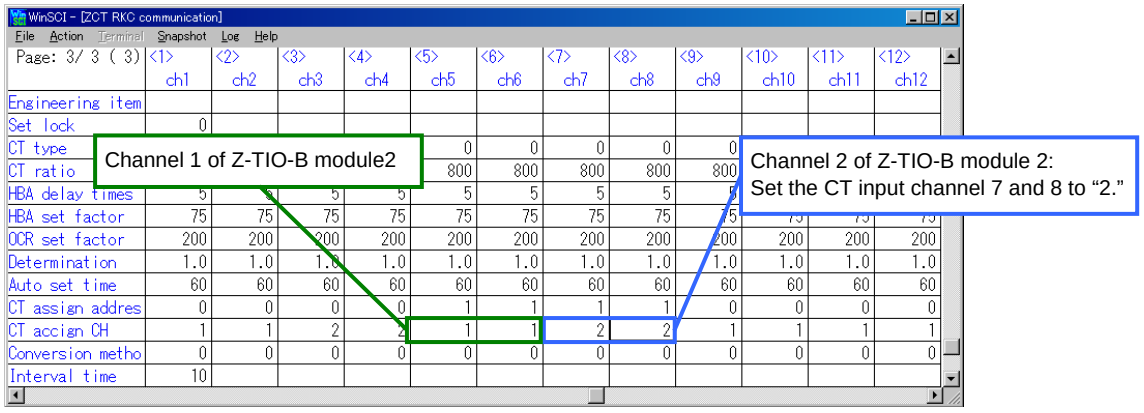
Engineering item												
Set lock	0											
CT type	0	0	0	0	0	0	0	0	0			
CT ratio	800	800	800	800	800	800	800	800	800			
HBA delay times	5	5	5	5	5	5	5	5	5			
HBA set factor	75	75	75	75	75	75	75	75	75	75	75	75
OCR set factor	200	200	200	200	200	200	200	200	200	200	200	200
Determination	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Auto set time	60	60	60	60	60	60	60	60	60	60	60	60
CT assign addres	0	0	0	0	1	1	1	1	0	0	0	0
CT accign CH	1	1	2	2	1	1	1	1	1	1	1	1
Conversion metho	0	0	0	0	0	0	0	0	0	0	0	0
Interval time	10											

9. Follow the same steps to set CT input channels 5 to 8.
Assign the channels to channel 1 and channel 2 of Z-TIO-B module 2 (address 1).

- **CT input channel 5 and 6:** Assigned to channel 1, thus no change is needed.
- **CT input channel 7 and 8:** Assigned to channel 2, thus set to “2.”



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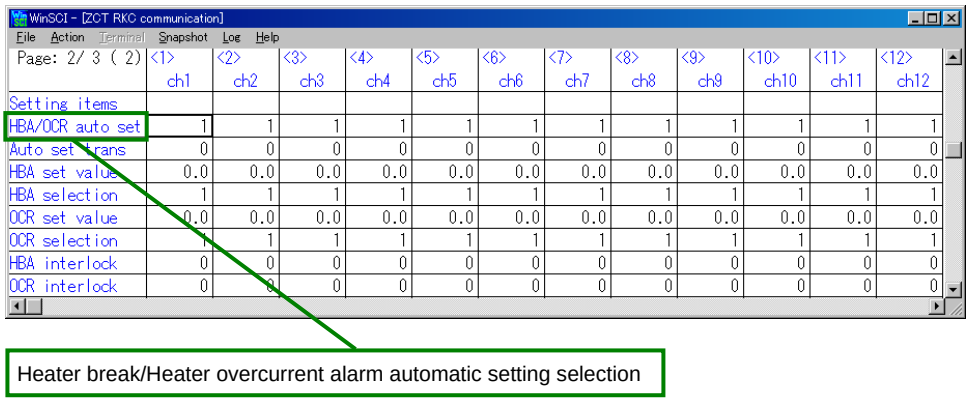
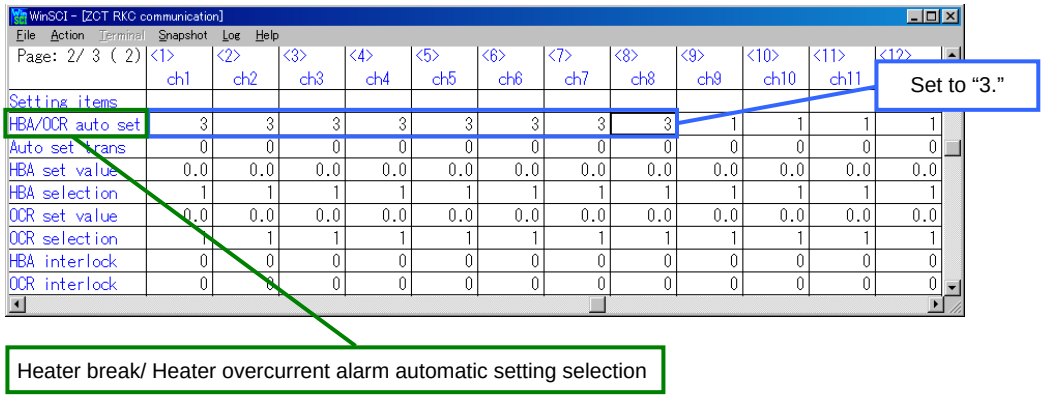
Engineering item												
Set lock	0											
CT type					0	0	0	0	0			
CT ratio					800	800	800	800	800			
HBA delay times	5	5	5	5	5	5	5	5	5			
HBA set factor	75	75	75	75	75	75	75	75	75	75	75	75
OCR set factor	200	200	200	200	200	200	200	200	200	200	200	200
Determination	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Auto set time	60	60	60	60	60	60	60	60	60	60	60	60
CT assign addres	0	0	0	0	1	1	1	1	0	0	0	0
CT accign CH	1	1	2	2	1	1	2	2	1	1	1	1
Conversion metho	0	0	0	0	0	0	0	0	0	0	0	0
Interval time	10											

10. Select the CT input channels for which automatic setting of the heater break alarm (HBA) and heater overcurrent alarm will be executed.
Go to the heater break/heater overcurrent alarm automatic setting selection screen.

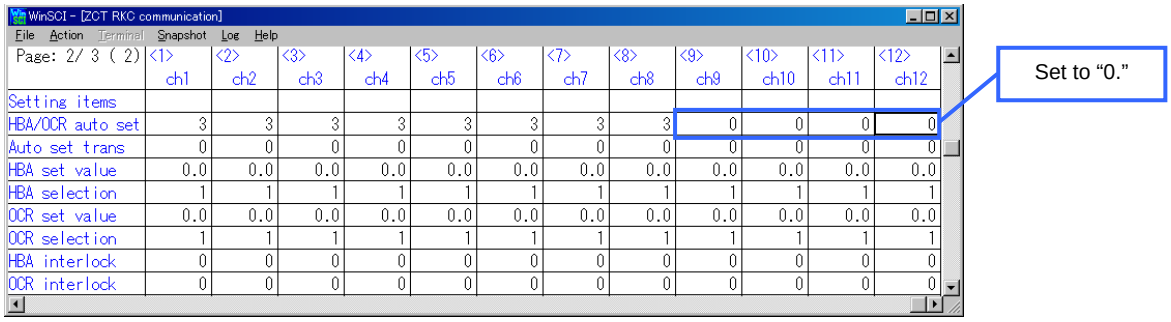


11. Select the CT input channel in heater break/heater overcurrent alarm automatic setting selection.
To perform automatic setting of the heater break alarm (HBA) set value and heater overcurrent alarm, set CT input channels 1 to 8 to "3."

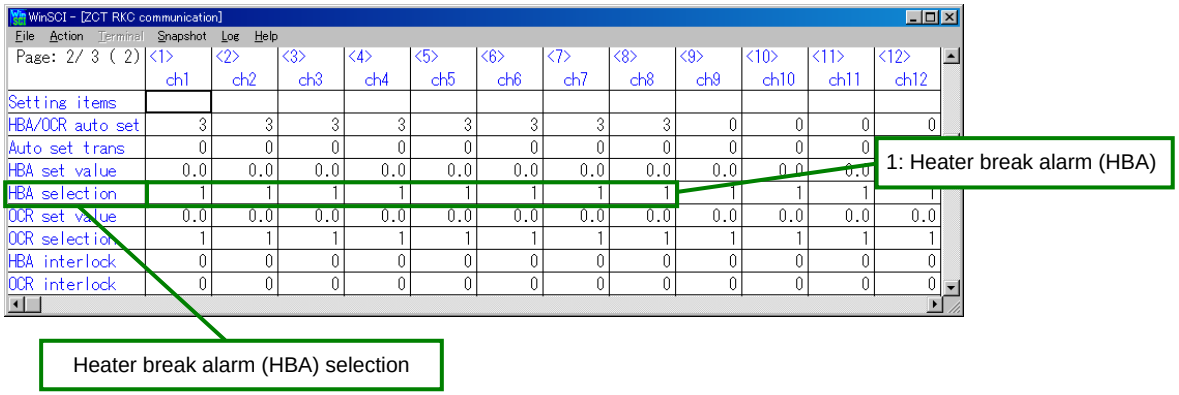


☞ For details of heater break/heater overcurrent alarm automatic setting selection, see on page **7-9**.

12. To prevent incorrect settings, disable CT input channels for which automatic setting will not be performed. In this example, CT input channels 9 to 12 will not be used, and thus these are set to "0."

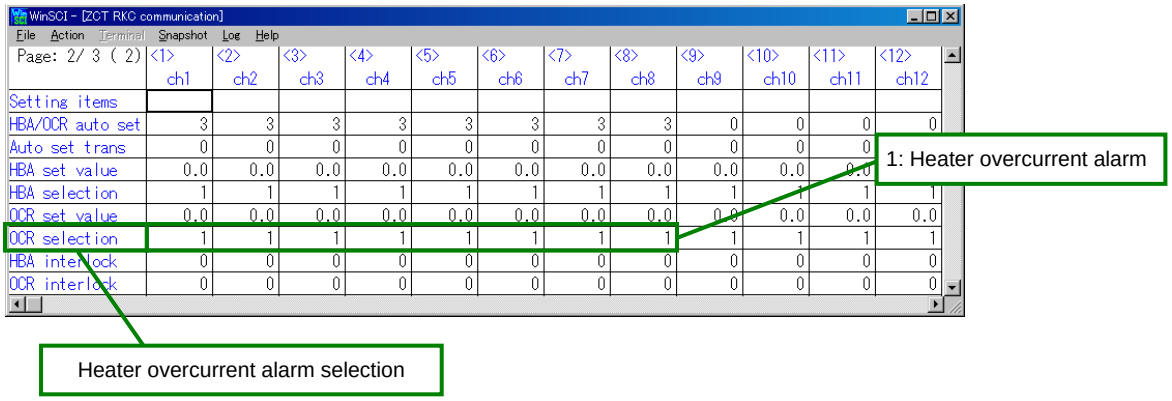


13. Select the alarm state when a heater break alarm (HBA) occurs. Set this in heater break alarm (HBA) selection. In the example, the factory set value "1" is used and thus no change is needed.



☞ For details of heater break alarm (HBA) selection, see on page **7-12**.

14. Select the alarm state when a heater overcurrent alarm occurs. Set this in heater overcurrent alarm selection. In the example, the factory set value "1" is used and thus no change is needed.



☞ For details of heater overcurrent alarm (HBA) selection, see on page **7-14**.

This completes the data setting that is required before automatic setting is performed.

6.3.4 Procedure for executing automatic setting

Automatic setting is executed by push button or communication.

- When the alarm values are automatically set by push button, batch setting of the CT input channels is possible.
  (However, only CT input channels for which automatic setting is enabled can be set.)
- When the alarm values are automatically set via communication, each CT input channel can be separately set.
  (However, only CT input channels for which automatic setting is enabled can be set.)

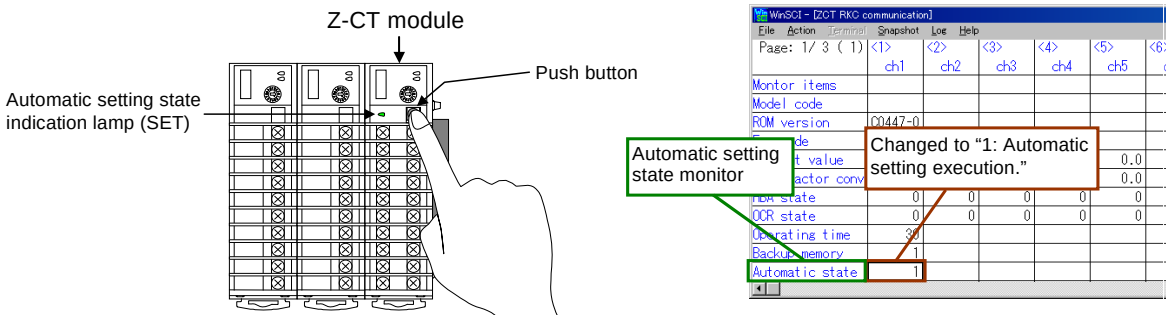
■ Execution by push button

1. Turn on the power of the heater.

2. Switch the SRZ unit to RUN and start heater control.

☞ For the RUN/STOP transfer of SRZ unit, see **SRZ Instruction Manual (IMS01T04-E□)**.

3. Immediately after switching to RUN, hold down the push button on the front of the Z-CT module for at least 2 seconds. Automatic setting of the heater break alarm (HBA) set value and heater overcurrent alarm starts. When automatic setting starts, the automatic setting state indication lamp (SET) lights up and the automatic setting state monitor changes to “1: Automatic setting execution.”



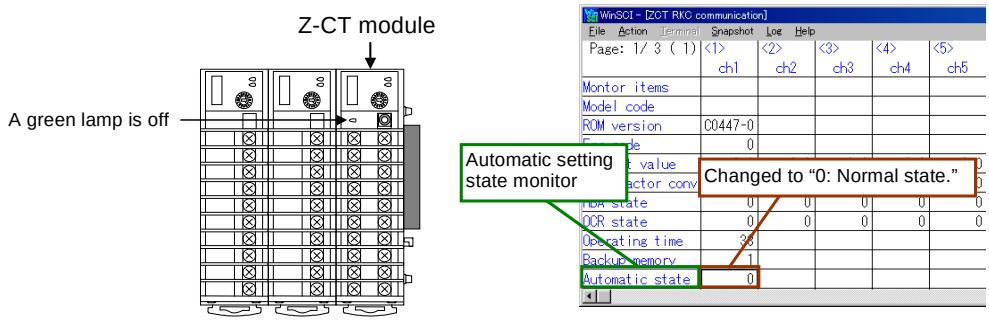
Automatic setting is most successful if performed while auto tuning (AT) is being executed.

If the ON time of control output is 0.5 seconds or less, automatic setting is not possible.

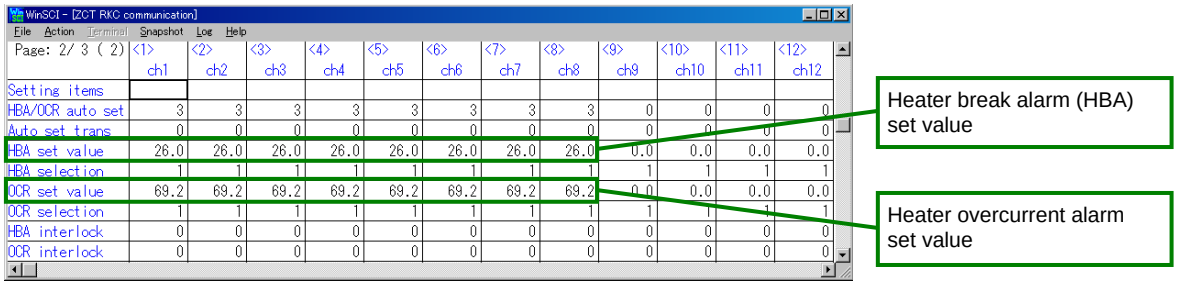
During automatic setting, automatic setting can be stopped by holding down the push button for at least two seconds.

The states of the automatic setting state indication lamp (SET) and automatic setting state monitor are linked.

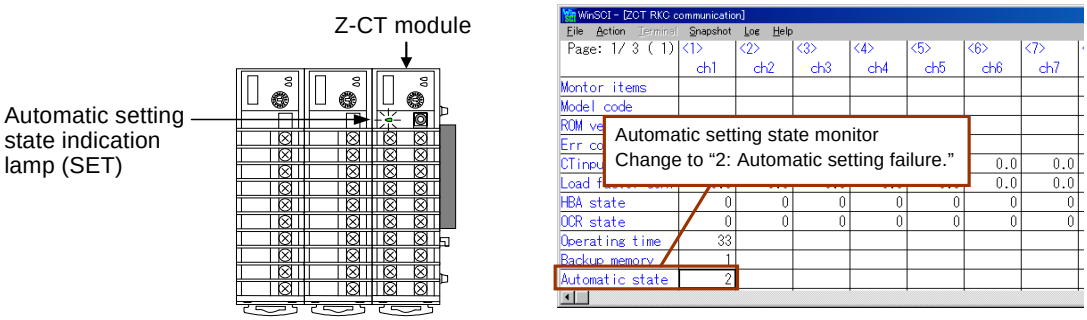
4. The automatic setting state indication lamp (SET) on the front of the Z-CT module will turn off when automatic setting ends. In addition, the automatic setting state monitor returns to “0: Normal state.”



5. Verify that the heater break alarm (HBA) set value and heater overcurrent alarm are set.

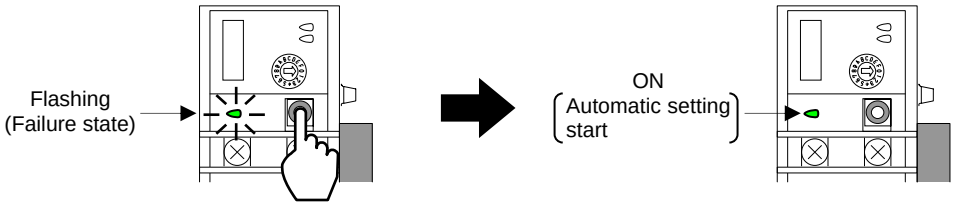


If the automatic setting is failed, automatic setting state indication lamp (SET) flashes.
In addition, the automatic setting state monitor returns to "2: Automatic setting failure."

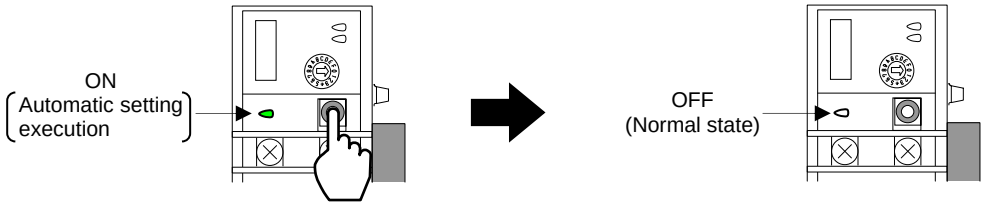


Release method of automatic setting failure state

① Hold down the push button at least 2 seconds to start automatic setting again.



② Hold down the push button at least 2 seconds during automatic setting to stop automatic setting. The automatic setting state indication lamp (SET) will stop lighting (ON state) and turn off, and the failure state will be cleared.



Note: The automatic setting state monitor changes to "0: Normal state."

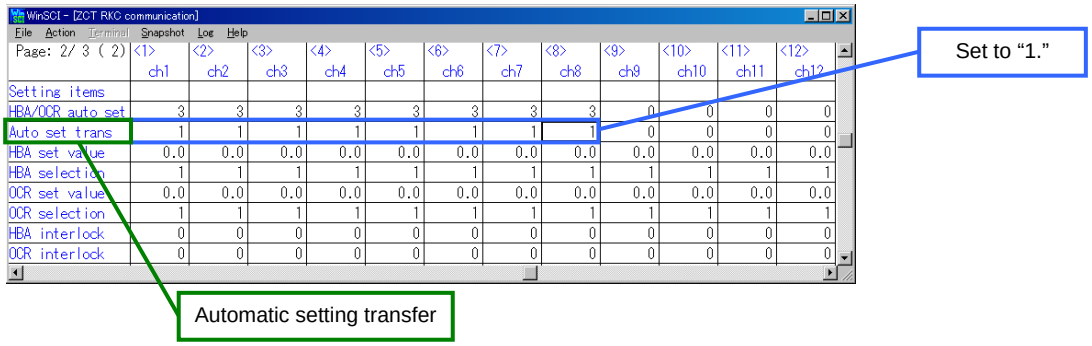
■ Execution via communication

1. Turn on the power of the heater.

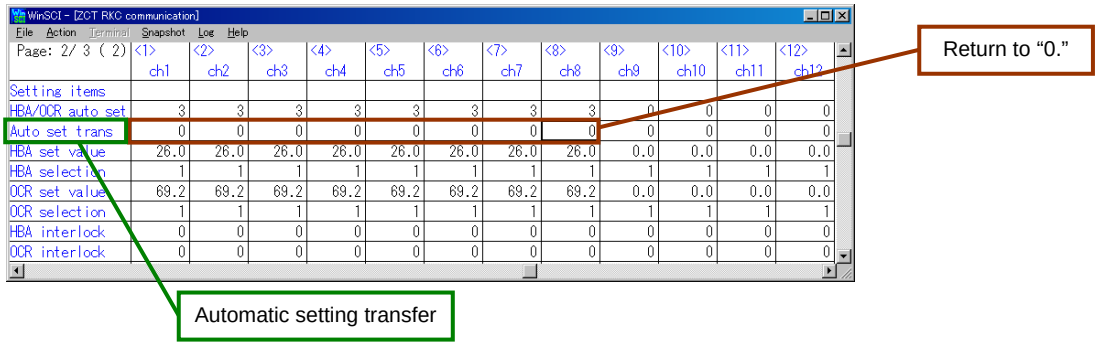
2. Switch the SRZ unit to RUN and start heater control.

☞ For the RUN/STOP transfer of SRZ unit, see **SRZ Instruction Manual (IMS01T04-E□)**.

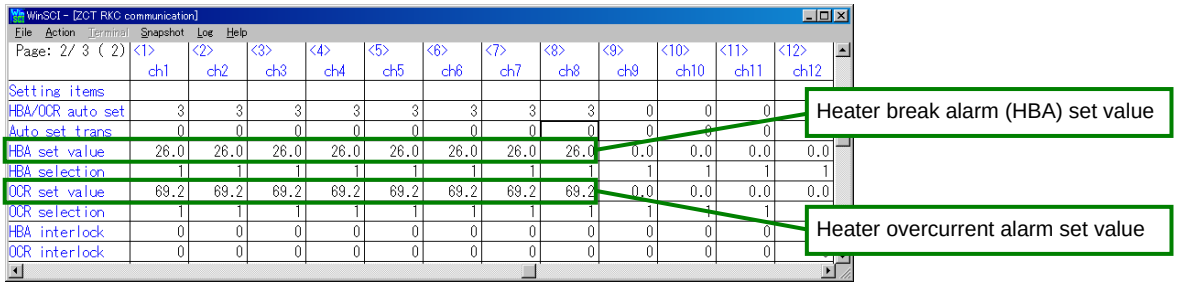
3. Set automatic setting transfer to “1” for each CT input channel.
Automatic setting of the heater break alarm (HBA) set value and heater overcurrent alarm starts.
When automatic setting starts, the automatic setting state indication lamp (SET) lights up.
In addition, automatic setting state monitor is changed to “1: automatic setting execution.” (See **P. 6-23**)



4. Automatic setting transfer reverts to “0: Normal state” when automatic setting ends. When automatic setting ends, the automatic setting state indication lamp (SET) turns off.
In addition, automatic setting state monitor is returned to “0: Normal state.”(See **P. 6-23**)

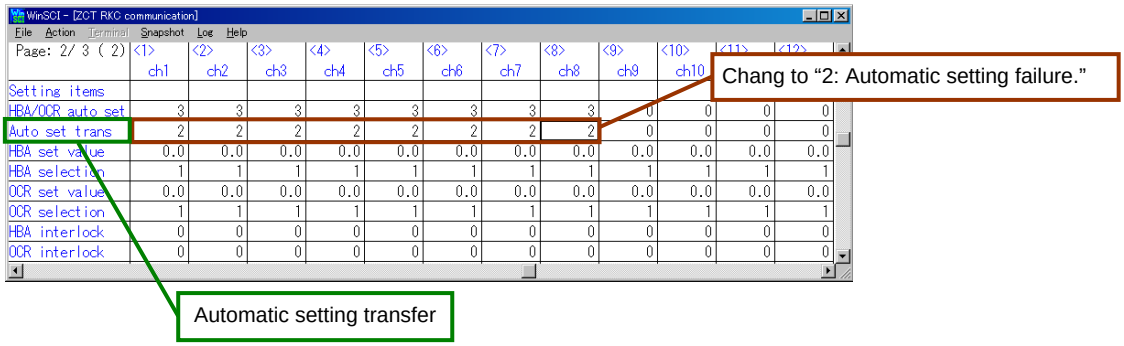


5. Verify that the heater break alarm (HBA) set value and heater overcurrent alarm are set.

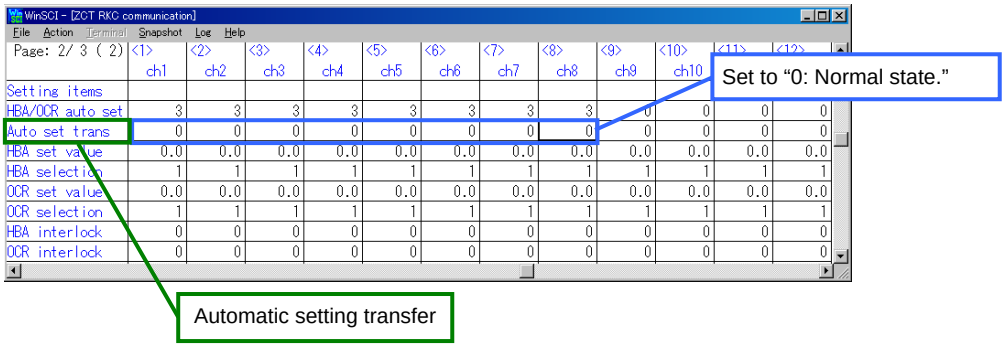


If the automatic setting is failed, automatic setting transfer is changed to “2: Automatic setting failure*.”

* “2: Automatic setting failure” is read only.



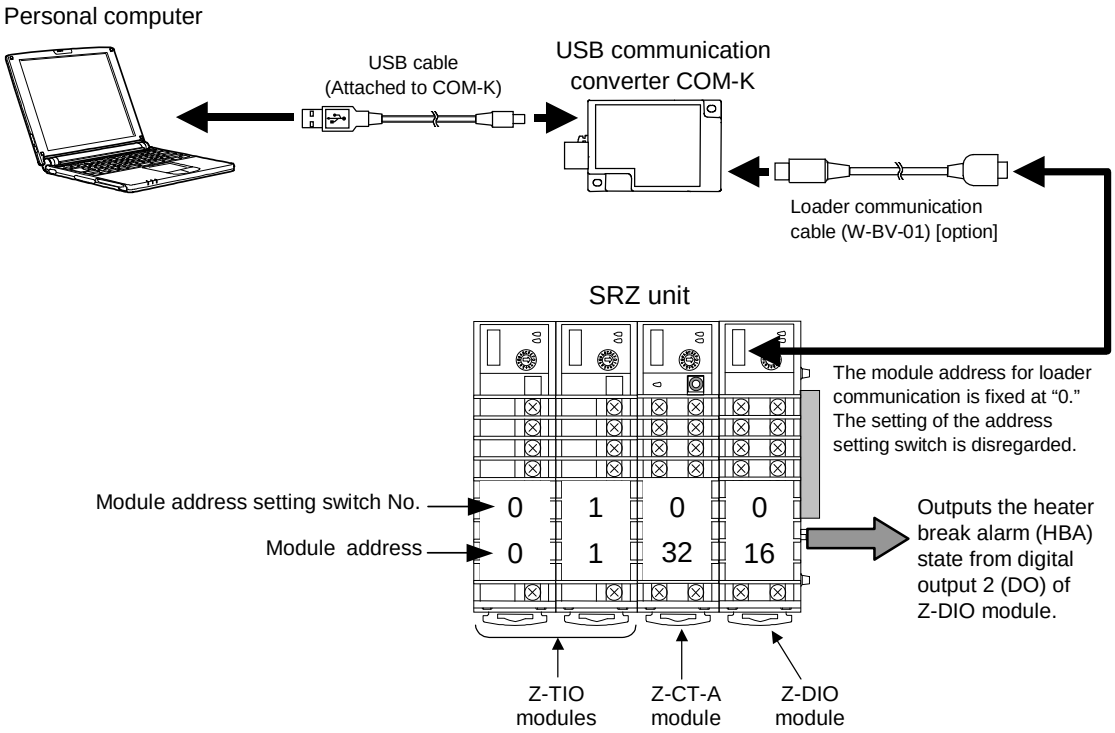
To clear the failure state, set automatic setting transfer to “0: Normal state.”



6.4 Digital Output (DO) of Heater Break Alarm (HBA)

The setting example of outputting the heater break alarm (HBA) state of the Z-CT module from digital output (DO) of the Z-DIO module is explained.

■ System configuration



■ Use instruments

- **SRZ unit**
  Temperature control module Z-TIO-B (2 channel type: No CT input [option]): 2
  Current transformer module Z-CT-A: 1
  Digital input/output module Z-DIO-A: 1
- **Communication converter**
  USB communication converter COM-K (RKC product): 1
  Loader communication cable W-BV-01 [option]: 1
- **Personal computer:** 1 (Software operation environment: Consult the manual that you downloaded.)
- **Communication program:**
  The customer must provide the communication program.

■ Condition

Output the heater break alarm (HBA) state (*logical OR* of ch1 to ch12) of the Z-CT module from digital output 2 (DO2) [HBA comprehensive output] of the Z-DIO module.

■ Setting procedure

(1) Preparation of loader communication

Conduct the setting for loader communication according to the following procedure.

- Install the driver of the USB communication converter COM-K in a personal computer.
  ☞ For the installation of the COM-K driver, see **COM-K Instruction Manual (IMR01Z01-E□)**.
- Prepare the communication program. Then conduct the communication setting of the personal computer.
  ☞ For details, see **6.3.2 Preparation of loader communication (P. 6-16)**.
- Connect a Z-DIO module to converter COM-K and personal computer by connection cable.
  ☞ For the connection method, see ■ **System configuration (P. 6-27)**.

(2) Data setting of Z-DIO module

Set the engineering setting data “DO output assignment 1 [DO1 to 4]” and “DO signal assignment module address 1 [DO1 to 4]” of Z-DIO module.

To configure engineering setting data, the RUN/STOP switch must be set to STOP (control stopped).

● Setting of DO output assignment 1 [DO1 to 4]

Set the DO output assignment 1 to “13.” (See **Table 1**.)

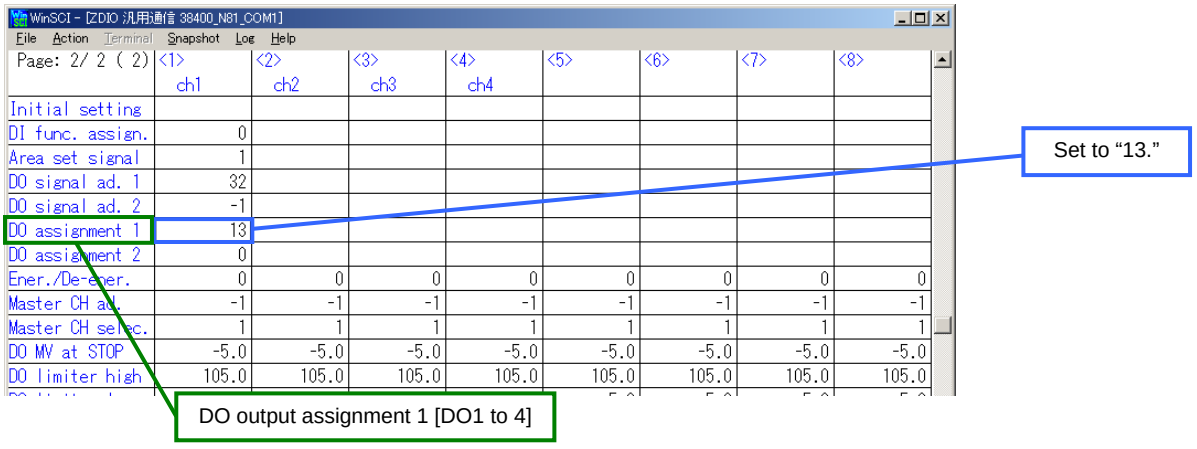
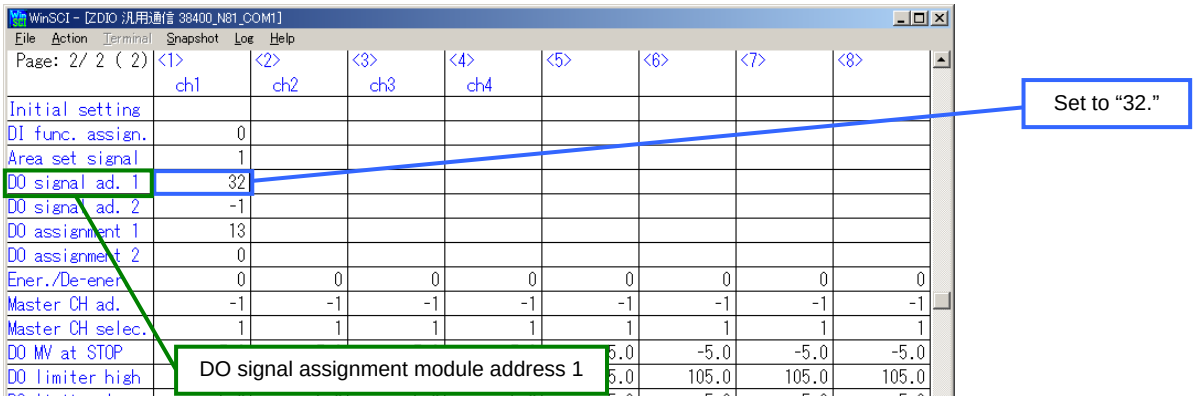


Table 1: DO output assignment 1 [DO1 to DO4]

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

● Setting of DO signal assignment module address 1 [DO1 to 4]

Set the module address “32” of the Z-CT module in DO signal assignment module address 1.



By means of the above settings, the heater break alarm (HBA) state (logical OR of ch1 to ch12) of the Z-CT module is output from DO2 (HBA comprehensive output) of the Z-DIO module.

The heater break alarm (HBA) state cannot be output from the digital output (DO) separately for each channel of the Z-CT module.

DO2 (HBA comprehensive output) outputs the logical OR of the heater break alarm (HBA) state of the Z-TIO module and the heater break alarm (HBA) state of the Z-CT module.

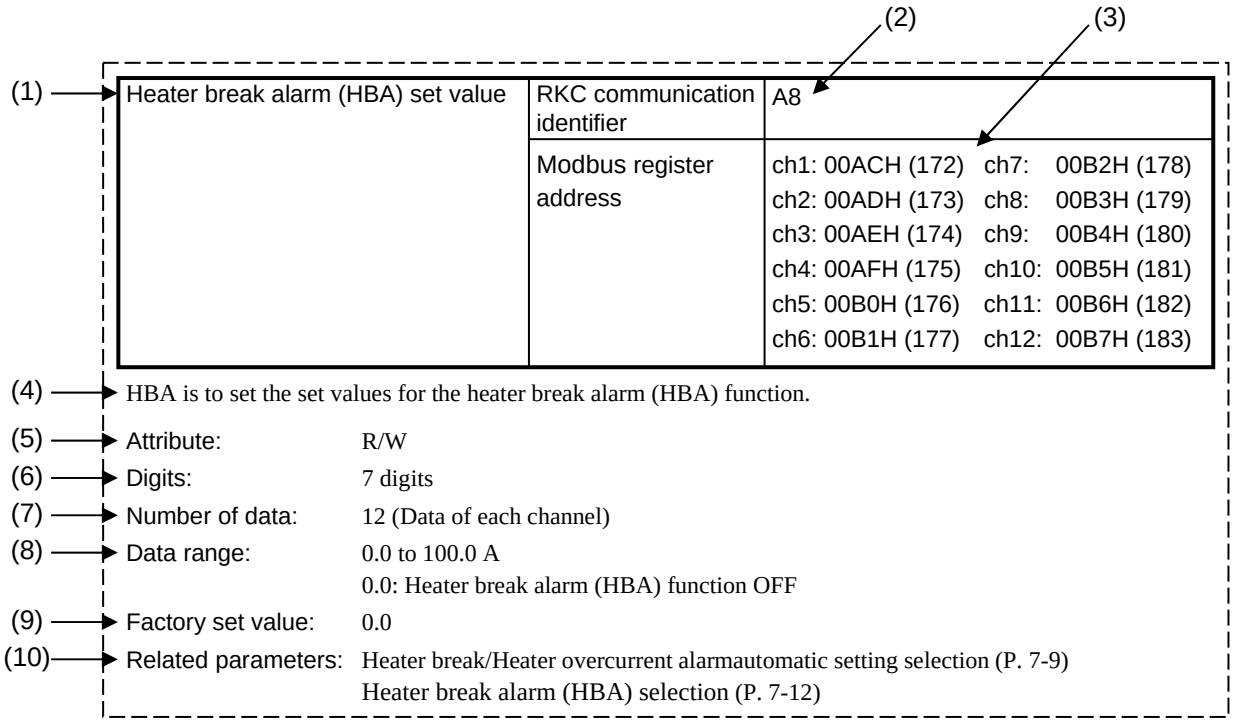
For details on the “DO output assignment 1 [DO1 to 4]” and “DO signal assignment module address 1 [DO1 to 4]” of Z-DIO module, see **SRZ Instruction Manual (IMS01T04-E□)**.

MEMO

COMMUNICATION DATA DESCRIPTION

7

7.1 Reference to Communication Data Contents



(1) Name: Communication data name

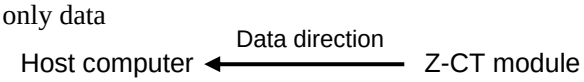
(2) RKC communication identifier:
Communication identifier of RKC communication

(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.

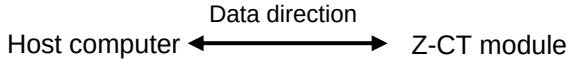
(4) Description: A short description of the communication data item

(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: 12
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.

7.2 Communication Data

Model code	RKC communication identifier	ID
	Modbus register address	—

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

Attribute: RO
Digits: 32 digits
Number of data: 1 (Data of each module)
Data range: —
Factory set value: —

ROM version	RKC communication identifier	VR
	Modbus register address	—

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

Attribute: RO
Digits: 8 digits
Number of data: 1 (Data of each module)
Data range: The version of loading software
Factory set value: —

Current transformer (CT) input value monitor	RKCcommunication identifier	M4
	Modbus register address	ch1: 0000H (0) ch7: 0006H (6) ch2: 0001H (1) ch8: 0007H (7) ch3: 0002H (2) ch9: 0008H (8) ch4: 0003H (3) ch10: 0009H (9) ch5: 0004H (4) ch11: 000AH (10) ch6: 0005H (5) ch12: 000BH (11)

This is the current value which captured by CT.

Phase control:

When the phase-angle is 0% or 100%, the root mean squared value is displayed.
At any other phase-angle, the current value "mean current value × 1.1" is displayed.

ON/OFF control:

When time proportioning output is used, switching ON/OFF during current measurement is not recognized by the Z-CT module, and thus an indeterminate value is displayed for the measured current.

The displayed CT input value varies depending on enable/disable and other conditions of the control method and heater break alarm (HBA) function. The conditions are shown below.

Control method	Heater break alarm (HBA) enabled/disabled	Load factor		
		0 %	Other than 0 % or 100 %	100 %
Phase control	When the control method is phase control, heater break alarm (HBA) cannot be availed.	Root mean squared value	Mean current value × 1.1	Root mean squared value
ON/OFF control	When the heater break alarm (HBA) is enabled	Root mean squared value	Holds the root mean squared current value when the load factor is 0%, or when the load factor is 100%.	Root mean squared value
	When the heater break alarm (HBA) is disabled *	Root mean squared value	The Z-CT module cannot recognize ON/OFF of control output, thus an indeterminate current value is displayed.	Root mean squared value

* When the heater break alarm (HBA) function is inactive.
- When the heater break alarm (HBA) set-value is set to "0.0"

Attribute: RO
Digits: 7 digits
Number of data: 12 (Data of each channel)
Data range: When the CT type is CTL-6-P-Z: 0.0 to 10.0 A
When the CT type is CTL-6-P-N: 0.0 to 30.0 A
When the CT type is CTL-12-S56-10L-N: 0.0 to 100.0 A
Factory set value: —

Load factor conversion CT monitor	RKC communication identifier	M5	
	Modbus register address	ch1: 000CH (12) ch2: 000DH (13) ch3: 000EH (14) ch4: 000FH (15) ch5: 0010H (16) ch6: 0011H (17)	ch7: 0012H (18) ch8: 0013H (19) ch9: 0014H (20) ch10: 0015H (21) ch11: 0016H (22) ch12: 0017H (23)

This value is mean current value or root mean squared value.
The display can be switched between the mean current value and root mean squared value.
The display is switched using the load factor conversion method (P. 7-27).
The load factor conversion CT monitor can be used when the heater break alarm (HBA) function is enabled.

Attribute: RO
Digits: 7 digits
Number of data: 12 (Data of each channel)
Data range: 0.0 to 100.0 A
Factory set value: —
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9), Automatic setting transfer (P. 7-10), Heater break alarm (HBA) set value (P. 7-11), CT type (P. 7-18), CT ratio (P. 7-19), Number of heater break alarm (HBA) delay times (P. 7-20) Automatic setting factor for heater break alarm (HBA) (P. 7-21), Determination current value for automatic setting (P. 7-23), Automatic setting time (P. 7-24), Module address assignments for CT input (P. 7-25), Module channel assignments for CT input (P. 7-26), Load factor conversion method (P. 7-27)

Heater break alarm (HBA) state monitor	RKC communication identifier	AF	
	Modbus register address	ch1: 0018H (24) ch2: 0019H (25) ch3: 001AH (26) ch4: 001BH (27) ch5: 001CH (28) ch6: 001DH (29)	ch7: 001EH (30) ch8: 001FH (31) ch9: 0020H (32) ch10: 0021H (33) ch11: 0022H (34) ch12: 0023H (35)

This monitors the state of the heater break alarm (HBA). As the Z-CT module does not have an alarm output terminal, use this monitor to check the state of the heater break alarm (HBA).

Attribute: RO
Digits: 1 digit
Number of data: 12 (Data of each channel)
Data range: 0: Normal
1: Break
2: Melting
Factory set value: —
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9), Automatic setting transfer (P. 7-10), Heater break alarm (HBA) set value (P. 7-11), Heater break alarm (HBA) selection (P. 7-12), Heater break alarm (HBA) interlock release (P. 7-15), CT type (P. 7-18) CT ratio (P. 7-19), Number of heater break alarm (HBA) delay times (P. 7-20) Automatic setting factor for heater break alarm (HBA) (P. 7-21), Determination current value for automatic setting (P. 7-23) Automatic setting time (P. 7-24), Module address assignments for CT input (P. 7-25), Module channel assignments for CT input (P. 7-26)

Heater overcurrent alarm state monitor	RKC communication identifier	AG
	Modbus register address	ch1: 0024H (36) ch7: 003AH (42) ch2: 0025H (37) ch8: 003BH (43) ch3: 0026H (38) ch9: 002CH (44) ch4: 0027H (39) ch10: 002DH (45) ch5: 0028H (40) ch11: 002EH (46) ch6: 0029H (41) ch12: 002FH (45)

This monitors the state of the heater overcurrent alarm (HBA). As the Z-CT module does not have an alarm output terminal, use this monitor to check the state of the heater overcurrent alarm.

Attribute: RO
Digits: 1 digit
Number of data: 12 (Data of each channel)
Data range: 0: Normal
1: Heater overcurrent
Factory set value: —
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10),
Heater overcurrent alarm set value (P. 7-13),
Heater overcurrent alarm selection (P. 7-14),
Heater overcurrent alarm interlock release (P. 7-16),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20)
Automatic setting factor for heater overcurrent alarm (P. 7-22),
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25)
Module channel assignments for CT input (P. 7-26)

Error code	RKC communication identifier	ER
	Modbus register address	0030H (48)

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

Attribute: RO
Digits: 7 digits
Number of data: 1 (Data of each module)
Data range: 0 to 7 (bit data)
RKC communication: 1: Adjustment data error
2: Data back-up error
4: A/D conversion error
Modbus communication: The output state is assigned as a bit image in binary numbers.

Bit image: 0000000000000000 Bit data: 0: OFF
1: ON
bit 15 ·····bit 0

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

Factory set value: —

Integrated operating time monitor	RKC communication identifier	UT
	Modbus register address	0031H (49)

This value is an integrated operating time of the Z-CT 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	0032H (50)

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: —

Automatic setting state monitor	RKC communication identifier	CJ
	Modbus register address	0033H (51)

Displays the automatic setting state of heater break alarm (HBA) and heater over current alarm.

Attribute: RO
Digits: 1 digit
Number of data: 1 (Data of each module)
Data range: 0: Normal state (state when automatic setting is not in operation)
1: Automatic setting execution
2: Automatic setting failure
Factory set value: —
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10),
Heater break alarm (HBA) set value (P. 7-11),
Heater break alarm (HBA) selection (P. 7-12),
Heater overcurrent alarm set value (P. 7-13),
Heater overcurrent alarm selection (P. 7-14),
Heater break alarm (HBA) interlock release (P. 7-15),
Heater overcurrent alarm interlock release (P. 7-16),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater break alarm (HBA) (P. 7-21),
Automatic setting factor for heater overcurrent alarm (P. 7-22),
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25),
Module channel assignments for CT input (P. 7-26)

The automatic setting state monitor is linked to the automatic setting state indication lamp (SET) and automatic setting transfer state.

Heater break/Heater overcurrent alarm automatic setting selection	RKC communication identifier	BT
	Modbus register address	ch1: 0094H (148) ch7: 009AH (154) ch2: 0095H (149) ch8: 009BH (155) ch3: 0096H (150) ch9: 009CH (156) ch4: 0097H (151) ch10: 009DH (157) ch5: 0098H (152) ch11: 009EH (158) ch6: 0099H (153) ch12: 009FH (159)

Use the push button or communication to select whether automatic setting of the heater break alarm (HBA) and heater overcurrent alarm is enabled or disabled for each CT input channel.
Even if automatic setting is executed for a CT input channel that is set to disabled, the alarm set value is not updated.

Attribute: R/W
Digits: 1 digit
Number of data: 12 (Data of each channel)
Data range: 0: Automatic setting is disabled. (Alarm set value cannot be automatically set by the push button and communication.)
1: Automatic setting for heater break alarm is enabled.
2: Automatic setting for heater overcurrent alarm set value is enabled.
3: Automatic setting for heater break alarm (HBA) and heater overcurrent alarm set values are enabled.

Valid: × Invalid: —

Set value	Automatic setting validity/invalidity	
	Heater break alarm (HBA)	Heater overcurrent alarm
0	—	—
1	×	—
2	—	×
3	×	×

Factory set value: 1
Related parameters: Automatic setting transfer (P. 7-10),
Heater break alarm (HBA) set value (P. 7-11),
Heater break alarm (HBA) selection (P. 7-12),
Heater overcurrent alarm set value (P. 7-13),
Heater overcurrent alarm selection (P. 7-14),
Heater break alarm (HBA) interlock release (P. 7-15),
Heater overcurrent alarm interlock release (P. 7-16),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater break alarm (HBA) (P. 7-21),
Automatic setting factor for heater overcurrent alarm (P. 7-22),
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24)
Module address assignments for CT input (P. 7-25),
Module channel assignments for CT input (P. 7-26)

Heater break alarm (HBA) and heater overcurrent alarm corresponds to the time proportioning output.

To prevent erroneous setting, set CT input channels for which automatic setting will not be performed to “0: Automatic setting is disabled.”

Automatic setting transfer	RKC communication identifier	BU
	Modbus register address	ch1: 00A0H (160) ch7: 00A6H (166) ch2: 00A1H (161) ch8: 00A7H (167) ch3: 00A2H (162) ch9: 00A8H (168) ch4: 00A3H (163) ch10: 00A9H (169) ch5: 00A4H (164) ch11: 00AAH (170) ch6: 00A5H (165) ch12: 00ABH (171)

Use communication to execute automatic setting of the heater break alarm (HBA) set value and heater overcurrent alarm set value. Automatic setting can be executed separately for each CT input channel.

Attribute: R/W
Digits: 1 digit
Number of data: 12 (Data of each channel)
Data range: 0: Normal state
1: Automatic setting execution
When "1" is set, automatic setting starts.
The automatic setting state monitor is "1" during automatic setting.
In addition, automatic setting state indication lamp (SET) is on.
When automatic setting ends normally, the monitor reverts to "0."
2: Automatic setting failure (RO)
If automatic setting fails, the value changes to "2."
The automatic setting state monitor also changes to "2" when automatic setting fails. In addition, the automatic setting state indication lamp (SET) blinks.
Factory set value: 0
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Heater break alarm (HBA) set value (P. 7-11),
Heater break alarm (HBA) selection (P. 7-12),
Heater overcurrent alarm set value (P. 7-13),
Heater overcurrent alarm selection (P. 7-14),
Heater break alarm (HBA) interlock release (P. 7-15),
Heater overcurrent alarm interlock release (P. 7-16),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater break alarm (HBA) (P. 7-21),
Automatic setting factor for heater overcurrent alarm (P. 7-22),
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25),
Module channel assignments for CT input (P. 7-26)

Automatic setting can only be executed for channels that are set to a value other than "0: Automatic setting is disabled" in heater break/heater overcurrent alarm automatic setting selection.

Heater break alarm (HBA) set value	RKC communication identifier	A8
	Modbus register address	ch1: 00ACH (172) ch7: 00B2H (178) ch2: 00ADH (173) ch8: 00B3H (179) ch3: 00AEH (174) ch9: 00B4H (180) ch4: 00AFH (175) ch10: 00B5H (181) ch5: 00B0H (176) ch11: 00B6H (182) ch6: 00B1H (177) ch12: 00B7H (183)

Heater break alarm (HBA) is to set the set values for the heater break alarm (HBA) function.
The settings can be configured using automatic setting or manual setting.
If the heater break alarm (HBA) set value is set to "0.0," heater break alarm (HBA) function is not activated. However, CT input value can be monitored.

Attribute: R/W
Digits: 7 digits
Number of data: 12 (Data of each channel)
Data range: 0.0 to 100.0 A
0.0: Heater break alarm function (HBA) OFF
(However, the current transformer (CT) input monitor can be availed.)
Factory set value: 0.0
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Heater break alarm (HBA) selection (P. 7-12),
Heater break alarm (HBA) interlock release (P. 7-15),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater break alarm (HBA) (P. 7-21),
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25),
Module channel assignments for CT input (P. 7-26)
Function: Heater break alarm (HBA) can only be used with time-proportional control output (relay, voltage pulse, triac or open collector output).
The heater break alarm (HBA) function monitors the current flowing through the load by a dedicated current transformer (CT), compares the measured value with the HBA set values, and detects a fault in the heating circuit.

Low or No current flow
(Heater break, malfunction of the control device, etc.):
When the control output is ON and the CT input value is equal to or less than the heater break determination point for the preset number of consecutive sampling cycles, an alarm is activated.
However, heater break alarm does not action when control output ON time is 0.5 second or less.

Overcurrent or short-circuit:
When the control output is OFF and the CT input value is equal to or greater than the heater break determination point for the preset number of consecutive sampling cycles, an alarm is activated.
However, heater break alarm does not action when control output OFF time is 0.5 second or less.

Heater break alarm (HBA) selection	RKC communication identifier	BZ
	Modbus register address	ch1: 00B8H (184) ch7: 00BEH (190) ch2: 00B9H (185) ch8: 00BFH (191) ch3: 00BAH (186) ch9: 00C0H (192) ch4: 00BBH (187) ch10: 00C1H (193) ch5: 00BCH (188) ch11: 00C2H (194) ch6: 00BDH (189) ch12: 00C3H (195)

Select whether or not an alarm state occurs when a heater break alarm (HBA) occurs.
If "0: Heater break alarm (HBA) unused" is set, an alarm state does not occur when a heater break alarm (HBA) occurs. However, the heater break alarm (HBA) function is active.

Attribute: R/W
Digits: 1 digit
Number of data: 12 (Data of each channel)
Data range: 0: Heater break alarm (HBA) unused
1: Heater break alarm (HBA)
2: Heater break alarm (HBA) (With alarm interlock function)
Factory set value: 1
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10),
Heater break alarm (HBA) set value (P. 7-11),
Heater break alarm (HBA) interlock release (P. 7-15),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater break alarm (HBA) (P. 7-21)
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25),
Module channel assignments for CT input (P. 7-26)
Function: The alarm interlock function is used to hold the alarm state even if the CT input value is out of the alarm zone after its entry into the alarm zone once.

Heater break alarm (HBA) can only be used with time proportional control output (relay, voltage pulse, triac or open collector output).

Heater overcurrent alarm set value	RKC communication identifier	A6
	Modbus register address	ch1: 00C4H (196) ch7: 00CAH (202) ch2: 00C5H (197) ch8: 00CBH (203) ch3: 00C6H (198) ch9: 00CCH (204) ch4: 00C7H (199) ch10: 00CDH (205) ch5: 00C8H (200) ch11: 00CEH (206) ch6: 00C9H (201) ch12: 00CFH (207)

Heater overcurrent alarm is to set the set values for the heater overcurrent alarm function.
The settings can be configured using automatic setting or manual setting.
If the heater overcurrent alarm set value is set to "0.0," heater overcurrent alarm function is not activated.

Attribute: R/W
Digits: 7 digits
Number of data: 12 (Data of each channel)
Data range: 0.0 to 105.0 A
0.0: Heater overcurrent alarm function OFF
Factory set value: 0.0
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10),
Heater overcurrent alarm selection (P. 7-14),
Heater overcurrent alarm interlock release (P. 7-16),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater overcurrent alarm (P. 7-22),
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25),
Module channel assignments for CT input (P. 7-26)
Function: Heater overcurrent alarm can only be used with time-proportional control output (relay, voltage pulse, triac or open collector output).
The heater overcurrent alarm function monitors the current flowing through the load by a dedicated current transformer (CT), compares the measured value with the heater overcurrent alarm set values, and detects a fault in the heating circuit.
However, heater break alarm does not action when control output ON time is 0.5 second or less.

Heater overcurrent alarm selection	RKC communication identifier	BO
	Modbus register address	ch1: 00D0H (208) ch7: 00D6H (214) ch2: 00D1H (209) ch8: 00D7H (215) ch3: 00D2H (210) ch9: 00D8H (216) ch4: 00D3H (211) ch10: 00D9H (217) ch5: 00D4H (212) ch11: 00DAH (218) ch6: 00D5H (213) ch12: 00DBH (219)

Select whether or not an alarm state occurs when a heater overcurrent alarm occurs.
If "0: Heater overcurrent alarm unused" is set, an alarm state does not occur when a heater overcurrent alarm occurs. However, the heater overcurrent alarm function is active.

Attribute: R/W
Digits: 1 digit
Number of data: 12 (Data of each channel)
Data range: 0: Heater overcurrent alarm unused
1: Heater overcurrent alarm
2: Heater overcurrent alarm (With alarm interlock function)
Factory set value: 1
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10),
Heater overcurrent alarm set value (P. 7-13)
Heater overcurrent alarm interlock release (P. 7-16),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater overcurrent alarm (P. 7-22)
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25),
Module channel assignments for CT input (P. 7-26)
Function: The alarm interlock function is used to hold the alarm state even if the CT input value is out of the alarm zone after its entry into the alarm zone once.

Heater overcurrent alarm can only be used with time proportional control output (relay, voltage pulse, triac or open collector output).

Heater break alarm (HBA) interlock release	RKC communication identifier	CX
	Modbus register address	ch1: 00DCH (220) ch7: 00E2H (226) ch2: 00DDH (221) ch8: 00E3H (227) ch3: 00DEH (222) ch9: 00E4H (228) ch4: 00DFH (223) ch10: 00E5H (229) ch5: 00E0H (224) ch11: 00E6H (230) ch6: 00E1H (225) ch12: 00E7H (231)

The alarm state is turned OFF when the alarm ON state is continued by the heater break alarm (HBA) interlock function.

Attribute: R/W

Digits: 1 digit

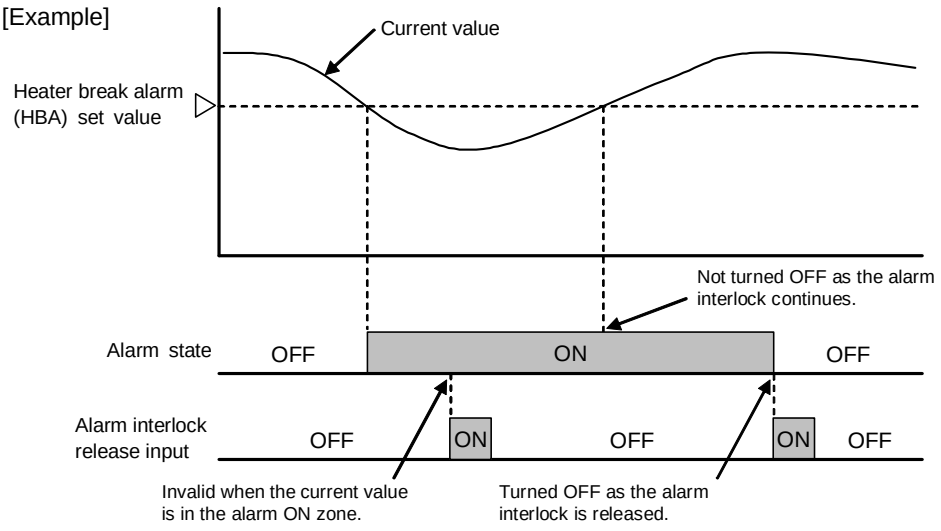
Number of data: 12 (Data of each channel)

Data range: 0: Normal state
1: Interlock release execution
(After the interlock is released, this automatically returns to "0.")

Factory set value: 0

Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10),
Heater break alarm (HBA) set value (P. 7-11),
Heater break alarm (HBA) selection (P. 7-12),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater break alarm (HBA) (P. 7-21)
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25),
Module channel assignments for CT input (P. 7-26)

Function: The following example shows how the alarm interlock is released.



To enable the heater break alarm (HBA) interlock function, the heater break alarm (HBA) selection must be set to "2: Heater break alarm (HBA) (With alarm interlock function)."

Heater overcurrent alarm interlock release	RKC communication identifier	CY
	Modbus register address	ch1: 00E8H (232) ch7: 00EEH (238) ch2: 00E9H (233) ch8: 00EFH (239) ch3: 00EAH (234) ch9: 00F0H (240) ch4: 00EBH (235) ch10: 00F1H (241) ch5: 00ECH (236) ch11: 00F2H (242) ch6: 00EDH (237) ch12: 00F3H (243)

The alarm state is turned OFF when the alarm ON state is continued by the heater overcurrent alarm interlock function.

Attribute: R/W

Digits: 1 digit

Number of data: 12 (Data of each channel)

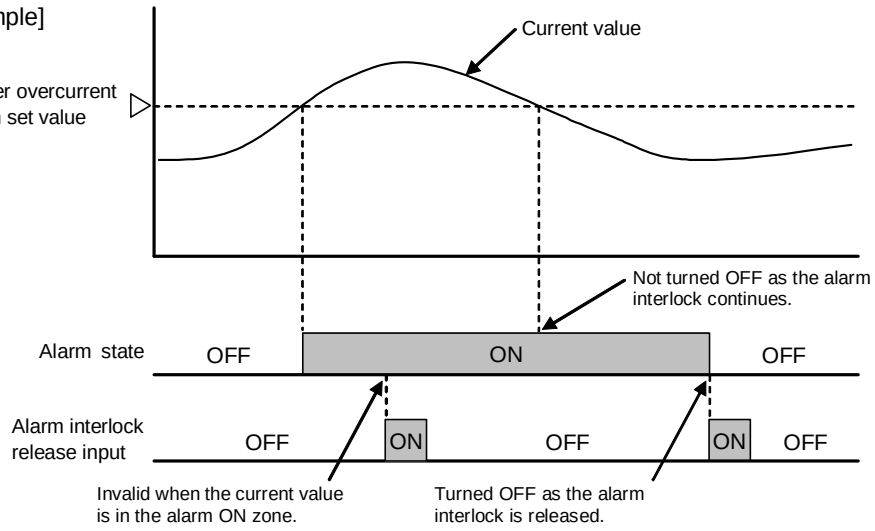
Data range: 0: Normal state
1: Interlock release execution
(After the interlock is released, this automatically returns to "0.")

Factory set value: 0

Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10),
Heater overcurrent alarm set value (P. 7-13),
Heater overcurrent alarm selection (P. 7-14),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater overcurrent alarm (P. 7-22)
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25),
Module channel assignments for CT input (P. 7-26)

Function: The following example shows how the alarm interlock is released.

[Example]



To enable the heater overcurrent alarm interlock function, the heater overcurrent alarm selection must be set to "2: Heater overcurrent alarm (With alarm interlock function)."

Set lock	RKC communication identifier	LK
	Modbus register address	0178H (376)

This restricts changes to the communication data settings. The setting can be used to prevent operation errors while the system is running. When "1: Lock" is set, the communication data of engineering setting mode cannot be changed.
In addition, when connected to a Z-COM module, the set lock state of the Z-CT module is linked to RUN/STOP transfer (identifier: SR, address: 0133H) of the Z-COM module.
When the Z-COM module is switched to STOP (control stop), the set lock (identifier: LK, address: 0178H) of the Z-CT module changes to "0: Unlock."

Communication data of engineering setting mode

- CT type
- CT ratio
- Number of heater break alarm (HBA) delay times
- Automatic setting factor for heater break alarm (HBA)
- Automatic setting factor for heater overcurrent alarm
- Determination current value for automatic setting
- Automatic setting time
- Module address assignments for CT input
- Module channel assignments for CT input
- Load factor conversion method
- Interval time

Attribute: R/W
Digits: 1 digit
Number of data: 1 (Data of each module)
Data range: 0: Unlock
1: Lock
Factory set value: 0
Related parameters: CT type (P. 7-18),
CT ratio (P. 7-19)
Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater break alarm (HBA) (P. 7-21)
Automatic setting factor for heater overcurrent alarm (P. 7-22),
Determination current value for automatic setting (P. 7-23)
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25)
Module channel assignments for CT input (P. 7-26),
Load factor conversion method (P. 7-27)
Interval time (P. 7-28)

CT type	RKC communication identifier	BV
	Modbus register address	ch1: 0179H (377) ch7: 017FH (383) ch2: 017AH (378) ch8: 0180H (384) ch3: 017BH (379) ch9: 0181H (385) ch4: 017CH (380) ch10: 0182H (386) ch5: 017DH (381) ch11: 0183H (387) ch6: 017EH (382) ch12: 0184H (388)

Type of CT to be connected to the Z-CT module.
Non-specified CTs can also be used. However, there are certain requirements.
If the following conditions are not met, the Z-CT module cannot capture the current value.

- Current range: 100.0 A max. (Must be used within a current range for which the input resolution does not exceed 30000.)
- Accuracy: 2 [%] of Reading or 1.0 [A]
- Allowable input range: −700.0 mV to +700.0 mV
- Display resolution: 0.1 [A]
- Input resolution: 30000 or less

<Computing equation>

$$\text{Input resolution} = 200000 \times \frac{\text{Current range}}{\text{CT ratio}}$$

Calculation example of input resolution

CT ratio (CT number of winds): 400 Current range: 0 to 50 A

$$\text{Input resolution} = 200000 \times \frac{50}{400} = 25000$$

Input resolution 25000

Attribute: R/W

Digits: 1 digit

Number of data: 12 (Data of each channel)

Data range:
0: CTL-6-P-N (0.0 to 30.0 A) [Specified CT]
1: CTL-12-S56-10L-N (0.0 to 100.0 A)* [Specified CT]
2: CTL-6-P-Z (0.0 to 10.0 A) [Specified CT]
* Set to 1 when using a non-specified CT.

Factory set value: Depends on model code (When not specifying: 0)

Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10), Heater break alarm (HBA) set value (P. 7-11),
Heater break alarm (HBA) selection (P. 7-12),
Heater overcurrent alarm set value (P. 7-13),
Heater overcurrent alarm selection (P. 7-14),
Heater break alarm (HBA) interlock release (P. 7-15),
Heater overcurrent alarm interlock release (P. 7-16),
CT ratio (P. 7-19), Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater break alarm (HBA) (P. 7-21),
Automatic setting factor for heater overcurrent alarm (P. 7-22),
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25),
Module channel assignments for CT input (P. 7-26)

CT ratio	RKC communication identifier	XT	
	Modbus register address	ch1: 0185H (389)	ch7: 018BH (395)
		ch2: 0186H (390)	ch8: 018CH (396)
		ch3: 0187H (391)	ch9: 018DH (397)
		ch4: 0188H (392)	ch10: 018EH (398)
		ch5: 0189H (393)	ch11: 018FH (399)
		ch6: 018AH (394)	ch12: 0190H (400)

Use to set the number of turns (ratio) of the current transformer that is used with the heater break alarm (HBA) and heater overcurrent alarm.
When using a non-specified CT, set the number of winds (ratio) of the CT.

Attribute: R/W
Digits: 7 digits
Number of data: 12 (Data of each channel)
Data range: 0 to 9999
Factory set value: CTL-6-P-N, CTL-6-P-Z: 800
CTL-12-S56-10L-N: 1000
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10),
Heater break alarm (HBA) set value (P. 7-11),
Heater break alarm (HBA) selection (P. 7-12),
Heater overcurrent alarm set value (P. 7-13),
Heater overcurrent alarm selection (P. 7-14),
Heater break alarm (HBA) interlock release (P. 7-15),
Heater overcurrent alarm interlock release (P. 7-16),
CT type (P. 7-18),
Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater break alarm (HBA) (P. 7-21),
Automatic setting factor for heater overcurrent alarm (P. 7-22),
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24)
Module address assignments for CT input (P. 7-25),
Module channel assignments for CT input (P. 7-26)

Number of heater break alarm (HBA) delay times	RKC communication identifier	DI
	Modbus register address	ch1: 0191H (401) ch7: 0197H (407) ch2: 0192H (402) ch8: 0198H (408) ch3: 0193H (403) ch9: 0199H (409) ch4: 0194H (404) ch10: 019AH (410) ch5: 0195H (405) ch11: 019BH (411) ch6: 0196H (406) ch12: 019CH (412)

To prevent producing a false alarm, the alarm function waits to produce an alarm status until the measured CT input value is in an alarm range for the preset number of consecutive sampling cycles.
This setting is common to both heater break alarm (HBA) and heater overcurrent alarm.

Attribute: R/W
Digits: 7 digits
Number of data: 12 (Data of each channel)
Data range: 0 to 255 times
Factory set value: 5
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10),
Heater break alarm (HBA) set value (P. 7-11),
Heater break alarm (HBA) selection (P. 7-12),
Heater overcurrent alarm set value (P. 7-13),
Heater overcurrent alarm selection (P. 7-14),
Heater break alarm (HBA) interlock release (P. 7-15),
Heater overcurrent alarm interlock release (P. 7-16),
CT type (P. 7-18),
CT ratio (P. 7-19),
Automatic setting factor for heater break alarm (HBA) (P. 7-21),
Automatic setting factor for heater overcurrent alarm (P. 7-22),
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25),
Module channel assignments for CT input (P. 7-26)

Automatic setting factor for heater break alarm (HBA)	RKC communication identifier	BW
	Modbus register address	ch1: 019DH (413) ch7: 01A3H (419) ch2: 019EH (414) ch8: 01A4H (420) ch3: 019FH (415) ch9: 01A5H (421) ch4: 01A0H (416) ch10: 01A6H (422) ch5: 01A1H (417) ch11: 01A7H (423) ch6: 01A2H (418) ch12: 01A8H (424)

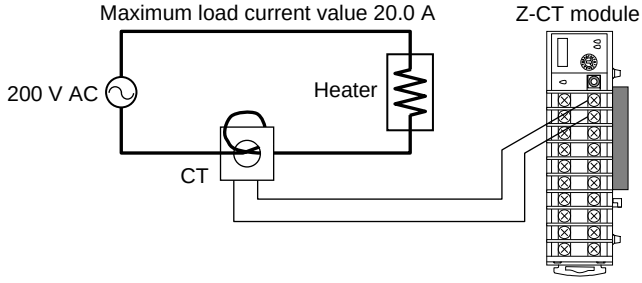
This factor is used for automatic setting of the heater break alarm (HBA) set value.
Set the percent to which the current decreases with respect to the maximum load current which is taken as the point of calculation of the heater break alarm (HBA) set value.

Attribute: R/W
Digits: 7 digits
Number of data: 12 (Data of each channel)
Data range: 1 to 100 %
Factory set value: 75
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10),
Heater break alarm (HBA) set value (P. 7-11),
Heater break alarm (HBA) selection (P. 7-12),
Heater break alarm (HBA) interlock release (P. 7-15),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20),
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25),
Module channel assignments for CT input (P. 7-26)

Example of automatic setting of the heater break alarm (HBA) set value when the automatic setting factor for heater break alarm (HBA) is set to “75 % (Factory set value).”

<Condition>

- Number of phase: Single-phase
- Heater capacity: 4 kW
- Power supply voltage: 200 V AC
- Number of heater: 1



The heater break alarm (HBA) set value is calculated using the equation below when automatic setting is executed.

Heater break alarm (HBA) set value = Maximum load current value [A] ×
Automatic setting factor for heater break alarm (HBA) [%]
= 20.0 [A] × 75 [%]
= 15.0 [A]

Heater break alarm (HBA) set value 15.0 A

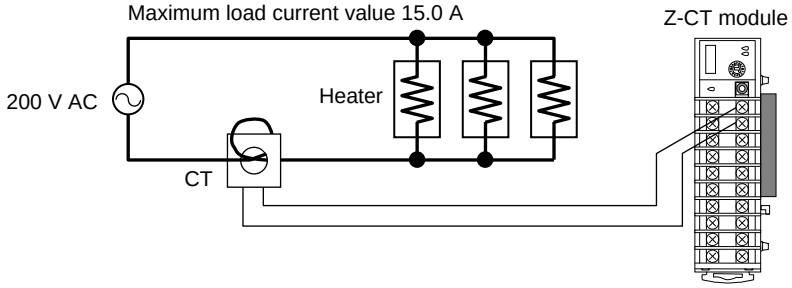
Automatic setting factor for heater overcurrent alarm	RKC communication identifier	B9
	Modbus register address	ch1: 01A9H (425) ch7: 01AFH (431) ch2: 01AAH (426) ch8: 01B0H (432) ch3: 01ABH (427) ch9: 01B1H (433) ch4: 01ACH (428) ch10: 01B2H (434) ch5: 01ADH (429) ch11: 01B3H (435) ch6: 01AEH (430) ch12: 01B4H (436)

This factor is used for automatic setting of the heater overcurrent alarm set value.
Set the percent to which the CT input value increases with respect to the maximum load current which is taken as the point of calculation of the heater overcurrent alarm set value.

Attribute: R/W
Digits: 7 digits
Number of data: 12 (Data of each channel)
Data range: 100 to 1000 %
Factory set value: 200
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10),
Heater overcurrent alarm set value (P. 7-13),
Heater overcurrent alarm selection (P. 7-14),
Heater overcurrent alarm interlock release (P. 7-16),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20),
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25),
Module channel assignments for CT input (P. 7-26)

Example of automatic setting of the heater overcurrent alarm set value when the automatic setting factor for heater overcurrent alarm is set to “200 % (Factory set value)”.

<Condition>
- Number of phase: Single-phase
- Heater capacity: 1 kW
- Power supply voltage: 200 V AC
- Number of heater: 3



The heater overcurrent alarm set value is calculated using the equation below when automatic setting is executed.

Heater overcurrent alarm set value = Maximum load current value [A] ×
Automatic setting factor for heater overcurrent alarm [%]
= 15.0 [A] × 200 [%]
= 30.0 [A]

Heater overcurrent alarm set value 30.0 A

Determination current value for automatic setting	RKC communication identifier	BP
	Modbus register address	ch1: 01B5H (437) ch7: 01BBH (443) ch2: 01B6H (438) ch8: 01BCH (444) ch3: 01B7H (439) ch9: 01BDH (445) ch4: 01B8H (440) ch10: 01BEH (446) ch5: 01B9H (441) ch11: 01BFH (447) ch6: 01BAH (442) ch12: 01C0H (448)

This is the minimum determination current value used for automatic setting of the heater break alarm (HBA) set value and heater overcurrent alarm set value.
If the value is below the automatic setting determination current value when automatic setting is executed, the heater break alarm (HBA) set value or heater overcurrent alarm set value will not be calculated.
If the CT input value is below the determination current value for automatic setting when automatic setting ends, automatic setting fails.

Attribute: R/W
Digits: 7 digits
Number of data: 12 (Data of each channel)
Data range: 0.0 to 100.0 A
Factory set value: 1.0
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10),
Heater break alarm (HBA) set value (P. 7-11),
Heater break alarm (HBA) selection (P. 7-12),
Heater overcurrent alarm set value (P. 7-13),
Heater overcurrent alarm selection (P. 7-14),
Heater break alarm (HBA) interlock release (P. 7-15),
Heater overcurrent alarm interlock release (P. 7-16),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater break alarm (HBA) (P. 7-21),
Automatic setting factor for heater overcurrent alarm (P. 7-22),
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25),
Module channel assignments for CT input (P. 7-26)

Automatic setting time	RKC communication identifier	BQ
	Modbus register address	ch1: 01C1H (449) ch7: 01C7H (455) ch2: 01C2H (450) ch8: 01C8H (456) ch3: 01C3H (451) ch9: 01C9H (457) ch4: 01C4H (452) ch10: 01CAH (458) ch5: 01C5H (453) ch11: 01CBH (459) ch6: 01C6H (454) ch12: 01CCH (460)

This is the calculation time for automatic setting. If the automatic setting time is exceeded, automatic setting ends.
If calculation of the heater break alarm (HBA) set value or heater overcurrent alarm set value does not end within the automatic setting time, automatic setting fails.

Attribute: R/W
Digits: 7 digits
Number of data: 12 (Data of each channel)
Data range: 10 to 250 seconds
Factory set value: 60
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10),
Heater break alarm (HBA) set value (P. 7-11),
Heater break alarm (HBA) selection (P. 7-12),
Heater overcurrent alarm set value (P. 7-13),
Heater overcurrent alarm selection (P. 7-14),
Heater break alarm (HBA) interlock release (P. 7-15),
Heater overcurrent alarm interlock release (P. 7-16),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater break alarm (HBA) (P. 7-21),
Automatic setting factor for heater overcurrent alarm (P. 7-22),
Determination current value for automatic setting (P. 7-23),
Module address assignments for CT input (P. 7-25),
Module channel assignments for CT input (P. 7-26)

Module address assignments for CT input	RKC communication identifier	BX
	Modbus register address	ch1: 01CDH (461) ch7: 01D3H (467) ch2: 01CEH (462) ch8: 01D4H (468) ch3: 01CFH (463) ch9: 01D5H (469) ch4: 01D0H (464) ch10: 01D6H (470) ch5: 01D1H (465) ch11: 01D7H (471) ch6: 01D2H (466) ch12: 01D8H (472)

This assigns the target device addresses of the Z-TIO module or Z-DIO module for which determination of heater break alarm (HBA) and heater overcurrent alarm is performed.

Attribute: R/W
Digits: 7 digits
Number of data: 12 (Data of each channel)
Data range: 0 to 99
Factory set value: 0
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10),
Heater break alarm (HBA) set value (P. 7-11),
Heater break alarm (HBA) selection (P. 7-12),
Heater overcurrent alarm set value (P. 7-13),
Heater overcurrent alarm selection (P. 7-14),
Heater break alarm (HBA) interlock release (P. 7-15),
Heater overcurrent alarm interlock release (P. 7-16),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater break alarm (HBA) (P. 7-21),
Automatic setting factor for heater overcurrent alarm (P. 7-22),
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24),
Module channel assignments for CT input (P. 7-26)

☞ For details of module address assignments for CT input, see **6.3 Automatic Setting Example (P. 6-12).**

Module channel assignments for CT input	RKC communication identifier	BY
	Modbus register address	ch1: 01D9H (473) ch7: 01DFH (479) ch2: 01DAH (474) ch8: 01E0H (480) ch3: 01DBH (475) ch9: 01E1H (481) ch4: 01DCH (476) ch10: 01E2H (482) ch5: 01DDH (477) ch11: 01E3H (483) ch6: 01DEH (478) ch12: 01E4H (484)

This assigns the target channel numbers of the control output of the Z-TIO module or the digital output (DO) of the Z-DIO module for which determination of heater break alarm (HBA) and heater overcurrent alarm is performed.

Attribute: R/W
Digits: 7 digits
Number of data: 12 (Data of each channel)
Data range: 1 to 99
Factory set value: 1
Related parameters: Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10),
Heater break alarm (HBA) set value (P. 7-11),
Heater break alarm (HBA) selection (P. 7-12),
Heater overcurrent alarm set value (P. 7-13),
Heater overcurrent alarm selection (P. 7-14),
Heater break alarm (HBA) interlock release (P. 7-15),
Heater overcurrent alarm interlock release (P. 7-16),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater break alarm (HBA) (P. 7-21),
Automatic setting factor for heater overcurrent alarm (P. 7-22),
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25)

☞ For details of module channel assignments for CT input, see **6.3 Automatic Setting Example (P. 6-12).**

Load factor conversion method	RKC communication identifier	IC	
	Modbus register address	ch1: 01E5H (485)	ch7: 01EBH (491)
		ch2: 01E6H (486)	ch8: 01ECH (492)
		ch3: 01E7H (487)	ch9: 01EDH (493)
		ch4: 01E8H (488)	ch10: 01EEH (494)
		ch5: 01E9H (489)	ch11: 01EFH (495)
		ch6: 01EAH (490)	ch12: 01F0H (496)

Select the current type to be displayed on the load factor conversion CT monitor.
Select either mean current value conversion or root mean squared value conversion.
The load factor mean value conversion equation and the load factor root mean squared value conversion equation are shown below.

- Load factor mean value conversion equation:
  Mean = $I_{on} \times \theta$ [A]

- Load factor root mean squared value conversion equation:
  Root mean squared value = $I_{on} \times \sqrt{\theta}$ [A]

- I_{on}: Root mean squared current value [A] when output is ON
- θ: Load factor (θ = Manipulated output value (MV)／100)

Attribute: R/W
Digits: 1 digit
Number of data: 12 (Data of each channel)
Data range: 0: Mean conversion
1: Root mean squared value conversion
Factory set value: 0
Related parameters: Load factor conversion CT monitor (P. 7-5),
Heater break/Heater overcurrent alarm automatic setting selection (P. 7-9),
Automatic setting transfer (P. 7-10),
Heater break alarm (HBA) set value (P. 7-11),
Heater break alarm (HBA) selection (P. 7-12),
Heater overcurrent alarm set value (P. 7-13),
Heater overcurrent alarm selection (P. 7-14),
Heater break alarm (HBA) interlock release (P. 7-15),
Heater overcurrent alarm interlock release (P. 7-16),
CT type (P. 7-18),
CT ratio (P. 7-19),
Number of heater break alarm (HBA) delay times (P. 7-20),
Automatic setting factor for heater break alarm (HBA) (P. 7-21),
Automatic setting factor for heater overcurrent alarm (P. 7-22),
Determination current value for automatic setting (P. 7-23),
Automatic setting time (P. 7-24),
Module address assignments for CT input (P. 7-25)

When the heater break alarm (HBA) set value is set to “0.0: Heater break alarm (HBA) OFF”, the load factor conversion function is not activated.

The load factor conversion function corresponds to the time proportional output.

Interval time	RKC communication identifier	ZX
	Modbus register address	01F1H (497)

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

RS-485 sets the transmission transfer time to accurately assure the sending/receiving selection timing. The sending and receiving of RS-485 communication is conducted through two wires; consequently, the transmission and reception of data requires precise timing.
Then, set the desired transmission transfer time to secure the time until the transmission line is changed to data receiving after the host computer ends its sending.
The controller's interval time must match the specifications of the host computer.

TROUBLE SHOOTING

8

Solutions for Problems

This section explains probable causes and treatment procedures if any abnormality occurs in the instrument. For any inquiries, please contact RKC sales office or the agent, to confirm the specifications of the product.

If it is necessary to replace a device, always strictly observe the warnings below.

⚠ WARNING

- To prevent electric shock or instrument failure, always turn off the system power before replacing the instrument.
- To prevent electric shock or instrument failure, always turn off the power before mounting or removing the instrument.
- To prevent electric shock or instrument failure, do not turn on the power until all the wiring is completed. Make sure that the wiring has been properly made 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.**

■ Module mainframe

Problem	Probable cause	Solution
FAIL/RUN lamp does not light up	Power not being supplied	Check external breaker etc.
	Appropriate power supply voltage not being supplied	Check the power supply
	Power supply terminal contact defect	Retighten the terminals
	Power supply section defect	Replace Z-CT 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-CT module
The FAIL/RUN lamp is lit (red): FAIL status	CPU section or power section defect	Replace Z-CT module

■ Heater break alarm (HBA), Heater overcurrent alarm

Problem	Probable cause	Solution
Heater break alarm (HBA) or heater overcurrent alarm cannot be automatically set.	Continuous output (voltage output or current output) is used.	Use time proportional output
	The CT assignment is not set	Set the “Module address assignments for CT input” and “Module channel assignments for CT input.”
	Automatic setting is disabled.	Set automatic setting enable in heater break/heater overcurrent alarm automatic setting selection
	The proportional period of the Z-TIO module is less than 0.5 seconds	Set the proportional period of the Z-TIO module to more than 0.5 seconds
	The CT input value during automatic setting is less than the automatic setting determination current value	Change the automatic setting determination current value
	The load factor is low	Lengthen the automatic setting time
		Execute automatic setting of heater break alarm (HBA) or heater overcurrent alarm while autotuning (AT) of the Z-TIO module is being executed
Heater break is not detected	Heater break alarm (HBA) is set to “unused.”	Set to use heater break alarm (HBA) in heater break alarm (HBA) selection
Heater overcurrent alarm is not detected	Heater overcurrent alarm is set to “unused.”	Set to use heater overcurrent alarm in heater overcurrent alarm selection
Alarm interlock cannot be released	Continued alarm state	Resolve the problem that is causing the alarm and then execute alarm interlock release

■ RKC communication

Problem	Probable cause	Solution
No response	Wrong connection, no connection or disconnection of the communication cable	Confirm the connection method or condition and connect correctly
	Breakage, wrong wiring, or imperfect contact of the communication cable	Confirm the wiring or connector and repair or replace the wrong one
	Mismatch of the setting data of communication speed and data bit configuration with those of the host computer	Confirm the settings and set them correctly
	Wrong address setting	
	Error in the data format	Reexamine the communication program
	Transmission line is not set to the receive state after data send	
EOT return	The specified identifier is invalid	Confirm the identifier is correct or that with the correct function is specified. Otherwise correct it
	Error in the data format	Reexamine the communication program
NAK return	Error occurs on the line (parity bit error, framing error, etc.)	Confirm the cause of error, and solve the problem appropriately. (Confirm the transmitting data, and resend data)
	BCC error	
	The data exceeds the setting range	Confirm the setting range and transmit correct data
	The block data length of the transmission exceeds 128 bytes	Divide the block using ETB before sending it
	The specified identifier is invalid	Confirm the identifier is correct or that with the correct function is specified. Otherwise correct it

■ Modbus

Problem	Probable cause	Solution
No response	Wrong connection, no connection or disconnection of the communication cable	Confirm the connection method or condition and connect correctly
	Breakage, wrong wiring, or imperfect contact of the communication cable	Confirm the wiring or connector and repair or replace the wrong one
	Mismatch of the setting data of communication speed and data bit configuration with those of the host computer	Confirm the settings and set them correctly
	Wrong address setting	
	There is length of query message exceeds set range	
	A transmission error (overrun error, framing error, parity error or CRC-16 error) is found in the query message	Re-transmit after time-out occurs or verify communication program
	The time interval between adjacent data in the query message is too long, exceeding 24 bit's time	
Error code 1	Function cod error (Specifying nonexistent function code)	Confirm the function code
Error code 2	When the mismatched address is specified	Confirm the address of holding register
Error code 3	• When the 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.

9

SPECIFICATIONS

Specifications

■ Current transformer (CT) input

Number of inputs: 12 points

Current transformer (CT): CTL-6-P-Z
CTL-6-P-N
CTL-12-S56-10L-N
(Current transformer (CT) is sold separately.)

Input capture range:

CTL-6-P-Z:	0.0 to 10.0 A
CTL-6-P-N:	0.0 to 30.0 A
CTL-12-S56-10L-N:	0.0 to 100.0 A

Sampling cycle: 3 seconds

■ Performance (Ambient temperature: 23±2 °C However, excluding CT error)

Current transformer (CT) input accuracy:

0.0 to 10.0 A:	±0.3 A
0.0 to 30.0 A:	±2 % of Reading or ±1.0 A
0.0 to 100.0 A:	±2 % of Reading or ±1.0 A

Input resolution:

CTL-6-P-Z:	1/30000
CTL-6-P-N:	1/7500
CTL-12-S56-10L-N:	1/20000

Input influence (5 to 40 °C) caused by ambient temperature:

0.0 to 10.0 A:	±0.012 % of Span/°C
0.0 to 30.0 A:	±0.02 % of Span/°C
0.0 to 100.0 A:	±0.02 % of Span/°C

Influence of power frequency (Load power):

47.5 to 52.5 Hz (50 Hz):
3.6 % of Reading
57.0 to 63.0 Hz (60 Hz):
2.5 % of Reading

■ Indication lamp

Number of indicates: 3 points

Indication contents:

- Operation state indication (1 point)
  When normal (RUN): A green lamp is on
  Self-diagnostic error (FAIL): A green lamp flashes
  Instrument abnormality (FAIL): A red lamp is on
- Communication state indication (1 point)
  During data send and receive (RX/TX): A green lamp turns on
- Heater break alarm (HBA)/Heater overcurrent alarm
  Automatic setting state indication (1 point)
  Automatic setting execution (SET): A green lamp is on
  Automatic setting failure (SET): A green lamp flashes

■ Event (alarm) function

● Heater break alarm (HBA) [time proportioning output]

Number of HBA: 12 points [One point CT input per one heater break alarm (HBA)]

Setting range: 0.0 to 100.0 A (0.0: heater break alarm (HBA) function OFF)
However, no heater break alarm function is activated if the time proportioning cycle ON time and OFF time are less than 0.5 seconds.

Additional function: Number of heater break alarm (HBA) delay times
Alarm interlock function

Alarm contents: Heater break, operating unit melting

● Heater overcurrent alarm [time proportioning output]

Number of HBA: 12 points (One point CT input per one heater overcurrent alarm)

Setting range: 0.0 to 105.0 A (0.0: heater overcurrent alarm function OFF)
However, no heater overcurrent alarm function is activated if the time proportioning cycle ON time and OFF time are less than 0.5 seconds.

Additional function: Number of heater break alarm (HBA) delay times
Alarm interlock function

■ Host 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 or 38400 bps

Data bit configuration:
Start bit: 1
Data bit: RKC communication: 7 or 8
Modbus: 8
Parity bit: Without, Odd or Even
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

Maximum connections: Up to 16 modules
The maximum number of SRZ modules (including other function modules) on the same communication line is 31.

Signal logic: RS-485

Signal voltage	Logic
V (A) – V (B) ≥ 2 V	0 (SPACE)
V (A) – V (B) ≤ –2 V	1 (MARK)

Voltage between V (A) and V (B) is the voltage of (A) terminal for the (B) terminal.

■ Loader communication function

Interface: Connection with a loader communication cable for our USB converter COM-K (sold separately).

Synchronous method: Start/stop synchronous type

Communication speed: 38400 bps

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

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

Maximum connections: 1 module (Address: 0 fixed)

■ Auto setting function

Function: Heater break alarm (HBA) and heater overcurrent alarm can be automatically set.

Setting method:
Set by the push button: CT input channel batch setting
Set via the communication: Set at each CT input channel

Automatic setting state indication: Display the automatic setting state of each CT input channel as a logical *OR* in the automatic setting state indication lamp (SET).

Automatic setting state indication lamp (SET) is on:
Lights solidly when automatic setting is in progress for a CT input channel.

Automatic setting state indication lamp (SET) flashes:
Flashes when automatic setting has failed for a CT input channel.

Automatic setting state indication lamp (SET) is off:
Off when automatic setting has not been performed or when automatic setting has ended normally.

■ Current transformer (CT) input value monitor

Current transformer (CT) input value monitor:

Displays the current value which captured by CT.
However, when the CT module is used by itself or the heater break alarm (HBA) function is off, ON/OFF of the control output cannot be determined and thus the current value is indeterminate.

Control method	Heater break alarm (HBA) enabled/disabled	Load factor		
		0 %	Other than 0% or 100%	100 %
Phase control	When the control method is phase control, heater break alarm (HBA) cannot be availed.	Root mean squared value	Mean current value × 1.1	Root mean squared value
ON/OFF control	When the heater break alarm (HBA) is enabled	Root mean squared value	Holds the root mean squared current value when the load factor is 0 %, or when the load factor is 100 %.	Root mean squared value
	When the heater break alarm (HBA) is disabled	Root mean squared value	The Z-CT module cannot recognize ON/OFF of control output, thus an indeterminate current value is displayed.	Root mean squared value

Load factor conversion CT monitor:

This converts the load factor into a mean or a root mean squared value and displays the result. (Selectable)
In addition, when the heater break alarm (HBA) set value is set to "0.0: Heater break alarm (HBA) OFF," the monitor function is not activated.

■ Self-diagnostic function

Control stop: Adjustment data error (Err 1)
Data back-up error (Err 2)
A/D conversion error (Err 4)

Action stop (Error number is not displayed [Operation: Impossible]):
Power supply voltage monitoring

Display when the self-diagnostic result is error:
A green lamp (FAIL/RUN) flashes

■ Instrument abnormality monitor

Monitor the instrument state by watchdog timer.

Instrument status: Action stop
The communication does not respond.
A red lamp (FAIL/RUN) is on

■ 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):
35 mA max. (at 24 V DC)

Rush current: 10 A or less

■ Standard

CE marking: EMC: EN61326-1

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

RCM: EN55011

■ General specifications

Insulation resistance:

Between CT input terminal and grounding:
20 MΩ or more at 500 V DC
Between power supply terminal and grounding:
20 MΩ or more at 500 V DC
Between power supply and CT input terminals:
20 MΩ or more at 500 V DC

Withstand voltage:

Time: 1 min.	①	②	③	④
① Grounding terminal				
② Power terminal	750 V AC			
③ CT input terminal	750 V AC	750 V AC	400 V AC *	
④ Communication	750 V AC		750 V AC	

* ③ and ③ are the withstand voltage between CT input channels 1 to 6 and CT input channels 7 to 12.

Power failure: A power failure of 4 ms or less will not affect the control action.

Memory backup: Backed up by non-volatile memory (FRAM)
Number of writing: Approx. 10,000,000,000 times or more
Data storage period: Approx. 10 years

Allowable ambient temperature: −10 to +50 °C

Allowable ambient humidity: 5 to 95 %RH
(Absolute humidity: MAX.W.C 29.3 g/m^3 dry air at 101.3 kPa)

Installation environment conditions:
Indoor use
Altitude up to 2000 m

Transportation and Storage environment conditions:
Vibration:
- Amplitude: < 7.5 mm (2 to 9 Hz)
- Acceleration: < 20 m/s^2 (9 to 150 Hz)

Each direction of XYZ axes

Shock: Height 800 mm or less

Temperature:
- At storage: −25 to +70 °C
- At transport: −40 to +70 °C

Humidity: 5 to 95 %RH (Non condensing)

Mounting and Structure:
Mounting method: DIN rail mounting or Panel mounting
Case material: PPE [Flame retardancy: UL94 V-1]
Panel sheet material: Polyester

Weight:
Terminal type module: Approx. 140 g
Connector type module: Approx. 120 g

Dimensions:
Terminal type module: 30.0 (W) × 100.0 (H) × 85.0 (D) mm*
Connector type module: 30.0 (W) × 100.0 (H) × 76.9 (D) mm*
* Excluding protruding parts

The first edition: AUG. 2007 [IMQ00]
The fifth edition: JUN. 2018 [IMQ00]

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IMS01T21-E5 **JUN. 2018**