Digital Controller

HA400/HA900
HA401/HA901

Operation Manual

RKC® RKC INSTRUMENT INC.

IMR01N02-E7

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

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

NOTICE

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

⚠ WARNING

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

CAUTION

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

FOR PROPER DISPOSAL

- When disposing of each part used for this instrument, always follows the procedure for disposing of industrial wastes stipulated by the respective local community.

DOCUMENT CONFIGURATION

There are seven manuals pertaining to this product. Please be sure to read all manuals specific to your application requirements. If you do not have a necessary manual, please contact RKC sales office, the agent, or download from the official RKC website.

Manual	Manual Number	Remarks
HA400/HA900/HA401/HA901 Instruction Manual [1]	IMR01N01-E□	This manual is enclosed with instrument. This manual explains the mounting and wiring, front panel name, and the operation mode outline.
HA400/HA900/HA401/HA901 Operation Manual [1]	**IMR01N02-E7**	This Manual. This manual explains the method of the mounting and wiring, the operation of various functions, and troubleshooting.
HA400/HA900/HA401/HA901 Communication Instruction Manual [1, 2] [RKC communication/MODBUS]	IMR01N03-E□	This manual explains RKC communication protocol, Modbus, and relating to the communication parameters setting.
HA400/HA900/HA401/HA901 Communication Instruction Manual [2] [PROFIBUS]	IMR01N04-E□	This manual explains PROFIBUS communication connection and configuration.
HA400/HA900/HA401/HA901 Communication Instruction Manual [2] [DeviceNet]	IMR01N05-E□	This manual explains DeviceNet communication connection and node address setting.
HA400/HA900/HA401/HA901 Communication Instruction Manual [2] [CC-Link]	IMR01N20-E□	This manual explains CC-Link communication connection and relating to the communication parameters setting.
Infrared Communication Software **RKCIR** for HA Series Controller PDA INSTALL GUIDE	IMT01C01-E□	This manual describes downloading of the "RKCIR infrared communication software" and installation of this software to the PDA.

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

[2] Optional function

Read this manual carefully before operating the instrument. Please place the manual in a convenient location for easy reference.

SYMBOLS

Safety 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.

Character Symbols:

0	1	2	3	4	5	6	7	8	9	Minus	Period
											

A	B (b)	C	D (d)	E	F	G	H	I	J	K	L
											

M	N (n)	O (o)	P	Q (q)	R (r)	S	T	U	u	V	W
											

X	Y	Z	Degree	／

Character LED lighting state:

 : Dim lighting

 : Bright lighting

 : Flashing

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APPENDIX

MEMO

1. OUTLINE

This chapter describes features, package contents and model code, etc.
The digital controller of this high performance type has the following features:

■ High-speed sampling time (25 ms)

Suitable for fast responding control systems.

■ Autotuning function corresponding to fast response

- The HA400/900 is best suited for applications that reach setpoint quickly (within 30 seconds). *
- The HA401/901 is best suited for applications that take more than 30 seconds to reach setpoint. *

* Autotuning a process with a fast response may produce PID constants that would fluctuate the process excessively. If the process is less than 5 minutes to setpoint, RKC recommends adjusting the AT differential gap to less than 10 seconds (default value in the HA401/901) prior to autotuning.

■ Up to two inputs, 2-loop control in one instrument

Control mode is selectable from 1 loop control, 2-loop control (2 input type only) and cascade control.

■ Direct function keys

Three Direct function keys on the front panel are provided for one-key operation to switch Auto/Manual, Remote/Local, and RUN/STOP.

■ Up to 16 memory areas or Ramp/Soak control

HA400/900/401/901 can store up to 16 sets of control parameters. Ramp/Soak control is available by using the memory area function.

■ Two communication ports (optional)

HA400/900/401/901 incorporates a maximum of two communication ports to communicate with a computer, operation panel, programmable controller, etc.

1.1 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. (Refer to below)

Accessories	Q'TY	Remarks	
☐ Instrument	1	————	
☐ Mounting brackets	Each 2	Waterproof/dustproof options: each 4	
☐ Instruction Manual (IMR01N01-E☐)	1	Enclosed with instrument	
☐ Operation Manual (IMR01N02-E7)	1	This manual (sold separately)	This manual can be downloaded from the official RKC website: http://www.rkcinst.com/english/manual_load.htm.
☐ Communication Instruction Manual (IMR01N03-E☐) [RKC communication/Modbus]	1	Optional (sold separately)	
☐ Communication Instruction Manual (IMR01N04-E☐) [PROFIBUS]	1	Optional With PROFIBUS	
☐ Communication Instruction Manual (IMR01N05-E☐) [DeviceNet]	1	Optional With DeviceNet	
☐ Communication Instruction Manual (IMR01N20-E☐) [CC-Link]	1	Optional With CC-Link	
☐ PDA Install Guide (IMT01C01-E☐)	1	Infrared communication software "RKCIR"	
☐ Power feed transformer (100V type or 200V type)	1	Optional	
☐ Current transformer (CTL-6-P-N or CTL-12-S56-10L-N)	1 or 2	Optional (sold separately)	

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

1.2 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.

High-speed AT type:

HA400
HA900 −□ □−□ □−□ ∗ □ □−□ □ □ □−□/□/Y

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14)

Standard AT type:

HA401
HA901 −□ □−□ □−□ ∗ □ □−□ □ □ □−□/□/Y

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14)

(1) Input 1 type

K : K thermocouple J : J thermocouple T : T thermocouple S : S thermocouple R : R thermocouple
A : PLII thermocouple N : N thermocouple E : E thermocouple B : B thermocouple W : W5Re/W26Re
D : RTD (3-wire) [Factory set value: Pt100] [1] C : RTD (4-wire) [Factory set value: Pt100] [1, 2]
3 : Voltage (low) input group (0 to 10 mV, 0 to 100 mV, 0 to 1 V) [Factory set value: 0 to 1 V] [1]
6 : Voltage (high) input group (0 to 5 V, 1 to 5 V, 0 to 10 V) [Factory set value: 1 to 5 V] [1]
8 : Current input group (0 to 20 mA, 4 to 20 mA) [Factory set value: 4 to 20 mA] [1]

[1] To change the input type, refer to **8. ENGINEERING MODE. (P. 50)**
[2] Not available as a two-input specification.

(2) Input 2 type

0 : None
K : K thermocouple J : J thermocouple T : T thermocouple S : S thermocouple R : R thermocouple
A : PLII thermocouple N : N thermocouple E : E thermocouple B : B thermocouple W : W5Re/W26Re
D : RTD (3-wire) [Factory set value: Pt100] [1]
3 : Voltage (low) input group (0 to 10 mV, 0 to 100 mV, 0 to 1 V) [Factory set value: 0 to 1 V] [1]
6 : Voltage (high) input group (0 to 5 V, 1 to 5 V, 0 to 10 V) [Factory set value: 1 to 5 V] [1]
8 : Current input group (0 to 20 mA, 4 to 20 mA) [Factory set value: 4 to 20 mA] [1]

Non-isolated type (for remote input) [2]

G : Voltage (low) input group (0 to 10 mV, 0 to 100 mV, 0 to 1 V) [Factory set value: 0 to 1 V] [1]
V : Voltage (high) input group (0 to 5 V, 1 to 5 V, 0 to 10 V) [Factory set value: 1 to 5 V] [1]
Y : Current input group (0 to 20 mA, 4 to 20 mA) [Factory set value: 4 to 20 mA] [1]

[1] To change the input type, refer to **8. ENGINEERING MODE. (P. 50)**
[2] When 4-wire RTD is selected for Input 1, only remote input (no-isolation) can be selected for Input 2.

Continued on the next page.

(3) Output 1 (OUT1)

N : None	T : Triac output	6 : Voltage output (1 to 5 V DC)
M : Relay contact output	4 : Voltage output (0 to 5 V DC)	7 : Current output (0 to 20 mA DC)
V : Voltage pulse output	5 : Voltage output (0 to 10 V DC)	8 : Current output (4 to 20 mA DC)

(4) Output 2 (OUT2)

N : None	T : Triac output	6 : Voltage output (1 to 5 V DC)
M : Relay contact output	4 : Voltage output (0 to 5 V DC)	7 : Current output (0 to 20 mA DC)
V : Voltage pulse output	5 : Voltage output (0 to 10 V DC)	8 : Current output (4 to 20 mA DC)

(5) Power supply voltage

3 : 24 V AC/DC	4 : 100 to 240 V AC

(6) Output 3 (OUT3)

N : None	T : Triac output	6 : Voltage output (1 to 5 V DC)
M : Relay contact output	4 : Voltage output (0 to 5 V DC)	7 : Current output (0 to 20 mA DC)
V : Voltage pulse output	5 : Voltage output (0 to 10 V DC)	8 : Current output (4 to 20 mA DC)

P : Sensor power supply output

(7) Output 4 (OUT4)/Output 5 (OUT5) *

N : None	
1 : OUT4 (Relay contact output)	OUT5 (No output)
2 : OUT4 (Relay contact output)	OUT5 (Relay contact output)

* When "P: Sensor power supply output" is selected for OUT3, OUT4 and OUT5 are fixed as "N: None" and not selectable.

(8) Event input (optional)

N : None

1 : Event input [Dry contact input (5 points): for Memory area selection] *

* CC-Link cannot be specified.

Continued on the next page.

(9) CT input/Power feed forward input/Feedback resistance input (optional)

N : None
S : CT 1 point (CTL-12-S56-10L-N)
F : Feedback resistance input
T : CT 2 points (CTL-6-P-N)
P : CT 1 point (CTL-6-P-N)
U : CT 2 points (CTL-12-S56-10L-N)
1 : Power feed forward input (one 100-120 V AC transformer included)
2 : Power feed forward input (one 200-240 V AC transformer included)
3 : CT 1 point (CTL-6-P-N) + Power feed forward input (one 100-120 V AC transformer included)
4 : CT 1 point (CTL-6-P-N) + Power feed forward input (one 200-240 V AC transformer included)
5 : CT 1 point (CTL-12-S56-10L-N) + Power feed forward input (one 100-120 V AC transformer included)
6 : CT 1 point (CTL-12-S56-10L-N) + Power feed forward input (one 200-240 V AC transformer included)

(10) Communication 1/Event input (optional)

N : None
6 : RS-485 (Modbus)
1 : RS-232C (RKC communication)
8 : RS-232C (Modbus)
5 : RS-485 (RKC communication)
D : Event input [Dry contact input (2 points): for operation mode transfer]

(11) Communication 2 (optional)

N : None
6 : RS-485 (Modbus)
A : DeviceNet
1 : RS-232C (RKC communication)
7 : RS-422A (Modbus)
B : PROFIBUS
4 : RS-422A (RKC communication)
8 : RS-232C (Modbus)
C: CC-Link *
5 : RS-485 (RKC communication)

* Event input [Dry contact input (5 points)] cannot be specified.

(12) Waterproof/Dustproof (optional)

N : None
1 : Waterproof/Dustproof

(13) Case color

N : White
A : Black

(14) Instrument version

Y : Version symbol (Infrared communication function included)

1.3 Input/Output Functions

This section describes the input/output functions of the instrument. To learn how to set each function, refer to the respective page.

■ INPUT

In addition to measured input, 5 optional input functions are available.

Measured input:

- 1-input or 2-input. (Specify when ordering)
- Input types available for measured inputs are shown in the table below.

Thermocouple *	K, J, T, S, R, E, B, PLII, N, W5Re/W26Re	
RTD *	Pt100, JPt100	[Factory set value: Pt100]
Voltage (low) *	0 to 100 mV DC, 0 to 10 mV DC, 0 to 1 V DC	[Factory set value: 0 to 1 V DC]
Voltage (High) *	0 to 5 V DC, 1 to 5 V DC, DC 0 to 10 V DC	[Factory set value: 1 to 5 V DC]
Current *	0 to 20 mA DC, 4 to 20 mA DC	[Factory set value: 4 to 20 mA DC]

* To change the input type, refer to **8. ENGINEERING MODE. (P. 66)**

- The second measured input can be used as isolated remote input.

Event input:

- Optional Event input hardware is necessary. (Specify when ordering)
- Event input can be used for the following functions. (Refer to P. 70.)

Memory area selection (Number of areas: 1 to 16 or 1 to 8)
Operation mode transfer (RUN/STOP, Remote/Local, Auto/Manual.)

Remote input (non-isolated type):

- Remote input is to change a control setpoint by using current or voltage input from an external device.
- Remote input is available with 1-input controller. (Specify when ordering)
- Measured input at Input 1 is not isolated from remote input at Input 2. If isolated remote input is necessary, specify 2-input controller when ordering, and use the second input for remote input.
- Any one of the following input types can be selected. (Refer to P. 66.)

Voltage (low)	0 to 100 mV DC, 0 to 10 mV DC, 0 to 1 V DC
Voltage (high)	0 to 5 V DC, 1 to 5 V DC, DC 0 to 10 V DC
Current	0 to 20 mA DC, 4 to 20 mA DC

CT input:

- CT input is used for Heater break alarm function to detect a heater break or short-circuit.
- Up to two CT inputs can be selected. (Specify when ordering)
- Only one CT input is available when Power feed forward input is selected.
- Measured input is not isolated from CT input.
- CT inputs accept signal from dedicated current transformers (CT).
  Two types of CT available. (Refer to P. 81.)

CTL-6-P-N (for 0 to 30 A)
CTL-12-S56-10L-N (for 0 to 100 A)

Power feed forward (PFF) input:

- Power feed forward input is used for Power feed forward function to achieve accurate control. PFF monitors power supply voltage variation on a device and compensates control output from the controller.
- Two types of dedicated transformer is available. (Specify either of them when ordering)

PFT-01	100 V type transformer (100 to 120 V AC)
PFT-02	200 V type transformer (200 to 240 V AC)

Feedback resistance input:

- Feedback resistance input is used to monitor a valve position when Position proportioning PID control is selected as control action.
- Measured input is not isolated from Feedback resistance input.

■ OUTPUT

Up to five outputs are available. They may be used as Control output, Event output or Transmission output by specifying the output type or by activating the output logic function (output logic selection).

Output1 to 3 (OUT1 to OUT3):

- Control output, Event output, HBA alarm output, or Transmission output can be allocated to output 1 to 3. (Refer to P. 73 to 80.)
- Number of outputs and output types must be specified when ordering.
- OUT3 is selectable for Sensor power supply output (optional). (Specify when ordering)
- Output types available for OUT1 to OUT3 are shown in the table below.

Relay contact output	250 V AC, 3A (Resistive load), 1a contact
Voltage pulse output	0/12 V DC (Load resistance: 600 Ω or more)
Triac output	0.4 A (Allowable load current)
Voltage output	0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC (Load resistance: 1 kΩ or more)
Current output	0 to 20 mA DC, 4 to 20 mA DC (Load resistance: 600 Ω or less)
Sensor power supply output [Only OUT3 is selectable]	Rated voltage: 24 V DC ± 5% Rated current: 24 mA max.

- OUT3 is isolated from both OUT1 and OUT2.
- OUT1 and OUT2 are not isolated from each other except for relay or triac output. When relay or triac output is used, there is isolation between outputs.
- There is isolation between input and output.
- There is isolation between output and power supply terminals.

Output 4 to 5 (OUT4 to OUT5):

- The output type for OUT4 and OUT5 is relay only. OUT4 and OUT5 can be used for Event output and/or HBA alarm output. (Refer to P. 73 to 80.)

  Relay contact output 250 V AC, 1A (Resistive load), 1a contact
- When OUT3 is used for a Sensor power supply output (optional), OUT4 and OUT5 are not available.

Event output function (EV1 to EV4)

- The following event types can be selected for EV1 to EV4.

Deviation high	Band	SV high	————
Deviation low	Process high	SV low	————
Deviation high/low	Process low	LBA (Only EV3 and EV4 can be selected)	

- The maximum number of Event output is four.
- Output allocation is necessary to output the event state from output terminals. (Refer to P. 73.)

Transmission output 1 to 3 (AO1 to AO3):

- Maximum three transmission output can be allocated to OUT1, OUT2, and OUT3. Maximum number of output available for transmission output varies by other output use for control output and event output. Parameter values shown in the following table can be output by transmission output. (Refer to P. 75.)

Input 1 side	Measured value (PV), Set value (SV), Manipulated output value (MV), Deviation (PV−SV)
Input 2 side	Measured value (PV), Set value (SV), Manipulated output value (MV), Deviation (PV−SV)

Output logic function:

Output logic function allocates output functions to output terminals. Logic output such as *OR/AND* is available for event output. The following signals are allocated by output logic function. Transmission output needs to be allocated separately. (Refer to P. 70 to 73.)

Input	Analog signal: Control output value (max. 2 points)
	Digital signal: Event action state (4 points), HBA action state (max. 2 points), Position proportioning output state (2 points), Contact input state (max. 7 points), Control area number (4 points) Operation state (3 points): LOC/MAN/REM
Output	Computed output from OUT1 to OUT5.

■ COMMUNICATION

Communication 1, Communication 2 (optional):

Up to two communication ports are available to communicate with a computer or programmable controller. When DI 6 and DI7 are used, communication port 1 is not available. (Specify when ordering)

The protocols available for each port are shown in the table below.

	Communication 1 function *	Communication 2 function *
Interface *	RS-485, RS-232C	RS-485, RS-232C, RS-422A
Protocol *	RKC communication, Modbus	RKC communication, Modbus
Open Network *	—	PROFIBUS, DeviceNet

* Specify when ordering.

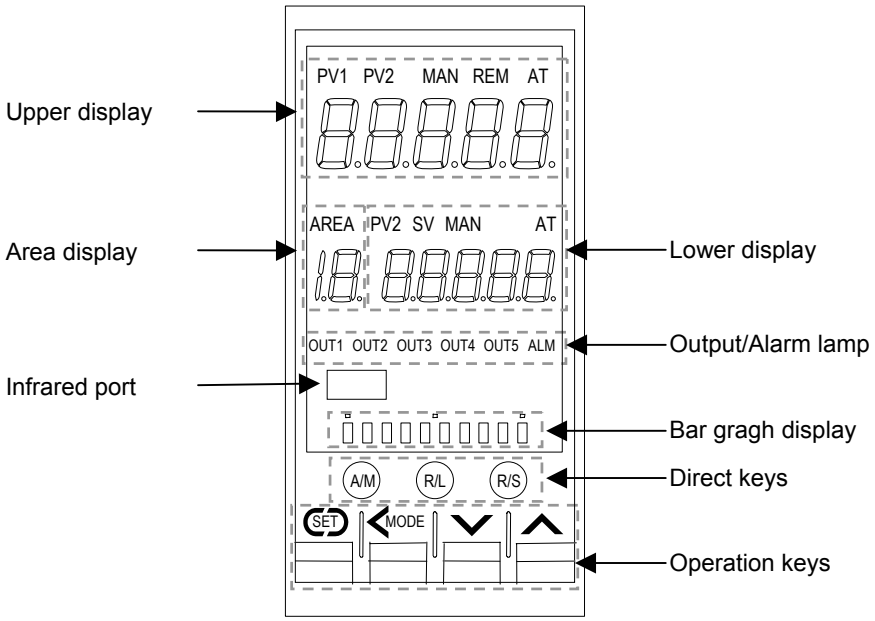
Infrared communication:

Infrared communication can be used when sending and receiving data between this controller and the PDA installed with the RKCIR software.

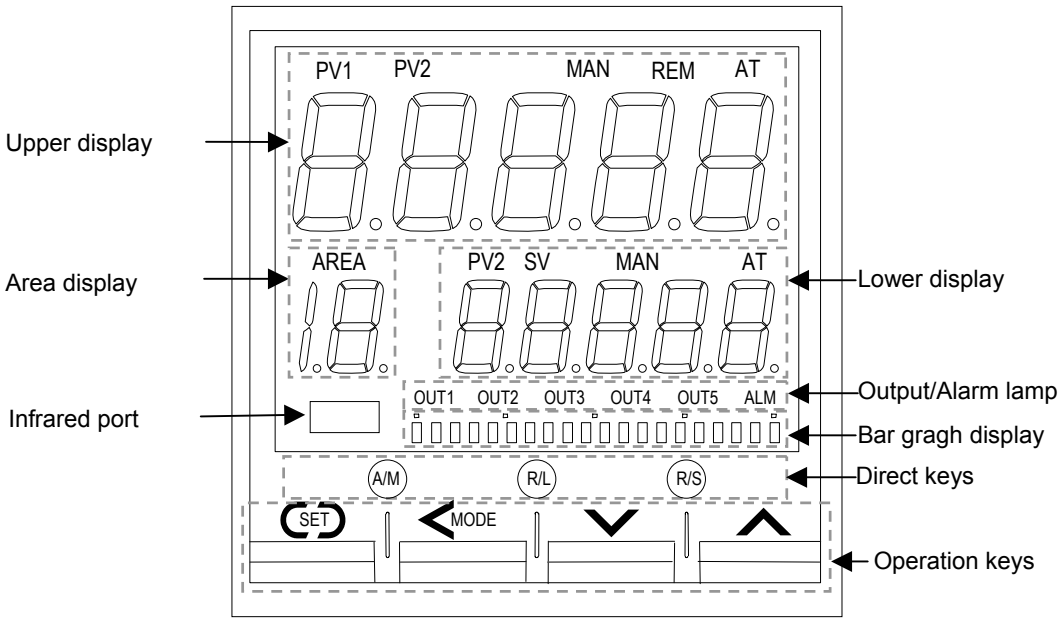
1.4 Parts Description

This chapter describes various display units and the key functions.

HA400/401



HA900/901



● Upper display

Measured value 1 (PV1) lamp	[Green]	Lights when measured value 1 is displayed on the PV1/PV2 display unit.
Measured value 2 (PV2) lamp *	[Green]	Lights when measured value 2 is displayed on the PV1/PV2 display unit.
Manual (MAN) mode lamp	[Green]	Lights when operated in manual mode.
Remote (REM) mode lamp	[Green]	Lights when remote setting function is activated.
Autotuning (AT) lamp	[Green]	Flashes when autotuning is activated. (After autotuning is completed: AT lamp will go out)
Measured value (PV1/PV2) display		Displays PV1, PV2 or various parameters' symbols.

* This lamp is activated only with 2-input controller.

● Lower display

Measured value 2 (PV2) lamp *	[Green]	Lights when measured value 2 is displayed on the SV display unit.
Set value (SV) lamp	[Green]	Lights when Set value (SV) is displayed on the SV display unit.
Manual (MAN) mode lamp *	[Green]	Lights when operated in manual mode.
Autotuning (AT) lamp *	[Green]	Flashes when autotuning is activated. (After autotuning is completed: AT lamp will go out)
Set value (SV) display		Displays SV, PV2 or various parameters' set values.

* This lamp is activated only with 2-input controller.

● Area display

Area (AREA) lamp	[Green]	Lights when memory area number is displayed.
Memory area display		Displays memory area number (1 to 16).

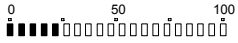
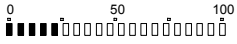
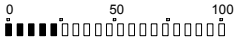
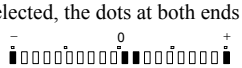
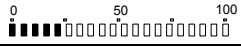
● Output/Alarm lamp

Output (OUT1 to OUT5) lamp	[Green]	Lights when the output corresponding to each lamp is ON.
Alarm (ALM) lamp	[Red]	Lights when alarm (Event or HBA function) is turned on. The type of alarm which is on can be checked on the event monitor display.

These lamps works with outputs (control, alarm, retransmission) which are assigned to OUT1 to OUT5.
For assignment of outputs to OUT1 through OUT5, refer to Transmission Output Type Selection (P.75) and Output Logic Selection (P.73).

● Bar graph display [Green] *

One of the displays shown in the table below can be selected for the bar-graph.

Manipulated output value (MV) display	Displays the Manipulated output value (MV). When Manipulated output value (MV) is at 0 % or less, the left-end dot of the bar-graph flashes. When MV exceeds 100 %, the right-end dot flashes. [Example] 0 50 100 
Measured value display	Displays the Measured value (PV). Scaling is available within the input range. [Example] 0 50 100 
Set value display	Displays the Set value (SV). Scaling is available within the input range. [Example] 0 50 100 
Deviation display	Displays the deviation between the Measured value (PV) and the Set value (SV). When the Deviation display is selected, the dots at both ends of bar-graph light. [Example] − 0 + 
Feedback resistance input value (POS) display	Displays the Feedback resistance input value (POS). (Available with position proportioning PID control) [Example] 0 50 100 

* The number of dots: 10 dots (HA400/401) 20 dots (HA900/901)

The bar-graph function is not activated at the factory unless the controller is specified as position proportioning PID controller when ordered Bar graph display can be selected in the Engineering mode. Refer to selecting the bar graph display. (P. 64)

● Direct keys

A/M	Auto/Manual transfer key	Switching the Auto/Manual control mode between Auto (PID control) mode and Manual mode.
R/L	Remote/Local transfer key	Switching the Remote/Local control mode between Remote control and Local control.
R/S	RUN/STOP transfer key	Switching the RUN/STOP mode between RUN and STOP.

To avoid damage to the instrument, never use a sharp object to press keys.

For the Auto/Manual transfer key, it is possible to select among Auto/Manual transfer for (1) Input 1, (2) Input 2, or (3) both Input 1 and Input 2. (Refer to P. 65.)

Use/Unuse of Direct key function are programmable. (Refer to P. 65.)

To prevent operator error, a direct key cannot be operated in positioning adjustment (automatic adjustment).

● Operation keys

SET	Set (SET) key	Used for parameter calling up and set value registration.
MODE	Shift key	Shift digits when settings are changed. Used to selection operation between modes.
∨	Down key	Decrease numerals.
∧	Up key	Increase numerals.

To avoid damage to the instrument, never use a sharp object to press keys.

● Infrared port

Used when sending and receiving data between this controller and the PDA installed with the RKCIR software.

The RKCIR software can be downloaded from the official RKC website. For this purpose, user registration address and password are required. For details, refer to **PDA INSTALL GUIDE (IMT01C01-E□)**.

2. MOUNTING

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.

2.1 Mounting Cautions

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

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

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

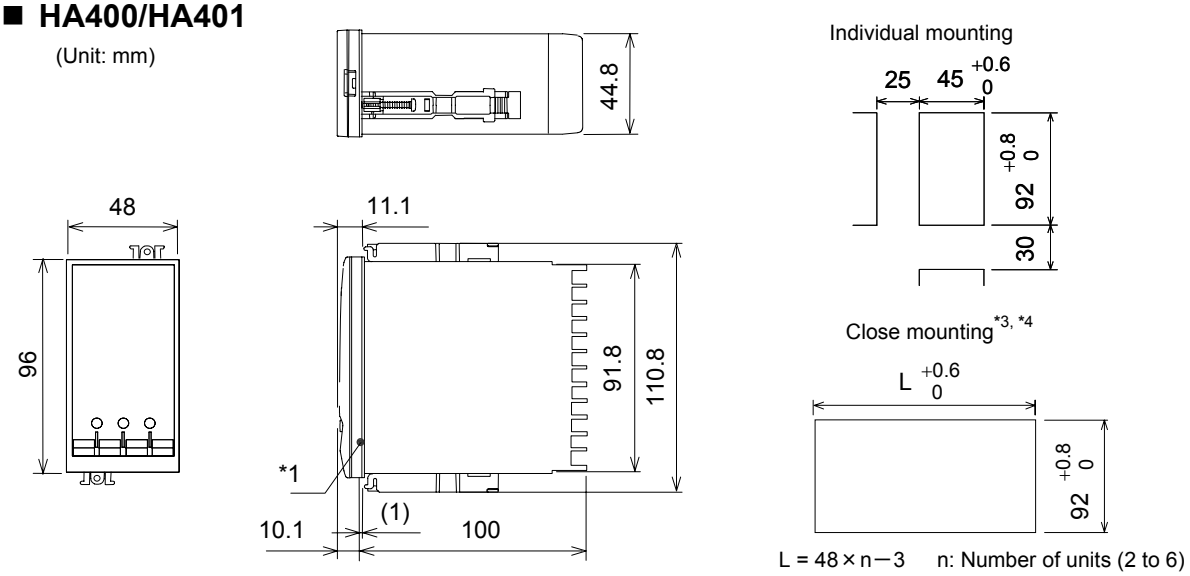
(4) Mount this instrument in the panel considering the following conditions:
- Provide adequate ventilation space so that heat does not build up.
- Do not mount this instrument directly above equipment that generates large amount of heat (heaters, transformers, semi-conductor functional devices, large-wattage resistors).
- If the ambient temperature rises above 50 °C, cool this instrument with a forced air fan, cooler, etc. Cooled air should not blow directly on this instrument.
- In order to improve safety and the immunity to withstand noise, mount this instrument as far away as possible from high voltage equipment, power lines, and rotating machinery.
  – High voltage equipment: Do not mount within the same panel.
  – Power lines: Separate at least 200 mm.
  – Rotating machinery: Separate as far as possible.
- Mount this instrument in the horizontal direction for panel. If you did installation except a horizontal direction, this causes malfunction.

(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 easy reach of the operator. It should be marked as the disconnecting device for the equipment.

2.2 Dimensions

■ HA400/HA401

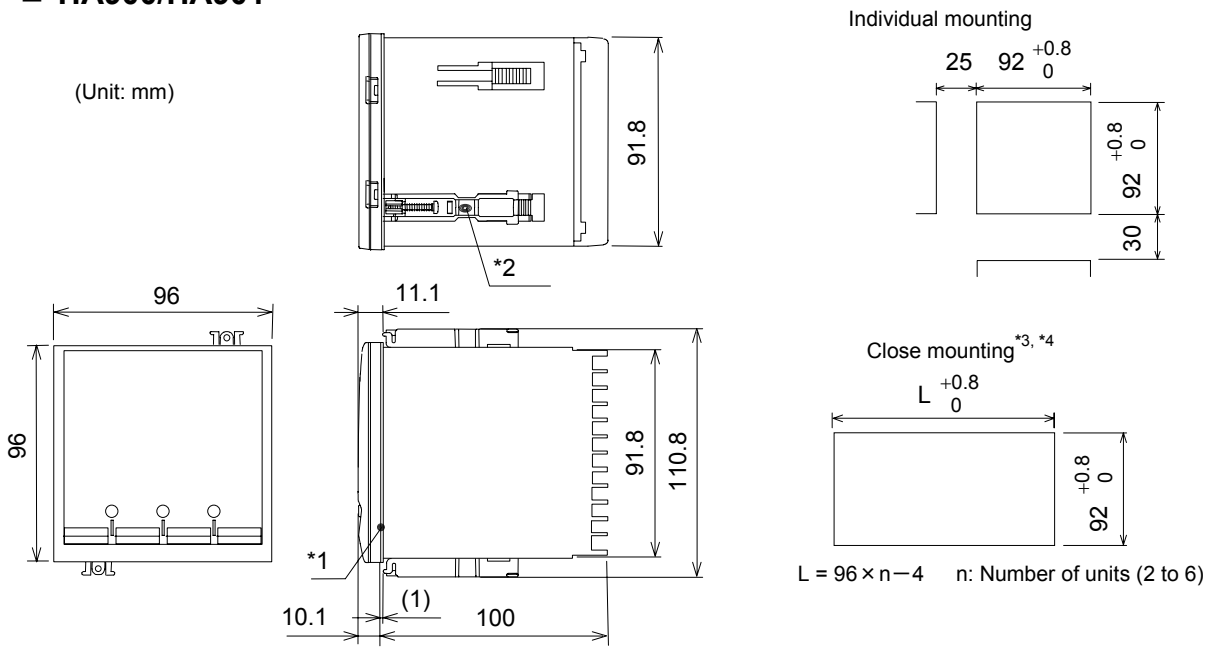
(Unit: mm)



L = 48 × n − 3 n: Number of units (2 to 6)

■ HA900/HA901

(Unit: mm)



L = 96 × n − 4 n: Number of units (2 to 6)

*1 Rubber (Optional)

*2 Up to 4 mounting brackets may be used.

*3 If the HA400/401s or HA900/901s have waterproof/dustproof (optional), protection will be compromised and not meet IP65 by close mounting.

*4 When controllers are closely mounted, ambient temperature must not exceed 50 °C (122°F).
For mounting of the HA400/401 or HA900/901, panel thickness must be between 1 to 10 mm. When mounting multiple HA400/401s or HA900/901s close together, the panel strength should be checked to ensure proper support.

2.3 Procedures of Mounting and Removing

■ Mounting procedures

1. Prepare the panel cutout as specified in **2.2 Dimensions**.
(Panel thickness: 1 to 10 mm)

2. Insert the instrument through the panel cutout.

3. Insert the mounting bracket into the mounting groove of the instrument.
Do not push the mounting bracket forward. (Fig. 1)

4. Secure the bracket to the instrument by tightening the screw.
Take care to refrain from moving the bracket forward.

5. Only turn about one full revolution after the screw touches the panel. (Fig. 2)

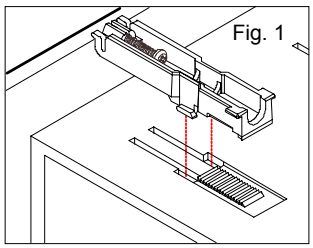


Fig. 1

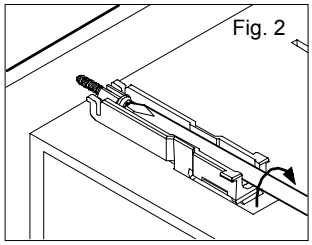


Fig. 2

If the screw has been rotated too tight, the screw may turn idle.
In such a case, loosen the screw once and tighten it again until the instrument is firmly fixed.

6. The other mounting bracket should be installed in the same way described in ***3.*** to ***5.***

When the instrument is mounted, always secure with two mounting brackets so that upper and lower mounting brackets are positioned diagonally. (HA900/901 type)

The waterproof/dustproof (optional) on the front of the instrument conforms to IP65 when mounted on the panel. For effective waterproof/dustproof, the gasket must be securely placed between instrument and panel without any gap. If gasket is damaged, please contact RKC sales office or the agent.

■ Removal procedures

1. Turn the power OFF.

2. Remove the wiring.

3. Loosen the screw of the mounting bracket.

4. Hold the mounting bracket by the edge (①) and tilt it (②) to remove from the case. (Fig. 3)

5. The other mounting bracket should be removed in the same way as described in ***3.*** and ***4.***

6. Pull out the instrument from the mounting cutout while holding the front panel frame of this instrument. (Fig. 4)

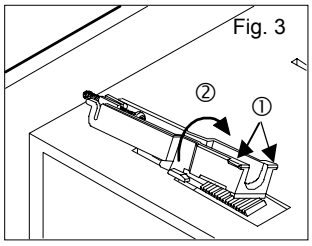


Fig. 3

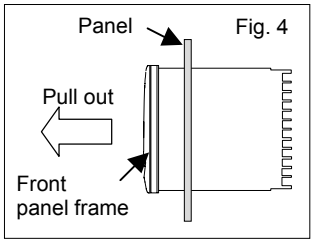


Fig. 4

When pulling out only the internal assembly from the instrument case after being wired, refer to **12. REMOVING THE INTERNAL ASSEMBLY (P. 125).**

3. WIRING

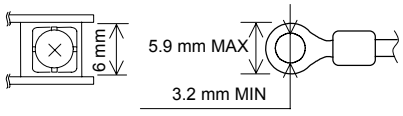
This chapter describes wiring cautions, wiring layout and wiring of terminals.

⚠ WARNING

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

3.1 Wiring Cautions

- For thermocouple input, use the appropriate compensation wire.
- For RTD input, use low resistance lead wire with no difference in resistance between the three or four lead wires.
- To avoid noise induction, keep input signal wire away from instrument power line, load lines and power lines of other electric equipment.
- If there is electrical noise in the vicinity of the instrument that could affect operation, use a noise filter.
  - Shorten the distance between the twisted power supply wire pitches to achieve the most effective noise reduction.
  - Always install the noise filter on a grounded panel. Minimize the wiring distance between the noise filter output and the instrument power supply terminals to achieve the most effective noise reduction.
  - Do not connect fuses or switches to the noise filter output wiring as this will reduce the effectiveness of the noise filter.
- Allow approximately 5 seconds for contact output when the instrument is turned on. Use a delay relay when the output line is used for an external interlock circuit.
- Power supply wiring must be twisted and have a low voltage drop.
- This instrument is not furnished with a power supply switch or fuse. If a fuse or power supply switch is required, install close to the instrument.
  Recommended fuse rating: Rated voltage 250 V, Rated current 1 A
  Fuse type: Time-lag fuse
- For an instrument with 24 V power supply, supply power from a SELV circuit.
- Use the solderless terminal appropriate to the screw size.
  Screw size: M3 × 6 (With 5.8 × 8 square washer)
  Recommended tightening torque: 0.4 N·m (4 kgf·cm)
  Recommended dimension:

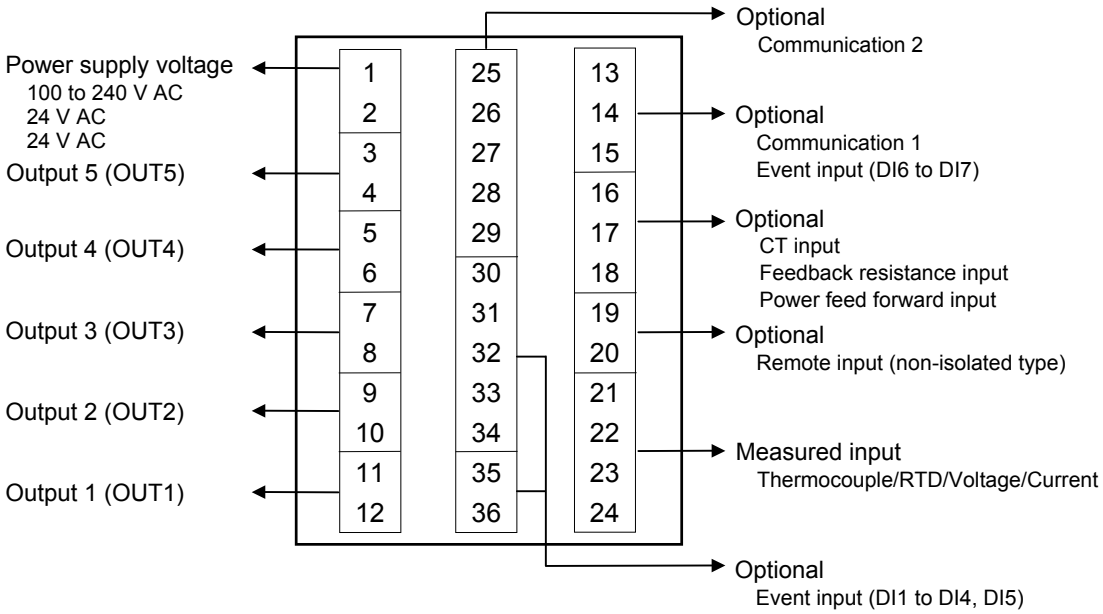


- Make sure that the any wiring such as solderless terminal is not in contact with the adjoining terminals.

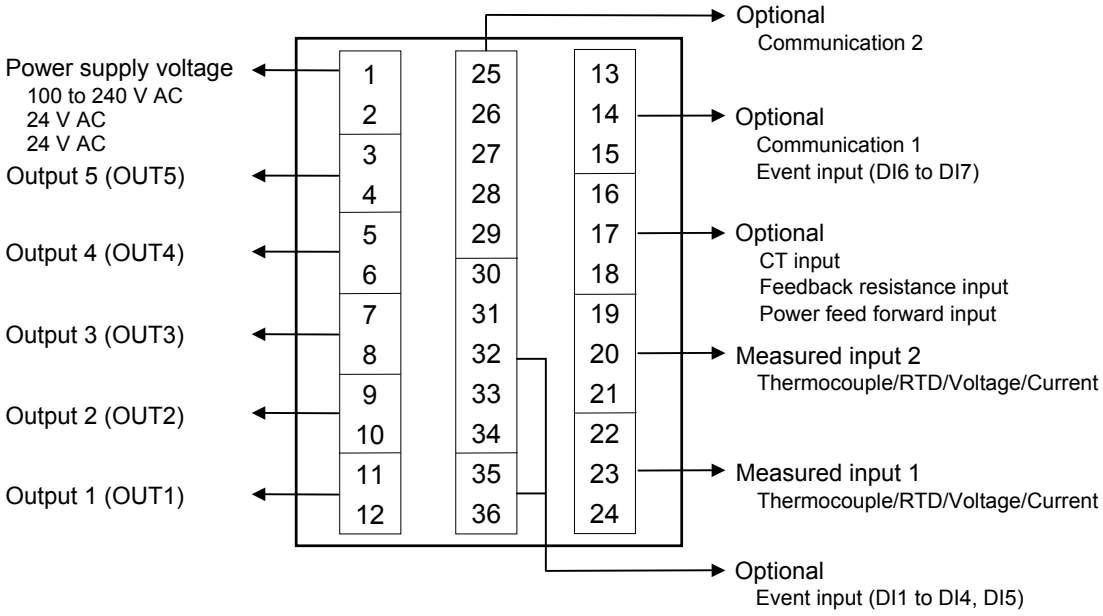
3.2 Terminal Layout

The terminal layout is as follows. HA400/401 is used in the figures for explanation, but the same terminal layouts also apply to HA900/901.

■ 1-input controller



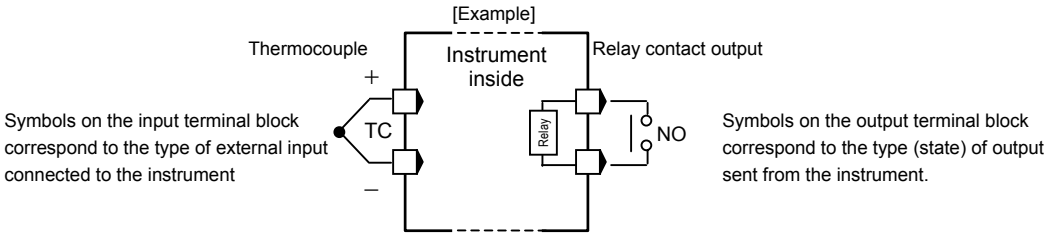
■ 2-input controller



3.3 Wiring of Each Terminal

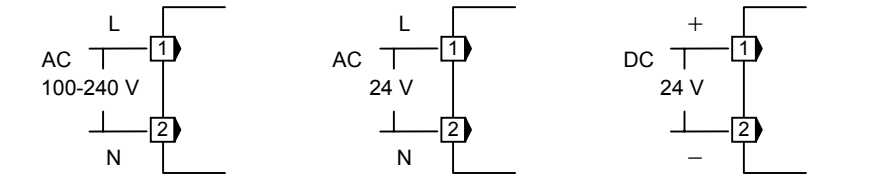
Prior to conducting wiring, always check the polarity of each terminal.

The terminal nameplate of this instrument and its descriptions are shown in the following.



■ Power supply

- Connect the power to terminal numbers 1 and 2.



100-240 V AC power supply type | 24 V AC power supply type | 24 V DC power supply type

- The power supply types must be specified when ordering. Power supply voltage for the controller must be within the range shown below for the controller to satisfy the control accuracy in the specifications.

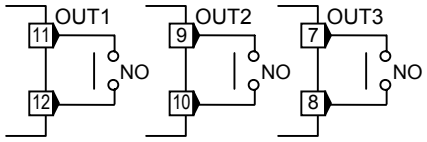
Power supply type	Power consumption
90 to 264 V AC [Power supply voltage range], 50/60 Hz, (Rating 100 to 240 V AC)	HA400/401: 16.5 VA max. (at 100 V AC), 22.5 VA max. (at 240 V AC) HA900/901: 17.5 VA max. (at 100 V AC), 24.0 VA max. (at 240 V AC)
21.6 to 26.4 V AC [Power supply voltage range], 50/60 Hz, (Rating 24 V AC)	HA400/401: 15.0 VA max. (at 24 V AC) HA900/901: 16.0 VA max. (at 24 V AC)
21.6 to 26.4 V DC [Power supply voltage range], (Rating 24 V DC)	HA400/401: 430 mA max. (at 24 V DC) HA900/901: 470 mA max. (at 24 V DC)

- If there is electrical noise in the vicinity of the instrument that could affect operation, use a noise filter.
- Power supply wiring must be twisted and have a low voltage drop.
- For an instrument with 24 V power supply, supply power from a SELV circuit.
- This instrument is not furnished with a power supply switch or fuse. If a fuse or power supply switch is required, install close to the instrument.
  Recommended fuse rating: Rated voltage 250 V, Rated current 1 A
  Fuse type: Time-lag fuse

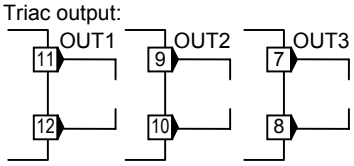
■ Output 1 to 3 (OUT1 to OUT3)

- Terminal 11 and 12 are for output 1 (OUT1); Terminal 9 and 10 are for output 2 (OUT2); and Terminal 7 and 8 are for output 3 (OUT3).
- Connect an appropriate load according to the output type.

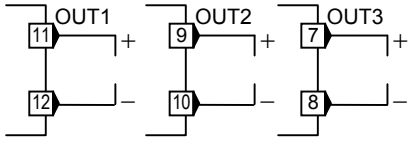
Relay contact output:



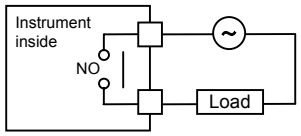
Triac output:



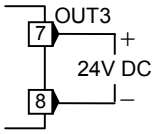
Voltage pulse output/Voltage output/Current output:



Example of wiring is as follows:

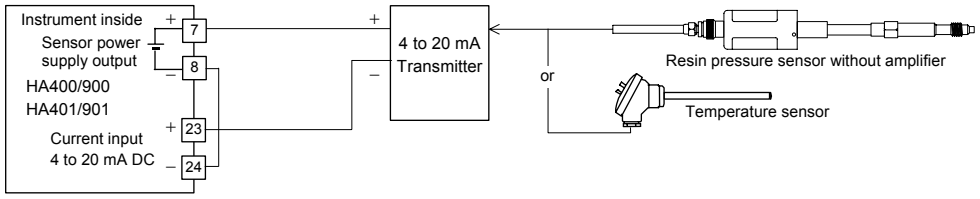


Sensor power supply output (Optional) *

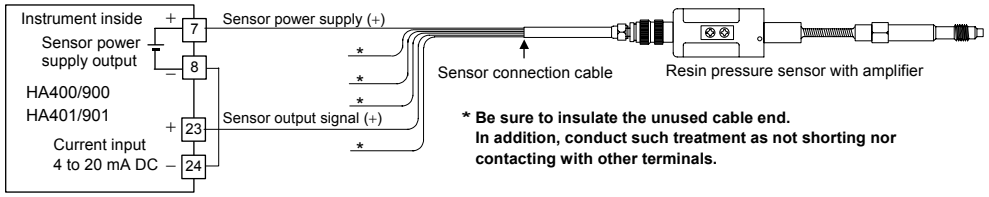


* Output 3 can be used as a power supply output (optional) for the transmitter (pressure sensor, temperature sensor, etc).

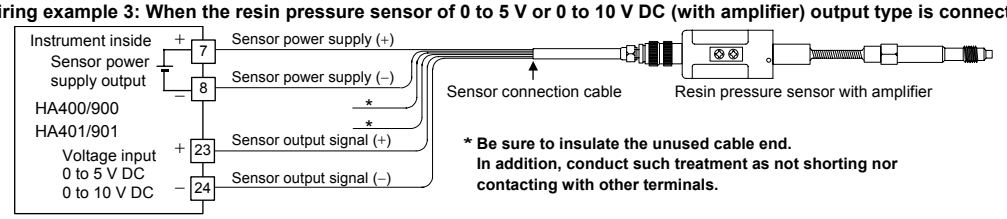
Wiring example 1: Connection to a transmitter (4 to 20 mA DC type)



Wiring example 2: When the resin pressure sensor of 4 to 20 mA DC (with amplifier) output type is connected



Wiring example 3: When the resin pressure sensor of 0 to 5 V or 0 to 10 V DC (with amplifier) output type is connected



- Number of outputs and output types must be specified when ordering. Control output, Event output, HBA alarm output, or Transmission output can be allocated to output 1 to 3. The specifications of each output are as follows.

Output type	Specifications
Relay contact output	250 V AC, 3A (Resistive load), 1a contact Electrical life 300,000 times or more (Rated load)
Voltage pulse output	0/12 V DC (Load resistance: 600 Ω or more)
Triac output	0.4 A (Allowable load current)
Voltage output	0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC (Load resistance: 1 kΩ or more) Output resolution: 11 bits or more
Current output	0 to 20 mA DC, 4 to 20 mA DC (Load resistance: 600 Ω or less) Output resolution: 11 bits or more
Sensor power supply output [Only OUT3 is selectable]	Rated voltage: 24 V DC ± 5% Rated current: 24 mA max.

Continued on the next page.

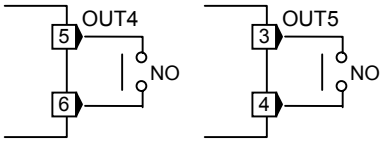
Continued from the previous page.

- OUT3 is isolated from both OUT1 and OUT2.
- OUT1 and OUT2 are not isolated from each other except for relay or triac output. When relay or triac output is used, there is isolation between outputs.
- There is isolation between input and output.
- There is isolation between output and power supply terminals.

■ Output 4 to 5 (OUT4 to OUT5)

- Terminal 5 and 6 are for output 4 (OUT4); and Terminal 3 and 4 are for output 5 (OUT5).
- Output type is only relay contact output.

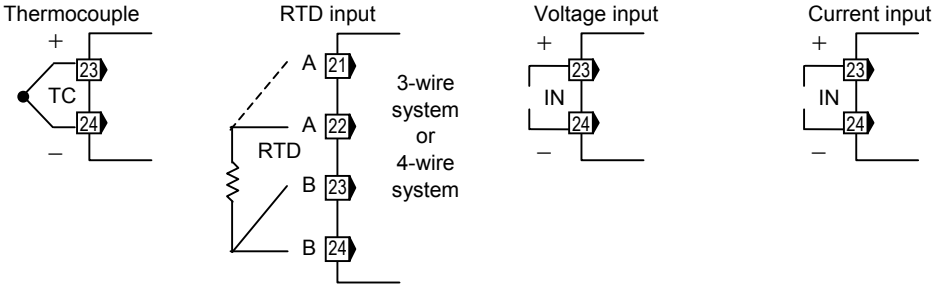
Relay contact output 250 V AC, 1A (Resistive load), 1a contact Electrical life 300,000 times or more (Rated load)



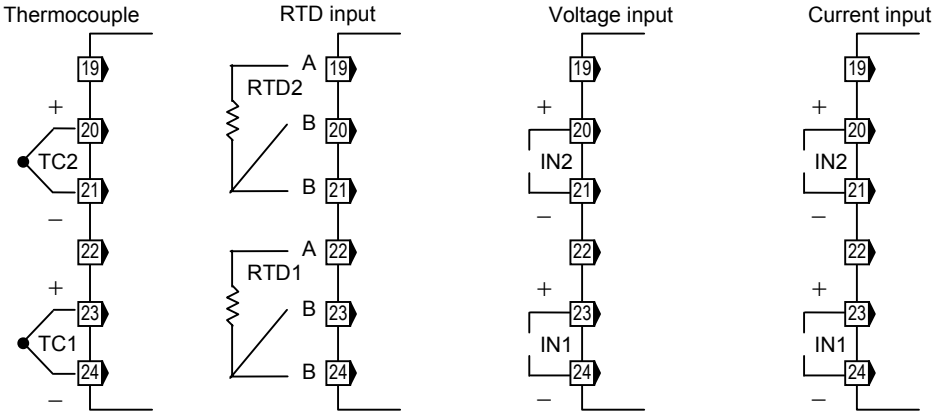
- OUT4 and OUT5 can be used for Event output and/or HBA alarm output.
- When OUT3 is used for a Sensor power supply output (optional), OUT4 and OUT5 are not available.

■ Measured input

- For the 1-input controller, terminals 21 to 24 are allocated to the measured input.



- For the 2-input controller, terminals 22 to 24 are allocated to Input 1, and terminals 19 to 21 are allocated to Input 2.



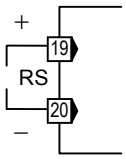
- The input types needs to be specified when ordering. The input types are as follows.

Thermocouple:	K, J, T, S, R, E, B, PLII, N, W5Re/W26Re	Voltage (low):	0 to 100 mV DC, 0 to 10 mV DC, 0 to 1 V DC
		Voltage (high):	0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC
RTD:	Pt100, JPt100	Current:	0 to 20 mA DC, 4 to 20 mA DC

- For thermocouple input, use an appropriate compensation wire. For RTD input, use the same low resistance lead wires for all connections.

■ Remote input (optional)

- With non-isolated remote input, terminals 19 to 20 are allocated to Remote input.



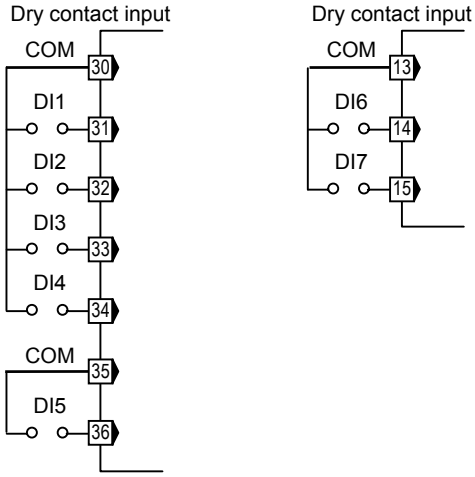
Any one of the following input types can be selected.

Voltage (low):	0 to 100 mV DC, 0 to 10 mV DC, 0 to 1 V DC
Voltage (high):	0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC
Current:	0 to 20 mA DC, 4 to 20 mA DC

- Input 2 of the 2-input controller can be used as isolated Remote Input.
- Measured input is not isolated from Remote input (non-isolated type).

■ Event input (optional)

- With Event input, terminals 13 to 15 and 30 to 36 are allocated to Event input. Event input must be specified when ordering.



- Event input can not be selected if Communication 1 function is specified. Use Communication 2 function if both event inputs and communications are necessary.
- Contact input from external devices or equipment should be dry contact input. If it is not dry contact input, the input should have meet the specifications below.

  Contact specifications: At OFF (contact open): 500 kΩ or more At ON (contact closed) 10 Ω or less

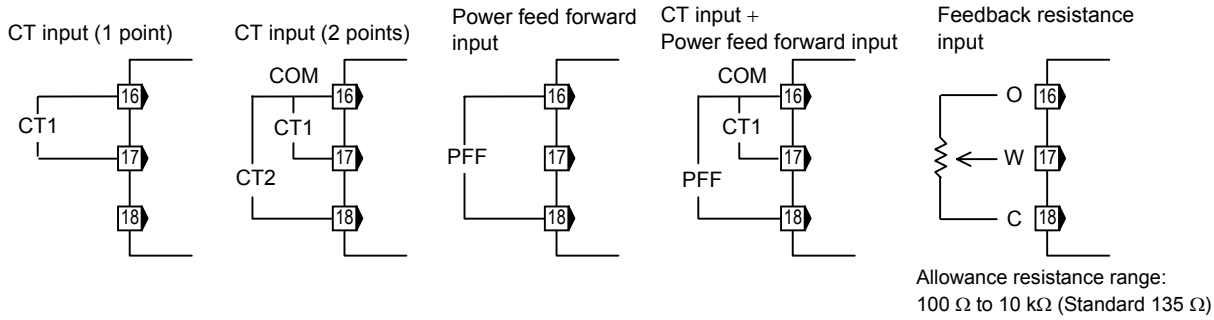
- The following functions can be assigned to event inputs.

  Memory area selection, RUN/STOP transfer, Remote/Local transfer, Auto/Manual transfer

☞ To assign functions to event inputs, refer to **8. ENGINEERING MODE. (P. 50)**

■ CT input/Power feed forward input/Feedback resistance input (optional)

- With CT input, Power feed forward input or Feedback resistance input, terminals 16 to 18 are allocated to the specified input.
- When using CT input, connect CTs to the relevant terminals.
- When using Power feed forward input, connect the dedicated transformer included.
- When using Feedback resistance input, connect a potentiometer to the relevant terminals.



Allowance resistance range:
100 Ω to 10 kΩ (Standard 135 Ω)

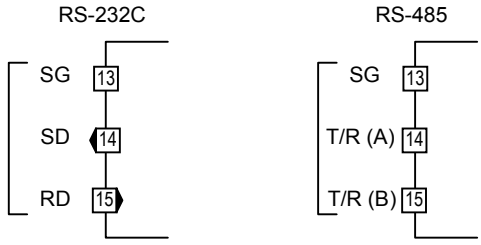
- CT input and Feedback resistance input are not isolated between measured input.

■ Communication 1/Communication 2 (optional)

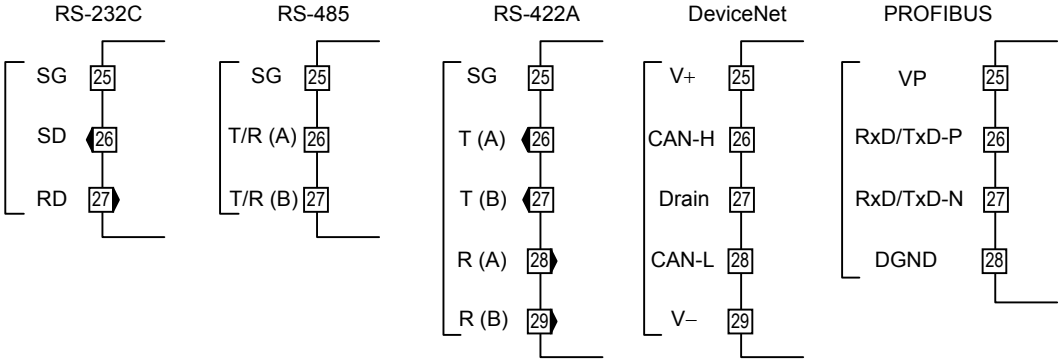
- With Communication function 1, terminals 13 to 15 are allocated to Communication 1.
- With Communication function 2, terminals 25 to 29 are allocated to Communication 2.
- Communication 1 can not be selected if Event input function is specified.
- Conduct wiring to the relevant terminals meeting the specified communication interface. For details of wiring, refer to **Communication Instruction Manual (IMR01N03-E□).***

* Refer to **Communication Instruction Manual (IMR01N04-E□)** for PROFIBUS, **Communication Instruction Manual (IMR01N05-E□)** for DeviceNet, and **Communication Instruction Manual (IMR01N20-E□)** for CC-Link.

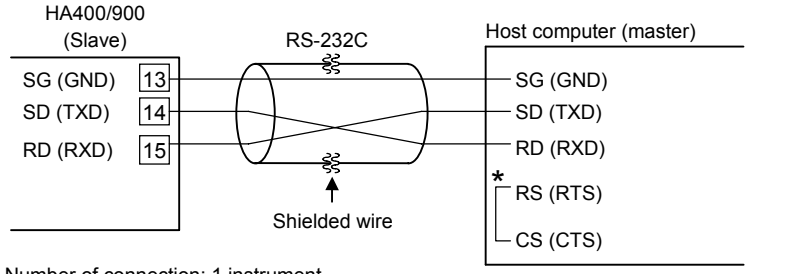
[Communication 1]



[Communication 2]



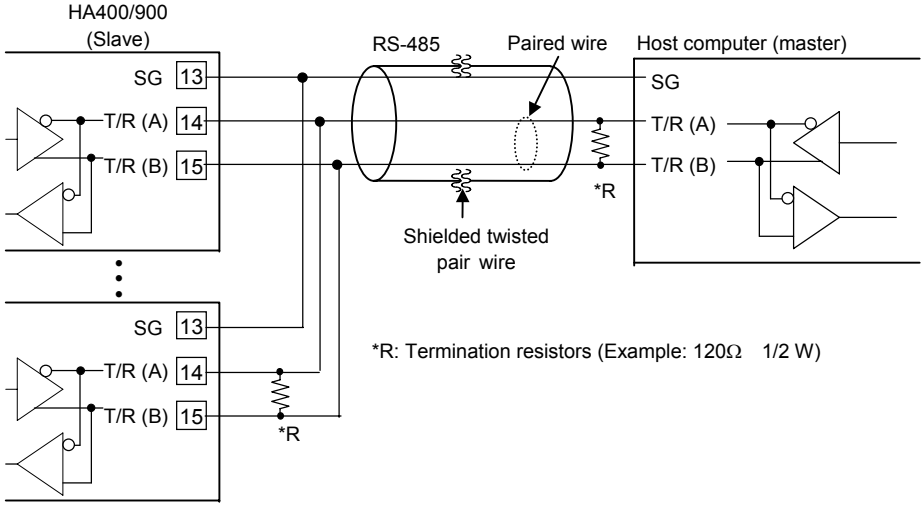
Example 1: Connection to the RS-232C port of the host computer (master)



Number of connection: 1 instrument

* Short RS and CS within connector

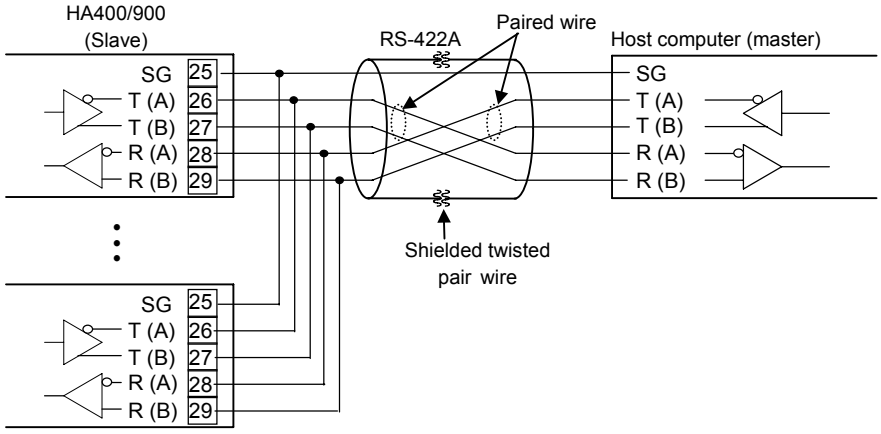
Example 2: Connection to the RS-485 port of the host computer (master)



*R: Termination resistors (Example: 120Ω 1/2 W)

Maximum connections: 32 instruments maximum including a host computer

Example 3: Connection to the RS-422A port of the host computer (master)



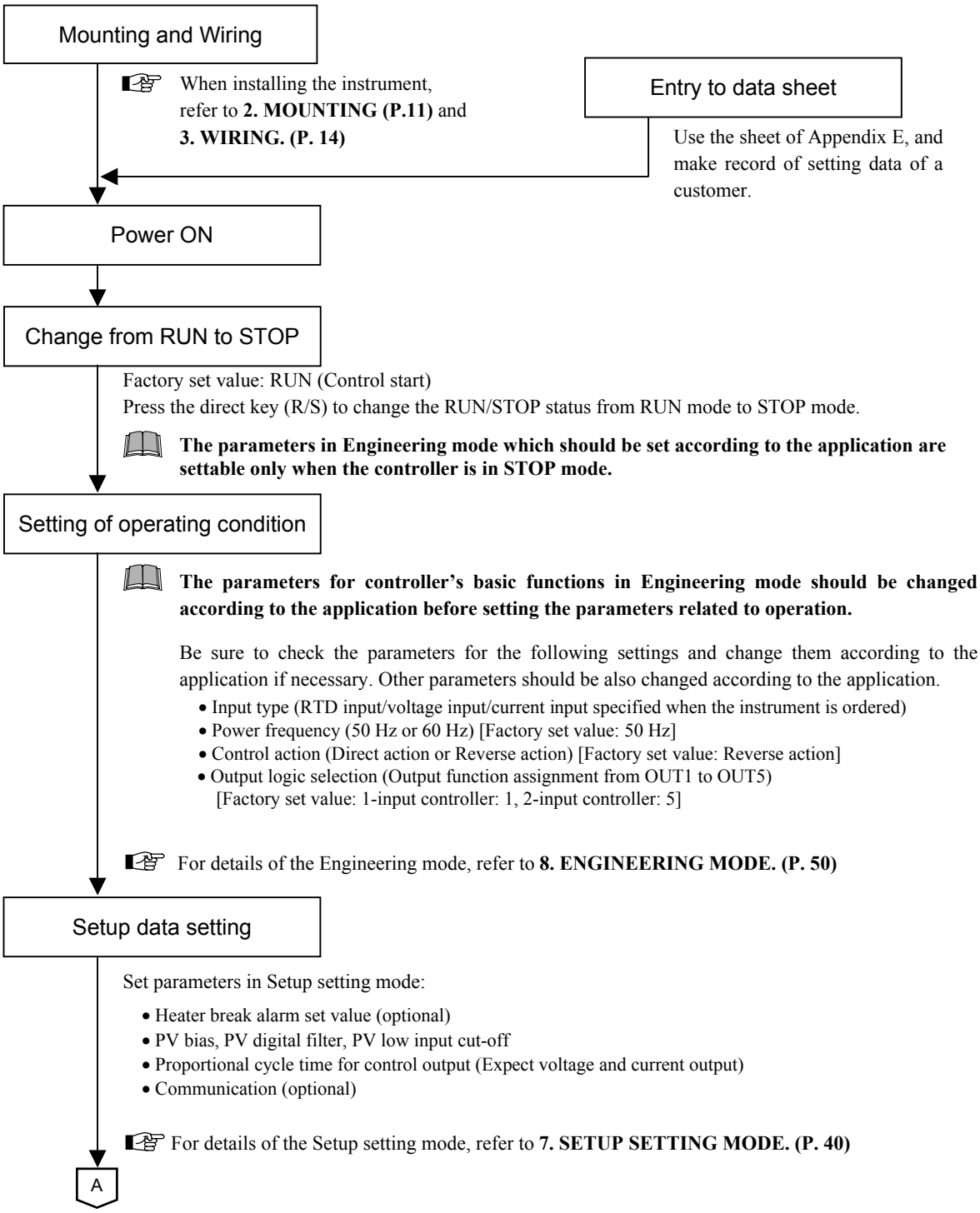
Maximum connections: 32 instruments maximum including a host computer

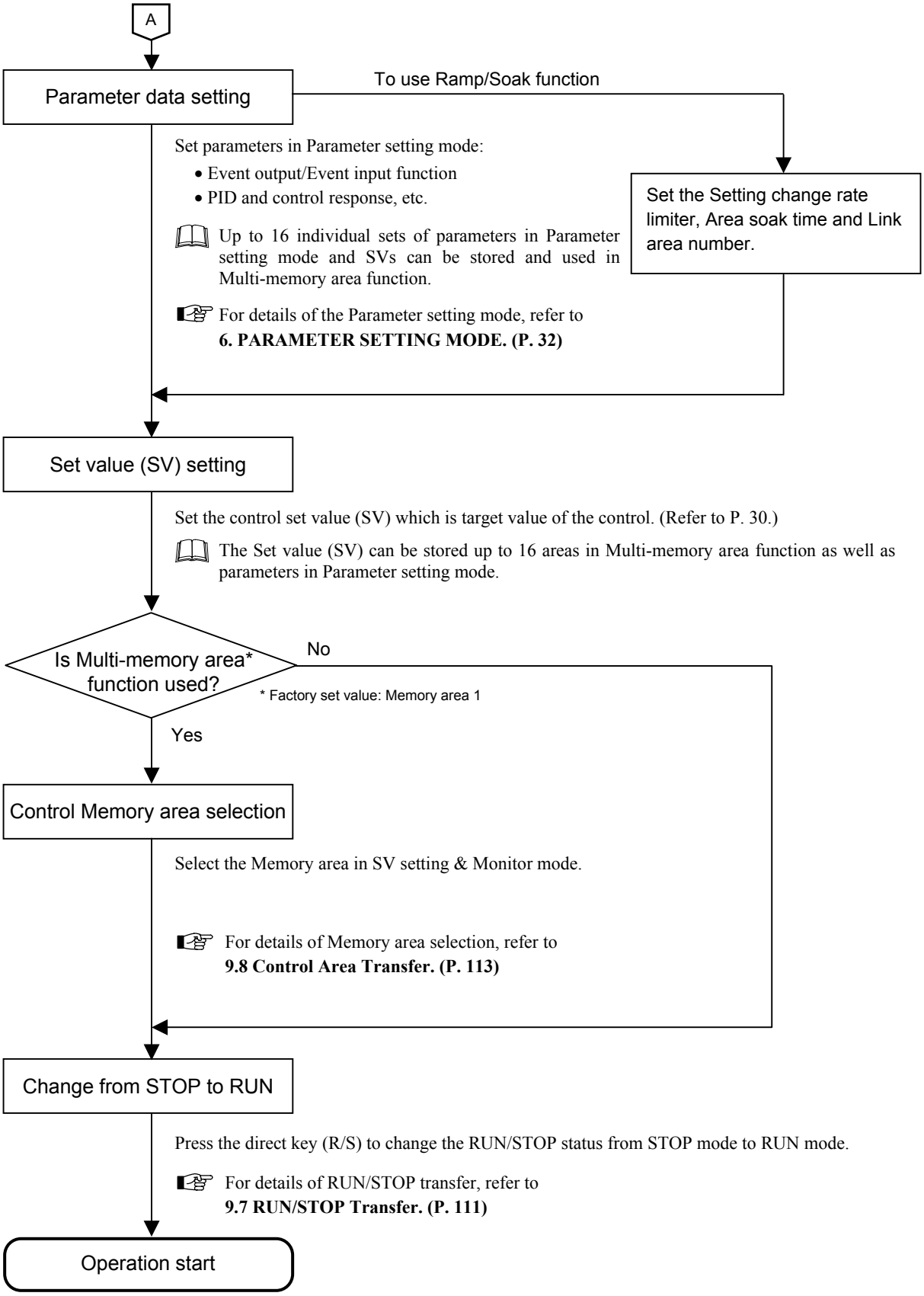
4. SETTING

This chapter describes procedures to set operating conditions of a customer and parameter of various setting modes.

4.1 Setting Procedure to Operation

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

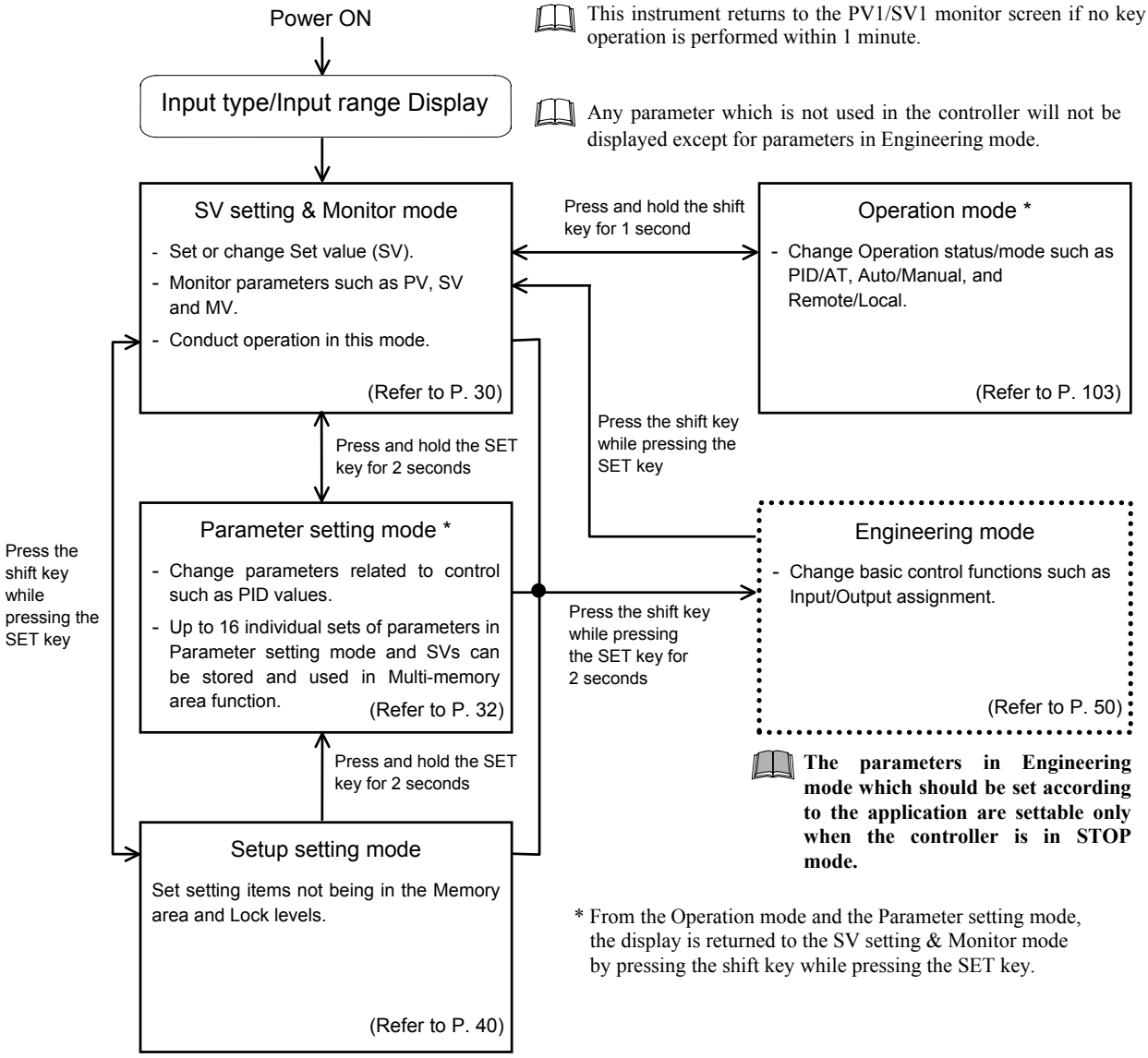



A
Parameter data setting
To use Ramp/Soak function
Set parameters in Parameter setting mode:
• Event output/Event input function
• PID and control response, etc.
Up to 16 individual sets of parameters in Parameter setting mode and SVs can be stored and used in Multi-memory area function.
For details of the Parameter setting mode, refer to
6. PARAMETER SETTING MODE. (P. 32)
Set the Setting change rate limiter, Area soak time and Link area number.
Set value (SV) setting
Set the control set value (SV) which is target value of the control. (Refer to P. 30.)
The Set value (SV) can be stored up to 16 areas in Multi-memory area function as well as parameters in Parameter setting mode.
Is Multi-memory area* function used?
No
* Factory set value: Memory area 1
Yes
Control Memory area selection
Select the Memory area in SV setting & Monitor mode.
For details of Memory area selection, refer to
9.8 Control Area Transfer. (P. 113)
Change from STOP to RUN
Press the direct key (R/S) to change the RUN/STOP status from STOP mode to RUN mode.
For details of RUN/STOP transfer, refer to
9.7 RUN/STOP Transfer. (P. 111)
Operation start

4.2 Operation Menu

The controller has five different setting modes. All settable parameters belong to one of them. The following chart shows how to access different setting mode.

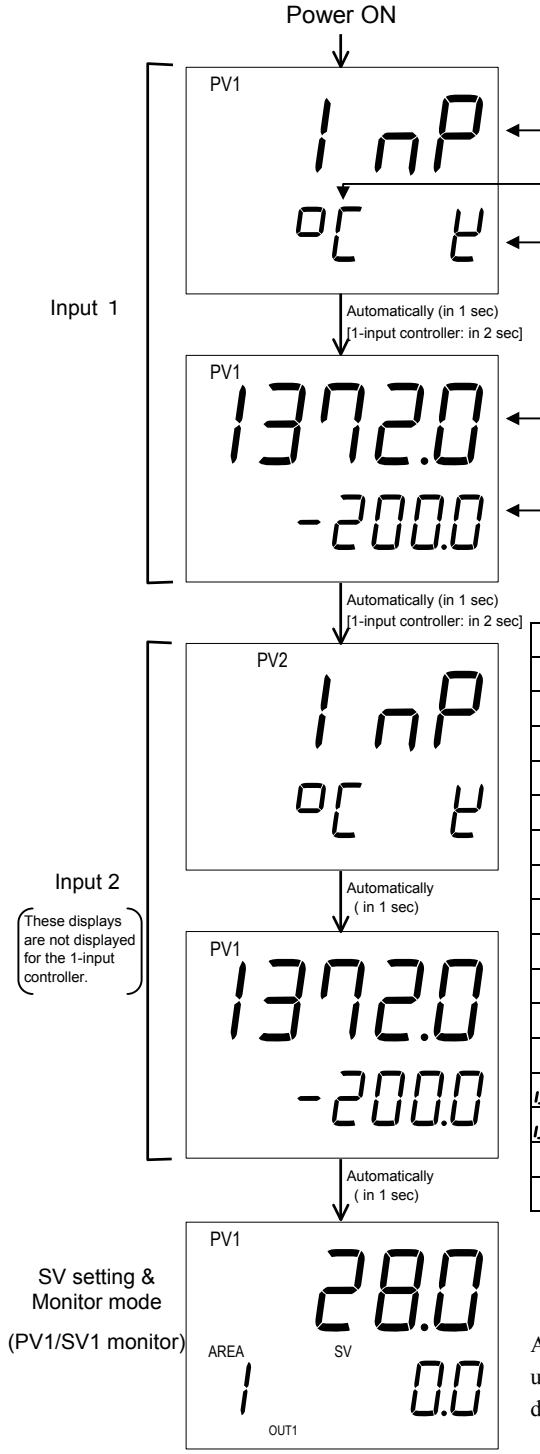
☞ For the details of key operation, refer to **4.3 Key Operation (P. 26)**.



■ Input type and input range display

This instrument immediately confirms inputs type symbol and input range following power ON.

Example: When sensor type of Input 1 and Input 2 is K thermocouple (2-input controller)



* Input Type Symbol Table

Symbol	Input type	Input range
E	K	–200.0 to +1372.0 °C, –328.0 to +2501.6 °F
J	J	–200.0 to +1200.0 °C, –328.0 to +2192.0 °F
T	T	–200.0 to +400.0 °C, –328.0 to +752.0 °F
S	S	–50.0 to +1768.0 °C, –58.0 to +3214.4 °F
r	R	–50.0 to +1768.0 °C, –58.0 to +3214.4 °F
P	PLII	0.0 to 1390.0 °C, 32.0 to 2534.0 °F
n	N	0.0 to 1300.0 °C, 32.0 to 2372.0 °F
U	W5Re/W26Re	0.0 to 2300.0 °C, 32.0 to 4172.0 °F
E	E	–200.0 to +1000.0 °C, –328.0 to +1832.0 °F
b	B	0.0 to 1800.0 °C, 32.0 to 3272.0 °F
Pt3	Pt100 (3-wire system)	–200.0 to +850.0 °C, –328.0 to +1562.0 °F
Pt4	Pt100 (4-wire system)	–200.0 to +850.0 °C, –328.0 to +1562.0 °F
JP3	JPt100 (3-wire system)	–200.0 to +600.0 °C, –328.0 to +1112.0 °F
JP4	JPt100 (4-wire system)	–200.0 to +600.0 °C, –328.0 to +1112.0 °F
V	Voltage (mV, V)	Programmable range
I	Current (mA)	(–19999 to +99999)

After the input type symbol and the input range are displayed on the display unit, the PV1/SV1 monitor screen (SV setting & Monitor mode) is displayed.

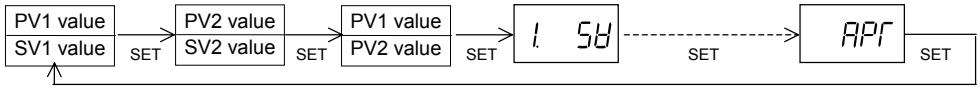
4.3 Key Operation

Basic key operations common to each mode (set item change, set value change and registration) and Data lock function are described in the following.

■ Scrolling through parameters

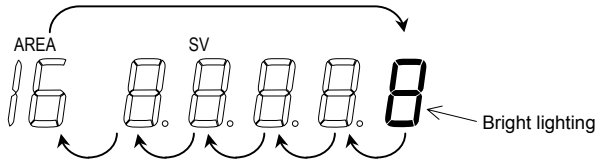
- Press to scroll through parameters in the same mode/area.
- To go back to the first parameter, keep pressing SET keys until it is displayed again.

Example: When the SV setting & Monitor mode is selected (2-input controller)



■ Changing Set value (SV)

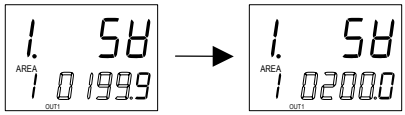
- The high-lighted digit indicates which digit can be set. Press Shift key to go to a different digit. Every time the shift key is pressed, the high-lighted digit moves as follows.



The following is also available when changing the set value.

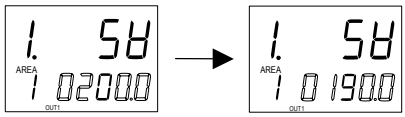
- Increase SV from 199.9 °C to 200.0 °C:

1. Press the shift key to light brightly the tenths place (first digit from the right).
2. Press the UP key to change to 0.
The display changes to 200.0.



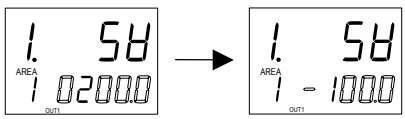
- Decrease SV from 200.0 °C to 190.0 °C:

1. Press the shift key to light brightly the tens place.
2. Press the DOWN key to change to 9.
The display changes to 190.0.



- Decrease SV from 200.0 °C to –100.0 °C:

1. Press the shift key to light brightly the hundreds place.
2. Press the DOWN key (three times) to change to –1.
The display changes to –100.0.



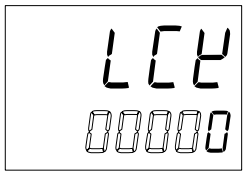
- **To store a new value for the parameter, always press the SET key.** The display changes to the next parameter and the new value will be stored.

A new value will not be stored without pressing SET key after the new value is displayed on the display.

After a new value has been displayed by using the UP and DOWN keys, the SET key must be pressed within 1 minute, or the new value is not stored and the display will return to the PV1/SV1 monitor screen.

■ Data lock function

- The Data lock function limits access of unauthorized personnel to the parameters and prevents parameter change by mistake.
- There are 8 set data lock levels. The set data lock level can be set in Setup setting mode.

Character display	Parameters which can be changed	Set value
	All parameters [Factory set value]	00000
	SV, EV1 to EV4, Memory area selection, Parameters in F10 to F91	00001
	All parameters except for EV1 to EV4	00010
	SV	00011
	All parameters except for SV	00100
	EV1 to EV4	00101
	All parameters except for SV and EV1 to EV4	00110
	No parameter (All Locked)	00111

- Data lock level can be changed in both RUN and STOP mode.
- Parameters protected by Data lock function are still displayed for monitoring.

■ How to restrict operation of the direct keys

Three Direct function keys on the front panel are provided for one-key operation to switch Auto/Manual, Remote/Local, and RUN/STOP. Use/Unuse of Direct keys is settable in Engineering mode. (Refer to P. 65.)

4.4 Changing Parameter Settings

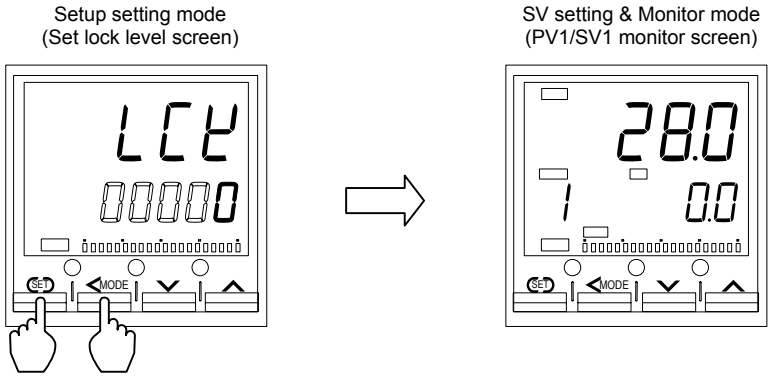
Procedures to change parameter settings are shown below.

■ Change Settings

Example: Change the Set value 1 (SV1) of Input 1 from 0.0 °C to 200.0 °C

1. **Go to the mode in which the parameter is displayed**

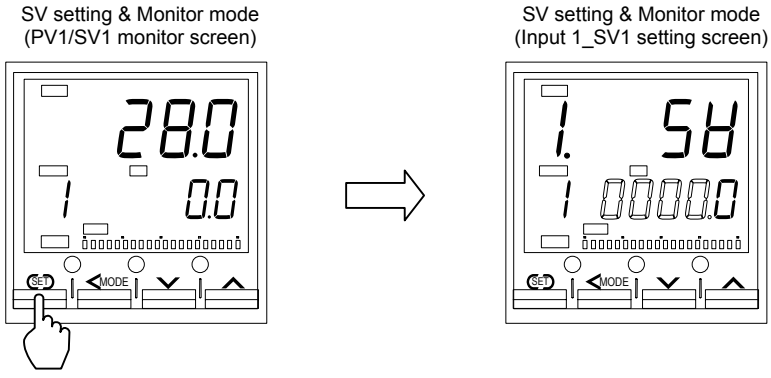
If the current mode is not SV setting & Monitor mode, press the shift key while pressing the SET key to return to the SV setting & Monitor mode.



☞ For the mode transfer, refer to **4.2 Operation Menu. (P. 24)**

2. **Select the parameter**

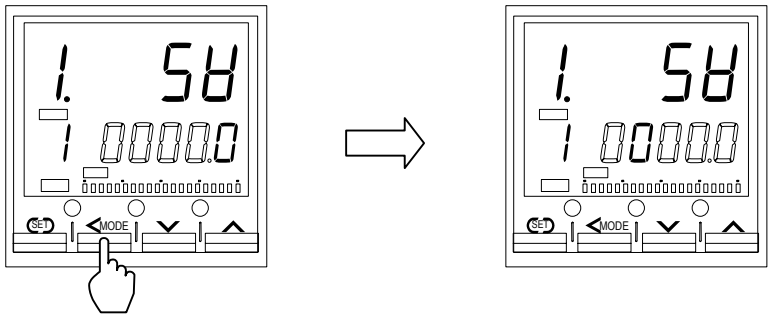
Press the SET key until "1. SV" (Input 1_SV1 setting screen) is displayed. To go to the next parameter, press SET key. To go back to the first parameter, keep pressing SET keys until it is displayed again.



Continued on the next page.

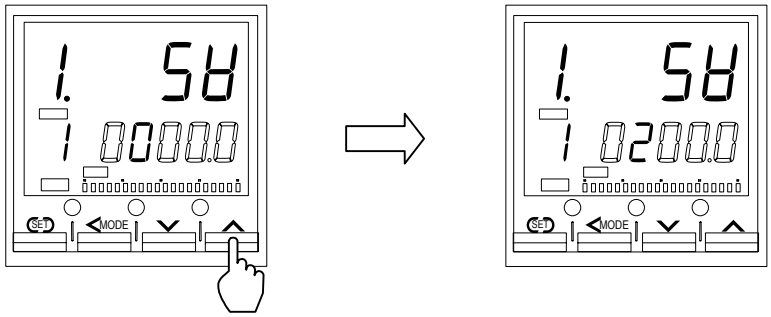
3. **Shift the high-lighted digit**

The high-lighted digit indicates which digit can be set. Press the shift key to high-light the hundreds digit.



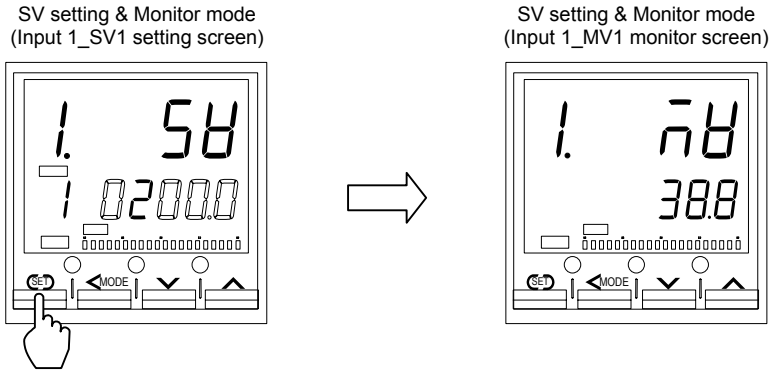
4. **Change the set value**

Press the UP key to change the number to 2.



5. **Store the set value**

Press the SET key to store the new set value. The display goes to the next parameter.



5. SV SETTING & MONITOR MODE

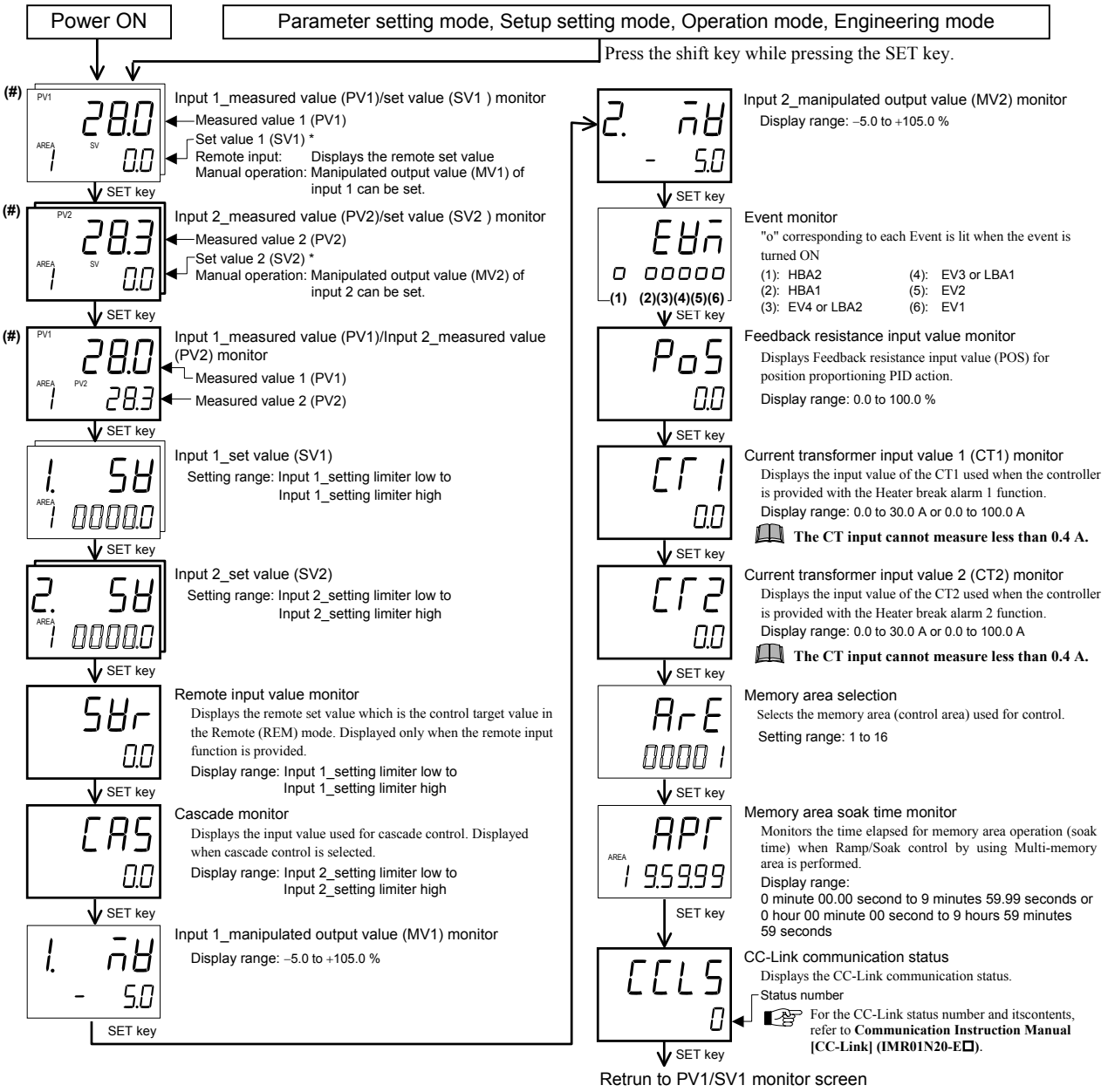
5.1 Display Sequence

In SV setting & Monitor mode, the following operations are possible.

Change the Set value (SV), Change Memory Area,

Monitor the Measured value (PV) and the Manipulated value (MV), etc.

When the power is turned on, the controller goes to this mode after self-diagnostics. Use this mode during normal operation. To return to this mode from the Operation mode or the Parameter setting mode, press the shift key while pressing the SET key.



* With the Setting change rate limiter when the set value is changed, the displayed set value changes according to the ramp-up/down rate.

: Parameters related to multi-memory area function : Parameters displayed when function is specified.

Parameters which are not related to existing functions on the controller are not displayed.

This instrument returns to the PV1/SV1 monitor screen if no key operation is performed within 1 minute. [Exempts, screen of (#) mark]

For the monitor screen, refer to **9.3 Monitoring Display in Operation. (P. 104)**

For the memory area selection, refer to **9.8 Control Area Transfer. (P. 113)**

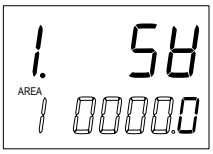
5.2 Procedure for Set Value (SV) Setting

Up to 16 individual sets of SVs and parameters in Parameter setting mode can be stored and used in Multi-memory area function. Some examples of changing the Set value (SV) described in the following. The same setting procedure applies when parameters corresponding to the Multi-memory area function are also set.

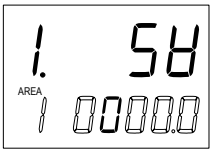
● Change the Set value (SV)

Change SV1 of Input 1 from 0.0 °C to 200.0 °C:

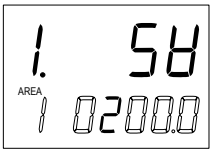
1. Press the SET key several times at PV1/SV1 monitor screen until Input1_SV1 setting screen is displayed.



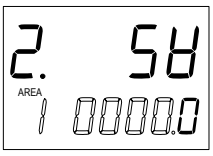
2. Press the shift key to high-light the hundreds digit.
The high-light digit indicates which digit can be set.



3. Press the UP key to change the number to 2.



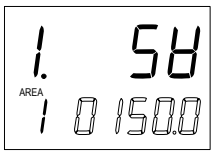
4. Press the SET key to store the new value. The display goes to the next parameter.
(Example: Input 2_SV2 setting screen)



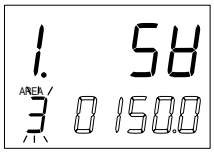
● Change the Set value (SV) of another Memory area which is not selected for ongoing control

While Memory area 1 is selected for ongoing control, change SV1 of Input 1 in Memory area 3 from 150.0 °C to 100.0 °C:

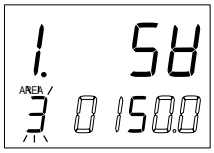
1. Go to Input 1_SV1 setting screen. Press the shift key until the Memory area display unit is high-lighted.
The high-lighted digit indicates which digit can be set.



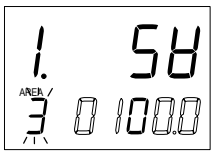
2. Press the UP key to change to 3. The SV display shows the Set value (SV1) of Input 1 of the Memory area 3, and the number in AREA (Area number) display flashes.



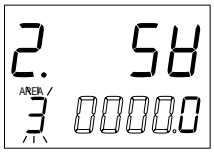
3. Press the shift key to high-light the tens digit.
The Area number is flashing.



4. Press the DOWN key to change the number to 0 in the tens digit.



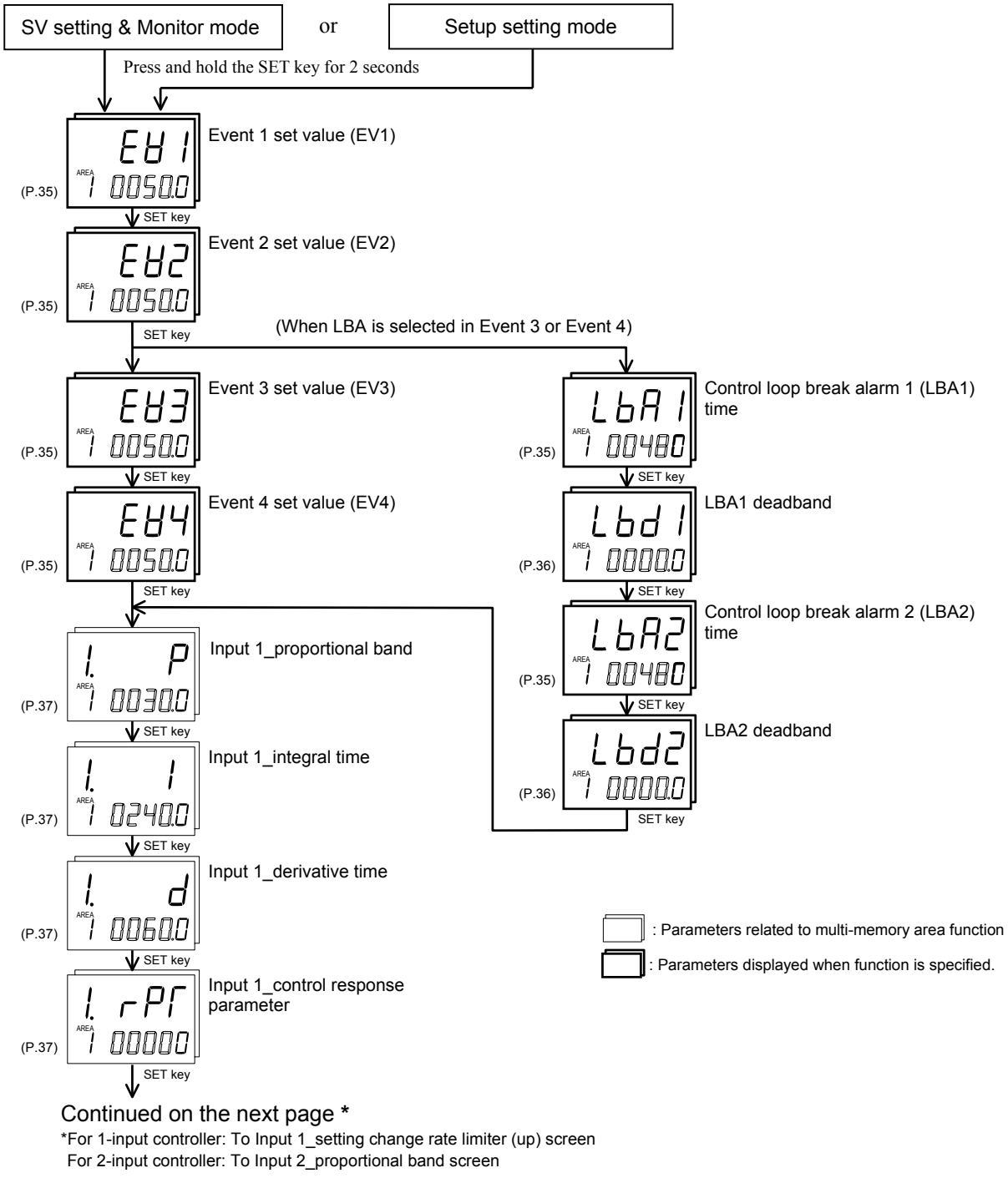
5. Press the SET key to store the new value. The display goes to the next parameter.
(Example: Input 2_SV2 setting screen)



6. PARAMETER SETTING MODE

6.1 Display Sequence

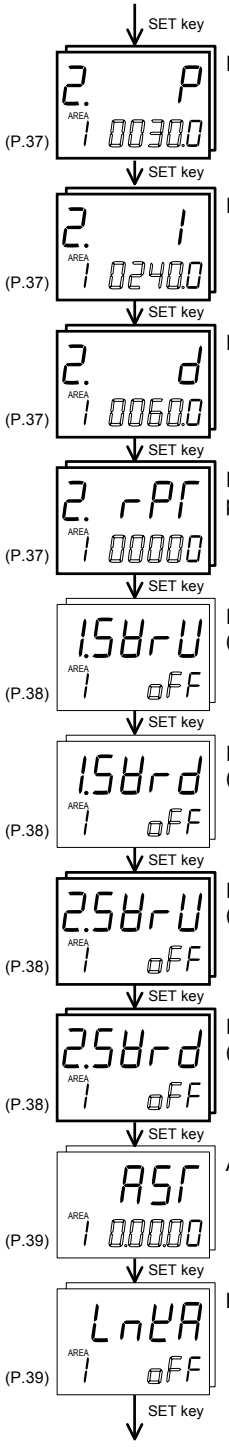
In Parameter setting mode, the following operations are possible. Set parameters relating to control such as PID constants, Event set values, and the Setting change rate limiter. To go to Parameter setting mode, press and hold the SET key for 2 seconds at SV setting & Monitor mode or Setup setting mode. Up to 16 individual sets of SVs and parameters in Parameter setting mode can be stored and used in Multi-memory area function. Ramp/Soak control is possible by using Area soak time, Link area number and Setting change rate limiter (up/down) in Parameter setting mode.



Continued on the next page *

*For 1-input controller: To Input 1_setting change rate limiter (up) screen
For 2-input controller: To Input 2_proportional band screen

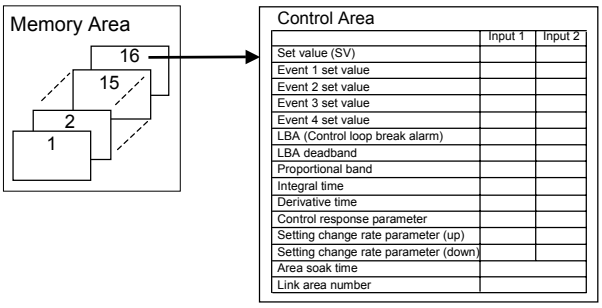
From Input 1_control response parameter setting screen



Return to first parameter setting item of Parameter setting mode

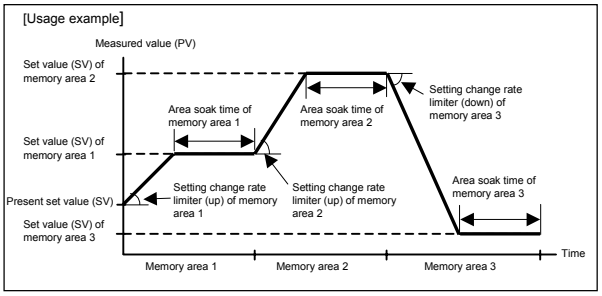
Multi-memory area function:

- Multi-memory area function can store up to 16 individual sets of SVs and parameters in Parameter setting mode.
  One of the Areas is used for control, and the currently selected area is "Control Area".



	Input 1	Input 2
Set value (SV)		
Event 1 set value		
Event 2 set value		
Event 3 set value		
Event 4 set value		
LBA (Control loop break alarm)		
LBA deadband		
Proportional band		
Integral time		
Derivative time		
Control response parameter		
Setting change rate parameter (up)		
Setting change rate parameter (down)		
Area soak time		
Link area number		

- Ramp/Soak control is possible by using Area soak time, Link area number and Setting change rate limiter (up/down) in Parameter setting mode.



: Parameters related to multi-memory area function

: Parameters displayed when function is specified.

Parameters which are not related to existing functions on the controller are not displayed.

To return the SV setting & Monitor mode, press and hold the SET key for 2 seconds, or press the shift key while pressing the SET key.

This instrument returns to the PV1/SV1 monitor screen if no key operation is performed within 1 minute.

6.2 Parameter List

Parameter		Page
Event 1 set value	EV1 (EV1)	P. 35
Event 2 set value	EV2 (EV2)	P. 35
Event 3 set value	EV3 (EV3)	P. 35
Event 4 set value	EV4 (EV4)	P. 35
Control loop break alarm 1 (LBA1) time	LbA1 (LbA1)	P. 35
LBA1 deadband	Lbd1 (Lbd1)	P. 36
Control loop break alarm 2 (LBA2) time	LbA2 (LbA2)	P. 35
LBA2 deadband	Lbd2 (Lbd2)	P. 36
Input 1_proportional band	1. P (1. P)	P. 37
Input 1_integral time	1. I (1. I)	P. 37
Input 1_derivative time	1. d (1. d)	P. 37
Input 1_control response parameter	1. rPT (1. rPT)	P. 37
Input 2_proportional band	2. P (2. P)	P. 37
Input 2_integral time	2. I (2. I)	P. 37
Input 2_derivative time	2. d (2. d)	P. 37
Input 2_control response parameter	2. rPT (2. rPT)	P. 37

Parameter		Page
Input 1_setting change rate limiter (up)	1.SVrU (1.SVrU)	P. 38
Input 1_setting change rate limiter (down)	1.SVrd (1.SVrd)	P. 38
Input 2_setting change rate limiter (up)	2.SVrU (2. SVrU)	P. 38
Input 2_setting change rate limiter (down)	2.SVrd (2.SVrd)	P. 38
Area soak time	AST (AST)	P. 39
Link area number	LnKA (LnKA)	P. 39

6.3 Description of Each Parameter

■ Event 1 set value (EV1) Event 2 set value (EV2) Event 3 set value (EV3) Event 4 set value (EV4)

EV1 to EV4 are set values of the Event action.

Data range: Deviation: −Input span to +Input span
Process: Input scale low to Input scale high
SV: Input scale low to Input scale high

Factory set value: 50.0

For the 2-input controller, EVs have to be allocated to either Input 1 or Input 2 (Factory set value: allocated to Input 1). Refer to "Event assignment" in F41 to F44 of the Engineering mode (P. 80).

■ Control loop break alarm (LBA) time (LbA1, LbA2)

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

Data range: OFF (Unused), 1 to 7200 seconds

Factory set value: 480

For the 2-input controller, LBAs have to be allocated to either Input 1 or Input 2 (Factory set value: allocated to Input 1). Refer to "Event assignment" in F41 to F44 of the Engineering mode (P. 80).

LBA Function: The Control loop break alarm (LBA) function is used to detect a load (heater) break or a failure in the external actuator (power controller, magnet relay, etc.), or a failure in the control loop caused by an input (sensor) break. The LBA function is activated when control output reaches 0 % (low limit with output limit function) or 100 % (high limit with output limit function). LBA monitors variation of the Measured value (PV) for the length of LBA time. When the LBA time has elapsed and the PV is still within the alarm determination range, the LBA will be ON.

[Alarm action]

LBA determination range: TC/RTD input: 2 °C [2 °F] (fixed)
Voltage/Current input: 0.2 % of input span (fixed)

- **When the output reaches 0 % (low limit with output limit function)**

For direct action: When the LBA time has passed and the PV has not risen beyond the alarm determination range, the alarm will be turned on.

For reverse action: When the LBA time has passed and the PV has not fallen below the alarm determination range, the alarm will be turned on.

- **When the output exceeds 100 % (high limit with output limit function)**

For direct action: When the LBA time has passed and the PV has not fallen below the alarm determination range, the alarm will be turned on.

For reverse action: When the LBA time has passed and the PV has not risen beyond the alarm determination range, the alarm will be turned on.

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

■ LBA deadband (Lbd1, Lbd2)

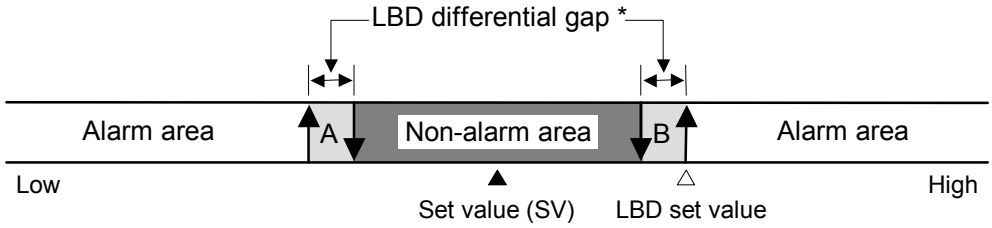
The LBA deadband gives a neutral zone to prevent the Control loop break alarm (LBA) from malfunctioning caused by disturbance.

Data range: 0.0 to Input span
(Varies with the setting of the Decimal point position)

Factory set value: 0.0

LBA Deadband function:

The LBA may malfunction due to external disturbances. To prevent malfunctioning due to external disturbance, LBA deadband (LBD) sets a neutral zone in which LBA is not activated. When the Measured value (PV) is within the LBD area, LBA will not be activated. If the LBD setting is not correct, the LBA will not work correctly.



* TC/RTD input: 0.8 °C [°F] (fixed) Voltage/Current input: 0.8 % of input span (fixed)

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

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

LBA function is not operative when:
- AT function is activated.
- The controller is in STOP mode.
- LBA function is set to "OFF."
- LBA function is not assigned to Event (ES3) or Event 4 (ES4).

If the LBA time is too short or does not match the controlled object requirements, LBA may turn ON or OFF at inappropriate time or remain OFF. Change the LBA time based on the malfunction.

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

■ Proportional band (1. P, 2. P) for PI/PID control

Data range: TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C [°F])
(Varies with the setting of the Decimal point position)
Voltage (V)/Current (I) inputs: 0.0 to 1000.0 % of input span
0 (0.0, 0.00): ON/OFF action

Factory set value: Input 1_proportional band (1. P): 30.0
Input 2_proportional band (2. P): 30.0

Related parameters: ON/OFF action differential gap (upper/lower) (P. 88)

■ Integral time (1. I, 2. I) for PI/PID control

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

Data range: OFF (PD action),
1 to 3600 seconds, 0.1 to 3600.0 seconds, or 0.01 to 360.00 seconds
(Varies with the setting of the Integral/Derivative time decimal point position selection)

Factory set value: Input 1_integral time (1. I): 240.00
Input 2_integral time (2. I): 240.00

Related parameters: Integral/Derivative time decimal point position selection (P. 87)

■ Derivative time (1. d, 2. d) for PID control

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

Data range: OFF (PI action),
1 to 3600 seconds, 0.1 to 3600.0 seconds, or 0.01 to 360.00 seconds
(Varies with the setting of the Integral/Derivative time decimal point position selection)

Factory set value: Input 1_derivative time (1. d): 60.00
Input 2_derivative time (2. d): 60.00

Related parameters: Integral/Derivative time decimal point position selection (P. 87)

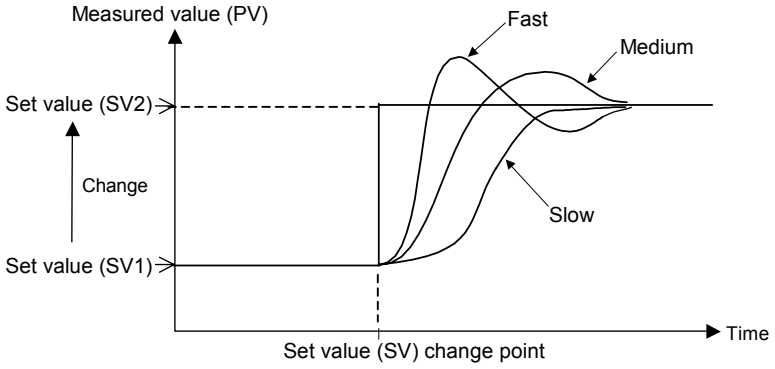
■ Control response parameter (1. rPT, 2. rPT)

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

Data range: 0: Slow 1: Medium 2: Fast

Factory set value: Input 1_control response parameter (1. rPT): 0
Input 2_control response parameter (2. rPT): 0

Control Response: The control response for the Set value (SV) change can be selected among Slow, Medium, and Fast. If a fast response is required, Fast is chosen. Fast may cause overshoot. If overshoot is critical, Slow is chosen.



■ Setting change rate limiter (up) (1. SVrU, 2. SVrU)

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

Data range: OFF (Unused), 0.1 to Input span/unit time
(Varies with the setting of the Decimal point position)
Factory set value: Input 1_setting change rate limiter (up) (1. SVrU): OFF
Input 2_setting change rate limiter (up) (2. SVrU): OFF

The unit time can be changed by the Setting change rate limiter unit time in the Engineering mode (P. 99). (Factory set value: 60 seconds)

■ Setting change rate limiter (down) (1. SVrd, 2. SVrd)

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

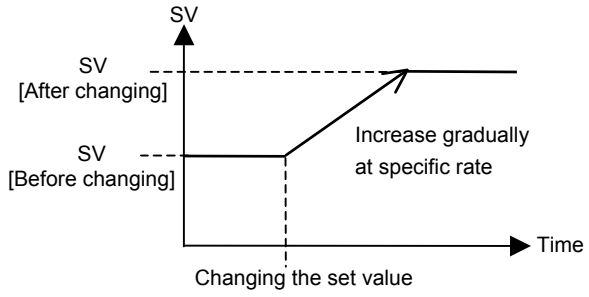
Data range: OFF (Unused), 0.1 to Input span/unit time
(Varies with the setting of the Decimal point position)
Factory set value: Input 1_setting change rate limiter (down) (1. SVrd): OFF
Input 2_setting change rate limiter (down) (2. SVrd): OFF

The unit time can be changed by the Setting change rate limiter unit time in the Engineering mode (P. 99). (Factory set value: 60 seconds)

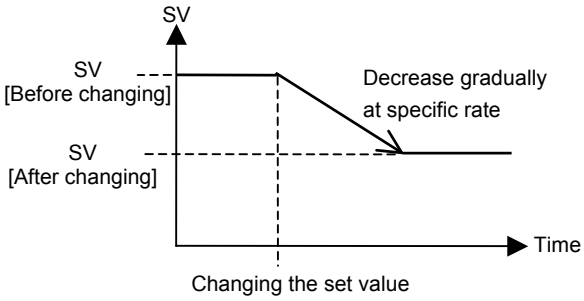
Setting change rate limiter:

Application examples of setting change rate limiter:

- Increasing the SV to a higher value



- Decreasing the SV to a lower value



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

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

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

If the rate of Setting change limiter is set to any value other than "OFF (Unused)," the Event re-hold action to be taken by a Set value (SV) change becomes invalid.

■ Area soak time (AST)

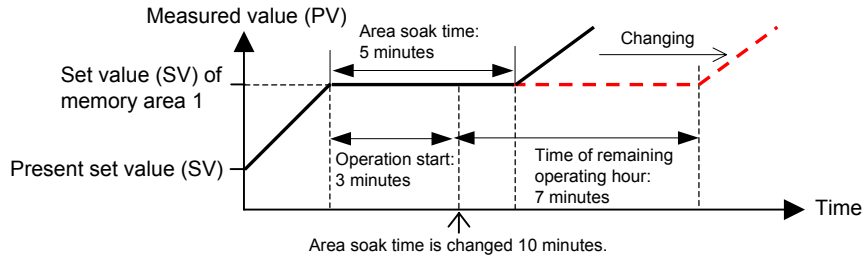
Area soak time is used for Ramp/Soak control function in conjunction with Link area number and Setting change rate limiter (up/down).

Data range: 0 hour 00.00 second to 9 minutes 59.99 seconds or
0 hour 00 minute 00 second to 9 hours 59 minutes 59 seconds

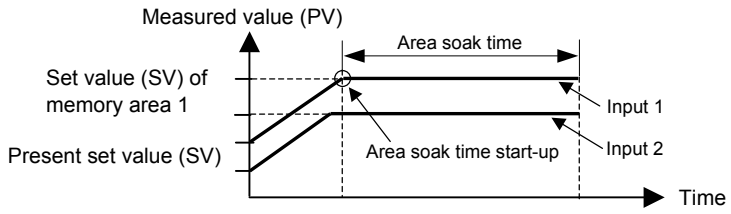
Factory set value: 0.00.00 (0 minute 00.00 second)

The unit time can be changed by the Soak time unit selection in the Engineering mode. (P. 99).
(Factory set value: 0 minute 00.00 second to 9 minutes 59.99 seconds)

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



For the instrument with the 2-input specification, its area soaking starts based on the arrival at the memory area set value of Input 1 or that of Input 2, whichever later.



■ Link area number (LnKA)

Link area number is used for Ramp/Soak control function in conjunction with Area soak time and Setting change rate limiter (up/down).

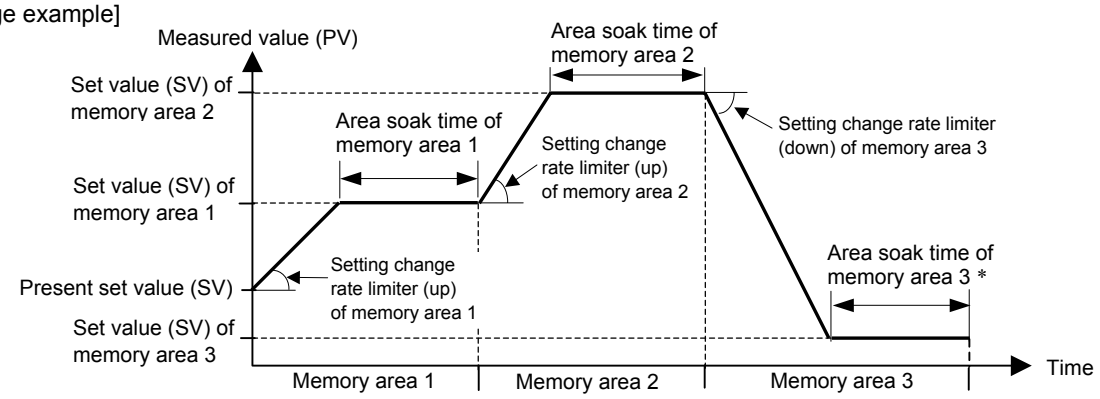
Data range: OFF (No link), 1 to 16

Factory set value: OFF

Ramp/Soak Control Function:

Ramp/Soak control is possible by using Area soak time, Link area number and Setting change rate limiter (up/down) in Parameter setting mode.

[Usage example]



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

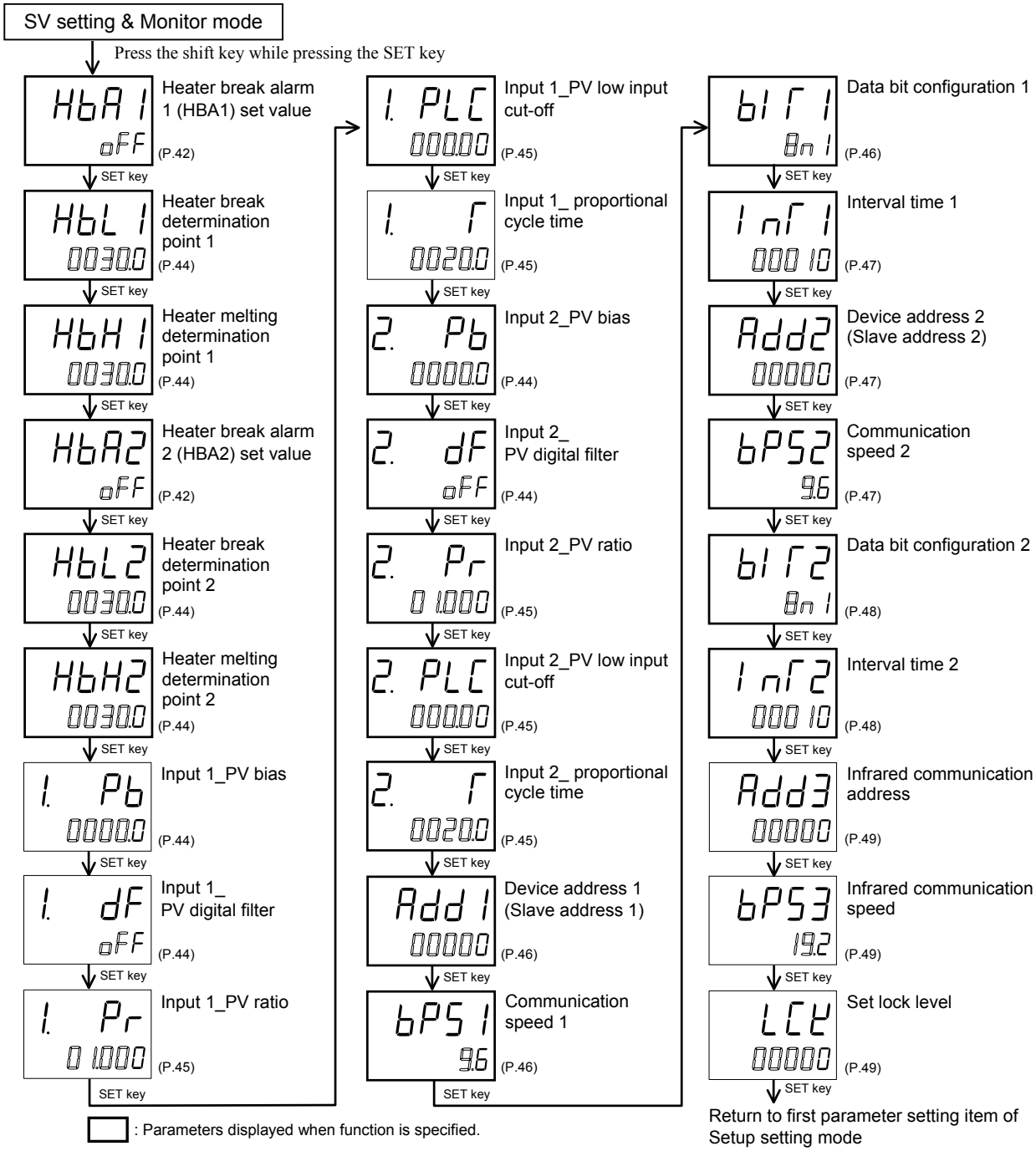
7. SETUP SETTING MODE

7.1 Display Sequence

In Setup setting mode, the following operations are possible.

Change other operation/control related parameters
Change Communication parameters
Change Data lock level

To go to Setup setting mode from SV setting & Monitor mode, press the shift key while pressing the SET key.



Parameters which are not related to existing functions on the controller are not displayed.

To return the SV setting & Monitor mode, press the shift key while pressing the SET key.

This instrument returns to the PV1/SV1 monitor screen if no key operation is performed within 1 minute.

7.2 Parameter List

Parameter		Page
Heater break alarm 1 (HBA1) set value	HbA1 (HbA1)	P. 42
Heater break determination point 1	HbL1 (HbL1)	P. 44
Heater melting determination point 1	HbH1 (HbH1)	P. 44
Heater break alarm 2 (HBA2) set value	HbA2 (HbA2)	P. 42
Heater break determination point 2	HbL2 (HbL2)	P. 44
Heater melting determination point 2	HbH2 (HbH2)	P. 44
Input 1_PV bias	1. Pb (1. Pb)	P. 44
Input 1_PV digital filter	1. dF (1. dF)	P. 44
Input 1_PV ratio	1. Pr (1. Pr)	P. 45
Input 1_PV low input cut-off	1. PLC (1. PLC)	P. 45
Input 1_ proportional cycle time	1. T (1. T)	P. 45
Input 2_PV bias	2. Pb (2. Pb)	P. 44
Input 2_PV digital filter	2. dF (2. dF)	P. 44
Input 2_PV ratio	2. Pr (2. Pr)	P. 45
Input 2_PV low input cut-off	2. PLC (2. PLC)	P. 45
Input 2_ proportional cycle time	2. T (2. T)	P. 45

Parameter		Page
Device address 1 (Slave address 1)	Add1 (Add1)	P. 46
Communication speed 1	bPS1 (bPS1)	P. 46
Data bit configuration 1	bIT1 (bIT1)	P. 46
Interval time 1	InT1 (InT1)	P. 47
Device address 2 (Slave address 2)	Add2 (Add2)	P. 47
Communication speed 2	bPS2 (bPS2)	P. 47
Data bit configuration 2	bIT2 (bIT2)	P. 48
Interval time 2	InT2 (InT2)	P. 48
Infrared communication address	Add3 (Add3)	P. 49
Infrared communication speed	bPS3 (bPS3)	P. 49
Set lock level	LCK (LCK)	P. 49

7.3 Description of Each Parameter

■ Heater break alarm 1 (HBA1) set value (HbA1)
Heater break alarm 2 (HBA2) set value (HbA2)

HBA1 and HBA2 are to set the set values for the Heater break alarm (HBA) function. The HBA function detects a fault in the heating circuit by monitoring the current flowing through the load by a dedicated current transformer (CT).

Up to two Heater break alarms are available with the controller. CT input 1 is for HBA1, and CT input 2 for HBA2. CT inputs can be assigned to one output from OUT1 to OUT5. To use HBA for a three-phase load, both CT inputs can be assigned to the same output.

Two types of Heater break alarms, type A and type B are available. An appropriate type should be selected depending on the application. (Refer to "Heater Break Alarm Function" below.)

These parameters, HBA set values (HbA1 and HbA2) are used for both types. However, each type has different function and care must be used to set an appropriate set value.

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

For type "B" HBA,

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

Data range: With CTL-6-P-N (0-30A) : OFF (Not used), 0.1 to 30.0 A
With CTL-12-S56-10L-N (0-100A): OFF (Not used), 0.1 to 100.0 A

Factory set value: OFF

Related parameters: Heater break determination point (P. 44), Heater melting determination point (P. 44), Heater break alarm (HBA) type selection (P. 81), CT ratio (P. 81), CT assignment (P. 82), Number of heater break alarm (HBA) delay times (P. 82)

Heater Break Alarm Function:

< Heater break alarm (HBA) type A >

Heater break alarm (HBA) type A can only be used with time-proportional control output (Relay contact, Voltage pulse, or Triac output). The HBA function monitors the current flowing through the load by a dedicated Current transformer (CT), compares the measured value with the HBA set values, and detects a fault in the heating circuit.

Low or No current flow (Heater break, malfunction of the control device, etc.):
When the control output is ON and the CT input value is equal to or less than the Heater break determination point for the preset number of consecutive sampling cycles, an alarm is activated.

Over current or short-circuit:
When the control output is OFF and the CT input value is equal to or greater than the Heater break determination point for the preset number of consecutive sampling cycles, an alarm is activated.

Continued on the next page.

Continued from the previous page.

< Heater break alarm (HBA) type B >

Heater break alarm (HBA) type B can be used with both continuous control output (Voltage/Current continuous output). The HBA function assumes that the heater current value is proportional* to the control output value of the controller, otherwise viewed as the Manipulated variable (MV), and compare it with the CT input value to detect a fault in the heating or cooling circuit.

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

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

The alarm determination point (Low) is calculated as follows:

[Non-alarm range (Low) width] = (HbL1 or HbL2) x (HbA1 or HbA2)

[Alarm determination point (Low)] = [(HbA1 or HbA2) x (MV1 or MV2)] – [Non-alarm range (Low) width]

When the CT input value is equal to or less than the heater break determination point for the preset number of consecutive sampling cycles, an alarm status is produced.

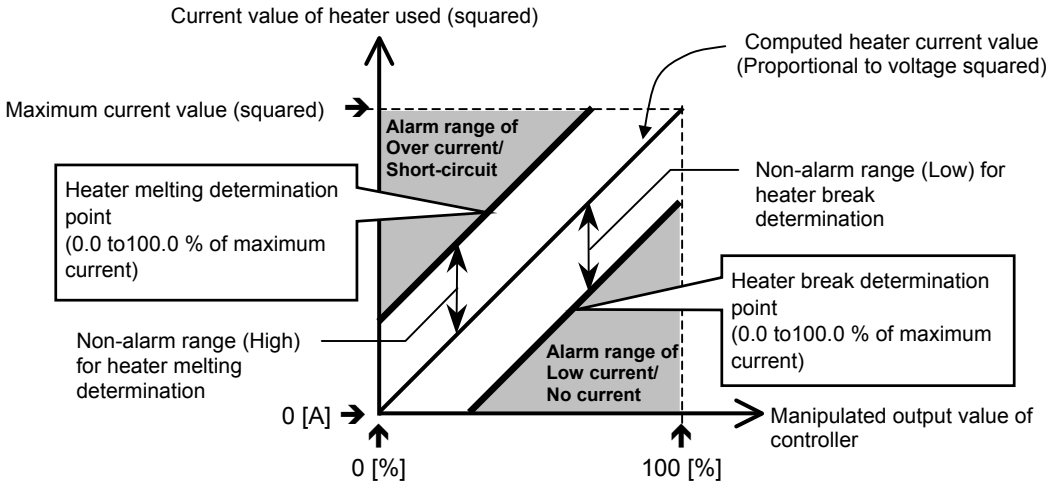
Over current or short-circuit

The alarm determination point (High) is calculated as follows:

[Non-alarm range (High) width] = (HbH1 or HbH2) x (HbA1 or HbA2)

[Alarm determination point (High)] = [(HbA1 or HbA2) x (MV1 or MV2)] + [Non-alarm range (High) width]

When the CT input value is equal to or greater than the Heater melting determination point for the preset number of consecutive sampling cycles, an alarm status is produced.



The current factory set values of HbLs and HbHs are set to 30.0 %. If any of the following conditions exists, set them to a slightly larger value to prevent a false alarm.

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

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

■ Heater break determination point 1 (HbL1) Heater break determination point 2 (HbL2)

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

Data range: Heater break determination point 1:
0.0 to 100.0 % of heater break alarm 1 (HBA1) set value
(0.0: Heater break determination is invalid)
Heater break determination point 2:
0.0 to 100.0 % of heater break alarm 2 (HBA2) set value
(0.0: Heater break determination is invalid)

Factory set value: 30.0

Related parameters: Heater break alarm (HBA) set value (P. 42), Heater melting determination point (P. 44), Heater break alarm (HBA) type selection (P. 81), Number of heater break alarm (HBA) delay times (P. 82)

Function: Refer to Heater break alarm (HBA) set value (P. 42, P.43)

■ Heater melting determination point 1 (HbH1) Heater melting determination point 2 (HbH2)

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

Data range: Heater melting determination point 1:
0.0 to 100.0 % of heater break alarm 1 (HBA1) set value
(0.0: Heater melting determination is invalid)
Heater melting determination point 2:
0.0 to 100.0 % of heater break alarm 2 (HBA2) set value
(0.0: Heater melting determination is invalid)

Factory set value: 30.0

Related parameters: Heater break alarm (HBA) set value (P. 42), Heater break determination point (P. 44), Heater break alarm (HBA) type selection (P. 81), Number of heater break alarm (HBA) delay times (P. 82)

Function: Refer to Heater break alarm (HBA) set value (P. 42, P.43)

■ PV bias (1. Pb, 2. Pb)

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

Data range: −Input span to +Input span

Factory set value: Input 1_PV bias (1. Pb): 0
Input 2_PV bias (2. Pb): 0

■ PV digital filter (1. dF, 2. dF)

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

Data range: OFF (Unused), 0.01 to 10.00 seconds

Factory set value:
HA400/900: Input 1_PV digital filter (1. dF): OFF
Input 2_PV digital filter (2. dF): OFF
HA401/901: Input 1_PV digital filter (1. dF): 1.00
Input 2_PV digital filter (2. dF): 1.00

■ PV ratio (1. Pr, 2. Pr)

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

Data range: 0.500 to 1.500

Factory set value: Input 1_PV ratio (1. Pr): 1.000
Input 2_PV ratio (2. Pr): 1.000

■ PV low input cut-off (1. PLC, 2. PLC)

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

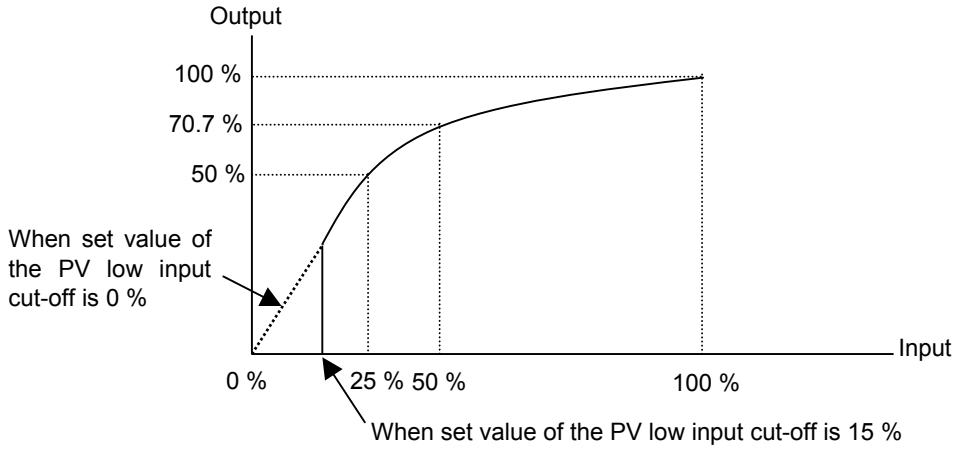
Data range: 0.00 to 25.00 % of input span

Factory set value: Input 1_PV low input cut-off (1. PLC): 0.00
Input 2_PV low input cut-off (2. PLC): 0.00

Related parameters: Square root extraction selection (P. 69)

PV low input cut-off function:

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



■ Proportional cycle time (1. T, 2. T)

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

Data range: 0.1 to 100.0 seconds

Factory set value: Input 1_Proportional cycle time (1. T):
Relay contact output: 20.0 seconds
Voltage pulse output and triac output: 2.0 seconds
Input 2_Proportional cycle time (2. T):
Relay contact output: 20.0 seconds
Voltage pulse output and triac output: 2.0 seconds

The Proportional cycle time becomes invalid when the Voltage/Current output is selected as control output type.

■ Device address 1 (Slave address 1) (Add1)

Device address 1 is used to set the Slave address of the controller for Communication 1 function (optional).

Data range: 0 to 99 (RKC communication, Modbus)
Factory set value: 0

Do not use the same device address for more than one controller in multi-drop connection. Each controller must have a unique address in multi-drop connection.

In Modbus communication, two-way communication is not possible when the address is 0.

■ Communication speed 1 (bPS1)

Communication speed 1 is to set communication speed for Communication 1 function (optional).

Data range: 2.4: 2400 bps
4.8: 4800 bps
9.6: 9600 bps
19.2: 19200 bps
38.4: 38400 bps
Factory set value: 9.6

Set the same communication speed for both the HA400/900/401/901 (slave) and the host computer (master).

■ Data bit configuration 1 (bIT1)

This item is data bit configuration of communication 1 function (optional).

Data range: Refer to below

[Data bit configuration table]

Set value	Data bit	Parity bit	Stop bit
8n1 (8n1)	8	Without	1
8n2 (8n2)	8	Without	2
8E1 (8E1)	8	Even	1
8E2 (8E2)	8	Even	2
8o1 (8o1)	8	Odd	1
8o2 (8o2)	8	Odd	2
7n1 (7n1) *	7	Without	1
7n2 (7n2) *	7	Without	2
7E1 (7E1) *	7	Even	1
7E2 (7E2) *	7	Even	2
7o1 (7o1) *	7	Odd	1
7o2 (7o2) *	7	Odd	2

Setting range of Modbus

Setting range of RKC communication

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

Factory set value: 8n1 (Data bit: 8, Parity bit: Without, Stop bit: 1)

■ Interval time 1 (InT1)

This item is Interval time of Communication 1 function (optional).

Data range: 0 to 250 ms

Factory set value: 10

Interval Time function:

The Interval time for the HA400/900 (HA401/901) should be set to provide a time for host computer to finish sending all data including stop bit and switch the line to receive status for the host.

If the Interval time between the two is too short, the HA400/900 (HA401/901) may send data before the host computer is ready to receive it. In this case, communication transmission cannot be conducted correctly. For a successful communication sequence to occur, the HA400's or HA900's (the HA401's or HA901's) interval time must match the specifications of the host computer.

■ Device address 2 (Slave address 2) (Add2)

Device address 2 is used to set the Slave address of the controller for Communication 2 function (optional).

Data range: 0 to 99 (RKC communication, Modbus)
0 to 63 (DeviceNet)
0 to 64 (CC-Link: 1 station occupied 1 time, 1 station occupied 4 times, 1 station occupied 8 times)
0 to 126 (PROFIBUS)
1 to 61 (CC-Link: 4 stations occupied 1 time)

Factory set value: 0

Do not use the same device address for more than one controller in multi-drop connection. Each controller must have a unique address in multi-drop connection.

In Modbus, PROFIBUS and CC-Link communications, two-way communications are not possible when the addresses are 0.

■ Communication speed 2 (bPS2)

Communication speed 2 is to set communication speed for Communication 2 function (optional).

Data range:

2.4: 2400 bps	125: 125 kbps [1]	156: 156 kbps [2]
4.8: 4800 bps	250: 250 kbps [1]	625: 625 kbps [2]
9.6: 9600 bps	500: 500 kbps [1]	2500: 2.5 Mbps [2]
19.2: 19200 bps		5000: 5 Mbps [2]
38.4: 38400 bps		10000: 10 Mbps [2]

[1] A communication speed of 125 to 500 kbps can be selected for DeviceNet.

[2] A communication speed of 156 kbps, 625 kbps, and 2.5 to 10 Mbps can be selected for CC-Link.

Factory set value: 9.6 (RKC communication, Modbus)
125 (DeviceNet)
156 (CC-Link)

Set the same communication speed for both the HA400/900/401/901 (slave) and the host computer (master).

Communication speed 2 is not necessary to be selected for PROFIBUS.

■ Data bit configuration 2 (bIT2)

This item is Data bit configuration of Communication 2 function (optional).

Data range: Refer to below

[Data bit configuration table]

Set value	Data bit	Parity bit	Stop bit
8n1 (8n1)	8	Without	1
8n2 (8n2)	8	Without	2
8E1 (8E1)	8	Even	1
8E2 (8E2)	8	Even	2
8o1 (8o1)	8	Odd	1
8o2 (8o2)	8	Odd	2
7n1 (7n1) *	7	Without	1
7n2 (7n2) *	7	Without	2
7E1 (7E1) *	7	Even	1
7E2 (7E2) *	7	Even	2
7o1 (7o1) *	7	Odd	1
7o2 (7o2) *	7	Odd	2

Setting range of Modbus

Setting range of RKC communication

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

Factory set value: 8n1 (Data bit: 8, Parity bit: Without, Stop bit: 1)

Data bit configuration 2 is not necessary to be selected for PROFIBUS, DeviceNet and CC-Link.

■ Interval time 2 (InT2)

This item is Interval time of Communication 2 function (optional).

Data range: 0 to 250 ms

Factory set value: 10

Interval Time function: Refer to “Interval time 1 (InT1)” on page 47.

If the Interval time between the two is too short, the HA400/900 (HA401/901) may send data before the host computer is ready to receive it. In this case, communication transmission cannot be conducted correctly. For a successful communication sequence to occur, the HA400’s or HA900’s (the HA401’s or HA901’s) interval time must match the specifications of the host computer.

■ Infrared communication address (Add3)

Infrared communication address is used to set the device address of the controller for Infrared communication function.

Data range: 0 to 99
Factory set value: 0

■ Infrared communication speed (bPS3)

This item is communication speed of the Infrared communication function.

Data range: 9.6: 9600 bps 19.2: 19200 bps
Factory set value: 19.2

The factory set value of the Infrared communication speed of your PDA's * is 19200 bps.

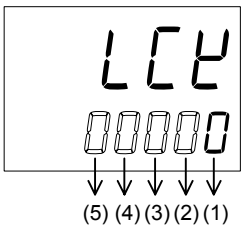
Data bit, Stop bit and Parity bit on this controller under Infrared communication are fixed to the following settings. The relevant bits on the PDA* are fixed to the same settings as on this controller prior to factory set value. Therefore do not change them at the site.

- Data bit: 7-bit
- Parity bit: Even
- Stop bit: 1-bit

* The PDA being used is necessary to be installed with the infrared communication software RKCIR.

■ Set lock level (LCK)

The Set lock level restricts parameter setting changes by key operation (Set data lock function).
This function prevents the operator from making errors during operation.



Data range:

(1) Parameters other than Set value (SV) and Event set value (EV1 to EV4):
0: Unlock 1: Lock

(2) Event set value (EV1 to EV4)
0: Unlock 1: Lock

(3) Set value (SV)
0: Unlock 1: Lock

(4) **"0" Fixed (No setting)**

(5) **"0" Fixed (No setting)**

Factory set value: 00000

In the Set lock level, Data lock is not possible for the following parameters.

- Memory area selection (SV setting & Monitor mode),
- Parameters of function block number F10 to F91 (Engineering mode)

Set lock level can be changed in both RUN and STOP mode.

Parameters protected by Data lock function are still displayed for monitoring.

8. ENGINEERING MODE

⚠ WARNING

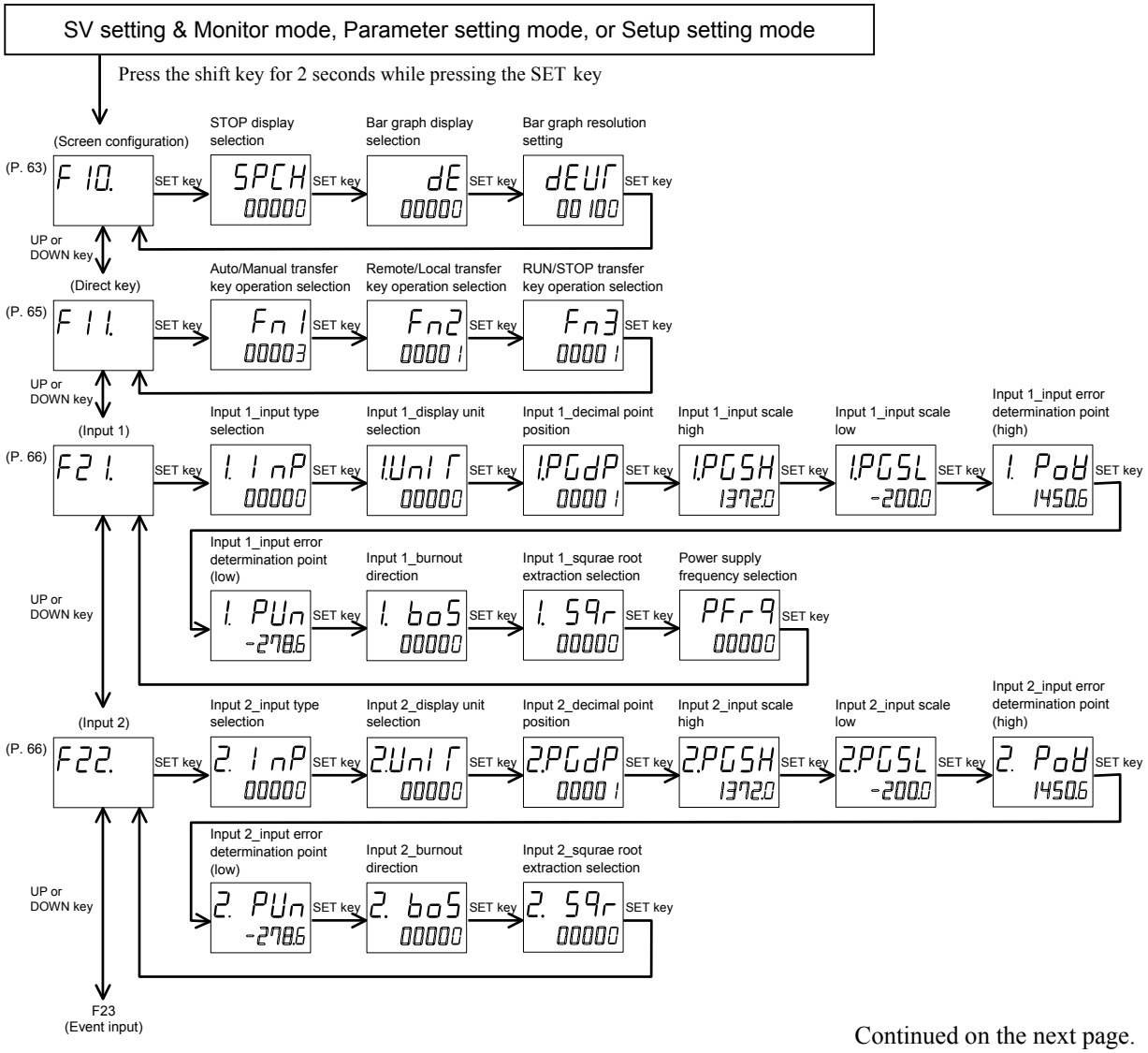
Parameters in the Engineering mode should be set according to the application before setting any parameter related to operation. Once the Parameters in the Engineering mode are set correctly, no further changes need to be made to parameters for the same application under normal conditions. If they are changed unnecessarily, it may result in malfunction or failure of the instrument. RKC will not bear any responsibility for malfunction or failure as a result of improper changes in the Engineering mode.

Parameters in Engineering mode are settable only when the controller is in STOP mode.

All parameters of the engineering mode are displayed regardless of the instrument specification.

8.1 Display Sequence

To go to Engineering mode, press the shift key for 2 seconds while pressing the SET key at SV setting & Monitor mode, Parameter setting mode, or Setup setting mode.



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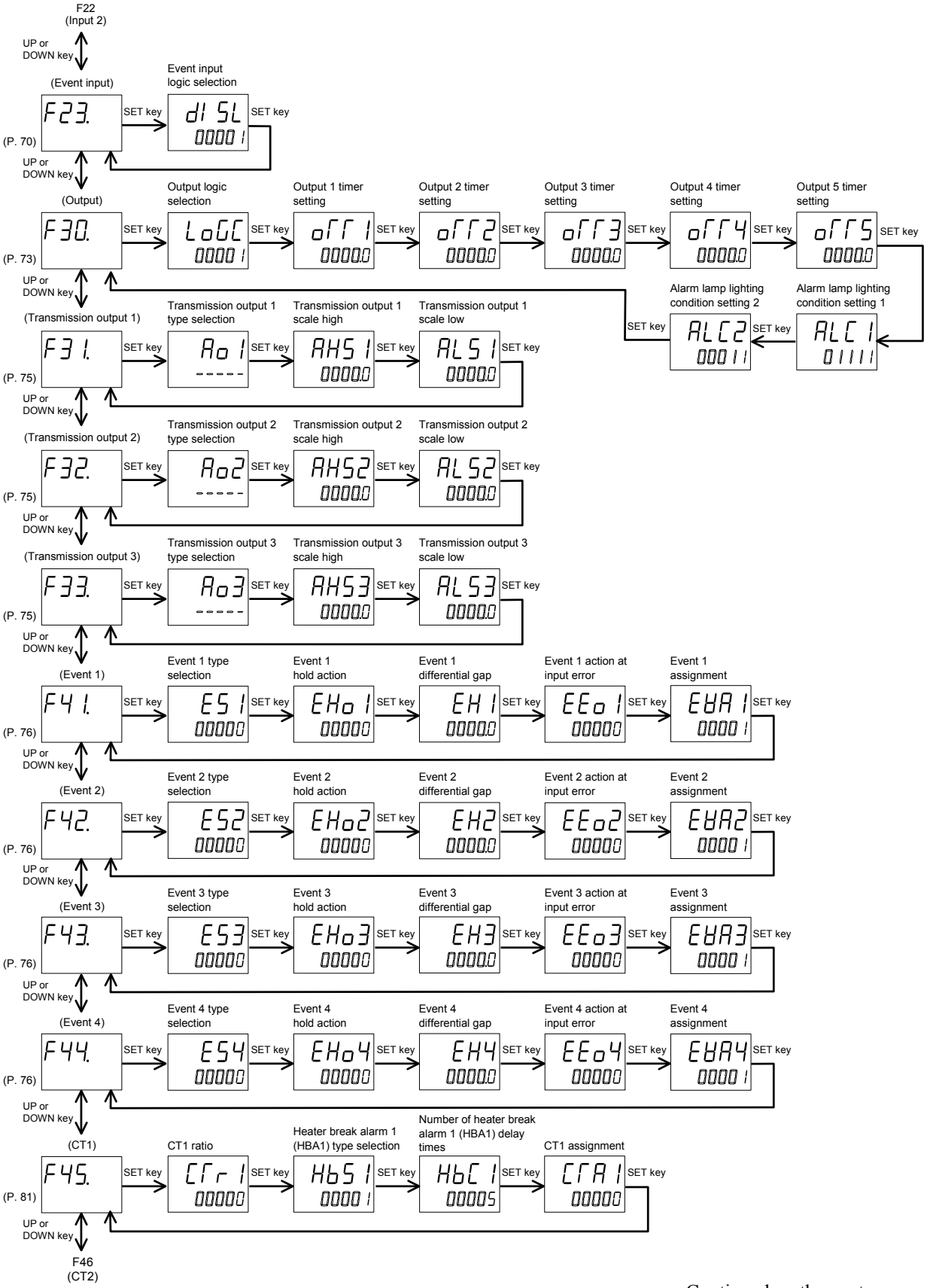

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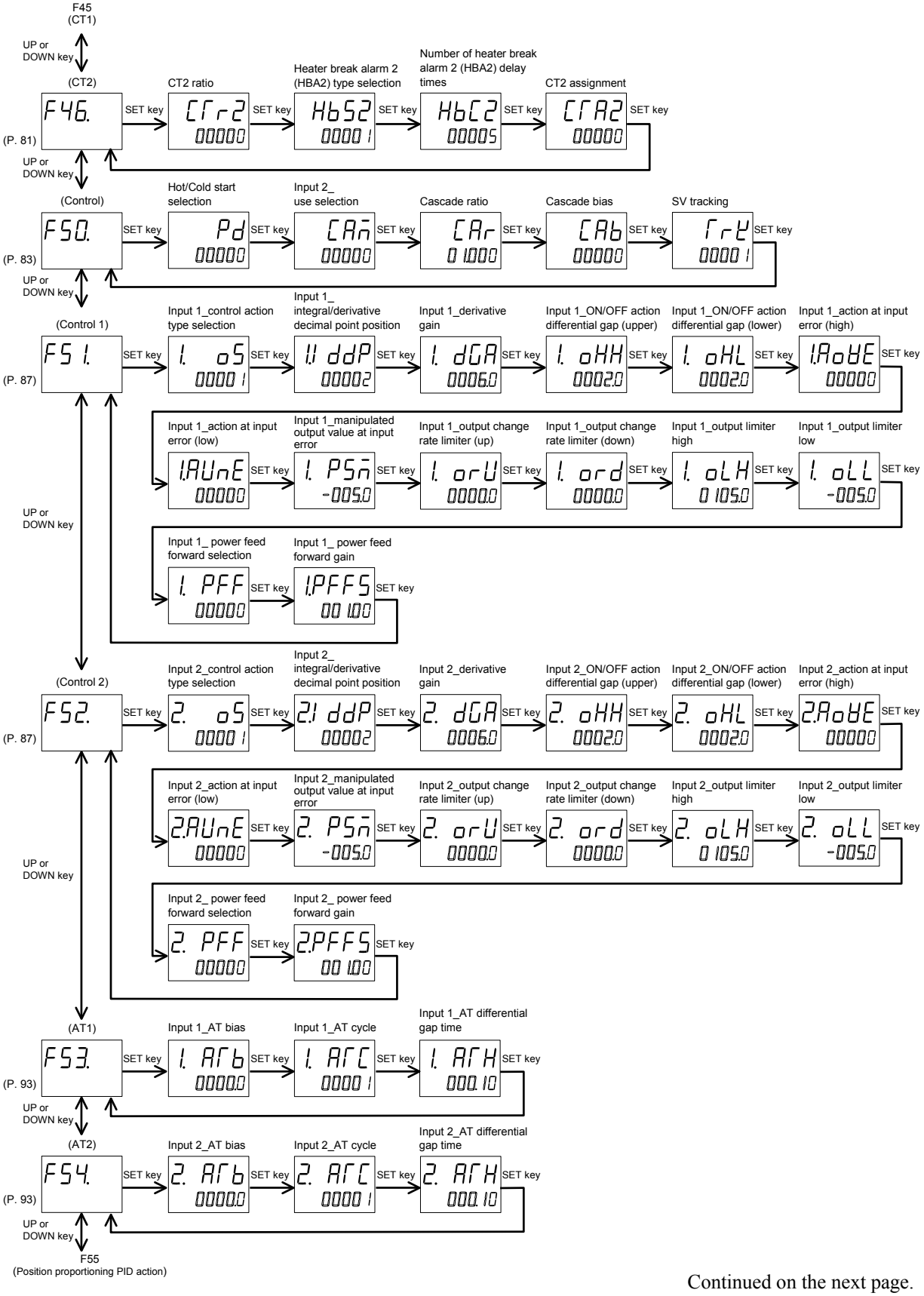

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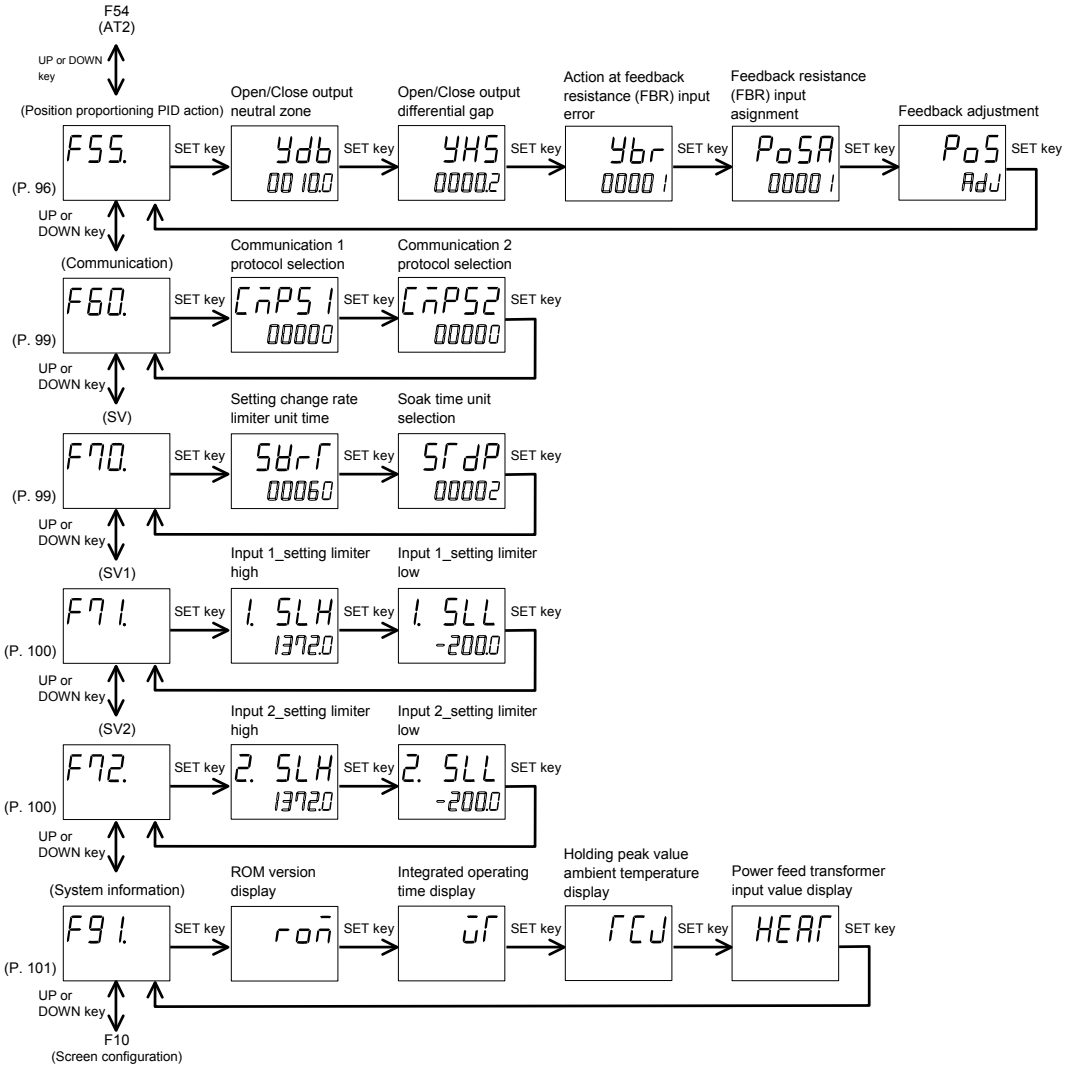

To return to the SV setting & Monitor mode, press and hold the SET key for 2 seconds, or press the shift key while pressing the SET key.

If the key is not pressed within 1 minute, the display will automatically return to the SV setting & Monitor mode.

8.2 Parameter List

Function block		Parameter		Page
F10. (F10.)	Screen configuration	STOP display selection	SPCH (SPCH)	P. 63
		Bar graph display selection	dE (dE)	P. 64
		Bar graph resolution setting	dEUT (dEUT)	
F11. (F11.)	Direct key	Auto/Manual transfer key operation selection	Fn1 (Fn1)	P. 65
		Remote/Local transfer key operation selection	Fn2 (Fn2)	
		RUN/STOP transfer key operation selection	Fn3 (Fn3)	
F21. (F21.)	Input 1	Input 1_input type selection	1. InP (1. InP)	P. 66
		Input 1_display unit selection	1.UnIT (1. UnIT)	P. 67
		Input 1_decimal point position	1.PGdP (1.PGdP)	
		Input 1_input scale high	1.PGSH (1.PGSH)	
		Input 1_input scale low	1.PGSL (1.PGSL)	P. 68
		Input 1_input error determination point (high)	1. PoH (1. PoV)	
		Input 1_input error determination point (low)	1. PUn (1. PUn)	
		Input 1_burnout direction	1. boS (1.boS)	P. 69
		Input 1_square root extraction selection	1. SQr (1. SQr)	
		Power supply frequency selection	PFrQ (PFrQ)	
F22. (F22.)	Input 2	Input 2_input type selection	2. InP (2. InP)	P. 66
		Input 2_display unit selection	2.UnIT (2. UnIT)	P. 67
		Input 2_decimal point position	2.PGdP (2.PGdP)	
		Input 2_input scale high	2.PGSH (2.PGSH)	
		Input 2_input scale low	2.PGSL (2.PGSL)	P. 68
		Input 2_input error determination point (high)	2. PoH (2. PoV)	
		Input 2_input error determination point (low)	2. PUn (2. PUn)	
		Input 2_burnout direction	2. boS (2.boS)	P. 69
		Input 2_square root extraction selection	2. SQr (2. SQr)	
F23. (F23.)	Event input	Event input logic selection	dISL (dISL)	P. 70
F30. (F30.)	Output	Output logic selection	LoGC (LoGC)	P. 73
		Output 1 timer setting	oTT1 (oTT1)	P. 74
		Output 2 timer setting	oTT2 (oTT2)	
		Output 3 timer setting	oTT3 (oTT3)	
		Output 4 timer setting	oTT4 (oTT4)	
		Output 5 timer setting	oTT5 (oTT5)	
		Alarm lamp lighting condition setting 1	ALC1 (ALC1)	
		Alarm lamp lighting condition setting 2	ALC2 (ALC2)	

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Function block		Parameter		Page
F31. (F31.)	Transmission output 1	Transmission output 1 type selection	Ao1 (Ao1)	P. 75
		Transmission output 1 scale high	AHS1 (AHS1)	
		Transmission output 1 scale low	ALS1 (ALS1)	
F32. (F32.)	Transmission output 2	Transmission output 2 type selection	Ao2 (Ao2)	P. 75
		Transmission output 2 scale high	AHS2 (AHS2)	
		Transmission output 2 scale low	ALS2 (ALS2)	
F33. (F33.)	Transmission output 3	Transmission output 3 type selection	Ao3 (Ao3)	P. 75
		Transmission output 3 scale high	AHS3 (AHS3)	
		Transmission output 3 scale low	ALS3 (ALS3)	
F41. (F41.)	Event 1	Event 1 type selection	ES1 (ES1)	P. 76
		Event 1 hold action	EHo1 (EHo1)	P. 78
		Event 1 differential gap	EH1 (EH1)	P. 79
		Event 1 action at input error	EEo1 (EEo1)	P. 80
		Event 1 assignment	EVA1 (EVA1)	
F42. (F42.)	Event 2	Event 2 type selection	ES2 (ES2)	P. 76
		Event 2 hold action	EHo2 (EHo2)	P. 78
		Event 2 differential gap	EH2 (EH2)	P. 79
		Event 2 action at input error	EEo2 (EEo2)	P. 80
		Event 2 assignment	EVA2 (EVA2)	
F43. (F43.)	Event 3	Event 3 type selection	ES3 (ES3)	P. 76
		Event 3 hold action	EHo3 (EHo3)	P. 78
		Event 3 differential gap	EH3 (EH3)	P. 79
		Event 3 action at input error	EEo3 (EEo3)	P. 80
		Event 3 assignment	EVA3 (EVA3)	
F44. (F44.)	Event 4	Event 4 type selection	ES4 (ES4)	P. 76
		Event 4 hold action	EHo4 (EHo4)	P. 78
		Event 4 differential gap	EH4 (EH4)	P. 79
		Event 4 action at input error	EEo4 (EEo4)	P. 80
		Event 4 assignment	EVA4 (EVA4)	
F45. (F45.)	CT input 1 (CT1)	CT1 ratio	CTr1 (CTr1)	P. 81
		Heater break alarm 1 (HBA1) type selection	HbS1 (HbS1)	
		Number of heater break alarm 1 (HBA1) delay times	HbC1 (HbC1)	P. 82
		CT1 assignment	CTA1 (CTA1)	

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Function block		Parameter		Page
F46. (F46.)	CT input 2 (CT2)	CT2 ratio	CTr2 (CTr2)	P. 81
		Heater break alarm 2 (HBA2) type selection	HbS2 (HbS2)	
		Number of heater break alarm 2 (HBA2) delay times	HbC2 (HbC2)	P. 82
		CT2 assignment	CTA2 (CTA2)	
F50. (F50.)	Control	Hot/Cold start selection	Pd (Pd)	P. 83
		Input 2_use selection	CAM (CAM)	P. 84
		Cascade ratio	CAr (CAr)	
		Cascade bias	CAb (CAb)	P. 85
		SV tracking	TrK (TrK)	P. 86
F51. (F51.)	Control 1	Input 1_control action type selection	1. oS (1. oS)	P. 87
		Input 1_integral/derivative decimal point position	1.1 ddP (1.IddP)	
		Input 1_derivative gain	1. dGA (1. dGA)	
		Input 1_ON/OFF action differential gap (upper)	1. oHH (1. oHH)	P. 88
		Input 1_ON/OFF action differential gap (lower)	1. oHL (1. oHL)	
		Input 1_action at input error (high)	1.AoVE (1.AoVE)	P. 89
		Input 1_action at input error (low)	1.AUnE (1.AUnE)	
		Input 1_manipulated output value at input error	1. PSM (1. PSM)	
		Input 1_output change rate limiter (up)	1. orU (1. orU)	P. 90
		Input 1_output change rate limiter (down)	1. ord (1. ord)	P. 91
		Input 1_output limiter high	1. oLH (1. oLH)	
		Input 1_output limiter low	1. oLL (1. oLL)	
		Input 1_power feed forward selection	1. PFF (1. PFF)	P. 92
		Input 1_power feed forward gain	1.PFFS (1.PFFS)	P. 93
F52. (F52.)	Control 2	Input 2_control action type selection	2. oS (2. oS)	P. 87
		Input 2_integral/derivative decimal point position	2.1 ddP (2.IddP)	
		Input 2_derivative gain	2. dGA (2. dGA)	
		Input 2_ON/OFF action differential gap (upper)	2. oHH (2. oHH)	P. 88
		Input 2_ON/OFF action differential gap (lower)	2. oHL (2. oHL)	
		Input 2_action at input error (high)	2.AoVE (2.AoVE)	P. 89
		Input 2_action at input error (low)	2.AUnE (2.AUnE)	
		Input 2_manipulated output value at input error	2. PSM (2. PSM)	
		Input 2_output change rate limiter (up)	2. orU (2. orU)	P. 90
		Input 2_output change rate limiter (down)	2. ord (2. ord)	P. 91
		Input 2_output limiter high	2. oLH (2. oLH)	
		Input 2_output limiter low	2. oLL (2. oLL)	

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Function block		Parameter		Page
F52. (F52.)	Control 2	Input 2_power feed forward selection	2. PFF (2. PFF)	P. 92
		Input 2_power feed forward gain	2.PFFS (2.PFFS)	P. 93
F53. (F53.)	Autotuning 1 (AT1)	Input 1_AT bias	1. ATb (1. ATb)	P. 93
		Input 1_AT cycle	1. ATC (1. ATC)	P. 94
		Input 1_AT differential gap time	1. ATH (1. ATH)	P. 95
F54. (F54.)	Autotuning 2 (AT2)	Input 2_AT bias	2. ATb (2. ATb)	P. 93
		Input 2_AT cycle	2. ATC (2. ATC)	P. 94
		Input 2_AT differential gap time	2. ATH (2. ATH)	P. 95
F55. (F55.)	Position proportioning PID action	Open/Close output neutral zone	Ydb (Ydb)	P. 96
		Open/Close output differential gap	YHS (YHS)	P. 97
		Action at feedback resistance (FBR) input error	Ybr (Ybr)	
		Feedback resistance (FBR) input assignment	PoSA (PoSA)	
		Feedback adjustment	PoS (PoS)	P. 98
F60. (F60.)	Communication	Communication 1 protocol selection	CMPS1 (CMPS1)	P. 99
		Communication 2 protocol selection	CMPS2 (CMPS2)	
F70. (F70.)	Set value (SV)	Setting change rate limiter unit time	SVrT (SVrT)	P. 99
		Soak time unit selection	STdP (STdP)	
F71. (F71.)	Set value 1 (SV1)	Input 1_setting limiter high	1. SLH (1. SLH)	P. 100
		Input 1_setting limiter low	1. SLL (1. SLL)	
F72. (F72.)	Set value 2 (SV2)	Input 2_setting limiter high	2. SLH (2. SLH)	P. 100
		Input 2_setting limiter low	2. SLL (2. SLL)	
F91. (F91.)	System information	ROM version display	RoM (RoM)	P. 101
		Integrated operating time display	WT (WT)	
		Holding peak value ambient temperature display	TCJ (TCJ)	
		Power feed transformer input value display	HEAT (HEAT)	

8.3 Precaution Against Parameter Change

If any of the following parameters is changed, the set values of relevant parameters are initialized or is automatically converted according to the new setting. It may result in malfunction or failure of the instrument.

- **Input Type Selection of Input 1 (1. InP)**
- **Input Type Selection of Input 2 (2. InP)**
- **Engineering Display Unit Selection of Input 1 (1. UnIT)**
- **Engineering Display Unit Selection of Input 2 (2. UnIT)**
- **Input 1_Decimal Point Position (1. PGdP)**
- **Input 2_Decimal Point Position (2. PGdP)**
- **Event 1 Type Selection (ES1)**
- **Event 2 Type Selection (ES2)**
- **Event 3 Type Selection (ES3)**
- **Event 4 Type Selection (ES4)**
- **Transmission Output 1 Type Selection (Ao1)**
- **Transmission Output 2 Type Selection (Ao2)**
- **Transmission Output 3 Type Selection (Ao3)**

Before changing any parameter setting on the above list, always record all parameter settings in SV setting & Monitor mode, Setup setting mode, Parameter setting mode and Engineering mode. And after the change, always check all parameter settings in SV setting & Monitor mode, Setup setting mode, Parameter setting mode and Engineering mode by comparing them with the record taken before the change.

When any one of the following parameters' settings are changed,

- **Input Type Selection of Input 1 (1. InP)**
- **Input Type Selection of Input 2 (2. InP)**
- **Engineering Display Unit Selection of Input 1 (1. UnIT)**
- **Engineering Display Unit Selection of Input 2 (2. UnIT)**

all parameter settings shown in the table below will be changed to Factory Default Values according to the new setting. They must be changed according to the application.

Mode	Description	Default value		
		TC input	RTD input	Voltage/current input
Engineering mode	Decimal point position	1 (One decimal place)		
	Input scale high	Maximum value of input range		100.0
	Input scale low	Minimum value of input range		0.0
	Input error determination point (high)	Maximum value of input range + (5 % of input span)		
	Input error determination point (low)	Minimum value of input range − (5 % of input span)		
	Burnout direction	0 (Upscale)		
	Transmission output 1 scale high	Measured value (PV) and Set value (SV): Input scale high Manipulated output value (MV): 100.0 Deviation: +Input span		
	Transmission output 2 scale high			
	Transmission output 3 scale high			

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Mode	Description	Default value		
		TC input	RTD input	Voltage/current input
Engineering mode	Transmission output 1 scale low	Measured value (PV) and Set value (SV): Input scale low Manipulated output value (MV): 0.0 Deviation: −Input span		
	Transmission output 2 scale low			
	Transmission output 3 scale low			
	Event 1 hold action	0 (Without hold action)		
	Event 2 hold action			
	Event 3 hold action			
	Event 4 hold action			
	Event 1 differential gap	2.0 °C [°F]		0.2 % of input span
	Event 2 differential gap			
	Event 3 differential gap			
	Event 4 differential gap			
	Cascade ratio	1.000 (Input 2 only)		
	Cascade bias	0.0 (Input 2 only)		
	ON/OFF action differential gap (upper)	1.0 °C [°F]		0.1 % of input span
	ON/OFF action differential gap (lower)			
	AT bias	0		
	Setting limiter high	Input scale high		
	Setting limiter low	Input scale low		
Setup setting mode	PV bias	0		
	PV ratio	1.000		
	PV low input cut-off	0.00 %		
Parameter setting mode	Event 1 set value	50		
	Event 2 set value			
	Event 3 set value			
	Event 4 set value			
	Control loop break alarm1 (LBA1) time	480 seconds		
	Control loop break alarm2 (LBA2) time			
	LBA1 deadband	0.0		
	LBA2 deadband			
	Proportional band	30		
	Integral time	240.0 seconds		
	Derivative time	60.0 seconds		
	Control response parameter	0 (Slow)		
	Setting change rate limiter (up)	OFF (Unused)		
	Setting change rate limiter (down)			
SV setting & Monitor mode	Set value (SV)	0.0 °C [°F]		0.0 %

When any one of the following parameters' settings are changed,

- **Event 1 Type Selection (ES1)**
- **Event 2 Type Selection (ES2)**
- **Event 3 Type Selection (ES3)**
- **Event 4 Type Selection (ES4)**

all parameter settings shown in the table below will be changed to Factory Default Values according to the new setting. They must be changed according to the application.

Mode	Description	Default value		
		TC input	RTD input	Voltage/current input
Engineering mode	Event 1 hold action	0 (Without hold action)		
	Event 2 hold action			
	Event 3 hold action			
	Event 4 hold action			
	Event 1 differential gap	2.0 °C [°F]		0.2 % of input span
	Event 2 differential gap			
	Event 3 differential gap			
	Event 4 differential gap			
Parameter setting mode	Event 1 set value	50		
	Event 1 set value			
	Event 1 set value			
	Event 1 set value			
	Control loop break alarm1 (LBA1) time (Event 3 only)	480 seconds		
	Control loop break alarm2 (LBA2) time (Event 4 only)	480 seconds		
	LBA1 deadband (Event 3 only)	0.0		
	LBA2 deadband (Event 4 only)	0.0		

When any one of the following parameters' settings are changed,

- **Transmission Output 1 Type Selection (Ao1)**
- **Transmission Output 2 Type Selection (Ao2)**
- **Transmission Output 3 Type Selection (Ao3)**

all parameter settings shown in the table below will be changed to Factory Default Values according to the new setting. They must be changed according to the application.

Mode	Description	Default value		
		TC input	RTD input	Voltage/current input
Engineering mode	Transmission output 1 scale high	Measured value (PV) and Set value (SV): Input scale high Manipulated output value (MV): 100.0 Deviation: +Input span		
	Transmission output 2 scale high			
	Transmission output 3 scale high			
	Transmission output 1 scale low	Measured value (PV) and Set value (SV): Input scale low Manipulated output value (MV): 0.0 Deviation: –Input span		
	Transmission output 2 scale low			
	Transmission output 3 scale low			

When any one of the following parameters' settings are changed,

- **Input 1_Decimal Point Position (1. PGdP)**
- **Input 2_Decimal Point Position (2. PGdP)**

all parameter settings shown in the table below will be automatically converted into the a values to match the new decimal point position as long as the converted values are in the acceptable range of each parameter. They must be check and changed if necessary according to the application

Mode	Description
Engineering mode	Input scale high
	Input scale low
	Input error determination point (high)
	Input error determination point (low)
	Transmission output 1 scale high
	Transmission output 2 scale high
	Transmission output 3 scale high
	Transmission output 1 scale low
	Transmission output 2 scale low
	Transmission output 3 scale low
	Event 1 hold action
	Event 2 hold action
	Event 3 hold action
	Event 4 hold action
	ON/OFF action differential gap (upper)
	ON/OFF action differential gap (lower)
	Setting limiter high
	Setting limiter low
Setup setting mode	PV bias
Parameter setting mode	Event 1 set value
	Event 2 set value
	Event 3 set value
	Event 4 set value
	LBA deadband
	Proportional band
	Setting change rate limiter (up)
	Setting change rate limiter (down)
SV setting & Monitor mode	Set value (SV)

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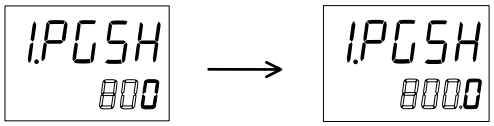
Precaution and Example of automatic conversion

- Decimal point position moves in accordance with the setting change.

Example: When the setting of the decimal point position is changed from 0 (no decimal place) to 1 (the first decimal place) with Input scale high (1.PGSH) set to 800 °C:

(1.PGSH) (1.PGSH)



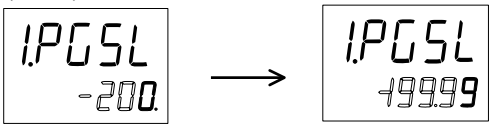
(Changed from 800 to 800.0)

The display will change from 800 to 800.0.

- The displayed range of the controller is between −19999 and +99999 regardless of the decimal point position.

Example: When RTD input is selected for Input 1, and Input Scale Low (1.PGSL) is 200°C, the decimal point position is changed from 0 to 2:

(1.PGSL) (1.PGSL)

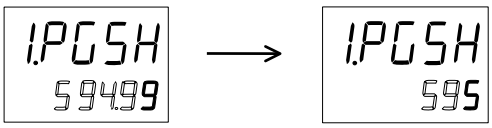


(Input scale low becomes −199.99, because −200.00 is out of the display range.)

- When a number of decimal places for the set value is reduced due to the decimal point change, the set value is rounded off to the first decimal place and will be displayed without any decimal place.

Example: When the decimal point position is changed from 2 (two decimal places) to 0 (no decimal place) and Input scale high (1.PGSH) is 594.99:

(1.PGSH) (1.PGSH)



(The figure is rounded off to the first decimal place, and the Input Scale High 1.PGSH becomes 595.)

In the above example, if the decimal point position is changed back to 2 from 0, "1.PGSH" becomes 595.00.

8.4 Screen Configuration (F10)

■ STOP display selection (SPCH)

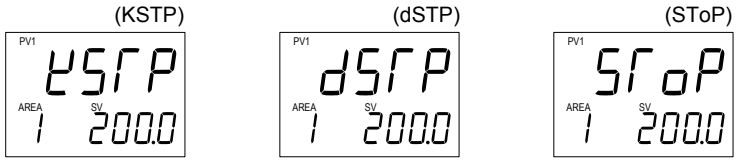
STOP message for control STOP mode can be displayed either on the upper display or the lower display.
SPCH is to select the display to show the STOP message.

Data range: 0: Displays on the Measured value (PV1/PV2) unit (TYPE 1)
1: Displays on the Set value (SV) unit (TYPE 2)

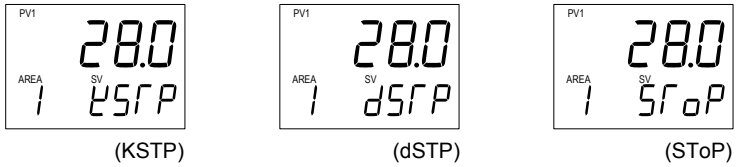
Factory set value: 0

There are three different characters for STOP mode depending on how to be transfered from RUN to STOP.

TYPE1:



TYPE2:



Display explanations:

		RUN/STOP with Event input	
		RUN (Contact closed)	STOP (Contact open)
RUN/STOP with key operation	RUN	RUN	STOP
		STOP is not displayed	dSTP (dSTP)
	STOP	STOP	STOP
		KSTP (KSTP)	STOP (STOP)

■ Bar graph display selection (dE)

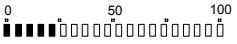
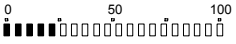
Use to select the contents of the bar graph display.

Data range:
0: No display
1: Input 1_manipulated output value (MV)
2: Input 1_measured value (PV)
3: Input 1_set value (SV)
4: Input 1_deviation value
5: Feedback resistance input value (POS)
6: Input 2_manipulated output value (MV)
7: Input 2_measured value (PV)
8: Input 2_set value (SV)
9: Input 2_deviation value

Factory set value: 0

Related parameters: Bar graph resolution setting (P. 64)

Bar graph display explanation:

Manipulated output value (MV) display	Displays the Manipulated output value (MV). When Manipulated output value (MV) is at 0 % or less, the left-end dot of the bar-graph flashes. When MV exceeds 100 %, the right-end dot flashes. [Display example] 
Measured value (PV) display	Scaling is available within the input range. [Display example] 
Set value (SV) display	Displays the Set value (SV). Scaling is available within the input range. [Display example] 
Deviation value display	Displays the deviation between the Measured value (PV) and the Set value (SV). When the Deviation display is selected, the dots at both ends of bar-graph light. A display resolution per dot is settable from 1 to 100. [Display example] 
Feedback resistance input value (POS) display	Displays the Feedback resistance input value (POS). It is available only with position proportioning PID control. [Display example] 

The number of dot points: 10 dots (HA400/401) 20 dots (HA900/901)

■ Bar graph resolution setting (dEUT)

Use to set the bar graph display resolution for the deviation display. Set several digits per 1 dot of the bar graph.

Data range: 1 to 100 digit/dot

Factory set value: 100

Related parameters: Bar graph display selection (P. 64)

8.5 Direct Key (F11)

■ Auto/Manual transfer key operation selection (Fn1)

Use to select Use/Unuse of Auto/Manual transfer key (A/M).

Data range: 0: Unused
1: Auto/Manual transfer for Input 1
2: Auto/Manual transfer for Input 2
3: Common Auto/Manual transfer for Input 1 and Input 2

Factory set value: 3

■ Remote/Local transfer key operation selection (Fn2)

Use to select Use/Unuse of Remote/Local transfer key (R/L).

Data range: 0: Unused
1: Remote/Local transfer

Factory set value: 1

■ RUN/STOP transfer key operation selection (Fn3)

Use to select Use/Unuse of RUN/STOP transfer key (R/S).

Data range: 0: Unused
1: RUN/STOP transfer

Factory set value: 1

8.6 Input 1 (F21) Input 2 (F22)

■ Input type selection (1. InP, 2. InP)

Data range: 0 to 23 (Refer to the following table)

[Input Range Table]

Set value	Input type		Input range	Hardware
0	TC input	K	–200 to +1372 °C or –328.0 to +2501.6 °F	Voltage (low) input group
1		J	–200 to +1200 °C or –328.0 to +2192.0 °F	
2		R	–50 to +1768 °C or –58.0 to +3214.4 °F	
3		S	–50 to +1768 °C or –58.0 to +3214.4 °F	
4		B	0 to 1800 °C or 32.0 to 3272.0 °F	
5		E	–200 to +1000 °C or –328.0 to +1832.0 °F	
6		N	0 to 1300 °C or 32.0 to 2372.0 °F	
7		T	–200 to +400 °C or –328.0 to +752.0 °F	
8		W5Re/W26Re	0 to 2300 °C or 32.0 to 4172.0 °F	
9		PLII	0 to 1390 °C or 32.0 to 2534.0 °F	
19	Voltage (low) input	0 to 1 V	Programmable range (–19999 to +99999)	
20		0 to 100 mV		
21		0 to 10 mV		
12	RTD input	3-wire system Pt100	–200 to +850 °C or –328.0 to +1562.0 °F	
13		3-wire system JPt100	–200 to +600 °C or –328.0 to +1112.0 °F	
22		4-wire system Pt100	–200 to +850 °C or –328.0 to +1562.0 °F	
23		4-wire system JPt100	–200 to +600 °C or –328.0 to +1112.0 °F	
14	Current input	0 to 20 mA	Programmable range (–19999 to +99999)	
15		4 to 20 mA		
16	Voltage (high) input	0 to 10 V	Programmable range (–19999 to +99999)	Voltage (high) input group
17		0 to 5 V		
18		1 to 5 V		

An input type change may only be made within the hardware groups as shown above.

Do not set to any number (including 10 and 11) which is not described in the input range table above. This may cause malfunctioning.

4-wire RTD input type (22 and 23) can not be selected for Input type selection of Input 2 (2. InP).

Refer to the above input range table to select input type of the remote input. Input range 0 to 13, 22 or 23 can not be selected for the Remote input.

Factory set value: Input 1_input type selection (1. InP):
Based on model code. (When not specifying: Type K)
Input 2_input type selection (2. InP):
Based on model code. (When not specifying: Type K)

Related parameters: Display unit selection (P. 67), Decimal point position (P. 67), Input scale high (P. 67), Input scale low (P. 68)

■ Display unit selection (1. UnIT, 2. UnIT)

Use to select the temperature unit for thermocouple (TC) and RTD inputs.

Data range: 0: °C
1: °F

Factory set value: Input 1_display unit selection (1. UnIT): 0
Input 2_display unit selection (2. UnIT): 0

■ Decimal point position (1. PGdP, 2. PGdP)

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

Data range:
TC inputs: 0 to 1
RTD inputs: 0 to 2
Voltage (V)/Current (I) inputs: 0 to 4

0: No decimal place
1: One decimal place
2: Two decimal places
3: Three decimal places
4: Four decimal places

Factory set value: Input 1_decimal point position (1. PGdP): 1
Input 2_decimal point position (2. PGdP): 1

Related parameters: Input type selection (P. 66), Input scale high (P. 67), Input scale low (P. 68)

■ Input scale high (1. PGSH, 2. PGSH)

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

Data range:
TC/RTD inputs:
Input scale low to Maximum value of the selected input range
Voltage (V)/Current (I) inputs:
−19999 to +99999 (Varies with the setting of the decimal point position)

Factory set value: Input 1_input scale high (1. PGSH):
TC/RTD inputs: Maximum value of the selected input range
Voltage (V)/Current (I) inputs: 100.0
Input 2_input scale high (2. PGSH):
TC/RTD inputs: Maximum value of the selected input range
Voltage (V)/Current (I) inputs: 100.0

Related parameters: Input type selection (P. 66), Decimal point position (P. 67), Input scale low (P. 68)

Input Scale High function:
The input scale range can be easily set by setting the Input scale high limit/low.

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

■ Input scale low (1. PGSL, 2. PGSL)

This value is to set the low limit of the input scale range.

Data range: TC/RTD inputs: Minimum value of the selected input range to Input scale high
Voltage (V)/Current (I) inputs:
−19999 to +99999 (Varies with the setting of the decimal point position)

Factory set value: Input 1_input scale low (1. PGSL):
TC/RTD inputs: Minimum value of the selected input range
Voltage (V)/Current (I) inputs: 0.0
Input 2_input scale low (2. PGSL):
TC/RTD inputs: Minimum value of the selected input range
Voltage (V)/Current (I) inputs: 0.0

Related parameters: Input type selection (P. 66), Decimal point position (P. 67), Input scale high (P. 67)

Input Scale Low function:
The input scale range can be easily set by setting the input scale high limit/low limit

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

■ Input error determination point (high) (1. PoV, 2. PoV)

Use to set Input error determination point (high). Input error determination function is activated when a measured value reaches the limit, and control output value selected by Action at input error will be output.

Data range: Input scale low − (5 % of input span) to Input scale high + (5 % of input span)

Factory set value: Input 1_input error determination point (high) (1. PoV)
TC/RTD inputs: Input scale high + (5 % of input span)
Voltage (V)/Current (I) inputs: 105.0
Input 2_input error determination point (high) (2. PoV)
TC/RTD inputs: Input scale high + (5 % of input span)
Voltage (V)/Current (I) inputs: 105.0

Related parameters: Input error determination point (low) (P. 68), Action at input error (high) (P. 89), Action at input error (low) (P. 89), Manipulated output value at input error (P. 89)

■ Input error determination point (low) (1. PUn, 2. PUn)

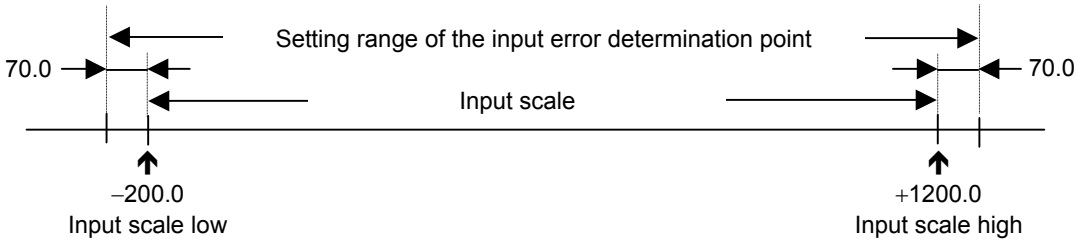
Use to set Input error determination point (low). Input error determination function is activated when a measured value reaches the limit, and control output value selected by Action at input error will be output.

Data range: Input scale low − (5 % of input span) to Input scale high + (5 % of input span)

Factory set value: Input 1_input error determination point (low) (1. PUn)
TC/RTD inputs: Input scale low − (5 % of input span)
Voltage (V)/Current (I) inputs: −5.0
Input 2_input error determination point (low) (2. PUn)
TC/RTD inputs: Input scale low − (5 % of input span)
Voltage (V)/Current (I) inputs: −5.0

Related parameters: Input error determination point (high) (P. 68), Action at input error (high) (P. 89), Action at input error (low) (P. 89), Manipulated output value at input error (P. 89)

[Example] When the input scale is −200.0 to +1200.0:
Input span: 1400.0, 5 % of input span: 70.0, Setting range: −270.0 to +1270.0



■ Burnout direction (1. boS, 2. boS)

Use to select Burnout direction in input break. When input break is detected by the controller, the measured value go either Upscale or Downscale according to the Burnout direction setting.

Data range: 0: Upscale
1: Downscale

Factory set value: Input 1_burnout direction (1. boS): 0
Input 2_burnout direction (2. boS): 0

For the following types of input, the action when an input break occurs is fixed, regardless of the Burnout direction setting.
- **RTD input: Upscale**
- **Voltage (high) input: Downscale (Indicates value near 0 V)**
- **Current input: Downscale (Indicates value near 0 mA)**

■ Square root extraction selection (1. SQr, 2. SQr)

Use to select Use/Unuse of the Square root extraction for the measured value.

Data range: 0: Unused
1: Used

Factory set value: Input 1_square root extraction selection (1. SQr): 0
Input 2_square root extraction selection (2. SQr): 0

Square Root Extraction function:

The controller can receive the input signal directly from a differential pressure type flow transmitter by using Square root extraction function without using a square root extractor.

■ Power supply frequency selection (PFrQ)

Use to select the power supply frequency of the controller suited to the application.

Data range: 0: 50 Hz
1: 60 Hz

Factory set value: 0

8.7 Event Input (F23)

■ Event input logic selection (dISL)

Use to assign the function (memory area, operation mode) for the Event inputs (DI 1 to DI 7).

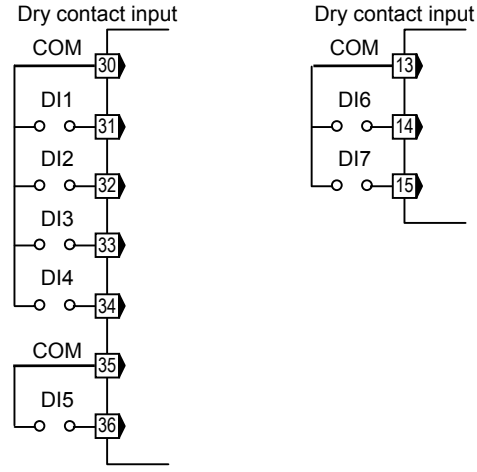
Data range: 0 to 6 (Refer to the following table)

[Function Assignment Table]

Set value	DI 1	DI 2	DI 3	DI 4	DI 5	DI 6	DI 7
	Terminal No. 30-31	Terminal No. 30-32	Terminal No. 30-33	Terminal No. 30-34	Terminal No. 35-36	Terminal No. 13-14	Terminal No. 13-15
0	Unused (No function assignment)						
1	Memory area number selection (1 to 16)				Memory area set	RUN/STOP transfer	Auto/Manual transfer
2	Memory area number selection (1 to 16)				Memory area set	RUN/STOP transfer	Remote/Local transfer
3	Memory area number selection (1 to 16)				Memory area set	Remote/Local transfer	Auto/Manual transfer
4	Memory area number selection (1 to 8)			Memory area set	RUN/STOP transfer	Remote/Local transfer	Auto/Manual transfer
5	Memory area number selection (1 to 8)			Memory area set	Remote/Local transfer	Unused	Unused
6	Memory area number selection (1 to 8)			Memory area set	Auto/Manual transfer	Unused	Unused

DI 6 and DI 7 cannot be used when the Communication 1 function is specified.

Event input terminals:



Contact input from external devices or equipment should be dry contact input. If it is not dry contact input, the input should have meet the specifications below.
Contact specifications: At OFF (contact open) 500 kΩ or more
At ON (contact closed) 10 Ω or less

Factory set value: 1

Event Input function: Refer to bellow.

● Contact status of memory area number selection

To store a new Memory area number as the Control area, close the DI for Memory area set.

Event input	Memory area number															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DI 1	×	–	×	–	×	–	×	–	×	–	×	–	×	–	×	–
DI 2	×	×	–	–	×	×	–	–	×	×	–	–	×	×	–	–
DI 3	×	×	×	×	–	–	–	–	×	×	×	×	–	–	–	–
DI 4	×	×	×	×	×	×	×	×	–	–	–	–	–	–	–	–

×: Contact open –: Contact closed

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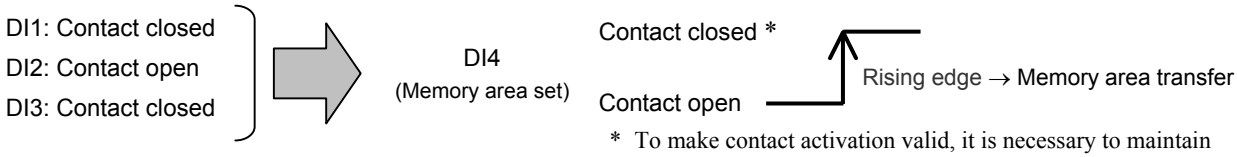
Transfer timing of memory area number:

[Example] Change the memory area number to 6
(when "4" is selected in "Event input logic selection")

First, close the contacts between DI1 and DI3 and the common terminal. Next, open the contact between DI2 and the common. Then, close the contact between DI4 and the common from open status, the memory area in the controller will change to "6".



* To make contact activation valid, it is necessary to maintain the same contact state (contact closed) for more than 200 ms.

- **DI Status for mode transfer**

	Contact closed	Contact open	No event input or not selected
RUN/STOP transfer	RUN (Control RUN)	STOP (Control STOP)	RUN (Control RUN)
Auto/Manual transfer	Auto	Manual	Auto
Remote/Local transfer *	Remote or cascade control	Local	Local

* If "Input 2_use selection (CAM)" of the Engineering mode is changed to "2: Cascade control (Slave)," "Remote/Local" needs to be changed to "Cascade/Local."

- **RUN/STOP transfer**

Mode select from front key or communication	Status of event input (DI)	Actual operation mode	STOP display
RUN (Control RUN)	Contact closed	RUN (Control RUN)	STOP is not displayed
	Contact open	STOP (Control STOP)	dSTP
STOP (Control STOP)	Contact closed		EXTP
	Contact open		StoP

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- **Auto/Manual transfer**

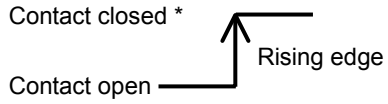
Mode select from front key or communication	Status of event input (DI)	Actual operation mode	Display lamp
Auto	Contact closed	Auto	MAN mode lamp ON
	Contact open	Manual	MAN mode lamp OFF
Manual	Contact closed		
	Contact open		

- **Remote/Local transfer**

Mode select from front key or communication	Status of event input (DI)	Actual operation mode	Display lamp
Remote	Contact closed	Remote	REM mode lamp ON
	Contact open	Local	REM mode lamp OFF
Local	Contact closed		
	Contact open		

Transfer timing of RUN/STOP, Auto/Manual, and Remote/Local:

The selection operation is taken when DI contact is closed from the open condition (Rising edge).



* To make contact activation valid, it is necessary to maintain the same contact state (contact closed) for more than 200 ms.

8.8 Output (F30)

■ Output logic selection (LoGC)

This is used to assign the output function (control output, event, etc.) for the output (OUT1 to OUT5).

Data range: 1 to 11 (Refer to the following table)

[Output Assignment Table] (M: Relay contact output, V: Voltage pulse output, R: Current output, E: Voltage, T: Triac output)

Set value	OUT1 (M/V/R/E/T)	OUT2 (M/V/R/E/T)	OUT3 (M/V/R/E/T)	OUT4 (M)	OUT5 (M)	Note
1	MV 1	HBA 1 (Energized) HBA 2 (Energized)	EV 3 (Energized) EV 4 (Energized)	EV 2 (Energized)	EV 1 (Energized)	—
2	MV 1	HBA 1 (De-energized HBA 2 (De-energized	EV 3 (De-energized) EV 4 (De-energized)	EV 2 (De-energized)	EV 1 (De-energized)	—
3	MV 1	EV 3 (Energized) EV 4 (Energized) HBA 1 (Energized) HBA 2 (Energized)	EV 2 (Energized)	EV 1 (Energized)	FAIL (De-energized)	Energized alarm corresponding to FAIL output
4	MV 1	EV 3 (De-energized) EV 4 (De-energized) HBA 1 (De-energized HBA 2 (De-energized	EV 2 (De-energized)	EV 1 (De-energized)	FAIL (De-energized)	De-energized alarm corresponding to FAIL output
5	MV 1	MV 2	EV 4 (Energized) HBA 2 (Energized)	EV 3 (Energized) HBA 1 (Energized)	EV 1 (Energized) EV 2 (Energized)	Energized alarm corresponding to two loops control
6	MV 1	MV 2	EV 4 (De-energized) HBA 2 (De-energized	EV 3 (De-energized) HBA 1 (De-energized	EV 1 (De-energized) EV 2 (De-energized)	De-energized alarm corresponding to two loops control
7	MV 1	MV 2	EV 3 (Energized) EV 4 (Energized) HBA 1 (Energized) HBA 2 (Energized)	EV 2 (Energized)	EV 1 (Energized)	Energized alarm corresponding to two loops control
8	MV 1	MV 2	EV 3 (De-energized) EV 4 (De-energized) HBA 1 (De-energized HBA 2 (De-energized	EV 2 (De-energized)	EV 1 (De-energized)	De-energized alarm corresponding to two loops control
9	MV 1 (OPEN)	MV 1 (CLOSE)	EV 3 (Energized) EV 4 (Energized) HBA 1 (Energized) HBA 2 (Energized)	EV 2 (Energized)	EV 1 (Energized)	Energized alarm corresponding to position proportioning PID control
10	MV 1 (OPEN)	MV 1 (CLOSE)	EV 3 (De-energized) EV 4 (De-energized) HBA 1 (De-energized HBA 2 (De-energized	EV 2 (De-energized)	EV 1 (De-energized)	De-energized alarm corresponding to position proportioning PID control
11	MV 1	EV 4 (Energized) HBA 2 (Energized)	EV 3 (Energized) HBA 1 (Energized)	EV 2 (Energized)	EV 1 (Energized)	Energized alarm

MV 1 = Manipulated output value of Input 1, MV 2 = Manipulated output value of Input 2, MV 1 (OPEN) = Open-side control output of Position proportioning PID control, MV 1 (CLOSE) = Close-side control output of Position proportioning PID control, HBA 1 = Output of Heater break alarm 1, HBA 2 = Output of Heater break alarm 2, EV 1 = Output of Event 1, EV 2 = Output of Event 2, EV 3 = Output of Event 3, EV 4 = Output of Event 4, FAIL = FAIL output

An output logic becomes *OR* output when two or more output functions are assigned to one output.

When three transmission outputs are selected, the transmission outputs are automatically assigned to OUT1 through OUT3 and it has priority over the Output logic selection (LoGC). To select Manipulated output value of Input 1 or Input 2 as output type of OUT1, OUT2 or OUT3, select "1. MV: Input 1_manipulated output value (MV)" or "2. MV: Input 2_ manipulated output value (MV)" at the parameters of Transmission output type selection.

Factory set value: For 1-input controller: 1
For 2-input controller: 5

Related parameters: Output timer setting (P. 74), Alarm lamp lighting condition setting (P. 74), Event type selection (P. 76), Transmission output type selection (P. 75), CT assignment (P. 82)

■ Output timer setting (oTT1 to oTT5)

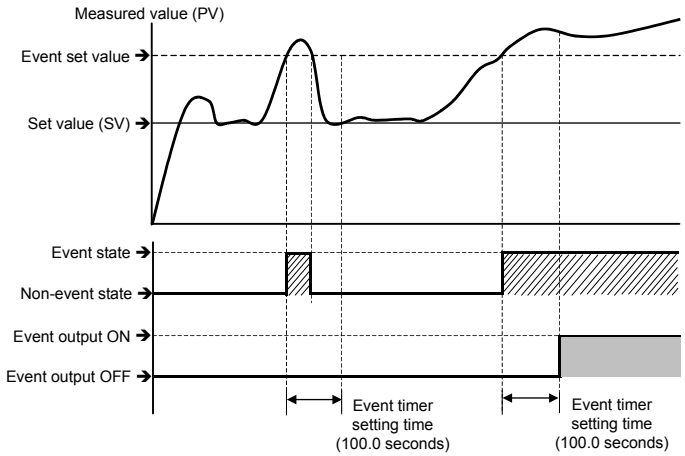
Output timer setting is to set an output delay time for event outputs.

Data range: 0.0 to 600.0 seconds
Factory set value: 0.0
Related parameters: Output logic selection (P. 73), Alarm lamp lighting condition setting (P. 74), Event type selection (P. 76)

Output Timer Setting function:

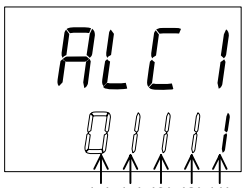
When an event condition becomes ON status, the output is suppressed until the Output Timer set time elapses. After the time is up, if the event output is still ON status, the output will be produced.

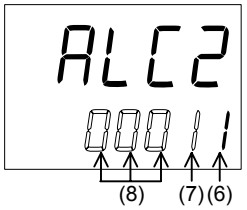
Example: When set the event timer to 100.0 seconds.



■ Alarm lamp lighting condition setting (ALC1, ALC2)

Use to set an alarm (ALM) lamp lighting conditions to Event 1 to Event 4, HBA1 and HBA2.





Data range:

[ALC1 screen]

(1) Event 1
0: ALM lamp is not lit 1: ALM lamp is lit

(2) Event 2
0: ALM lamp is not lit 1: ALM lamp is lit

(3) Event 3
0: ALM lamp is not lit 1: ALM lamp is lit

(4) Event 4
0: ALM lamp is not lit 1: ALM lamp is lit

(5) **"0" fixed (No setting)**

[ALC2 screen]

(6) HBA1 (Heater break alarm 1)
0: ALM lamp is not lit 1: ALM lamp is lit

(7) HBA2 (Heater break alarm 2)
0: ALM lamp is not lit 1: ALM lamp is lit

(8) **"0" fixed (No setting)**

Factory set value: Event 1 to Event 4: 1 (ALM lamp is lit)
HBA1, HBA2: 1 (ALM lamp is lit)
Related parameters: Output logic selection (P. 73), Output timer setting (P. 74), Event type selection (P. 76)

The alarm lamp is lit through the *OR* operation of Event 1 to Event 4, HBA1 and HBA2 each of which is set to "1: ALM lamp is lit."

8.9 Transmission Output 1_Type (F31) Transmission Output 2_Type (F32) Transmission Output 3_Type (F33)

■ Transmission output type selection (Ao1, Ao2, Ao3)

Use to select the transmission output type.

Data range:
- - - - - : None
1. PV (1. PV): Input 1_measured value (PV)
1. SV (1. SV): Input 1_set value (SV)
1. dEV (1.dEV): Input 1_deviation value
1. MV (1. MV): Input 1_manipulated output value (MV)
2. PV (2. PV): Input 2_measured value (PV)
2. SV (2. SV): Input 2_set value (SV)
2. dEV (2.dEV): Input 2_deviation value
2. MV (2. MV): Input 2_manipulated output value (MV)
PoS (PoS): Feedback resistance input value (POS)

Factory set value: - - - - - (None)

Related parameters: Transmission output scale high (P. 75), Transmission output scale low (P. 75)

Specify the output type of the transmission output when ordering.

When transmission outputs are selected and used, the outputs are allocated as follows.
- Transmission output 1: output 1 (OUT1)
- Transmission output 2: output 2 (OUT2)
- Transmission output 3: output 3 (OUT3)

The transmission has priority over the Output logic selection (LoGC).

■ Transmission output scale high (AHS1, AHS2, AHS3)

Use to set a scale high limit value of the transmission output.

Data range:
Measured value (PV) and Set value (SV): Input scale low to Input scale high
Manipulated output value (MV) and
Feedback resistance input value (POS): −5.0 to +105.0 %
Deviation: −Input span to +Input span

Factory set value:
Measured value (PV) and Set value (SV): Input scale high
Manipulated output value (MV) and
Feedback resistance input value (POS): 100.0
Deviation: +Input span

Related parameters: Transmission output type selection (P. 75), Transmission output scale low (P. 75)

■ Transmission output scale low (ALS1, ALS2, ALS3)

Use to set a scale low limit value of the transmission output.

Data range:
Measured value (PV) and Set value (SV): Input scale low to Input scale high
Manipulated output value (MV) and
Feedback resistance input value (POS): −5.0 to +105.0 %
Deviation: −Input span to +Input span

Factory set value:
Measured value (PV) and Set value (SV): Input scale low
Manipulated output value (MV) and
Feedback resistance input value (POS): 0.0
Deviation: −Input span

Related parameters: Transmission output type selection (P. 75), Transmission output scale high (P. 75)

8.10 Event 1 Type (F41) Event 3 Type (F43) Event 2 Type (F42) Event 4 Type (F44)

■ Event type selection (ES1, ES2, ES3, ES4)

Use to select a type of the event 1, 2, 3 and 4.

Data range:
0: None
1: Deviation high [1]
2: Deviation low [1]
3: Deviation high/low [1]
4: Band [1]
5: Process high [1]
6: Process low [1]
7: SV high
8: SV low
9: Control loop break alarm (LBA) [2]

[1] Event hold action is available.
[2] "9: Control loop break alarm (LBA)" can be selected only for Event 3 and Event 4.

Factory set value: 0

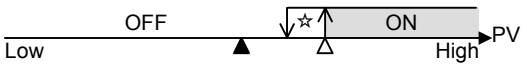
Related parameters: Output logic selection (P. 73), Output timer setting (P. 74), Alarm lamp lighting condition setting (P. 74), Event hold action (P. 78), Event differential gap (P. 79), Event assignment (P. 80), Event action at input error (P. 80), Event set value (P. 35), Control loop break alarm (LBA) time (P. 35), LBA deadband (P. 36)

● Event action type

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

Deviation high:

(Event set value is greater than 0.)

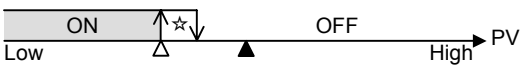


(Event set value is less than 0.)

Deviation low:

(Event set value is greater than 0.)

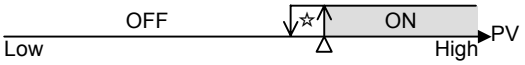
(Event set value is less than 0.)



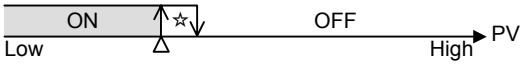
Deviation high/low:

Band:

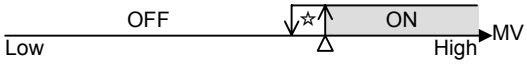
Process high:



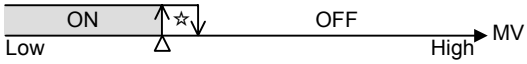
Process low:



SV high:



SV low:



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● Control loop break alarm (LBA)

The Control loop break alarm (LBA) function is used to detect a load (heater) break or a failure in the external actuator (magnet relay, etc.), or a failure in the control loop caused by an input (sensor) break. The LBA function is activated when control output reaches 0 % (low limit with output limit function) or 100 % (high limit with output limit function). LBA monitors variation of the Measured value (PV) for the length of LBA time. When the LBA time has elapsed and the PV is still within the alarm determination range, the LBA will be ON.

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

LBA determination range: TC/RTD input: 2 °C [2 °F] (fixed)
Voltage/Current input: 0.2 % of input span (fixed)

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

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

LBA function is not operative when:
- AT function is activated.
- The controller is in STOP mode.
- LBA function is set to “OFF.”
- LBA function is not assigned to Event (ES3) or Event 4 (ES4).

The LBA function does not detect a location which causes alarm status. If LBA alarm is ON, check each device or wiring of the control loop.

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

■ Event hold action (EHo1, EHo2, EHo3, EHo4)

Use to set a event hold action for the Event 1, 2, 3 or 4.

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

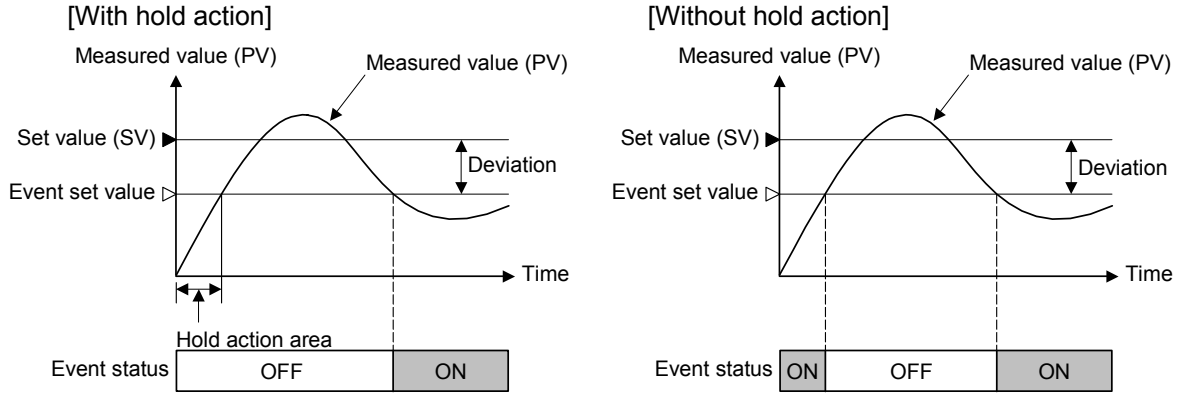
Data range: 0: OFF
1: ON
2: Re-hold action ON

Factory set value: 0

Related parameters: Event type selection (P. 76), Event differential gap (P. 79), Event assignment (P. 80), Event action at input error (P. 80), Event set value (P. 35)

● Hold action

When Hold action is ON, the event action is suppressed at start-up or STOP to RUN until the measured value has entered the non-event range.



● Re-hold action

When Re-hold action is ON, the event action is also suppressed at the control set value change until the Measured value has entered the non-event range.

Action condition	1: Hold action ON (Only Hold action)	2: Re-hold action ON (Hold and Re-hold actions)
When the power is turned on	Hold action	Hold action
When transferred from STOP (control STOP) to RUN (control RUN)	Hold action	Hold action
When the Set value (SV) is changed	Without Hold and Re-hold actions	Re-hold action

The Re-hold action is invalid for any of the following. However, the Hold action is valid.

- **When Setting change rate limiter other than "OFF (Unused)" are set**
- **When Remote/Local transfer is the remote mode**

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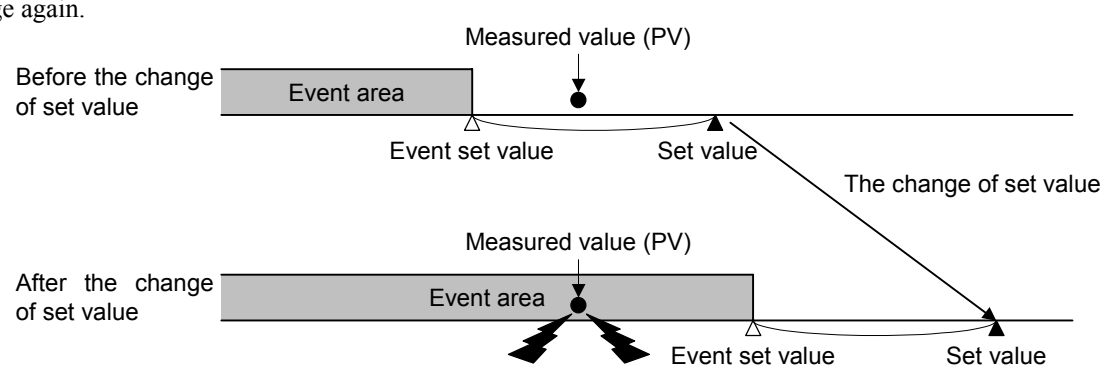
[Example] When Event 1 type is the deviation low:

When Re-hold action is OFF and event output type is deviation, the event output is produced due to the Set value change. The Re-hold action suppresses the alarm output until the Measured value has entered the non-event range again.



■ Event differential gap (EH1, EH2, EH3, EH4)

Use to set a differential gap of the Event 1, 2, 3 or 4.

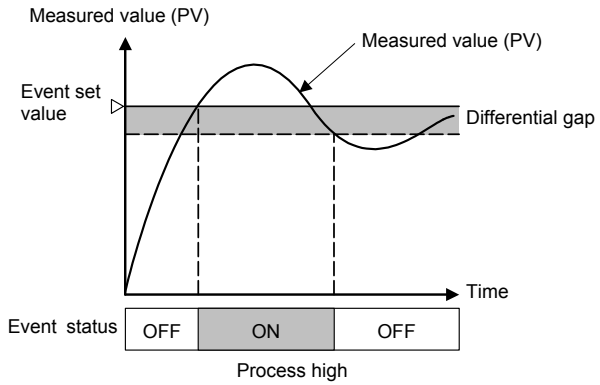
Data range: 0 to Input span
(Varies with the setting of the Decimal point position)

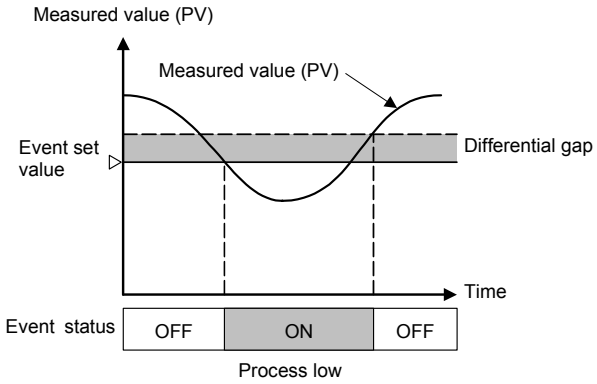
Factory set value: TC/RTD inputs: 2.0 °C [°F]
Voltage (V)/Current (I) inputs: 0.2 % of input span

Related parameters: Event type selection (P. 76), Event hold action (P. 78), Event assignment (P. 80), Event action at input error (P. 80), Event set value (P. 35)

Event differential gap function:

It prevents chattering of event output due to the measured value fluctuation around the Event set value.





■ Event action at input error (EEo1, EEo2, EEo3, EEo4)

Event action at input error is to select the Event action when the measured value reaches the Input error determination point (high or low limit).

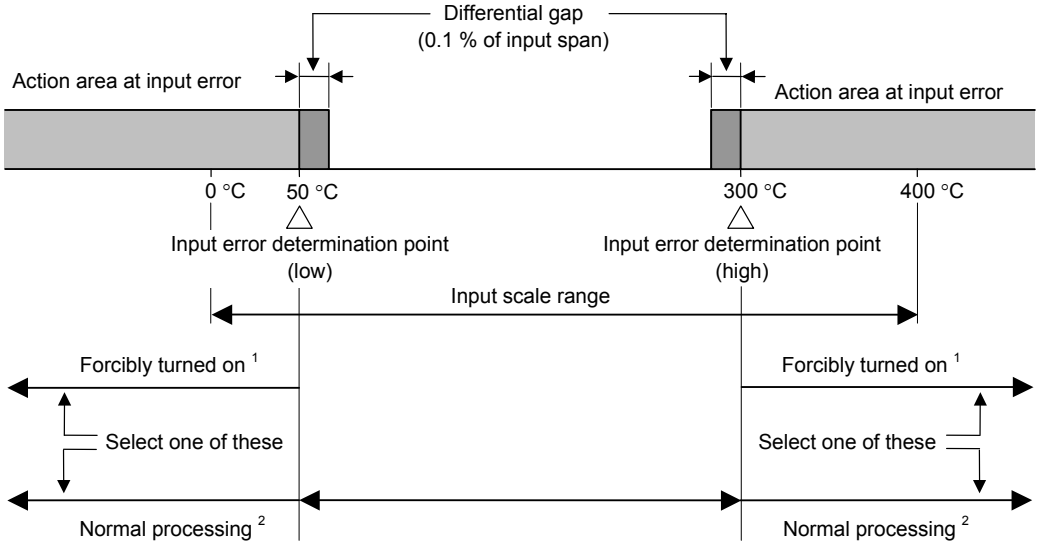
Data range: 0: Normal processing
1: Turn the event output ON

Factory set value: 0

Related parameters: Input error determination point (high) (P. 68),
Input error determination point (low) (P. 68)

Event action at input error:

Example: Input range: 0 to 400 °C
Input error determination point (high): 300 °C
Input error determination point (low): 50 °C



[1] The event output is forcibly turned on regardless of the event action status when the input is abnormal.

[2] The event output is produced depending on the selected event action status even if the input is abnormal.

■ Event assignment (EVA1, EVA2, EVA3, EVA4)

Use to assign event outputs to either Input 1 or Input 2.

Data range: 1: For Input 1
2: For Input 2

Factory set value: 1

Related parameters: Event type selection (P. 76), Event hold action (P. 78), Event differential gap (P. 79), Event action at input error (P. 80), Event set value (P. 35)

8.11 Current Transformer Input 1 (CT1) (F45) Current Transformer Input 2 (CT2) (F46)

The settings of parameters in this group become valid on the controller with the CT input (optional) function.

■ CT ratio (CTr1, CTr2)

Use to set the number of turns in the Current transformer which is used to monitor the current flowing through the load. There are two types of dedicated Current transformers.

Data range: 0 to 9999
Factory set value: When the CT type is CTL-6-P-N: 800
When the CT type is CTL-12-S56-10L-N: 1000
Related parameters: Output logic selection (P. 73), CT assignment (P. 82), Heater break alarm (HBA) set value (P. 42), Heater break determination point (P. 44), Heater melting determination point (P. 44)

■ Heater break alarm (HBA) type selection (HbS1, HbS2)

Use to select the Heater break alarm type.

Data range: 0: Heater break alarm (HBA) type A
1: Heater break alarm (HBA) type B
Factory set value: 1
Related parameters: Output logic selection (P. 73), CT ratio (P. 81), CT assignment (P. 82), Number of heater break alarm (HBA) delay times (P. 82), Heater break alarm (HBA) set value (P. 42), Heater break determination point (P. 44), Heater melting determination point (P. 44)

Heater Break Alarm Function:

< Heater break alarm (HBA) type A >

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

< Heater break alarm (HBA) type B >

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

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

■ Number of heater break alarm (HBA) delay times (HbC1, HbC2)

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 (HBA sampling cycle time: 500 ms).

Data range: 0 to 255
Factory set value: 5
Related parameters: Output logic selection (P. 73), CT ratio (P. 81), CT assignment (P. 82), Heater break alarm (HBA) type selection (P. 81), Heater break alarm (HBA) set value (P. 42), Heater break determination point (P. 44), Heater melting determination point (P. 44)

■ CT assignment (CTA1, CTA2)

Use to assign the current transformer input to an output from OUT1 to OUT5. The CT input 1 is tied to HBA1, and the CT input 2 tied to HBA2, so when CT1 is assigned to OUT1, HBA1 is also automatically assigned to OUT1.

Data range:
0: None
1: Output 1 (OUT1)
2: Output 2 (OUT2)
3: Output 3 (OUT3)
4: Output 4 (OUT4)
5: Output 5 (OUT5)

Factory set value:
CTA1 for:
Current transformer 1 (CT1) input not provided: 0
Current transformer 1 (CT1) input provided: 1 (When HBA1 is specified)
CTA2 for:
Current transformer 2 (CT2) input not provided: 0
Current transformer 2 (CT2) input provided: 2 (When HBA2 is specified)

Related parameters: Output logic selection (P. 73), CT ratio (P. 81), Heater break alarm (HBA) set value (P. 42), Heater break determination point (P. 44), Heater melting determination point (P. 44)

The Current transformer 1 (CTA1) is for the Heater break alarm 1 (HBA1). The Current transformer 2 (CTA2) is for the Heater break alarm 2 (HBA2). Select an appropriate output number by checking the Output logic selection or Transmission output type.

To use HBA for a three-phase load, both CT inputs can be assigned to the same output.

8.12 Control (F50)

■ Hot/Cold start selection (Pd)

Use to select the start mode at power recovery.

Data range: Refer to the following table

Set value	Power failure less than 3 seconds	Power failure 3 seconds or more
0	Hot start 1	Hot start 1
1	Hot start 1	Hot start 2
2	Hot start 1	Cold start
3	Hot start 2	Hot start 2
4	Hot start 2	Cold start
5	Cold start	Cold start
6	Hot start 1	Stop start
7	Hot start 2	Stop start
8	Stop start	Stop start

Factory set value: 0

Hot/Cold start function:

After the power failure, when power is back to the controller,

Hot start 1: the controller will return to the same operation mode and the same manipulated value which were used or calculated by the controller before power failure.

Hot start 2: the controller will return to the same operation mode which was used by the controller before power failure.

In the Manual mode, the output value will be at the low output limit value.
In the Auto mode, the controller will calculate the manipulated output value regardless that before power failure. So, the manipulated output varies.

Cold start: the controller will automatically go to Manual mode and output the low output limit value.

Stop start: Started in the control stop (STOP) state regardless of the RUN mode (Auto/Manual) before power failure. Set to the RUN mode before power failure when changed to RUN from STOP by RUN/STOP selection.

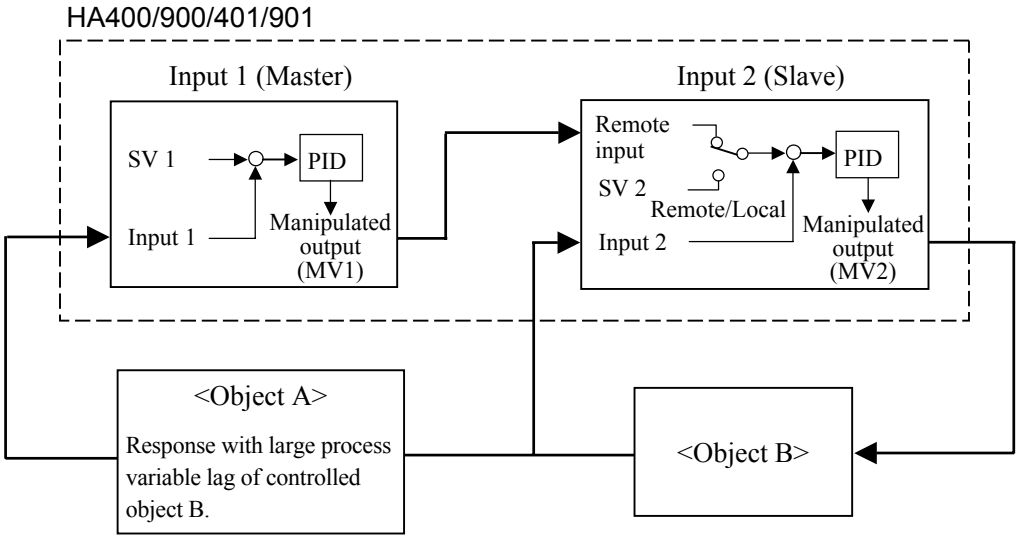
■ Input 2_use selection (CAM)

Use to select the usage of Input 2. Cascade control can be selected by this parameter.

Data range: 0: Single loop control
1: Remote input
2: Cascade control (Slave)

Factory set value: 0

Cascade control (slave) Diagram



■ Cascade ratio (CAr)

Cascade ratio is a multiplier which is used to convert the manipulated output (%) to cascade signal (°C or °F) at the cascade master.

Data range: 0.0000 to 1.5000
Factory set value: 1.0000
Related parameters: Cascade bias (P. 85)

■ Cascade bias (CAb)

The cascade bias is applied to the input value on the slave side in the cascade control.

Data range: −Input span to +Input span
Factory set value: 0
Related parameters: Cascade ratio (P. 84)

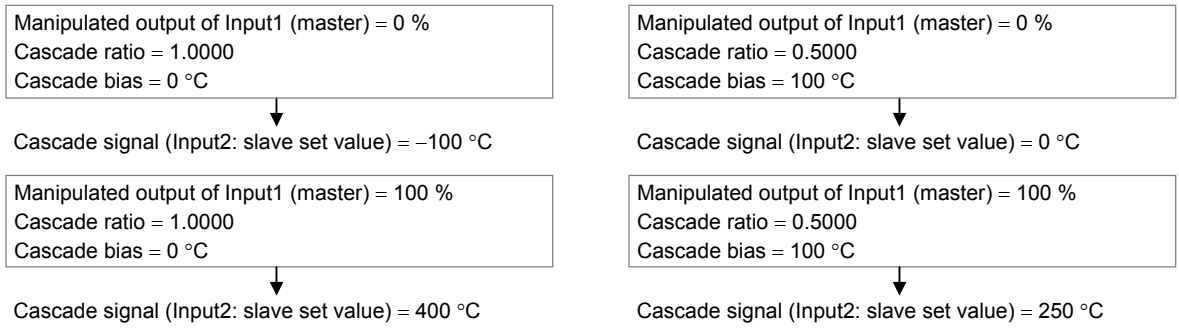
The functional description of the cascade control is shown in the following.

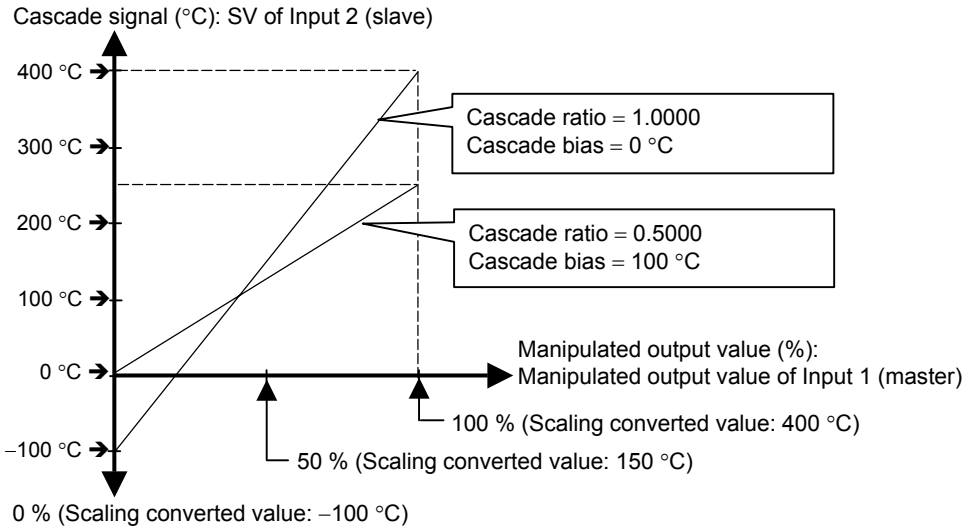
Cascade control

Cascade control monitors the controlled object temperature in the master unit and then corrects the set value in the slave unit depending on the deviation between the target value (set value) and actual temperature. The slave unit controls the non-controlled object (heater, refrigeration device, etc). As a result, the controlled object temperature can be reached and controlled at the target value. Cascade control is suitable for an application which has a large time lag between the heat/refrigeration source and section whose temperature is necessary to be controlled.

Example: Relationship between the manipulated output (%) in the cascade master and relevant cascade signal (°C)

Output scale in the Input 1 (master): 0 to 100 %
Input scale in the Input 2: −100 to +400 °C





■ SV tracking (TrK)

To select Use/Unuse of SV tracking.

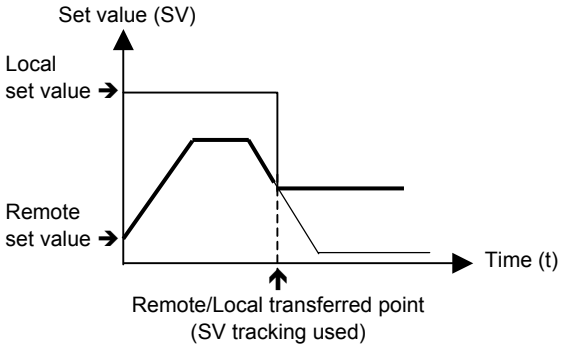
Data range: 0: Unused
1: Used

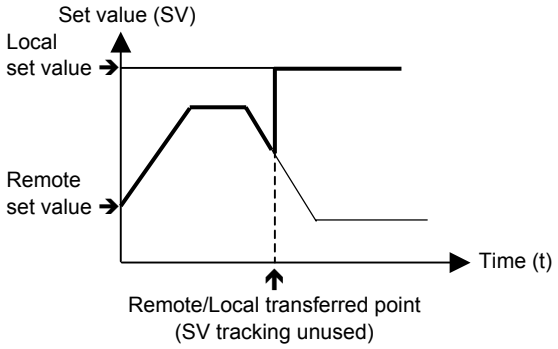
Factory set value: 1

SV Tracking function:

With SV tracking function, when Remote/Local mode is transferred from Remote to Local, the set value used in Remote mode before the mode transfer will be kept using in Local mode to prevent rapid set value change.

Operation mode:	Local →	Remote →	Local
Set value used	Local set value	Remote set value	Local set value
SV tracking used	Local set value ≠ Remote set value	Local set value = Remote set value	Local set value = Remote set value
SV tracking unused	Local set value ≠ Remote set value	Local set value ≠ Remote set value	Local set value ≠ Remote set value





8.13 Control 1 (F51) Control 2 (F52)

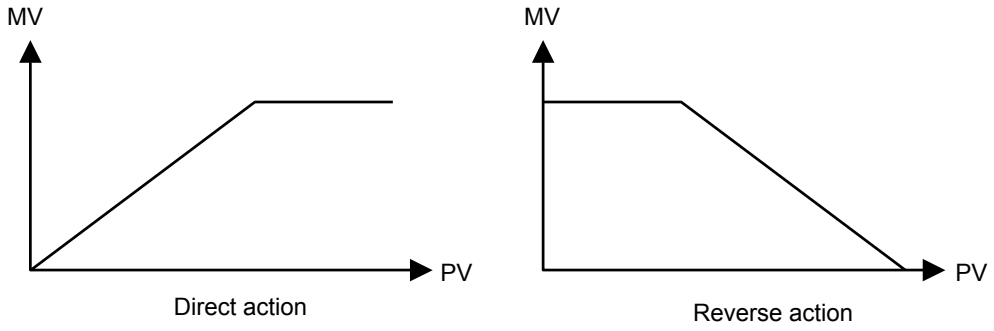
■ Control action type selection (1. oS, 2. oS)

Use to select Direct action/Reverse action.

Data range: 0: Direct action
1: Reverse action

Factory set value: Input 1_control action type selection (1. oS): 1
Input 2_control action type selection (2. oS): 1

Control action type: Direct action: The Manipulated output value (MV) increases as the Measured value (PV) increases. This action is used generally for cool control.
Reverse action: The Manipulated output value (MV) decreases as the Measured value (PV) increases. This action is used generally for heat control.



■ Integral/Derivative time decimal point position selection (1. IddP, 2. IddP)

Use to select a decimal point position of Integral time and Derivative time in PID control.

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

Factory set value: Input 1_integral/derivative time decimal point position selection (1. IddP): 2
Input 2_integral/derivative time decimal point position selection (2. IddP): 2

Related parameters: Integral time (P. 37), Derivative time (P. 37)

■ Derivative gain (1. dGA, 2.dGA)

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

Data range: 0.1 to 10.0

Factory set value: Input 1_derivative gain (1. dGA): 6.0
Input 2_derivative gain (2. dGA): 6.0

Under ordinary operation, it is not necessary to change Derivative gain set value.

■ ON/OFF action differential gap (upper) (1. oHH, 2. oHH)

Use to set the ON/OFF control differential gap (upper).

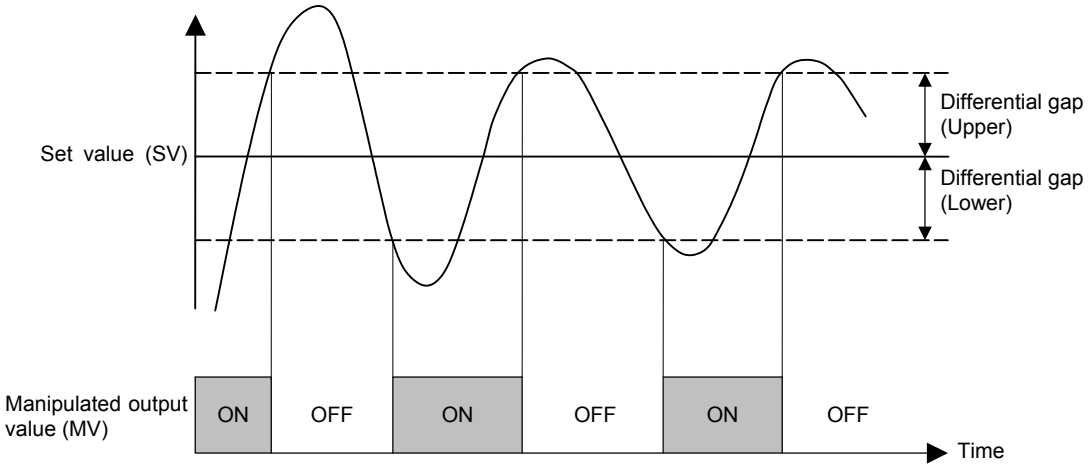
Data range: 0 to Input span
(Varies with the setting of the Decimal point position)

Factory set value: Input 1_ON/OFF action differential gap (upper) (1. oHH):
TC/RTD inputs: 1.0 °C [°F]
Voltage (V)/Current (I) inputs: 0.1 % of input span
Input 2_ON/OFF action differential gap (upper) (2. oHH):
TC/RTD inputs: 1.0 °C [°F]
Voltage (V)/Current (I) inputs: 0.1 % of input span

Related parameters: ON/OFF action differential gap (lower) (P. 88)

ON/OFF Action Differential Gap:

ON/OFF control is possible when the Proportional band is set to "0" or "0.0." In ON/OFF control with Reverse action, when the Measured value (PV) is smaller than the set value (SV), the Manipulated output (MV) is 100 % or ON. When the PV is higher than the SV, the MV is 0 % or OFF. Differential gap setting prevents control output from repeating ON and OFF too frequently.



■ ON/OFF action differential gap (lower) (1. oHL, 2. oHL)

Use to set the ON/OFF control differential gap (lower).

Data range: 0 to Input span
(Varies with the setting of the Decimal point position)

Factory set value: Input 1_ON/OFF action differential gap (lower) (1. oHL):
TC/RTD inputs: 1.0 °C [°F]
Voltage (V)/Current (I) inputs: 0.1 % of input span
Input 2_ON/OFF action differential gap (lower) (2. oHL):
TC/RTD inputs: 1.0 °C [°F]
Voltage (V)/Current (I) inputs: 0.1 % of input span

Related parameters: ON/OFF action differential gap (upper) (P. 88)

Description of function: Refer to **ON/OFF action differential gap (upper)**.

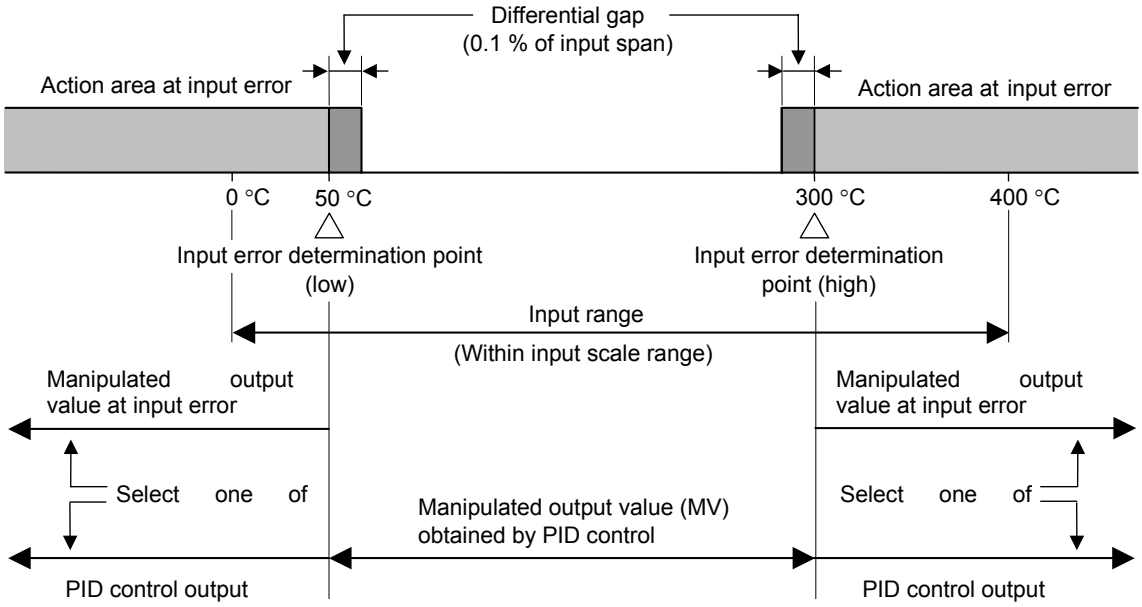
■ Action at input error (high) (1. AoVE, 2. AoVE)

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

Data range: 0: Normal control
1: Manipulated output value at input error (PSM)
Factory set value: Input 1_action at input error (high) (1. AoVE): 0
Input 2_action at input error (high) (2. AoVE): 0
Related parameters: Input error determination point (high) (P. 68),
Manipulated output value at input error (P. 89)

Input Error Determination:

Example: Input range: 0 to 400 °C
Input error determination point (high): 300 °C
Input error determination point (low): 50 °C



■ Action at input error (low) (1. AUnE, 2. AUnE)

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

Data range: 0: Normal control
1: Manipulated output value at input error (PSM)
Factory set value: Input 1_action at input error (low) (1. AUnE): 0
Input 2_action at input error (low) (2. AUnE): 0
Related parameters: Input error determination point (low) (P. 68),
Manipulated output value at input error (P. 89)

Description of function: Refer to **Action at input error (high)**.

■ Manipulated output value at input error (1. PSM, 2. PSM)

When the measured value reaches Input error determination point and Action at input error is set to "1", this manipulated value is output.

Data range: –5.0 to +105.0 %
Factory set value: Input 1_manipulated output value at input error (1. PSM): –5.0
Input 2_manipulated output value at input error (2. PSM): –5.0
Related parameters: Input error determination point (high) (P. 68), Input error determination point (low) (P. 68), Action at input error (high) (P. 89), Action at input error (low) (P. 89)

■ Output change rate limiter (up) (1. orU, 2. orU)

Use to set the Output change rate limiter (up) to limit of the variation of output is set.

Data range: 0.0 to 1000.0 %/second of manipulated output
(0.0: OFF)

Factory set value: Input 1_output change rate limiter (up) (1. orU): 0.0
Input 2_output change rate limiter (up) (2. orU): 0.0

Related parameters: Output change rate limiter (down) (P. 91), Output limiter high (P. 91), Output limiter low (P. 91)

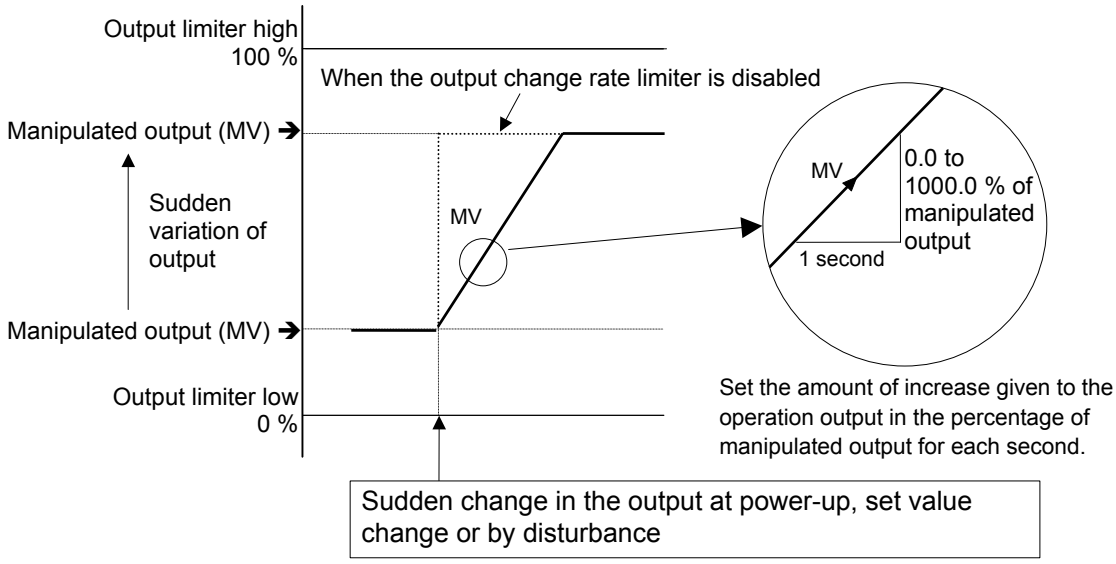
Output Change Rate Limiter:

The Output change rate limiter limits the variation of Manipulated output (MV) per second. This function is suitable for an application in which a sudden MV change is not acceptable.

[Example]

The Output change rate limiter is effective.

- The MV reaches 100 % when the power is turned on to the controller and such a sudden output change is not acceptable in the application.
- A sudden output change occurs at the SV change and it is not acceptable in the application.



The output changes at specific rates set by Output change rate limiter (up) even under the situations where a sudden output change would occur without Output change rate limiter function. There is also independent Output change rate limiter (down).

If the Output change rate is set smaller, it will cause slow control response and affect Derivative action.

When the Output change rate limiter is used, you may not be able to obtain appropriate PID constants by Autotuning.

The Output change rate limiter is particularly effective when a sudden MV change may create uncontrollable situation cause a large current flow. Also, it is very effective current output or voltage output is used as control output.

■ Output change rate limiter (down) (1. ord, 2. ord)

Use to set the Output change rate limiter (down).

Data range: 0.0 to 1000.0 %/second of manipulated output
(0.0: OFF)
Factory set value: Input 1_output change rate limiter (down) (1. ord): 0.0
Input 2_output change rate limiter (down) (2. ord): 0.0
Related parameters: Output change rate limiter (up) (P. 90), Output limiter high (P. 91),
Output limiter low (P. 91)
Description of function: Refer to **Output change rate limiter (up)**.

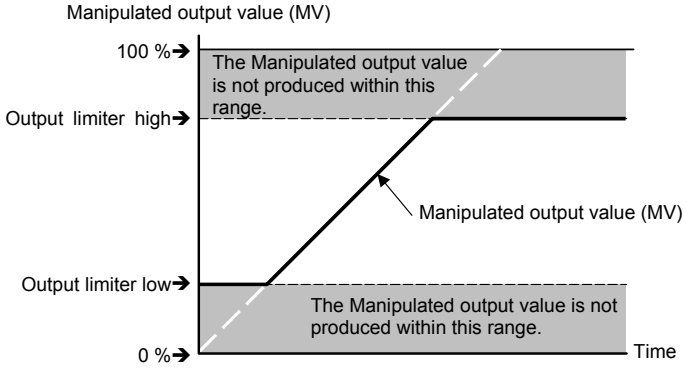
■ Output limiter high (1. oLH, 2. oLH)

Use to set the high limit value of manipulated output.

Data range: Output limiter low to 105.0 %
Factory set value: Input 1_output limiter high (1. oLH): 105.0
Input 2_output limiter high (2. oLH): 105.0
Related parameters: Output change rate limiter (up) (P. 90), Output change rate limiter (down) (P. 91),
Output limiter low (P. 91)

Output Limiter:

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



Output limiter is available for ON/OFF action.

■ Output limiter low (1. oLL, 2. oLL)

Use to set the low limit value of manipulated output.

Data range: −5.0 % to Output limiter high
Factory set value: Input 1_output limiter low (1. oLL): −5.0
Input 2_output limiter low (2. oLL): −5.0
Related parameters: Output change rate limiter (up) (P. 90), Output change rate limiter (down) (P. 91),
Output limiter high (P. 91)
Description of function: Refer to **Output limiter high**.

■ Power feed forward selection (1. PFF, 2. PFF)

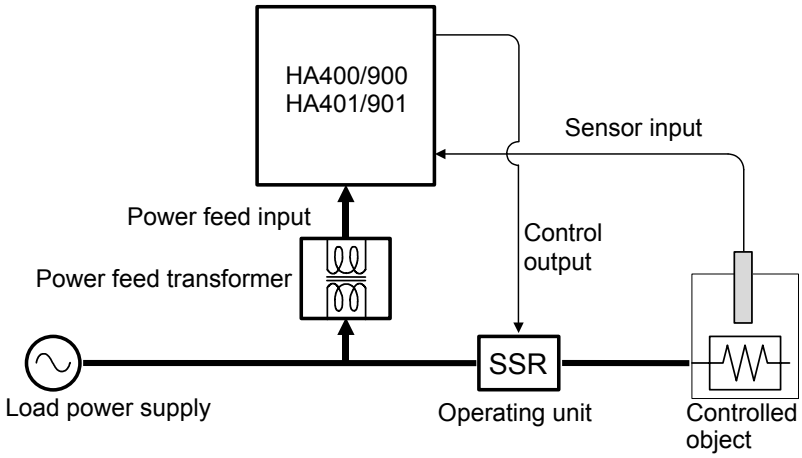
Use to select Use/Unuse of the Power feed forward (PFF) function.

Data range: 0: Unused
1: Used

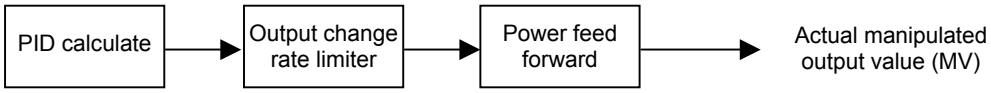
Factory set value: Input 1_power feed forward selection (1. PFF):
Based on the model code specified when ordered
Input 2_power feed forward selection (2. PFF):
Based on the model code specified when ordered

Power Feed Forward function:

The Power feed forward function monitors the electrical load through a dedicated transformer, and adjusts manipulated output to compensate power supply fluctuation. If the function detects approximately 30 % voltage drop, the controller automatically stops PID control.



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



Relationship between the Power feed forward and Output change rate limiter

When the Power feed forward function is set to "1: Used," control stops under the following condition. However, no "STOP" is displayed on the display unit.

- **When no power feed input is used (no power feed transformer is connected)**
- **When power feed input voltage becomes less than 30 % of rated value**

This parameter applies only to instruments specified with the Power feed forward function (optional) when ordered.

When the Power feed forward function is used for two-loop control, the power supply for controlled objects of both loops is required to be common.

Always use the dedicated power feed transformer included.

■ Power feed forward gain (1. PFFS, 2. PFFS)

Use to set a gain used for the Power feed forward (PFF) function. Power feed forward gain should not be changed under ordinary operation.

Data range: 0.01 to 5.00

Factory set value: Input 1_power feed forward gain (1. PFFS): 1.00
Input 2_power feed forward gain (2. PFFS): 1.00

Related parameters: Power feed forward selection (P. 92)

Power Feed Forward Gain:

Power supply voltage variations may give disturbances to the controlled temperature as they make an effect on external devices other than heaters. If in such a case, control stability can be maintained by adjusting the Power feed forward gain. Usually, the instrument is used at a gain of 1.00.

Under ordinary operation, it is not necessary to change Power feed forward gain set value.

8.14 Autotuning 1 (AT1) (F53) Autotuning 2 (AT2) (F54)

■ AT bias (1. ATb, 2. ATb)

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

Data range: –Input span to +Input span

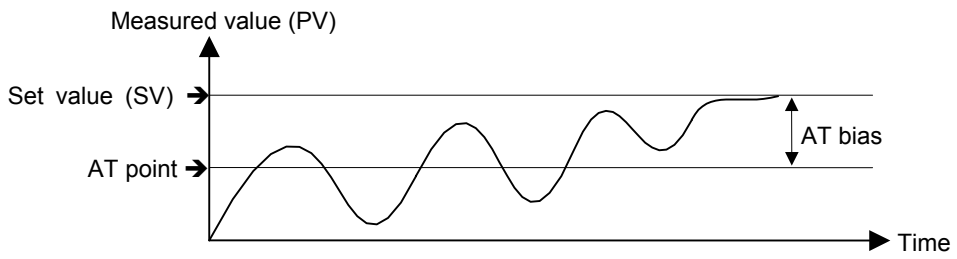
Factory set value: Input 1_AT bias (1. ATb): 0
Input 2_AT bias (2. ATb): 0

Related parameters: PID/AT transfer (P. 103), Autotuning (P. 107)

Functional description:

The AT bias is used to prevent overshoot during Autotuning in the application which does not allow overshoot even during Autotuning. RKC Autotuning method uses ON/OFF control at the set value to calculate the PID values. However, if overshoot is a concern during Autotuning, the desired AT bias should be set to lower the set point during Autotuning so that overshoot is prevented.

Example: When AT bias is set to the minus (–) side.



■ AT cycle (1. ATC, 2. ATC)

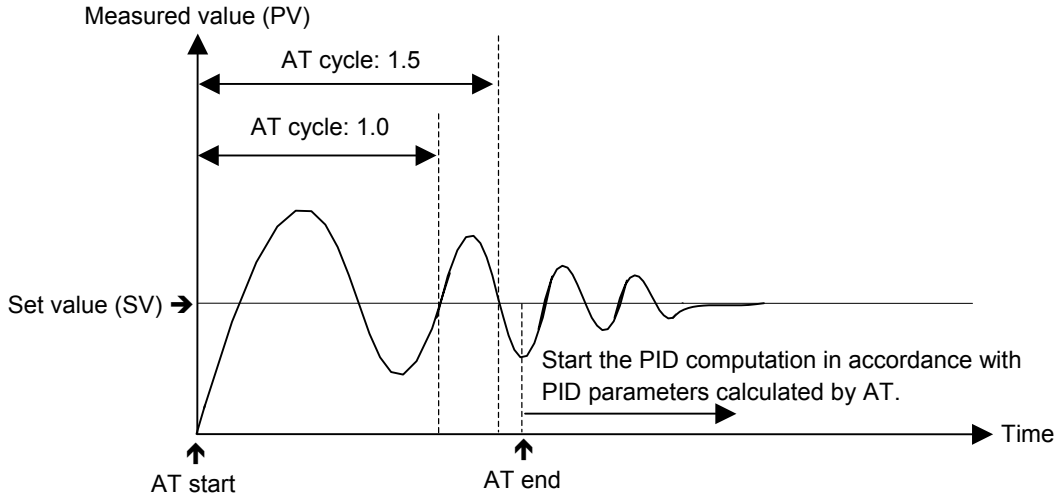
The number of ON/OFF cycles is selected when the Autotuning (AT) function is executed.

Data range: 0: 1.5 cycles
1: 2.0 cycles
2: 2.5 cycles
3: 3.0 cycles

Factory set value: Input 1_AT cycle (1. ATC): 1
Input 2_AT cycle (2. ATC): 1

Related parameters: PID/AT transfer (P. 103), Autotuning (P. 107)

Example: When the AT cycle is set to 1.5 cycle and the Autotuning (AT) function is executed just after the power is turned on.



■ AT differential gap time (1. ATH, 2. ATH)

Use to set an ON/OFF action differential gap time for Autotuning (AT). This function prevents the AT function from malfunctioning caused by noise.

Data range: 0.00 to 50.00 seconds

Factory set value: HA400/900: Input 1_AT differential gap time (1. ATH): 0.10
Input 2_AT differential gap time (2. ATH): 0.10
HA401/901: Input 1_AT differential gap time (1. ATH): 10.00
Input 2_AT differential gap time (2. ATH): 10.00

Related parameters: PID/AT transfer (P. 103), Autotuning (P. 107)

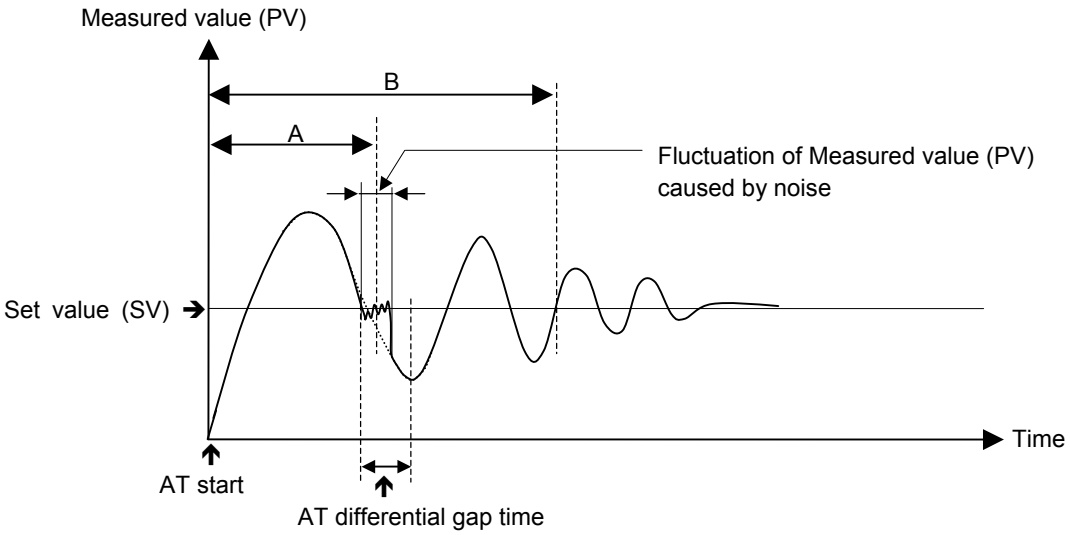
Functional description:

In order to prevent the output from chattering due to the fluctuation of a Measured value (PV) caused by noise during Autotuning, the output on or off state is held until AT differential gap time has passed after the output on/off state is changed to the other. Set AT differential gap time to "1/100 × Time required for temperature rise."

Example:

A: AT cycle time the AT differential gap time set to 0.00 second
The output chatters due to the fluctuation of the Measured value (PV) caused by noise, and Autotuning (AT) function is not able to monitor appropriate cycles to compute suitable PID values.

B: AT cycle time when the AT differential gap time is set to "Time corresponding to 0.25 cycles." The fluctuation of a Measured value (PV) caused by noise is ignored and as a result Autotuning (AT) function is able to monitor appropriate cycles to compute suitable PID values.



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

8.15 Position Proportioning PID Action (F55)

The settings of parameters in this group become valid on the controller with the Feedback resistance input (optional).

■ Open/Close output neutral zone (Ydb)

Use to set Open/Close output neutral zone.

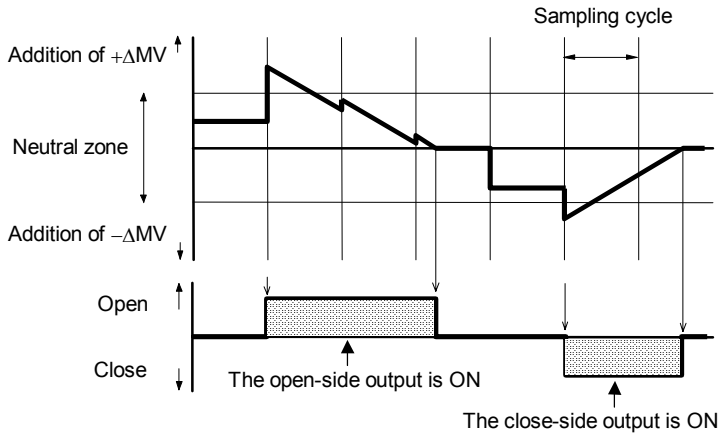
Data range: 0.1 to 10.0 % of output

Factory set value: 10.0

Related parameters: Open/Close output differential gap (P. 97), Action at feedback resistance (FBR) input error (P. 97), Feedback adjustment preparation screen (P. 98)

Open/Close Output Neutral Zone:

The neutral zone is used to prevent a control motor from repeating ON/OFF too frequently. When the PID computed output value is within the neutral zone, the controller will not output the MV to a control motor.



The controller does not output the ΔMV to a control motor when the PID computed output value is within the neutral zone.

■ Open/Close output differential gap (YHS)

Use to set differential gap of Open/Close output used in the Position proportioning PID control.

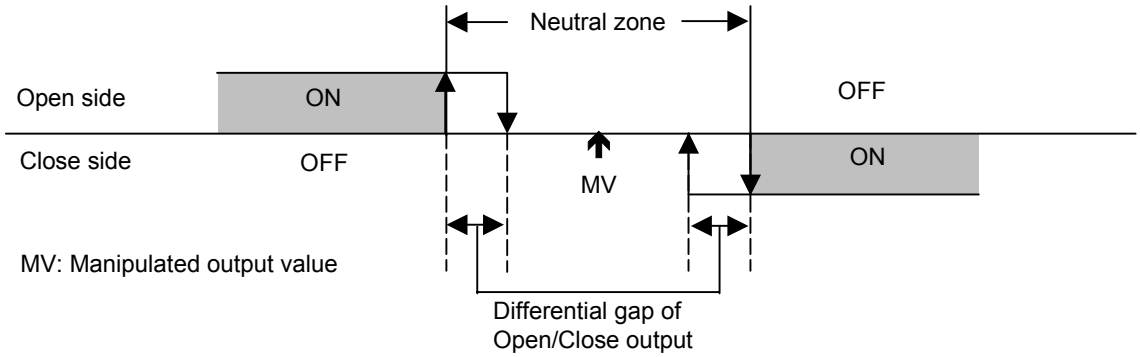
Data range: 0.1 to 5.0 % of output

Factory set value: 0.2

Related parameters: Open/Close output neutral zone (P. 96), Action at feedback resistance (FBR) input error (P. 97), Feedback resistance (FBR) input assignment (P. 97), Feedback adjustment (P. 98)

Open/Close Output Differential Gap:

The Open/Close output differential gap prevents output ON/OFF chattering caused by fluctuation of feedback resistance input.



■ Action at feedback resistance (FBR) input error (Ybr)

Use to select an action at the Feedback resistance (FBR) input break.

Data range: 0: Close-side output ON, Open-side output OFF
1: Close-side output OFF, Open-side output OFF
2: Close-side output OFF, Open-side output ON

Factory set value: 0

Related parameters: Open/Close output neutral zone (P. 96), Open/Close output differential gap (P. 97), Feedback resistance (FBR) input assignment (P. 97), Feedback adjustment (P. 98)

■ Feedback resistance (FBR) input assignment (PoSA)

Use to assign the Feedback resistance (FBR) input to an input.

Data range: 1: Input 1
2: Input 2

Factory set value: 1

Related parameters: Open/Close output neutral zone (P. 96), Open/Close output differential gap (P. 97), Action at feedback resistance (FBR) input error (P. 97), Feedback adjustment (P. 98)

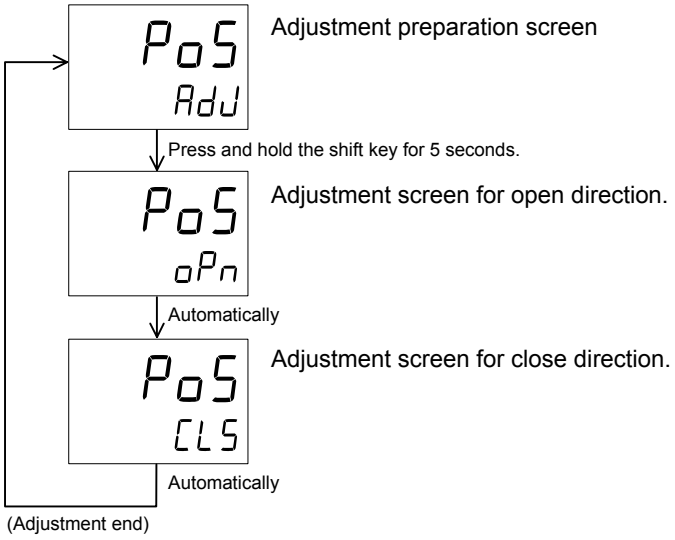
■ Feedback adjustment (PoS)

Feedback adjustment function is to adjust controller's output value to match the Feedback resistance (FBR) of the control motor. After the adjustment, the Manipulated output value of 0 to 100 % obtained after PID computation matches the valve position signal of the fully closed position to the fully opened position [Feedback resistance (FBR) input] sent from the control motor. The adjustment have to be completed before starting operation. Always make sure that the wiring is correct and the control motor operates normally before the adjustment. (Refer to P. 11)

Factory set value: —

Adjustment procedure:

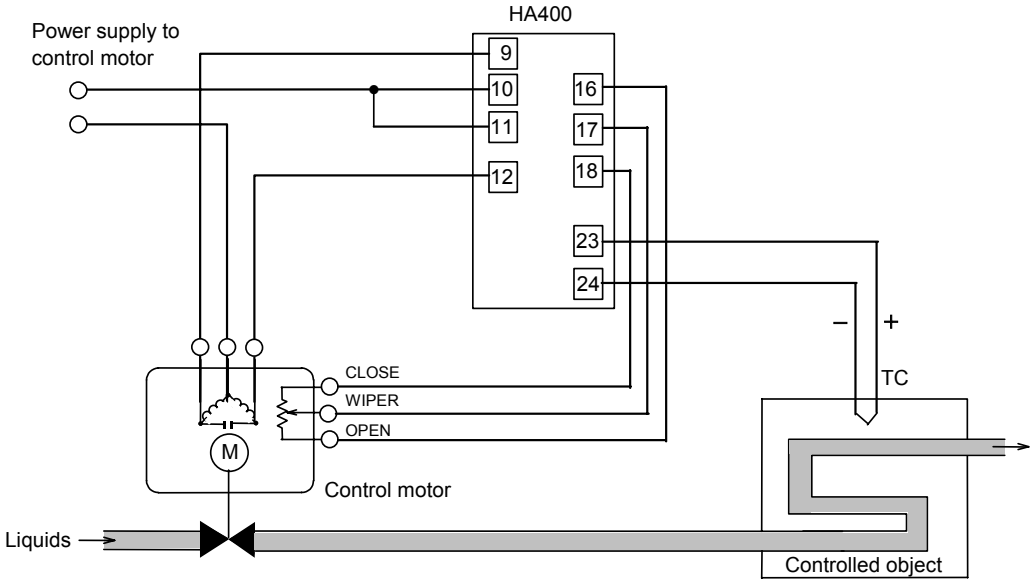
At the Adjustment preparation screen, press and hold the shift key for 5 seconds to start the adjustment. The display automatically returns to the Adjustment preparation screen after the adjustment is completed.



Position Proportioning PID control:

The Position proportioning PID control is performed by feeding back both the valve opening (Feedback resistance input) from the control motor and Measured value (PV) from the controlled object in the flow control.

[Wiring Example]



8.16 Communication Function (F60)

■ Communication protocol selection (CMPS1, CMPS2)

Use to select the protocol of Communication 1 and 2.

Data range: 0: RKC communication
1: Modbus 1 (Data transfer: In order of low-order word from high-order word)
2: Modbus 2 (Data transfer: In order of high-order word from low-order word)
10: CC-Link (1 station occupied 1 time)
11: CC-Link (1 station occupied 4 times)
12: CC-Link (1 station occupied 8 times)
13: CC-Link (4 stations occupied 1 time)

Factory set value: Communication 1: RKC communication: 0, Modbus: 2
Communication 2: RKC communication: 0, Modbus: 2, CC-Link: 10

Related parameters: Communication 1:
Device address 1 (P. 46), Communication speed 1 (P. 46), Data bit configuration 1 (P. 46), Interval time (P. 47)
Communication 2:
Device address 2 (P. 47), Communication speed 2 (P. 47), Data bit configuration 2 (P. 48), Interval time (P. 48)

Communication 1 and 2 (optional) must be specified when ordering.

If the Communication 2 function is for PROFIBUS or DeviceNet, the selection of the communication protocol (CMPS2) becomes invalid.

For the details of communication functions (RKC communication/Modbus), refer to the **Communication Instruction Manual (IMR01N03-E□)**. *

* Refer to **Communication Instruction Manual (IMR01N04-E□)** for PROFIBUS, **Communication Instruction Manual (IMR01N05-E□)** for DeviceNet, and **Communication Instruction Manual (IMR01N20-E□)** for CC-Link.

8.17 Set Value (SV) (F70)

■ Setting change rate limiter unit time (SVrT)

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

Data range: 1 to 3600 seconds

Factory set value: 60

Related parameters: Setting change rate limiter (up) (P. 38), Setting change rate limiter (down) (P. 38)

■ Soak time unit selection (STdP)

Use to select the time unit for Area soak time.

Data range: 0: 0 hour 00 minutes 00 second to 9 hours 59 minutes 59 seconds
2: 0 minutes 00.00 seconds to 9 minutes 59.99 seconds

Factory set value: 2

Related parameters: Area soak time (P. 39)

8.18 Set Value 1 (SV1) (F71) Set Value 2 (SV2) (F72)

■ Setting limiter high (1. SLH, 2. SLH)

Use to set a high limit of the set value.

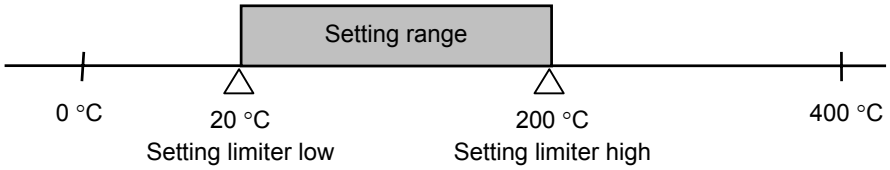
Data range: Setting limiter low to Input scale high

Factory set value: Input 1_setting limiter high (1.SLH): Input 1_input scale high
Input 2_setting limiter high (2.SLH): Input 2_input scale high

Related parameters: Decimal point position (P. 67), Input scale high (P. 67), Setting limiter low (P. 100)

Setting Limiter: Setting limiter is to set the range of the set value (SV).

Example: The input range (input scale range) is from 0 to 400 °C, the Setting limiter high is 200 °C, and the Setting limiter low is 20 °C.



■ Setting limiter low (1. SLL, 2. SLL)

Use to set a low limit of the set value.

Data range: Input scale low to Setting limiter high

Factory set value: Input 1_setting limiter low (1.SLL): Input 1_input scale low
Input 2_setting limiter low (2.SLL): Input 2_input scale low

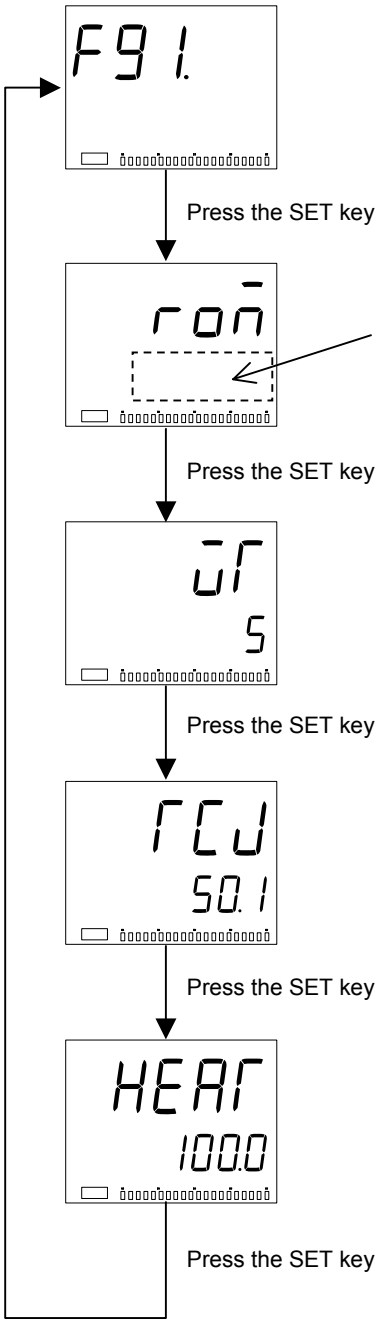
Related parameters: Decimal point position (P. 67), Input scale low (P. 68), Setting limiter high (P. 100)

Description of function: Refer to **Setting limiter high**.

8.19 System Information Display (F91)

System information (refer to below) can be checked on Function block F91.

Upper display: Character of the parameter
Lower display: value



Function block F91

ROM version display (RoM)

Displays the version of loaded software.

Integrated operating time display (WT)

Displays the integrated total operating time of the controller.
Display range: 0 to 99999 hours

Holding peak value ambient temperature display (TCJ)

Displays the maximum ambient temperature of the instrument.
Display range: –10.0 to +100.0 °C

Power feed transformer input value display (HEAT)

Displays the input value of a power feed transformer.
Display range: 0.0 to 160.0 %
(Display in the percentage of the rated value.)

9. OPERATION

9.1 Control RUN and STOP

There is no power switch on this instrument, and the instrument starts operation immediately following initial power-ON (Factory set value: RUN).
There are parameters in Engineering mode which can not be changed when the controller is in RUN mode. Press the direct key (R/S) to change the RUN/STOP mode from RUN to STOP when a change for the parameters in Engineering mode is necessary. Refer to **8. ENGINEERING MODE (P. 50)** for details.

☞ For detail of RUN/STOP transfer, refer to **9.7 RUN/STOP Transfer (P. 111)**.

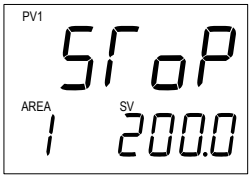
■ Operation under control RUN mode

- To change display contents in the monitoring state, go to SV setting & Monitor mode.
  ☞ **5. SV SETTING & MONITOR MODE (P. 30), 9.3 Monitoring Display in Operation (P. 104)**
- To change the Set value (SV), go to SV setting & Monitor mode.
  ☞ **5. SV SETTING & MONITOR MODE (P. 30)**
- To change parameters related to control, go to the Parameter setting mode.
  ☞ **6. PARAMETER SETTING MODE (P. 32), 7. SETUP SETTING MODE (P. 40)**
- To change the control Memory area, go to SV setting & Monitor mode.
  ☞ **5. SV SETTING & MONITOR MODE (P. 30)**
- To activate Autotuning (AT), go to the Operation mode.
  ☞ **9.2 Configuration of Operation Mode (P. 103), 9.4 Autotuning (AT) (P. 107)**
- To switch Auto/Manual, go to the Operation mode, or press the direct key (A/M).
  ☞ **9.2 Configuration of Operation Mode (P. 103), 9.5 Auto/Manual Transfer (P. 108)**
- To switch Remote/Local, go to the Operation mode, or press the direct key (R/L).
  ☞ **9.2 Configuration of Operation Mode (P. 103), 9.6 Remote/Local Transfer (P. 110)**

■ Display at control STOP

The STOP character is displayed on the Measured value (PV1/PV2) display unit while being stopped.
The display unit to display the STOP character is selectable.
Go to **"STOP display selection"** in the Engineering mode (P. 63).

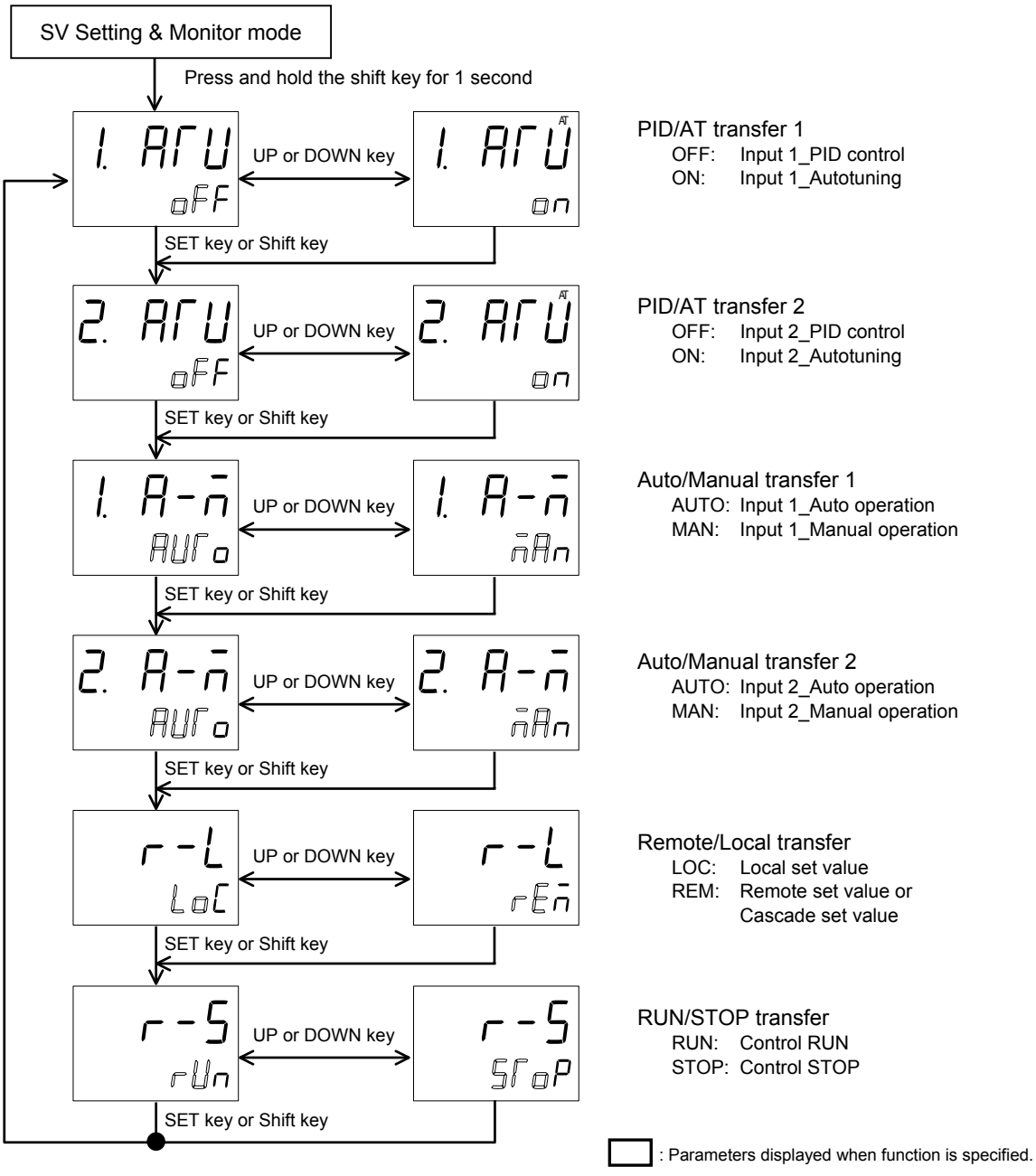
(Example: STOP character display)



9.2 Configuration of Operation Mode

■ Display Sequence

The operation mode is used to selects the operation modes (PID/AT, Auto/Manual, Remote/Local, RUN/STOP) of the instrument. Every time the SET key or the shift key is pressed, the display goes to the next parameters.



Auto/Manual, Remote/Local, RUN/STOP transfer is possible via respective Direct key.
To return the SV setting & Monitor mode, press and hold the shift key for 1 second, or press the shift key while pressing the SET key.
If the key is not pressed within 1 minute, the display will automatically return to the SV setting & Monitor mode.

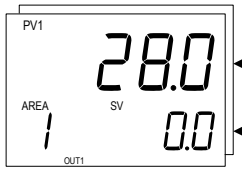
9.3 Monitoring Display in Operation

In SV setting & Monitor mode, the following operations are possible.

Change the Set value (SV)
Change Memory area
Monitor the Measured value (PV) and the Manipulated value (MV), etc.

Use this mode during normal operation.

■ Display Sequence



Input 1_measured value (PV1)/set value (SV1) monitor

Measured value 1 (PV1)

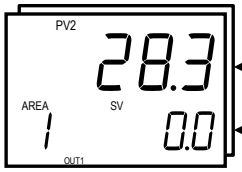
Set value 1 (SV1)

Remote mode: Displays the Remote set value.

Manual operation: The Manipulated output value (MV1) of Input 1 can be set.
Setting range: Input 1_output limiter low to Input 1_output limiter high

SET key

When the setting change rate limiter is set and the SV is changed, the SV changes at specific rates in the display.



Input 2_measured value (PV2)/set value (SV2) monitor

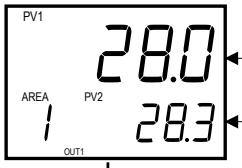
Measured value 2 (PV2)

Set value 2 (SV2)

Manual operation: The Manipulated output value (MV2) of Input 2 can be set.
Setting range: Input 2_output limiter low to Input 2_output limiter high

SET key

When the setting change rate limiter is set and the SV is changed, the SV changes at specific rates in the display.

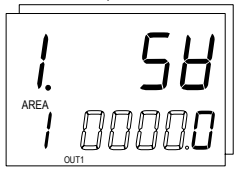


Input 1_measured value (PV1)/Input 2_measured value (PV2) monitor

Measured value 1 (PV1)

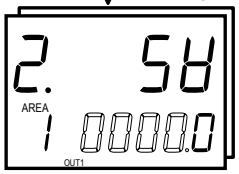
Measured value 2 (PV2)

SET key



Input 1_set value (SV1) setting

SET key



Input 2_set value (SV2) setting

SET key

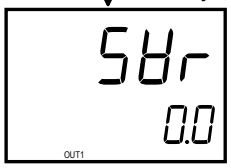
Continued on the next page.

: Parameters related to multi-memory area function

: Parameters displayed when function is specified.

Continued from the previous page.

SET key



Remote input value monitor

Displays the remote set value which is the control target value in the Remote (REM) mode. Displayed only when the Remote input function is provided.

Display range: Input 1_setting limiter low to Input 1_setting limiter high

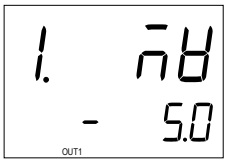
SET key

Cascade monitor

Displays the input value used for cascade control. Displayed when cascade control is selected.

Display range: Input 2_setting limiter low to Input 2_setting limiter high

SET key

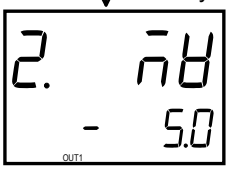


Input 1_manipulated output value (MV1) monitor

Displays Input 1_manipulated output value (MV1).

Display range: −5.0 to +105.0 %

SET key



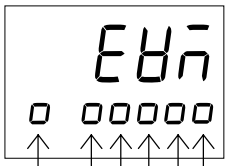
Input 2_manipulated output value (MV2) monitor

Displays Input 2_manipulated output value (MV2).

Displayed only when the Input 2_manipulated output value (MV2) function is provided.

Display range: −5.0 to +105.0 %

SET key

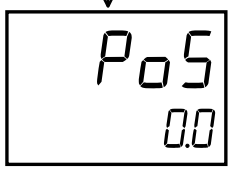


Event monitor

"o" corresponding to each Event is lit when the event is turned ON.

- Event 1 (EV1)
- Event 2 (EV2)
- Event 3 (EV3) or Control loop break alarm 1 (LBA1)
- Event 4 (EV4) or Control loop break alarm 2 (LBA2)
- Heater break alarm 1 (HBA1)
- Heater break alarm 2 (HBA2)

SET key



Feedback resistance input value monitor

Displays Feedback resistance input value (POS) for Position proportioning PID action.

Display range: 0.0 to 100.0 %

SET key

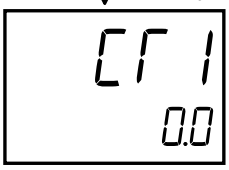
Continued on the next page.

: Parameters related to multi-memory area function

: Parameters displayed when function is specified.

Continued from the previous page.

SET key



Current transformer input value 1 (CT1) monitor

Displays the input value of the Current transformer 1 (CT1) used when the instrument is provided with the Heater break alarm 1 function.

Display range: 0.0 to 30.0 A or 0.0 to 100.0 A

The CT input cannot measure less than 0.4 A.

SET key

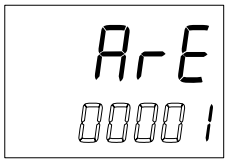
Current transformer input value 2 (CT2) monitor

Displays the input value of the Current transformer 2 (CT2) used when the instrument is provided with the Heater break alarm 2 function.

Display range: 0.0 to 30.0 A or 0.0 to 100.0 A

The CT input cannot measure less than 0.4 A.

SET key



Memory area selection

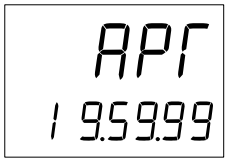
Selects the memory area (control area) used for control.

Setting range: 1 to 16

The Memory area selection can be made by Event input (optional).

9.8 Control Area Transfer (P. 113)

SET key

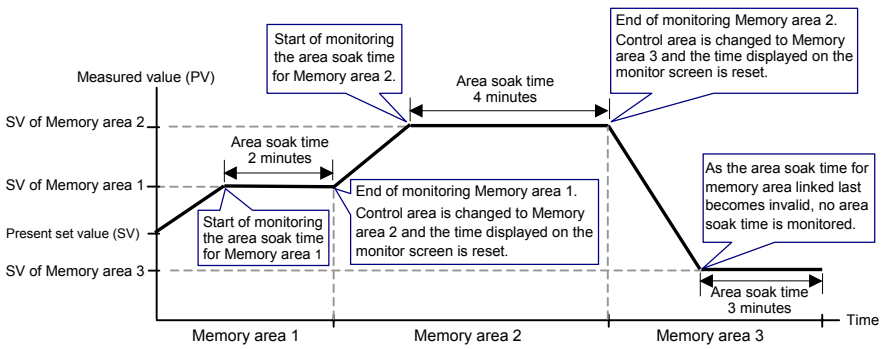


Memory area soak time monitor

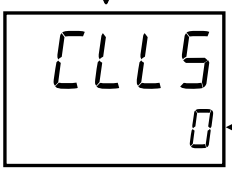
Monitors the time elapsed for Memory area operation (soak time) when Ramp/Soak control by using Multi-memory area is performed.

Display range: 0 minute 00.00 second to 9 minutes 59.99 seconds or
0 hour 00 minute 00 second to 9 hours 59 minutes 59 seconds

Monitoring Example:



SET key



CC-Link communication status

Displays the CC-Link communication status.

Status number

For the CC-Link status number and its contents, refer to **Communication Instruction Manual [CC-Link] (IMR01N20-E□)**.

SET key

Retrun to Input 1_measured value (PV1)/set value (SV1) monitor screen

: Parameters related to multi-memory area function

: Parameters displayed when function is specified.

9.4 Autotuning (AT)

Autotuning (AT) automatically measures, computes and sets the optimum PID values. The following conditions are necessary to carry out Autotuning and the conditions which will cause the Autotuning to stop.

■ Requirements for AT start

Start the Autotuning (AT) when all following conditions are satisfied:
To start Autotuning (AT), go to PID/AT transfer in Operation mode. (Refer to P. 103)

- Operation mode conditions are as follows:
  - Auto/Manual transfer → Auto mode
  - Remote/Local transfer → Local mode
  - PID/AT transfer → PID control
  - RUN/STOP transfer → Control RUN
- The Measured value (PV) is without input error range [Input error determination point (high) > Measured value (PV) > Input error determination point (low)].
- The Output limiter high is 0.1 % or higher and the Output limiter low is 99.9 % or less.


When the Autotuning (AT) is finished, the controller will automatically returns to PID control.

When the cascade control is activated, the AT function can not be turned on.

■ Requirements for AT cancellation

The Autotuning (AT) is canceled if any of the following conditions exist.

- When the Temperature set value (SV) is changed.
- When the Output limiter high or the Output limiter low is changed.
- When the PV bias, the PV digital filter, or the PV ratio is changed.
- When the Auto/Manual mode is changed to the Manual mode.
- When the Remote/Local mode is changed to the Remote mode.
- When the Measured value (PV) goes to input error range [Measured value (PV) ≥ Input error determination point (high) or Input error determination point (low) ≥ Measured value (PV)].
- When the power failure occurs.
- When the instrument is in the FAIL state.
- When the PID/AT transfer is changed to the PID control.
- When the RUN/STOP mode is changed to the control STOP.


If the AT is canceled, the controller immediately changes to PID control. The PID values will be the same as before AT was activated.

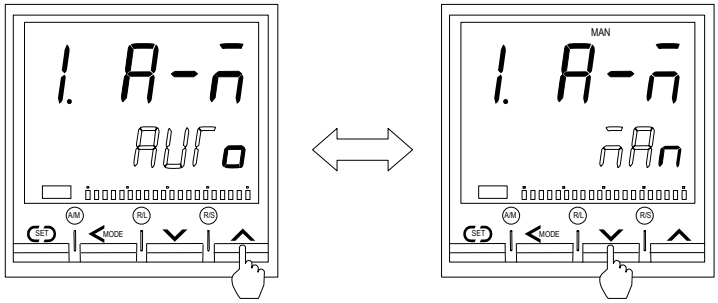
9.5 Auto/Manual Transfer

The Auto/Manual transfer can be made by Event input (optional) or Communication (optional) other than the key operation. For details of Auto/Manual transfer by communication, refer to the **Communication Instruction Manual (IMR01N03-E□)**.*

* Refer to **Communication Instruction Manual (IMR01N04-E□)** for PROFIBUS and **Communication Instruction Manual (IMR01N05-E□)** for DeviceNet, and **Communication Instruction Manual (IMR01N20-E□)** for CC-Link.

■ Auto/Manual transfer by Front key operation

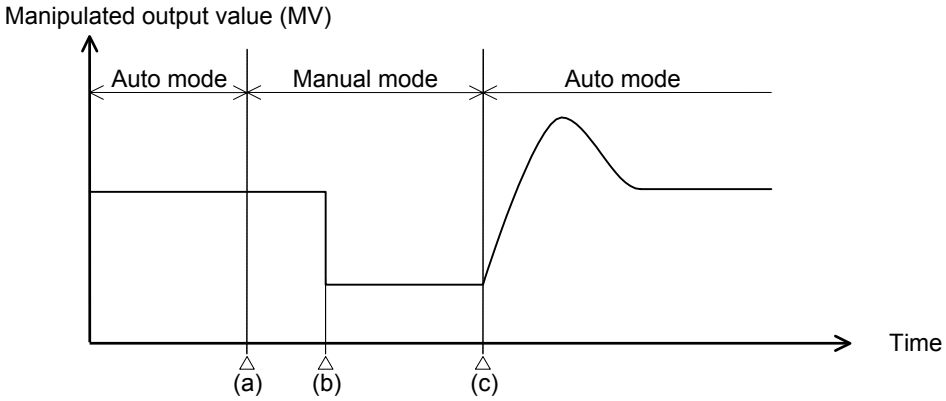
Every time the UP key or the DOWN key is pressed, the Auto mode is changed to the Manual mode alternately.



Auto mode　　Manual mode

(The above figure is an image of Auto/Manual transfer of Input 1.)

When Auto/Manual mode is changed from Auto to Manual or from Manual to Auto, the balanceless-bumpless function is activated to prevent control disturbance caused by a sudden output change.



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

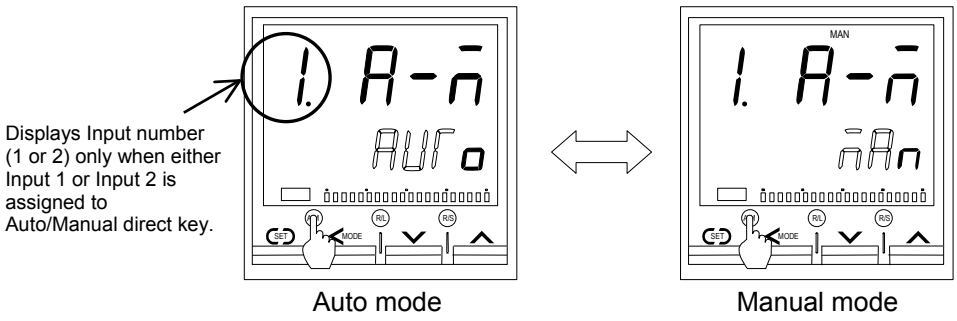
(b) The Manipulated output value is changed (Manual mode function)

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

For the Operation mode, refer to **9.2 Configuration of Operation Mode (P. 103)**.

■ Auto/Manual transfer by Direct key (A/M) operation

Every time the Auto/Manual (A/M) transfer key is pressed, the Auto mode is changed to the Manual mode alternately.



(The above figure is an image of Auto/Manual transfer of Input 1.)

When Auto/Manual mode is changed from Auto to Manual or from Manual to Auto, the balanceless-bumpless function is activated to prevent control disturbance caused by a sudden output change.

Direct key operation setting can be changed in Engineering mode. For details, refer to **8.5 Direct Keys (F11)** on page 65.

■ Auto/Manual transfer by Event input

Auto/Manual transfer by the Event input is possible with the **Event input logic selection (P. 70)** of the Engineering mode. The table below shows the actual operation modes and lamp status under different combinations of settings by front key, communication and Event input.

Mode select from front key or communication	Event input state	Actual operation mode	Lamp state
Auto	Contact closed	Auto	MAN mode lamp OFF
	Contact open	Manual	MAN mode lamp ON
Manual	Contact closed		
	Contact open		

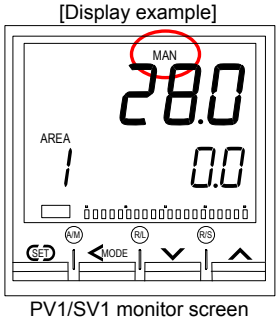
When the Event input is used for the setting change and the contact is closed, it takes approx. 0.5 seconds until the new setting is taken by the controller.

When Auto/Manual mode is changed from Auto to Manual or from Manual to Auto, the balanceless-bumpless function is activated to prevent control disturbance caused by a sudden output change.

■ Procedure for setting the Manipulated output value (MV) in Manual mode

When the controller is in Manual mode, the Manipulated output value (MV) can be manually set.

[Display example]



● Setting procedure

1. Make sure the Manual (MAN) mode lamp is lit.
2. Go to the "Input 1_PV1/SV1 monitor" screen in the SV setting & Monitor mode. Change the value by the UP and DOWN keys and then press the SET key to store the new setting.

9.6 Remote/Local Transfer

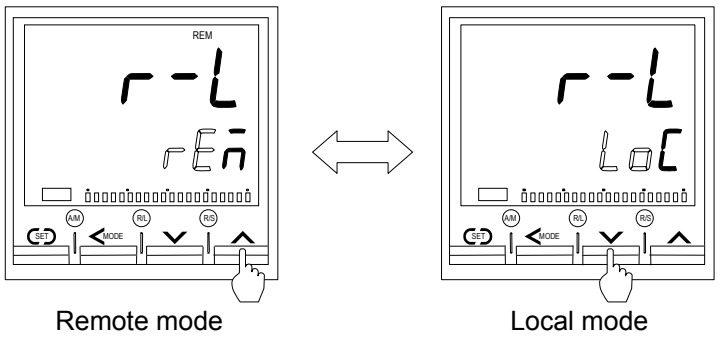
The Remote/Local transfer can be made by Event input (optional) or Communication (optional) other than the key operation. For details of the Remote/Local transfer by communication, refer to the **Communication Instruction Manual (IMR01N03-E□).***

* Refer to **Communication Instruction Manual (IMR01N04-E□)**, PROFIBUS and **Communication Instruction Manual (IMR01N05-E□)** for DeviceNet, and **Communication Instruction Manual (IMR01N20-E□)** for CC-Link.

If "Input 2_use selection (CAM)" of the Engineering mode is changed to "2: Cascade control (Slave)," "Remote/Local" needs to be changed to "Cascade/Local."

■ Remote/Local transfer by Front key operation

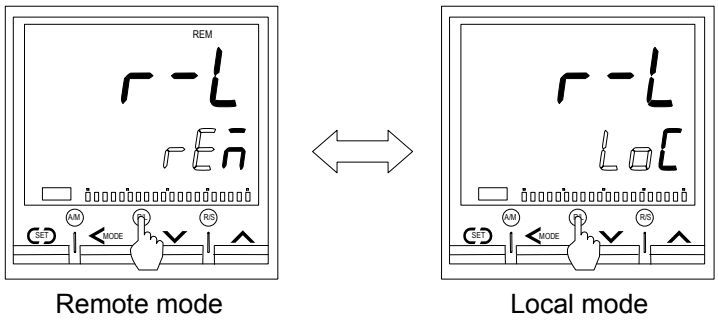
Every time the UP key or the DOWN key is pressed, the Remote mode is changed to the Local mode alternately.



For the Operation mode, refer to **9.2 Configuration of Operation Mode. (P. 103)**

■ Remote/Local transfer by Direct key (R/L) operation

Every time the Remote/Local (R/L) transfer key is pressed, the Remote mode is changed to the Local mode alternately.



Direct key operation setting can be changed in Engineering mode. For details, refer to **8.5 Direct Keys (F11)** on page 65.

■ Remote/Local transfer by Event input

Remote/Local transfer by the Event input is possible with the **Event input logic selection (P. 70)** of the Engineering mode. The table below shows the actual operation modes and lamp status under different combinations of settings by front key, communication and Event input.

Mode select from front key or communication	Event input state	Actual operation mode	Lamp state
Remote	Contact closed	Remote or cascade control	REM mode lamp ON
	Contact open	Local	REM mode lamp OFF
Local	Contact closed		
	Contact open		

When the Event input is used for the setting change and the contact is closed, it takes approx. 0.5 seconds until the new setting is taken by the controller.

9.7 RUN/STOP Transfer

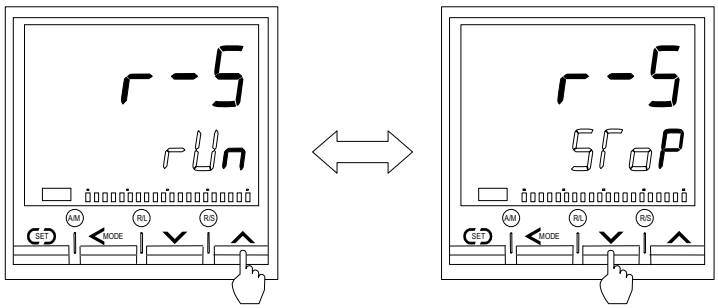
The RUN/STOP transfer can be made by Event input (optional) or Communication (optional) other than the key operation. For details of the RUN/STOP transfer by communication, refer to the **Communication Instruction Manual (IMR01N03-E□)**.*

* Refer to **Communication Instruction Manual (IMR01N04-E□)** for PROFIBUS and **Communication Instruction Manual (IMR01N05-E□)** for DeviceNet, and **Communication Instruction Manual (IMR01N20-E□)** for CC-Link.

- **The controller status at STOP mode is the same as that of Power-off. However for the specification with current output (other than 0 to 20 mA) or voltage output, an output of –5 % is fed when at STOP.**
- **If the instrument is transferred to RUN mode from STOP mode, it performs the same operation (control RUN, Event determination start-up) as the power-on.**

■ RUN/STOP transfer by Front key operation

Every time the UP key or the DOWN key is pressed, the RUN mode is changed to the STOP mode alternately.

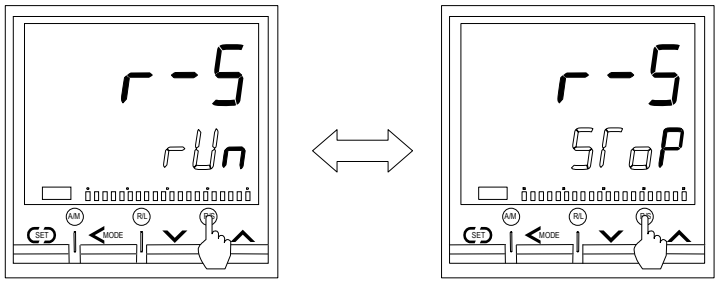


RUN mode STOP mode

For the Operation mode, refer to **9.2 Configuration of Operation Mode. (P. 103)**

■ RUN/STOP transfer by Direct key (R/S) operation

Every time the RUN/STOP (R/S) transfer key is pressed, the RUN mode is changed to the STOP mode alternately.



RUN mode STOP mode

☞ Direct key operation setting can be changed in Engineering mode. For details, refer to **8.5 Direct Keys (F11)** on page 65.

■ RUN/STOP transfer by Event input

RUN/STOP transfer by the Event input is possible with the **Event input logic selection (P. 70)** of the Engineering mode. The table below shows the actual operation modes and displays under different combinations of settings by front key, communication and Event input.

Mode select from front key or communication	Event input state	Actual operation mode	State of STOP character display
RUN (Control RUN)	Contact closed	RUN	STOP is not displayed
	Contact open	STOP	dSTP
STOP (Control STOP)	Contact closed		ESTP
	Contact open		SToP

When the Event output is used for the setting change and the contact is closed, it takes approx. 0.5 seconds until the new setting is taken by the controller.

If the controller does not have Event input function, only "SToP" is displayed.

9.8 Control Area Transfer

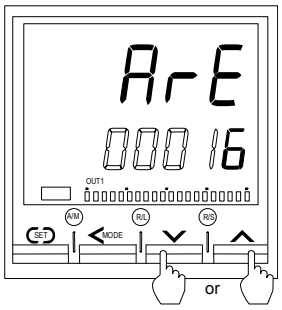
The control area transfer can be made by Event input (optional) or Communication (optional) other than the key operation. For details of transfer by communication, refer to the **Communication Instruction Manual (IMR01N03-E□)**.*

* Refer to **Communication Instruction Manual (IMR01N04-E□)** for PROFIBUS and **Communication Instruction Manual (IMR01N05-E□)** for DeviceNet, and **Communication Instruction Manual (IMR01N20-E□)** for CC-Link.

■ Control area transfer by Front key operation

Press the UP key or the DOWN key to change the desired memory area number used for this control. Press the SET key to store the new setting.

[Display example]



The Memory area number stored at last is taken as Control area.

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

For the SV setting & Monitor mode, refer to **5. SV SETTING & MONITOR MODE. (P. 30)**

■ Control area transfer by Event input

Memory area (control area) transfer by the Event input is possible with the **Event input logic selection (P. 70)** of the Engineering mode. The table below shows the Event input status and selected memory numbers for Control area transfer.

Event input	Memory area number															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DI 1	×	–	×	–	×	–	×	–	×	–	×	–	×	–	×	–
DI 2	×	×	–	–	×	×	–	–	×	×	–	–	×	×	–	–
DI 3	×	×	×	×	–	–	–	–	×	×	×	×	–	–	–	–
DI 4	×	×	×	×	×	×	×	×	–	–	–	–	–	–	–	–

×: Contact open –: Contact closed

To store a new Memory area number as the Control area, close the DI for Memory area set.

9.9 Start Action at Recovering Power Failure

The operation of this instrument is not affected by a power failure of 20 ms or less. The control start mode at power recovery after more than 20 ms power failure can be selected as follows.

Power failure less than 3 seconds	Power failure 3 seconds or more
Hot start 1	Hot start 1
	Hot start 2
	Cold start
	Stop start
Hot start 2	Hot start 2
	Cold start
	Stop start
Cold start	Cold start
Stop start	Stop start

(Factory set value: Less than 3 seconds…Hot start 1, 3 seconds or more…Hot start 1)

- **Each start state is shown below.**

  Hot start 1: the controller will return to the same operation mode and the same manipulated value which were used or calculated by the controller before power failure.

  Hot start 2: the controller will return to the same operation mode which was used by the controller before power failure.
  - In the Manual mode, the output value will be at the low output limit value.
  - In the Auto mode, the controller will calculate the manipulated output value regardless that before power failure. So, the manipulated output varies.

  Cold start: the controller will automatically go to Manual mode and output from the low output limit value.

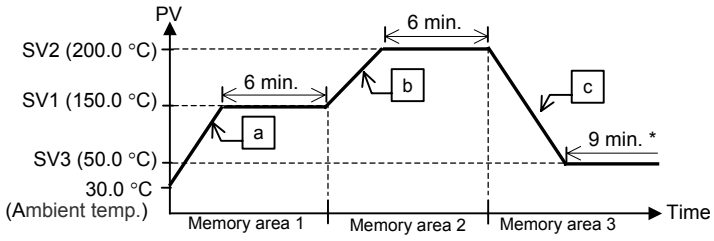
  Stop start: Started in the control stop (STOP) state regardless of the RUN mode (Auto/Manual) before power failure. Set to the RUN mode before power failure when changed to RUN from STOP by RUN/STOP selection.

Control start mode when the controller recovers from power failure can be selected in Engineering mode. For details, refer to **8.12 Control (F50)** on page 83.

9.10 Ramp/Soak Control

Ramp/Soak control is possible by using Area soak time, Link area number and Setting change rate limiter (up/down) in Parameter setting mode (P. 32). The operating procedure is described in the following.

Example: Ramp/Soak control by linking Memory area 1 to 3



	Area 1	Area 2	Area 3
Set value (SV)	150.0 °C	200.0 °C	50.0 °C
Setting change rate limiter (up) (a, b)	5.0 °C/min.	5.0 °C/min.	OFF
Setting change rate limiter (down) (c)	OFF	OFF	3.0 °C/min.
Area soak time	6 min.	6 min.	9 min. *
Link area number	2	3	OFF

The following is based on assumptions described below.

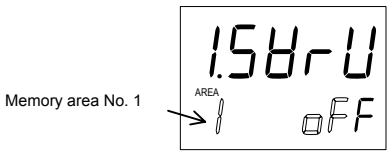
- 1-Input controller (measured input: 1 point)
- Present operating condition: Control STOP
- Control area before operation start: Memory area 1
- Setting of operation related parameters:
  All parameters other than the following items have been set to each of Memory areas 1, 2 and 3.
  SV, Setting change rate limiter, Area soak time, and Link area number

The unit time can be changed by the Setting change rate limiter and the Soak time unit selection in the Engineering mode. (P. 99)

* In this example, the Area soak time for Memory area 3.is set. However, as the Area soak time for the memory area linked last becomes invalid, the state of SV3 reached continues.

Step 1:
Set the Setting change rate limiter, Area soak time and Link area number to each of Memory area 1, 2 and 3.

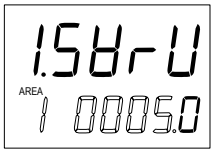
1. Press the SET key several times at Parameter setting mode until Input 1_setting change rate limiter (up) setting screen is displayed.



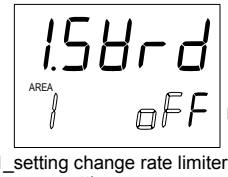
Memory area No. 1

Factory set value: OFF (Unused)

2. Press the UP key to change the number to 5.0.



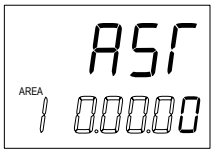
3. Press the SET key to store the new value. The display goes to the next parameter. Check that this screen is set to OFF.



Factory set value: OFF (Unused)

Input 1_setting change rate limiter (down) setting screen

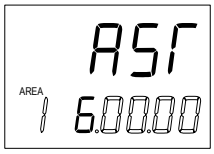
4. Press the SET key until Area soak time setting screen is displayed.



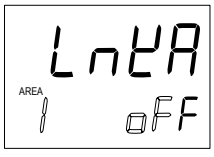
Factory set value: 0.00.00 (0 min.00.00 sec)

5. Press the shift key to high-light the most significant digit.

6. Press the UP key to change the number to 6.



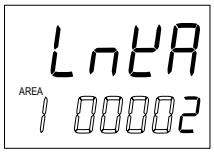
7. Press the SET key to store the new value. The display goes to the next parameter.



Factory set value: OFF (No link)

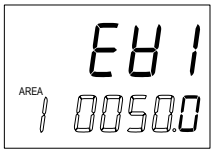
Link area number setting screen

8. Press the UP key to change the number to 2.



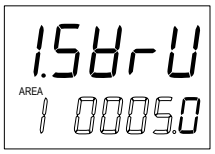
Continued on the next page.

9. Press the SET key to store the new value. The display goes to the next parameter.

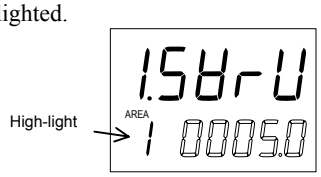


(Example: Event 1 set value setting screen)

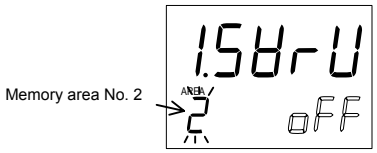
10. Set the Memory area 2.
Press the SET key several times until Input 1_setting change rate limiter (up) setting screen is displayed.



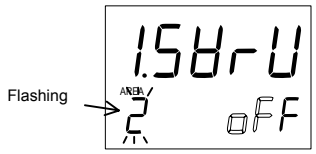
11. Press the shift key until the memory area display unit is high-lighted.



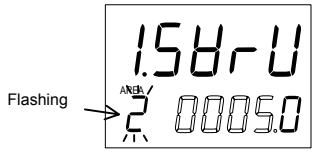
12. Press the UP key to change to 2. Area number display flashes.



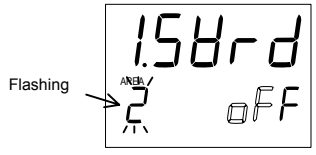
13. Press the shift key to high-light the least significant digit.



14. Press the UP key to change the number to 5.0.

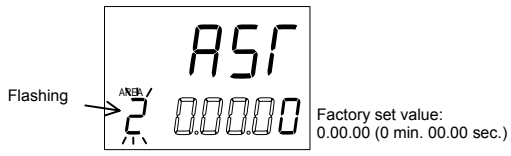


15. Press the SET key to store the new value. The display goes to the next parameter. Check that this screen is set to OFF.

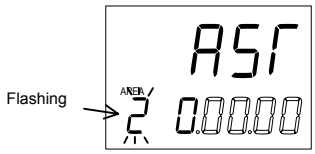


Input 1_setting change rate limiter setting (down) setting screen

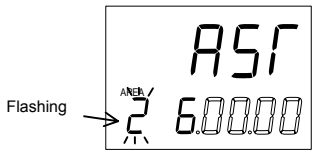
16. Press the SET key until Area soak time setting screen is displayed.



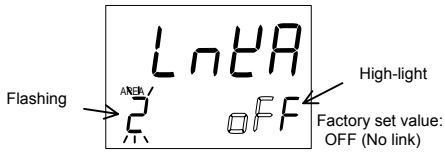
17. Press the shift key to high-light the most significant digit.



18. Press the UP key to change the number to 6.

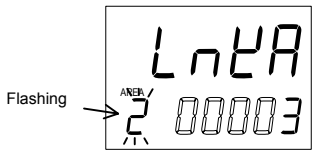


19. Press the SET key to store the new value. The display goes to the next parameter.

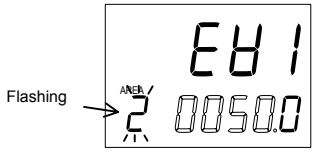


Link area number setting screen

20. Press the UP key to change the number to 3.

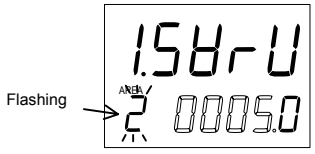


21. Press the SET key to store the new value. The display goes to the next parameter.



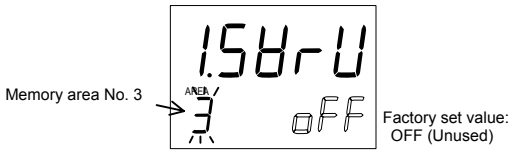
(Example: Event 1 set value setting screen)

22. Set the Memory area 3.
Press the SET key several times until Input 1_setting change rate limiter (up) setting screen is displayed.

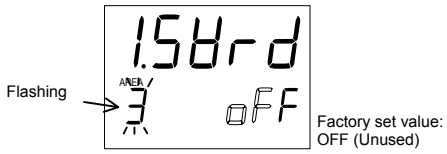


Continued on the next page.

23. Press the UP key to change the number to 3. Check that this screen is set to OFF.

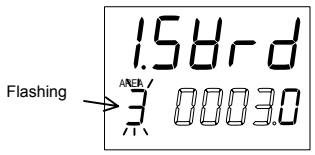


24. Press the SET key to store the new value. The display goes to the next parameter.

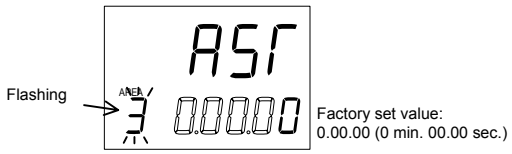


Setting change rate limiter (down) setting screen

25. Press the UP key to change the number to 3.0.

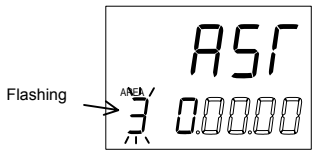


26. Press the SET key to store the new value. The display goes to the next parameter.

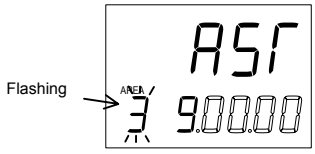


Area soak time setting screen

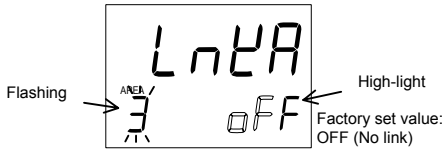
27. Press the shift key to high-light the most significant digit.



28. Press the UP key to change the number to 9.



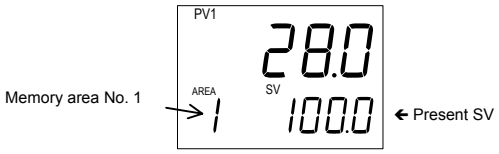
29. Press the SET key to store the new value. The display goes to the next parameter. Check that this screen is set to OFF.



Link area number setting screen

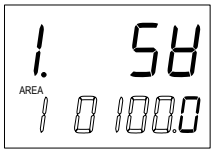
STEP 2:
Set the SV to each of Memory area 1, 2 and 3.

1. Press and hold the SET key for 2 seconds to change the mode from the Parameter setting mode to SV setting & Monitor mode. PV1/SV1 monitor screen is displayed.

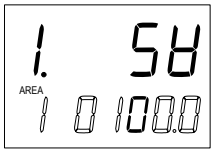


PV1/SV1 monitor screen

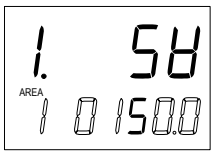
2. Press the SET key until Input 1_set value (SV1) setting screen is displayed.



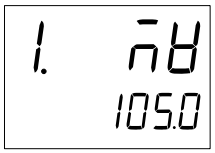
3. Press the shift key to high-light the tens digit.



4. Press the UP key to change the number to 5.

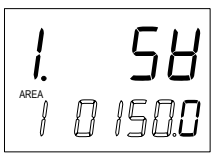


5. Press the SET key to store the new value. The display goes to the next parameter.



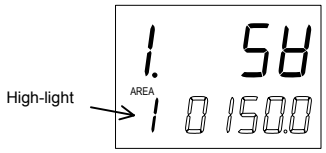
Example: Input 1_MV1 monitor screen

6. Set the set value (SV) of Memory area 2.
Press the SET key several times until Input 1_set value (SV1) setting screen is displayed.

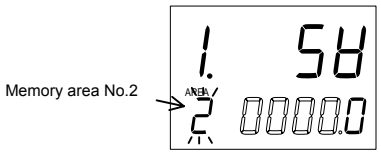


Continued on the next page.

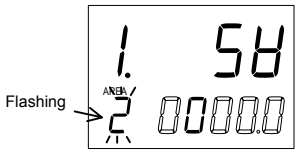
7. Press the shift key until the memory area display unit is displayed.



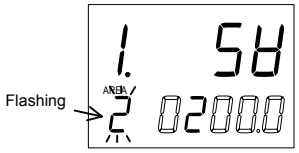
8. Press the UP key to change the number to 2. The number in AREA (Area number) display flashes.



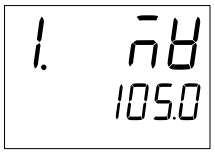
9. Press the shift key to high-light the hundreds digit.



10. Press the UP key to change the number to 2.

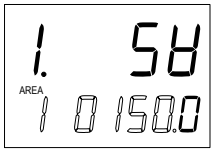


11. Press the SET key to store the new value. The display goes to the next parameter.

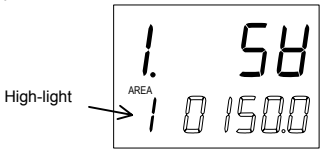


Example: Input 1_MV1 monitor screen

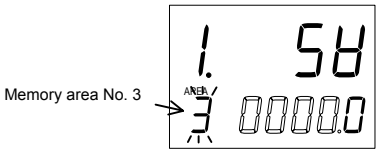
12. Set the set value (SV) of Memory area 3.
Press the SET key several times until Input 1_set value (SV1) setting screen is displayed.



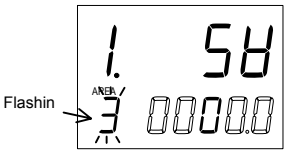
13. Press the shift key until the memory area display unit is displayed.



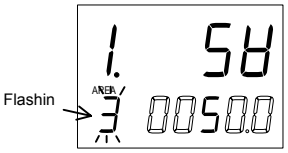
14. Press the UP key to change the number to 3. The number in AREA (Area number) display flashes.



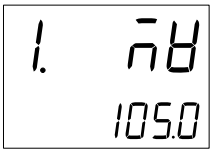
15. Press the shift key to high-light the tens digit.



16. Press the UP key to change the number to 5.



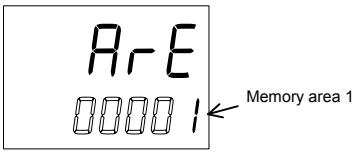
17. Press the SET key to store the new value. The display goes to the next parameter. The SV setting is finished.



(Example: Input 1_MV1 monitor screen)

STEP 3:
Check the control area number.

Press the SET key several times at SV setting & Monitor mode until Memory area selection setting screen is displayed. Check that the memory area at the time of operation start corresponds to Memory area 1.



STEP 4:
Change from STOP mode to RUN mode

Operation starts if turned from STOP mode to RUN mode by pressing the RUN/STOP (R/S) transfer key.

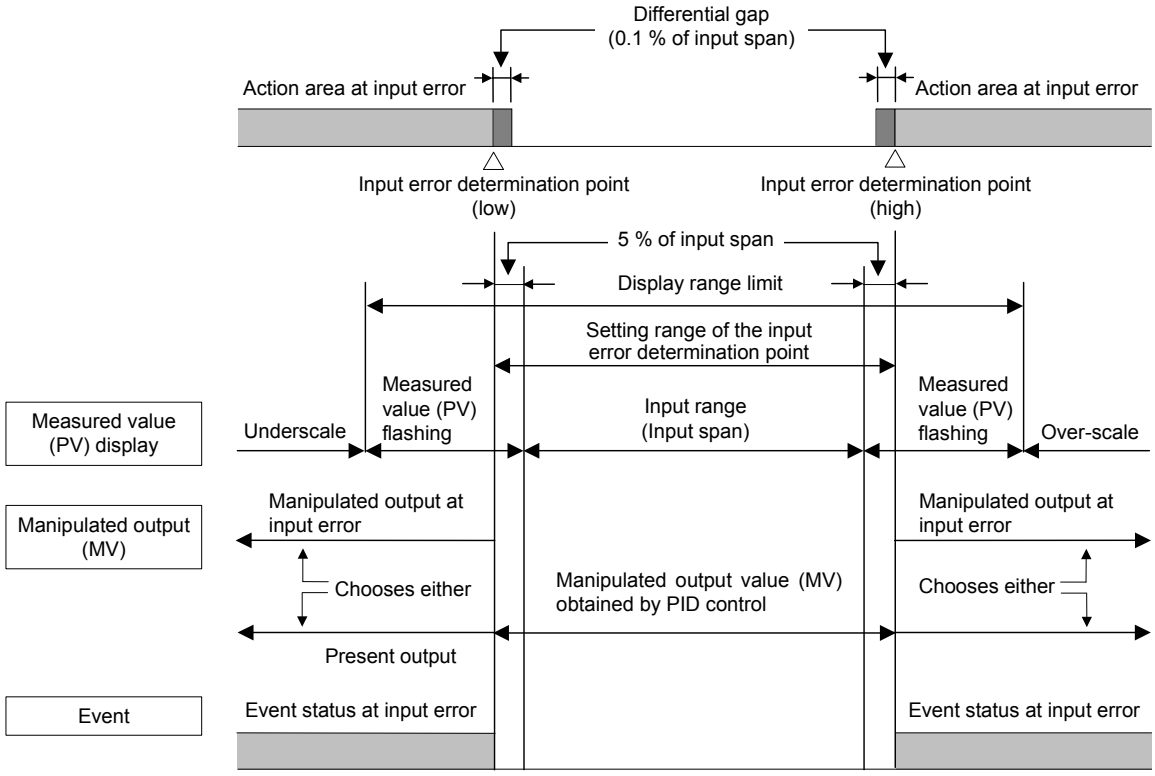
10. ERROR DISPLAY

10.1 Over-scale and Underscale

The table below shows displays, description, control actions and solutions when the Measured value (PV) exceeds the display range.

Display	Description	Action (Output)	Solution
Measured value (PV) [Flashing]	Input error Measured value (PV) exceeds the input error determination point (high /low limit).	Action at input error: Output depending on the action at input error (high/low limit) Event output: Output depending on the Event action at input error	Check input type, input range, sensor and sensor connection.
00000 [Flashing]	Over-scale Measured value (PV) is above the display range limit high (or 99999).		
-19999 [Flashing]	Underscale Measured value (PV) is below the display range limit low (or –19999).		

Prior to replacing the sensor, always turn OFF the power or change to STOP with RUN/STOP transfer.



10.2 Self-diagnostic Error

Displays and description of self-diagnostics are described in the following table:

Upper display	Lower display	Description	Action	Solution
Err	1 (1)	Adjusted data error • Adjusted data range is abnormal.	Display: Error display Output: OFF Communication: Possible	Turn off the power at once. If an error occurs after the power is turned on again, please contact RKC sales office or the agent.
	2 (2)	EEPROM error • Response signal from EEPROM is abnormal. • Data write failure	Display: Error display Output: OFF Communication: Possible	
	4 (4)	A/D conversion error • Response signal from A/D converter is abnormal. • A/D conversion count value is out of the specified range.	Display: Error display Output: OFF Communication: Possible	
	8 (8)	RAM check error	Display: All display is OFF Output: OFF Communication: No response	
	16 (16)	Hardware configuration error • Hardware is abnormal except A/D conversion circuit.	Display: Error display Output: OFF Communication: Possible	
	32 (32)	Software configuration error • There is an abnormality on download data and it cannot execute.	Display: Error display Output: OFF Communication: Possible	
	128 (128)	Watchdog timer error • The part of an internal task stops the action.	Display: Error display Output: OFF Communication: Possible	
	2048 (2048)	Program busy • Could not finish an internal program in a specified time.	Display: Error display Output: OFF Communication: Possible	

When two or more errors occur simultaneously, the error code numbers are totaled and displayed as one number.

11. TROUBLESHOOTING

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

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

⚠ WARNING

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

CAUTION

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

11.1 Display

Problem	Possible cause	Solution
No display appears	The internal assembly is not inserted into the case correctly.	Insert the internal assembly into the case correctly.
	Power supply terminal connection not correct	Connect the terminals correctly by referring to **3.3 Wiring of Each Terminal (P. 16)**.
	Power supply terminal contact defect	Retighten the terminals
	Proper power supply voltage is not being supplied.	Apply the normal power supply by referring to **B. Specifications (A-32)**.
Display is abnormal	Noise source is present near the instrument.	Separate the noise source from the instrument.
	Remote setting signal is input in parallel to two or more this instruments which use grounding type thermocouples.	Insert an isolator to enable isolated remote setting signal input for each instrument.

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Problem	Possible cause	Solution
Measured value (PV) display differs from the actual value	PV bias is set	Set the PV bias to "OFF" by referring to ■ **PV bias (P. 44)**. However, this is limited only to when the PV bias setting can be changed.

How to check if the input function of the controller is working correctly.

- When the controller is configured as Thermocouple input:
  Short the input terminals No. 23 and No. 24 for 1-input controller type (2-input controller type: No. 23 and No. 24 [TC1], No. 20 and No. 21 [TC2]). If the controller shows a Measured value around the ambient temperature of the input terminals, the input function of the controller is working correctly.
- When the controller is configured as RTD input:
  Connect a 100 Ω resister between the input terminals No. 22 and No. 23 for 1-input controller type (2-input controller type: No. 22 and No. 23 [RTD1], No. 19 and No. 20 [RTD2]) and short the input terminals No. 23 and No. 24 (2-input controller type: No. 23 and No. 24 [RTD1], No. 20 and No. 21 [RTD2]). If the controller shows Measured value around 0 °C (32 °F), the input function of the controller is working correctly.
- When the controller is configured as Voltage/Current input:
  Input a certain voltage or current from a voltage/current generator to the controller. If the controller shows the equivalent input value, the input setting and function of the controller is working correctly.

11.2 Control

Problem	Possible cause	Solution
Control is abnormal	The power supply is not correct.	Apply the normal power supply by referring to **B. Specifications (A-32)**.
	Sensor or input lead wires break.	Turn off the power or STOP the operation by "RUN/STOP transfer" and repair the sensor or replace it.
	Proper sensor is not used.	Use the specified sensor.
	The sensor is not wired correctly.	Conduct sensor wiring correctly by referring to **3.3 Wiring of Each Terminal (P. 16)**.
	Sensor insertion depth is insufficient.	Check whether sensor is inserted too loosely. If so, fully insert the sensor.
	Sensor insertion position is not appropriate.	Insert the sensor at the specified location.
	Input signal wires are not separated from instrument power and/or load wires.	Separate each wire.
	Noise source is present near the wiring.	Separate the noise source from the wiring.
	Inappropriate PID constants	Set the correct PID constants.

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Problem	Possible cause	Solution
Autotuning (AT) function not activated	Requirements for performing the Autotuning (AT) function are not satisfied.	Satisfy the requirements for performing the Autotuning (AT) function by referring to **9.4 Autotuning (P. 107)**.
Autotuning (AT) suspended	Requirements for suspending the Autotuning (AT) function are established.	Identify causes for Autotuning (AT) suspension by referring to **9.4 Autotuning (P. 107)** and then remove them. Then, execute the Autotuning (AT) function again.
Acceptable PID values can not be calculated by Autotuning (AT)	The Autotuning (AT) function does not appropriately much the characteristics of the controlled object.	Set PID constants manually.
	The Output change rate limiter is set.	Set PID constants manually.
No output change in step	The Output change rate limiter is set.	Set the Output change rate limiter to "0.0: OFF" by referring to **8.13 Control 1/Control 2 (P. 87).** However, this is limited only to when the Output change rate limiter setting can be changed.

11.3 Operation

Problem	Possible cause	Solution
Output does not become more than (or less than) a specific value	The Output limiter is set.	Change the Output limiter setting by referring to **8.13 Control 1/ Control 2 (P. 87).** However, this is limited only to when the Output limiter setting can be changed.
No setting change can be made by key operation	Set data is locked.	Release the set data lock by referring to ■ **Set lock level (P. 49)**.

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Problem	Possible cause	Solution
Set value (SV) does not become more than (or less than) a specific value	The Setting limiter is set.	Change the Setting limiter setting by referring to **8.18 Set Value 1 (SV1)/ Set Value 2 (SV2) (P. 100)**. However, this is limited only to when the Setting limiter setting can be changed.
Set value (SV) does not change immediately when the Set value (SV) is changed	The Setting change rate limiter is set.	Set the Setting change rate limiter to "OFF" by referring to ■ **Setting change rate limiter [up] (P. 38)**, ■ **Setting change rate limiter [down] (P. 38)**.

11.4 Other

Problem	Possible cause	Solution
Event action is abnormal	Event action is different from the specification.	Change the action by referring to **8.10 Event 1/Event 2/Event 3 /Event 4 (P. 76)** after the specification is confirmed.
	Event output relay contact energized/de-energized is reversed.	Confirm the selection of output logic calculation by referring to **8.8 Output (P. 73)**.
	Event differential gap setting is inappropriate.	Set the appropriate differential gap by referring to **8.10 Event 1/Event 2/ Event 3/Event 4 (P. 76)**.
No heater break can be detected	Setting of Heater break alarm is not appropriate.	Set the appropriate Heater break alarm value.
	The CT is not connected.	Connect the CT by referring to **3.3 Wiring of Each Terminal (P. 20)**.

12. REMOVING THE INTERNAL ASSEMBLY

Removing the internal assembly from the case is rarely required. Should you remove the internal assembly without disconnecting the external wiring, take the following steps:

⚠ WARNING

- To prevent electric shock or instrument failure, only qualified personnel should be allowed to pull out the internal assembly.
- To prevent electric shock or instrument failure, always turn off the power before pulling out the internal assembly.
- To prevent injury or instrument failure, do not touch the internal printed wiring board.

Apply pressure very carefully when removing internal assembly to avoid damage to the frame.

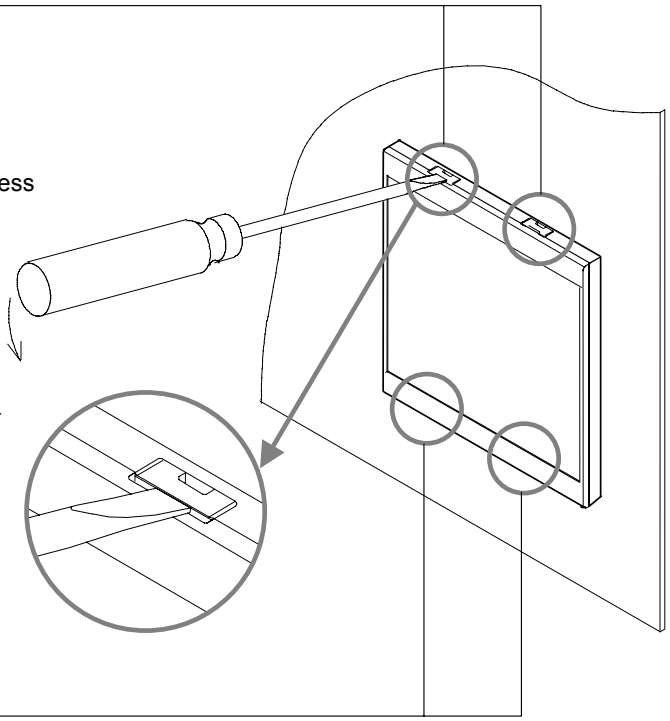
To conform to **IEC61010-1** requirements for protection from electric shock, the internal assembly of this instrument can only be removed with an appropriate tool.

■ Procedures

Lock (Upper: 2 places)

Recommended tool: Slotted screwdriver
Tip width: 6 mm or less

Unlock using such a slotted screwdriver. Gently press down on handle for the upper lock and lift up for the lower lock.



Lock (Lower: 2 places)

MEMO

APPENDIX

A. Setting Data List

A-1. SV setting & Monitor mode

Name	Parameter	Data range	Factory set value	User set value	Page
Input 1_ measured value (PV1)/ set value (SV1) monitor	—	The upper section: Displays Input 1_PV1 The lower section: Displays Input 1_SV1	—		P. 30 P. 104
Input 2_ measured value (PV2)/ set value (SV2) monitor	—	The upper section: Displays Input 2_PV2 The lower section: Displays Input 2_SV2	—		P. 30 P. 104
Input 1_ measured value (PV1)/ Input 2_measured value (PV2) monitor	—	The upper section: Displays Input 1_PV1 The lower section: Displays Input 2_PV2	—		P. 30 P. 104
Input 1_set value (SV1)	1. SV (1. SV)	Input 1_setting limiter low to Input 1_setting limiter high	0.0		P. 30
Input 2_set value (SV2)	2. SV (2. SV)	Input 2_setting limiter low to Input 2_setting limiter high	0.0		P. 30
Remote input value monitor	SVr (SVr)	Input 1_setting limiter low to Input 1 _setting limiter high	—		P. 30 P. 105
Cascade monitor	CAS (CAS)	Input 2_setting limiter low to Input 2_setting limiter high	—		P. 30 P. 105
Input 1_manipulated output value (MV1) monitor	1. MV (1. MV)	−5.0 to +105.0 %	—		P. 30 P. 105
Input 2_manipulated output value (MV2) monitor	2. MV (2. MV)	−5.0 to +105.0 %	—		P. 30 P. 105
Event monitor	EVM (EVM)	Area digits: HBA2 SV ten thousand digits: HBA1 SV thousands digits: EV4 (LBA2) SV hundreds digits: EV3 (LBA1) SV tens digits: EV2 SV units digits: EV1	—		P. 30 P. 105
Feedback resistance input value monitor	PoS (PoS)	0.0 to 100.0 %	—		P. 30 P. 105
Current transformer input value 1 (CT1) monitor	CT1 (CT1)	0.0 to 30.0 A or 0.0 to 100.0 A	—		P. 30 P. 106
Current transformer input value 2 (CT2) monitor	CT2 (CT2)	0.0 to 30.0 A or 0.0 to 100.0 A	—		P. 30 P. 106
Memory area selection	ArE (ArE)	1 to 16	1		P. 30 P. 106
Memory area soak time monitor	APT (APT)	0 minute 00.00 second to 9 minutes 59.99 seconds or 0 hour 00 minute 00 second to 9 hours 59 minutes 59 seconds	—		P. 30 P. 106
CC-Link communication status	CCLS (CCLS)	Displays the status number.	—		P. 30 P. 106

A-2. Setup setting mode

Name	Parameter	Data range	Factory set value	User set value	Page
Heater break alarm 1 (HBA1) set value	HbA1 (HbA1)	OFF (Unused) 0.1 to 30.0 A or 0.1 to 100.0 A	OFF		P. 42
Heater break determination point 1	HbL1 (HbL1)	0.0 to 100.0 % of Heater break alarm 1 (HBA1) set value 0.0: Heater break determination is invalid	30.0		P. 44
Heater melting determination point 1	HbH1 (HbH1)	0.0 to 100.0 % of Heater break alarm 1 (HBA1) set value 0.0: Heater melting determination is invalid	30.0		P. 44
Heater break alarm 2 (HBA2) set value	HbA2 (HbA2)	OFF (Unused) 0.1 to 30.0 A or 0.1 to 100.0 A	OFF		P. 42
Heater break determination point 2	HbL2 (HbL2)	0.0 to 100.0 % of Heater break alarm 2 (HBA2) set value 0.0: Heater break determination is invalid	30.0		P. 44
Heater melting determination point 2	HbH2 (HbH2)	0.0 to 100.0 % of Heater break alarm 2 (HBA2) set value 0.0: Heater melting determination is invalid	30.0		P. 44
Input 1_PV bias	1. Pb (1. Pb)	−Input span to +Input span	0		P. 44
Input 1_PV digital filter	1. dF (1. dF)	OFF (Unused) 0.01 to 10.00 seconds	HA400/900: OFF HA401/901: 1.00		P. 44
Input 1_PV ratio	1. Pr (1. Pr)	0.500 to 1.500	1.000		P. 45
Input 1_PV low input cut-off	1. PLC (1. PLC)	0.00 to 25.00 % of input span	0.00		P. 45
Input 1_proportional cycle time	1. T (1. T)	0.1 to 100.0 seconds Other outputs: Voltage pulse output and Triac output	Relay contact output: 20.0 Other outputs: 2.0		P. 45
Input 2_PV bias	2. Pb (2. Pb)	−Input span to +Input span	0		P. 44
Input 2_PV digital filter	2. dF (2. dF)	OFF (Unused) 0.01 to 10.00 seconds	HA400/900: OFF HA401/901: 1.00		P. 44
Input 2_PV ratio	2. Pr (2. Pr)	0.500 to 1.500	1.000		P. 45

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Name	Parameter	Data range	Factory set value	User set value	Page
Input 2_PV low input cut-off	2. PLC (2. PLC)	0.00 to 25.00 % of input span	0.00		P. 45
Input 2_proportional cycle time	2. T (2. T)	0.1 to 100.0 seconds Other outputs: Voltage pulse output and Triac output	Relay contact output: 20.0 Other outputs: 2.0		P. 45
Device address 1 (Slave address 1)	Add1 (Add1)	0 to 99 (RKC communication, Modbus)	0		P. 46
Communication speed 1	bPS1 (bPS1)	2.4: 2400 bps 4.8: 4800 bps 9.6: 9600 bps 19.2: 19200 bps 38.4: 38400 bps	9.6		P. 46
Data bit configuration 1	bIT1 (bIT1)	Refer to Data bit configuration on the next page.	8n1		P. 46
Interval time 1	InT1 (InT1)	0 to 250 ms	10		P. 47
Device address 2 (Slave address 2)	Add2 (Add2)	0 to 99 (RKC communication, Modbus) 0 to 63 (DeviceNet) 0 to 126 (PROFIBUS) 0 to 64 (CC-Link: 1 station occupied 1 time, 1 station occupied 4 times, 1 station occupied 8 times) 1 to 61 (CC-Link: 4 stations occupied 1 time)	0		P. 47
Communication speed 2	bPS2 (bPS2)	2.4: 2400 bps 4.8: 4800 bps 9.6: 9600 bps 19.2: 19200 bps 38.4: 38400 bps 125: 125 kbps [1] 250: 250 kbps [1] 500: 500 kbps [1] 156: 156 kbps [2] 625: 625 kbps [2] 2500: 2.5 kbps [2] 5000: 5 Mbps [2] 10000: 10 Mbps [2] [1] DeviceNet only [2] CC-Link only	RKC communication, Modbus: 9.6 DeviceNet: 125 CC-Link: 156		P. 47
Data bit configuration 2	bIT2 (bIT2)	Refer to Data bit configuration on the next page.	8n1		P. 48
Interval time 2	InT2 (InT2)	0 to 250 ms	10		P. 48
Infrared communication address	Add3 (Add3)	0 to 99	0		P. 49
Infrared communication speed	bPS3 (bPS3)	9.6: 9600 bps 19.2: 19200 bps	19.2		P. 49
Set lock level	LCK (LCK)	Refer to Set lock level list on the next page.	00000		P. 49

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Data bit configuration

Set value	Data bit	Parity bit	Stop bit
8n1 (8n1)	8	None	1
8n2 (8n2)	8	None	2
8E1 (8E1)	8	Odd	1
8E2 (8E2)	8	Even	2
8o1 (8o1)	8	Odd	1
8o2 (8o2)	8	Even	2
7n1 (7n1)	7	None	1
7n2 (7n2)	7	None	2
7E1 (7E1)	7	Odd	1
7E2 (7E2)	7	Odd	2
7o1 (7o1)	7	Even	1
7o2 (7o2)	7	Even	2

(7n1 to 7o2: Invalid for Modbus)

Set lock level list

Set value	Parameters which can be changed
00000	All parameters [Factory set value]
00001	SV, EV1 to EV4, Memory area selection, Parameters in F10 to F91
00010	All parameters except for EV1 to EV4
00011	SV
00100	All parameters except for SV
00101	EV1 to EV4
00110	All parameters except for SV and EV1 to EV4
00111	No parameter (All Locked)

A-3. Parameter setting mode

Name	Parameter	Data range	Factory set value	User set value	Page
Event 1 set value	EV1 (EV1)	Deviation: −Input span to +Input span Process/SV: Input scale low to Input scale high	50.0		P. 35
Event 2 set value	EV2 (EV2)	Deviation: −Input span to +Input span Process/SV: Input scale low to Input scale high	50.0		P. 35
Event 3 set value	EV3 (EV3)	Deviation: −Input span to +Input span Process/SV: Input scale low to Input scale high	50.0		P. 35
Control loop break alarm 1 (LBA1) time	LbA1 (LbA1)	OFF (Unused) 1 to 7200 seconds	480		P. 35
LBA1 deadband	Lbd1 (Lbd1)	0.0 to Input span (Varies with the setting of the Decimal point position)	0.0		P. 36
Event 4 set value	EV4 (EV4)	Deviation: −Input span to +Input span Process/SV: Input scale low to Input scale high	50.0		P. 35
Control loop break alarm 2 (LBA2) time	LbA2 (LbA2)	OFF (Unused) 1 to 7200 seconds	480		P. 35
LBA2 deadband	Lbd2 (Lbd2)	0.0 to Input span (Varies with the setting of the Decimal point position)	0.0		P. 36
Input 1_proportional band	1. P (1. P)	TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C [°F]) (Varies with the setting of the Decimal point position) Voltage (V)/Current (I) inputs: 0.0 to 1000.0 % of input span 0 (0.0, 0.00): ON/OFF action	30.0		P. 37
Input 1_integral time	1. I (1. I)	OFF (PD action) 1 to 3600 seconds, 0.1 to 3600.0 seconds, or 0.01 to 360.00 seconds (Varies with the setting of the Integral/Derivative time decimal point position selection)	240.00		P. 37
Input 1_derivative time	1. d (1. d)	OFF (PI action) 1 to 3600 seconds, 0.1 to 3600.0 seconds, or 0.01 to 360.00 seconds (Varies with the setting of the Integral/Derivative time decimal point position selection)	60.00		P. 37

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Name	Parameter	Data range	Factory set value	User set value	Page
Input 1_control response parameter	1. rPT (1. rPT)	0: Slow 1: Medium 2: Fast	0		P. 37
Input 2_proportional band	2. P (2. P)	TC/RTD inputs: 0 (0.0, 0.00) to Input span (Unit: °C [°F]) (Varies with the setting of the Decimal point position) Voltage (V)/Current (I) inputs: 0.0 to 1000.0 % of input span 0 (0.0, 0.00): ON/OFF action	30.0		P. 37
Input 2_integral time	2. I (2. I)	OFF (PD action) 1 to 3600 seconds, 0.1 to 3600.0 seconds, or 0.01 to 360.00 seconds (Varies with the setting of the Integral/Derivative time decimal point position selection)	240.00		P. 37
Input 2_derivative time	2. d (2. d)	OFF (PI action) 1 to 3600 seconds, 0.1 to 3600.0 seconds, or 0.01 to 360.00 seconds (Varies with the setting of the Integral/Derivative time decimal point position selection)	60.00		P. 37
Input 2_control response parameter	2. rPT (2. rPT)	0: Slow 1: Medium 2: Fast	0		P. 37
Input 1_setting change rate limiter (up)	1.SVrU (1.SVrU)	OFF (Unused) 0.1 to Input span/unit time * (Varies with the setting of the Decimal point position) * Unit time: 60 seconds (factory set value)	OFF		P. 38
Input 1_setting change rate limiter (down)	1.SVrd (1.SVrd)		OFF		P. 38
Input 2_setting change rate limiter (up)	2.SVrU (2. SVrU)		OFF		P. 38
Input 2_setting change rate limiter (down)	2.SVrd (2.SVrd)		OFF		P. 38
Area soak time	AST (AST)	0 minute 00.00 second to 9 minutes 59.99 seconds or 0 hour 00 minute 00 second to 9 hours 59 minutes 59 seconds	0.00.00		P. 39
Link area number	LnKA (LnKA)	OFF (No link) 1 to 16	OFF		P. 39

A-4. Engineering mode

■ Function block F10: Screen configuration

Name	Parameter	Data range	Factory set value	User set value	Page
STOP display selection	SPCH (SPCH)	0: Displays on the measured value (PV1/PV2) unit 1: Displays on the set value (SV) unit	0		P. 63
Bar graph display selection	dE (dE)	0: No display 1: Input 1_manipulated output value (MV) 2: Input 1_measured value (PV) 3: Input 1_set value (SV) 4: Input 1_deviation value 5: Feedback resistance input value (POS) 6: Input 2_manipulated output value (MV) 7: Input 2_measured value (PV) 8: Input 2_set value (SV) 9: Input 2_deviation value	0		P. 64
Bar graph resolution setting	dEUT (dEUT)	1 to 100 digit/dot	100		P. 64

■ Function block F11: Direct key

Name	Parameter	Data range	Factory set value	User set value	Page
Auto/Manual transfer key operation selection (A/M)	Fn1 (Fn1)	0: Unused 1: Auto/Manual transfer for Input 1 2: Auto/Manual transfer for Input 2 3: Auto/Manual transfer for Input 1 and Input 2	3		P. 65
Remote/Local transfer key operation selection (R/L)	Fn2 (Fn2)	0: Unused 1: Remote/Local transfer	1		P. 65
RUN/STOP transfer key operation selection (R/S)	Fn3 (Fn3)	0: Unused 1: RUN/STOP transfer	1		P. 65

■ Function block F21: Input 1

Name	Parameter	Data range	Factory set value	User set value	Page
Input 1_input type selection	1. InP (1. InP)	TC input 0: K −200 to +1372 °C −328.0 to +2501.6 °F 1: J −200 to +1200 °C −328.0 to +2192.0 °F 2: R −50 to +1768 °C −58.0 to +3214.4 °F 3: S −50 to +1768 °C −58.0 to +3214.4 °F 4: B 0 to 1800 °C 32.0 to 3272.0 °F 5: E −200 to +1000 °C −328.0 to +1832.0 °F 6: N 0 to 1300 °C 32.0 to 2372.0 °F 7: T −200 to +400 °C −328.0 to +752.0 °F 8: W5Re/W26Re 0 to 2300 °C 32.0 to 4172.0 °F 9: PLII 0 to 1390 °C 32.0 to 2534.0 °F RTD input (3-wire system) 12: Pt100 −200 to +850 °C −328.0 to +1562.0 °F 13: JPt100 −200 to +600 °C −328.0 to +1112.0 °F Voltage (V)/Current (I) inputs −19999 to +99999 14: 0 to 20 mA DC 15: 4 to 20 mA DC 16: 0 to 10 V DC 17: 0 to 5 V DC 18: 1 to 5 V DC 19: 0 to 1 V DC 20: 0 to 100 mV DC 21: 0 to 10 mV DC RTD input (4-wire system) 22: Pt100 −200 to +850 °C −328.0 to +1562.0 °F 23: JPt100 −200 to +600 °C −328.0 to +1112.0 °F	Based on model code. When not specifying: Type K		P. 66
Input 1_display unit selection	1.UnIT (1.UnIT)	0: °C 1: °F	0		P. 67

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Name	Parameter	Data range	Factory set value	User set value	Page
Input 1_decimal point position	1.PGdP (1.PGdP)	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places	1		P. 67
Input 1_input scale high	1.PGSH (1.PGSH)	TC/RTD inputs: Input scale low to Maximum value of the selected input range Voltage (V)/Current (I) inputs: −19999 to +99999 (Varies with the setting of the Decimal point position)	TC/RTD: Maximum value of the selected input range V/I: 100.0		P. 67
Input 1_input scale low	1.PGSL (1.PGSL)	TC/RTD inputs: Minimum value of the selected input range to Input scale high Voltage (V)/Current (I) inputs: −19999 to +99999 (Varies with the setting of the Decimal point position)	TC/RTD: Minimum value of the selected input range V/I: 0.0		P. 68
Input 1_input error determination point (high)	1. PoV (1. PoV)	Input scale low − (5 % of input span) to Input scale high + (5 % of input span)	TC/RTD: Input scale high + (5 % of input span) V/I: 105.0		P. 68
Input 1_input error determination point (low)	1. PUn (1. PUn)	Input scale low − (5 % of input span) to Input scale high + (5 % of input span)	TC/RTD: Input scale low − (5 % of input span) V/I: −5.0		P. 68
Input 1_burnout direction	1. boS (1. boS)	0: Upscale 1: Downscale	0		P. 69
Input 1_square root extraction selection	1. SQr (1. SQr)	0: Unused 1: Used	0		P. 69
Power supply frequency selection	PFrQ (PFrQ)	0: 50 Hz 1: 60 Hz	0		P. 69

■ Function block F22: Input 2

Name	Parameter	Data range	Factory set value	User set value	Page
Input 2_input type selection	2. InP (2. InP)	TC input 0: K −200 to +1372 °C −328.0 to +2501.6 °F 1: J −200 to +1200 °C −328.0 to +2192.0 °F 2: R −50 to +1768 °C −58.0 to +3214.4 °F 3: S −50 to +1768 °C −58.0 to +3214.4 °F 4: B 0 to 1800 °C 32.0 to 3272.0 °F 5: E −200 to +1000 °C −328.0 to +1832.0 °F 6: N 0 to 1300 °C 32.0 to 2372.0 °F 7: T −200 to +400 °C −328.0 to +752.0 °F 8: W5Re/W26Re 0 to 2300 °C 32.0 to 4172.0 °F 9: PLII 0 to 1390 °C 32.0 to 2534.0 °F RTD input (3-wire system) 12: Pt100 −200 to +850 °C −328.0 to +1562.0 °F 13: JPt100 −200 to +600 °C −328.0 to +1112.0 °F Voltage (V)/Current (I) inputs −19999 to +99999 14: 0 to 20 mA DC 15: 4 to 20 mA DC 16: 0 to 10 V DC 17: 0 to 5 V DC 18: 1 to 5 V DC 19: 0 to 1 V DC 20: 0 to 100 mV DC 21: 0 to 10 mV DC	Based on model code. When not specifying: Type K		P. 66
Input 2_display unit selection	2UnIT (2.UnIT)	0: °C 1: °F	0		P. 67

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Name	Parameter	Data range	Factory set value	User set value	Page
Input 2_decimal point position	2PGdP (2.PGdP)	0: No decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places	1		P. 67
Input 2_input scale high	2PGSH (2.PGSH)	TC/RTD inputs: Input scale low to Maximum value of the selected input range Voltage (V)/Current (I) inputs: −19999 to +99999 (Varies with the setting of the Decimal point position)	TC/RTD: Maximum value of the selected input range V/I: 100.0		P. 67
Input 2_input scale low	2PGSL (2.PGSL)	TC/RTD inputs: Minimum value of the selected input range to Input scale high Voltage (V)/Current (I) inputs: −19999 to +99999 (Varies with the setting of the Decimal point position)	TC/RTD: Minimum value of the selected input range V/I: 0.0		P. 68
Input 2_input error determination point (high)	2. PoH (2. PoV)	Input scale low − (5 % of input span) to Input scale high + (5 % of input span)	TC/RTD: Input scale high + (5 % of input span) V/I: 105.0		P. 68
Input 2_input error determination point (low)	2. PUn (2. PUn)	Input scale low − (5 % of input span) to Input scale high + (5 % of input span)	TC/RTD: Input scale low − (5 % of input span) V/I: −5.0		P. 68
Input 2_burnout direction	2. boS (2. boS)	0: Upscale 1: Downscale	0		P. 69
Input 2_square root extraction selection	2. SQr (2. SQr)	0: Unused 1: Used	0		P. 69

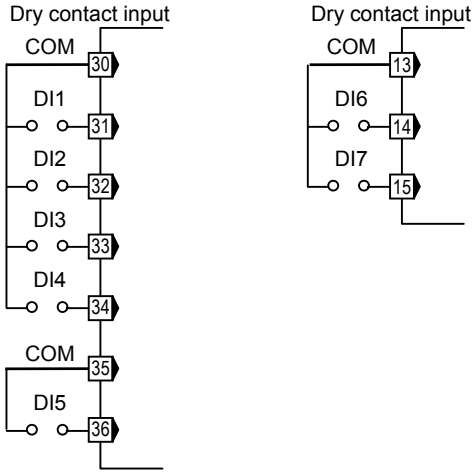
■ Function block F23: Event input

Name	Parameter	Data range	Factory set value	User set value	Page
Event input logic selection	dI SL (dISL)	0 to 6 (Refer to the following table.)	1		P. 70

Event input logic selection

Set value	DI 1	DI 2	DI 3	DI 4	DI 5	DI 6	DI 7
	Terminal No. 30-31	Terminal No. 30-32	Terminal No. 30-33	Terminal No. 30-34	Terminal No. 35-36	Terminal No. 13-14	Terminal No. 13-15
0	Unused (No function assignment)						
1	Memory area number selection (1 to 16)				Memory area set	RUN/STOP transfer	Auto/Manual transfer
2	Memory area number selection (1 to 16)				Memory area set	RUN/STOP transfer	Remote/Local transfer
3	Memory area number selection (1 to 16)				Memory area set	Remote/Local transfer	Auto/Manual transfer
4	Memory area number selection (1 to 8)			Memory area set	RUN/STOP transfer	Remote/Local transfer	Auto/Manual transfer
5	Memory area number selection (1 to 8)			Memory area set	Remote/Local transfer	Unused	Unused
6	Memory area number selection (1 to 8)			Memory area set	Auto/Manual transfer	Unused	Unused

With Event input (optional), terminals 13 to 15 and 30 to 36 are allocated to Event input. Event input must be specified when ordering.



- Event input can not be selected if Communication 1 function is specified. Use Communication 2 function if both event inputs and communications are necessary.
- Contact input from external devices or equipment should be dry contact input. If it is not dry contact input, the input should have meet the specifications below.

  Contact specifications: At OFF (contact open): 500 kΩ or more At ON (contact closed) 10 Ω or less

■ Function block F30: Output

Name	Parameter	Data range	Factory set value	User set value	Page
Output logic selection	LoGC (LoGC)	0 to 11 (Refer to the following table.)	1-input: 1 2-input: 5		P. 73
Output 1 timer setting	oTT1 (oTT1)	0.0 to 600.0 seconds	0.0		P. 74
Output 2 timer setting	oTT2 (oTT2)	0.0 to 600.0 seconds	0.0		P. 74
Output 3 timer setting	oTT3 (oTT3)	0.0 to 600.0 seconds	0.0		P. 74
Output 4 timer setting	oTT4 (oTT4)	0.0 to 600.0 seconds	0.0		P. 74
Output 5 timer setting	oTT5 (oTT5)	0.0 to 600.0 seconds	0.0		P. 74
Alarm lamp lighting condition setting 1	ALC1 (ALC1)	SV ten thousand digits: "0" Fixed SV thousands digits: 0 or 1 (Event 4) SV hundreds digits: 0 or 1 (Event 3) SV tens digits: 0 or 1 (Event 2) SV units digits: 0 or 1 (Event 1)	01111 (0: ALM lamp isn't lit 1: ALM lamp is lit)		P. 74
Alarm lamp lighting condition setting 2	ALC2 (ALC2)	SV ten thousand digits to SV hundreds digits: "0" Fixed SV tens digits: 0 or 1 (HBA2) SV units digits: 0 or 1 (HBA1)	00011 (0: ALM lamp isn't lit 1: ALM lamp is lit)		P. 74

Output logic selection

Set value	OUT1	OUT2	OUT3	OUT4	OUT5
1	MV1	HBA1 or HBA2 (Energized)	EV3 or EV4 (Energized)	EV2 (Energized)	EV1 (Energized)
2	MV1	HBA1 or HBA2 (De-energized)	EV3 or EV4 (De-energized)	EV2 (De-energized)	EV1 (De-energized)
3	MV1	EV3, 4 or HBA1, 2 (Energized)	EV2 (Energized)	EV1 (Energized)	FAIL (De-energized)
4	MV1	EV3, 4 or HBA1, 2 (De-energized)	EV2 (De-energized)	EV1 (De-energized)	FAIL (De-energized)
5	MV1	MV2	EV4 or HBA2 (Energized)	EV3 or HBA1 (Energized)	EV1 or EV2 (Energized)
6	MV1	MV2	EV4 or HBA2 (De-energized)	EV3 or HBA1 (De-energized)	EV1 or EV2 (De-energized)
7	MV1	MV2	EV3, 4 or HBA1, 2 (Energized)	EV2 (Energized)	EV1 (Energized)
8	MV1	MV2	EV3, 4 or HBA1, 2 (De-energized)	EV2 (De-energized)	EV1 (De-energized)
9	MV1 (OPEN)	MV1 (CLOSE)	EV3, 4 or HBA1, 2 (Energized)	EV2 (Energized)	EV1 (Energized)
10	MV1 (OPEN)	MV1 (CLOSE)	EV3, 4 or HBA1, 2 (De-energized)	EV2 (De-energized)	EV1 (De-energized)
11	MV1	EV4 or HBA2 (Energized)	EV3 or HBA1 (Energized)	EV2 (Energized)	EV1 (Energized)

■ Function block F31: Transmission output 1

Name	Parameter	Data range	Factory set value	User set value	Page
Transmission output 1_ type selection	Ao1 (Ao1)	-----: None 1. PV: Input 1_ measured value (PV) 1. SV: Input 1_set value (SV) 1.dEV: Input 1_deviation value 1. MV: Input 1_manipulated output value (MV) 2. PV: Input 2_ measured value (PV) 2. SV: Input 2_set value (SV) 2.dEV: Input 2_deviation value 2. MV: Input 2_manipulated output value (MV) PoS: Feedback resistance input value (POS)	-----: None		P. 75
Transmission output 1_ scale high	AHS1 (AHS1)	Measured value (PV) and Set value (SV): Input scale low to Input scale high Manipulated output value (MV) and Feedback resistance input value (POS): −5.0 to +105.0 % Deviation: −Input span to +Input span	PV/SV: Input scale high MV/POS: 100.0 Deviation: +Input span		P. 75
Transmission output 1_ scale low	ALS1 (ALS1)	Measured value (PV) and Set value (SV): Input scale low to Input scale high Manipulated output value (MV) and Feedback resistance input value (POS): −5.0 to +105.0 % Deviation: −Input span to +Input span	PV/SV: Input scale low MV/POS: 0.0 Deviation: −Input span		P. 75

■ Function block F32: Transmission output 2

Name	Parameter	Data range	Factory set value	User set value	Page
Transmission output 2_ type selection	Ao2 (Ao2)	-----: None 1. PV: Input 1_ measured value (PV) 1. SV: Input 1_set value (SV) 1.dEV: Input 1_deviation value 1. MV: Input 1_manipulated output value (MV) 2. PV: Input 2_ measured value (PV) 2. SV: Input 2_set value (SV) 2.dEV: Input 2_deviation value 2. MV: Input 2_manipulated output value (MV) PoS: Feedback resistance input value (POS)	-----: None		P. 75
Transmission output 2_ scale high	AHS2 (AHS2)	Measured value (PV) and Set value (SV): Input scale low to Input scale high Manipulated output value (MV) and Feedback resistance input value (POS): −5.0 to +105.0 % Deviation: −Input span to +Input span	PV/SV: Input scale high MV/POS: 100.0 Deviation: +Input span		P. 75
Transmission output 2_ scale low	ALS2 (ALS2)	Measured value (PV) and Set value (SV): Input scale low to Input scale high Manipulated output value (MV) and Feedback resistance input value (POS): −5.0 to +105.0 % Deviation: −Input span to +Input span	PV/SV: Input scale low MV/POS: 0.0 Deviation: −Input span		P. 75

■ Function block F33: Transmission output 3

Name	Parameter	Data range	Factory set value	User set value	Page
Transmission output 3_ type selection	Ao3 (Ao3)	-----: None 1. PV: Input 1_ measured value (PV) 1. SV: Input 1_set value (SV) 1.dEV: Input 1_deviation value 1. MV: Input 1_manipulated output value (MV) 2. PV: Input 2_ measured value (PV) 2. SV: Input 2_set value (SV) 2.dEV: Input 2_deviation value 2. MV: Input 2_manipulated output value (MV) PoS: Feedback resistance input value (POS)	-----: None		P. 75
Transmission output 3_ scale high	AHS3 (AHS3)	Measured value (PV) and Set value (SV): Input scale low to Input scale high Manipulated output value (MV) and Feedback resistance input value (POS): −5.0 to +105.0 % Deviation: −Input span to +Input span	PV/SV: Input scale high MV/POS: 100.0 Deviation: +Input span		P. 75
Transmission output 3_ scale low	ALS3 (ALS3)	Measured value (PV) and Set value (SV): Input scale low to Input scale high Manipulated output value (MV) and Feedback resistance input value (POS): −5.0 to +105.0 % Deviation: −Input span to +Input span	PV/SV: Input scale low MV/POS: 0.0 Deviation: −Input span		P. 75

■ Function block F41: Event 1

Name	Parameter	Data range	Factory set value	User set value	Page
Event 1 type selection	ES1 (ES1)	0: None 1: Deviation high 2: Deviation low 3: Deviation high/low 4: Band 5: Process high 6: Process low 7: SV high 8: SV low	0		P. 76
Event 1 hold action	EHo1 (EHo1)	0: OFF 1: ON 2: Re-hold action ON	0		P. 78
Event 1 differential gap	EH1 (EH1)	0 to Input span (Varies with the setting of the Decimal point position)	TC/RTD: 2.0 °C [°F] V/I: 0.2 % of input span		P. 79
Event 1 action at input error	EEo1 (EEo1)	0: Normal processing 1: Turn the event output ON	0		P. 80
Event 1 assignment	EVA1 (EVA1)	1: For Input 1 2: For Input 2	1		P. 80

■ Function block F42: Event 2

Name	Parameter	Data range	Factory set value	User set value	Page
Event 2 type selection	ES2 (ES2)	0: None 1: Deviation high 2: Deviation low 3: Deviation high/low 4: Band 5: Process high 6: Process low 7: SV high 8: SV low	0		P. 76
Event 2 hold action	EHo2 (EHo2)	0: OFF 1: ON 2: Re-hold action ON	0		P. 78
Event 2 differential gap	EH2 (EH2)	0 to Input span (Varies with the setting of the Decimal point position)	TC/RTD: 2.0 °C [°F] V/I: 0.2 % of input span		P. 79
Event 2 action at input error	EEo2 (EEo2)	0: Normal processing 1: Turn the event output ON	0		P. 80
Event 2 assignment	EVA2 (EVA2)	1: For Input 1 2: For Input 2	1		P. 80

■ Function block F43: Event 3

Name	Parameter	Data range	Factory set value	User set value	Page
Event 3 type selection	ES3 (ES3)	0: None 1: Deviation high 2: Deviation low 3: Deviation high/low 4: Band 5: Process high 6: Process low 7: SV high 8: SV low 9: Control loop break (LBA)	0		P. 76
Event 3 hold action	EHo3 (EHo3)	0: OFF 1: ON 2: Re-hold action ON	0		P. 78
Event 3 differential gap	EH3 (EH3)	0 to Input span (Varies with the setting of the Decimal point position)	TC/RTD: 2.0 °C [°F] V/I: 0.2 % of input span		P. 79
Event 3 action at input error	EEo3 (EEo3)	0: Normal processing 1: Turn the event output ON	0		P. 80
Event 3 assignment	EVA3 (EVA3)	1: For Input 1 2: For Input 2	1		P. 80

■ Function block F44: Event 4

Name	Parameter	Data range	Factory set value	User set value	Page
Event 4 type selection	ES4 (ES4)	0: None 1: Deviation high 2: Deviation low 3: Deviation high/low 4: Band 5: Process high 6: Process low 7: SV high 8: SV low 9: Control loop break (LBA)	0		P. 76
Event 4 hold action	EHo4 (EHo4)	0: OFF 1: ON 2: Re-hold action ON	0		P. 78
Event 4 differential gap	EH4 (EH4)	0 to Input span (Varies with the setting of the Decimal point position)	TC/RTD: 2.0 °C [°F] V/I: 0.2 % of input span		P. 79
Event 4 action at input error	EEo4 (EEo4)	0: Normal processing 1: Turn the event output ON	0		P. 80
Event 4 assignment	EVA4 (EVA4)	1: For Input 1 2: For Input 2	1		P. 80

■ Function block F45: Current transformer input 1 (CT1)

Name	Parameter	Data range	Factory set value	User set value	Page
CT1 ratio	CTr1 (CTr1)	0 to 9999	CTL-6-P-N: 800 CTL-12-S56-10L-N: 1000		P. 81
Heater break alarm 1 (HBA1) type selection	HbS1 (HbS1)	0: Heater break alarm (HBA) type A 1: Heater break alarm (HBA) type B	1		P. 81
Number of heater break alarm 1 (HBA1) delay times	HbC1 (HbC1)	0 to 255	5		P. 82
CT1 assignment	CTA1 (CTA1)	0: None 3: OUT3 1: OUT1 4: OUT4 2: OUT2 5: OUT5	CT1 provided: 1 CT1 not provided: 0		P. 82

■ Function block F46: Current transformer input 2 (CT2)

Name	Parameter	Data range	Factory set value	User set value	Page
CT2 ratio	CTr2 (CTr2)	0 to 9999	CTL-6-P-N: 800 CTL-12-S56-10L-N: 1000		P. 81
Heater break alarm 2 (HBA2) type selection	HbS2 (HbS2)	0: Heater break alarm (HBA) type A 1: Heater break alarm (HBA) type B	1		P. 81
Number of heater break alarm 2 (HBA2) delay times	HbC2 (HbC2)	0 to 255	5		P. 82
CT2 assignment	CTA2 (CTA2)	0: None 3: OUT3 1: OUT1 4: OUT4 2: OUT2 5: OUT5	CT2 provided: 1 CT2 not provided: 0		P. 82

■ Function block F50: Control

Name	Parameter	Data range	Factory set value	User set value	Page
Hot/Cold start selection	Pd (Pd)	Power failure less than 3 seconds: 0: Hot 1 5: Cold 1: Hot 1 6: Hot 1 2: Hot 1 7: Hot 2 3: Hot 2 8: Stop 4: Hot 2 Power failure 3 seconds or more: 0: Hot 1 5: Cold 1: Hot 2 6: Stop 2: Cold 7: Stop 3: Hot 2 8: Stop 4: Cold	0		P. 83
Input 2_use selection	CAn (CAM)	0: Single loop control 1: Remote input 2: Cascade control (Slave)	0		P. 84
Cascade ratio	CAr (CAr)	0.0000 to 1.5000	1.0000		P. 84
Cascade bias	CAb (CAb)	−Input span to +Input span	0.0		P. 85
SV tracking	trU (TrK)	0: Unused 1: Used	1		P. 86

■ Function block F51: Control 1

Name	Parameter	Data range	Factory set value	User set value	Page
Input 1_control action type selection	1. oS (1. oS)	0: Direct action 1: Reverse action	1		P. 87
Input 1_ integral/derivative time decimal point position selection	1.I ddP (1.I ddP)	0: No decimal place 1: One decimal place 2: Two decimal places	2		P. 87
Input 1_derivative gain	1. dGA (1. dGA)	0.1 to 10.0	6.0		P. 87
Input 1_ON/OFF action differential gap (upper)	1. oHH (1. oHH)	0 to Input span (Varies with the setting of the Decimal point position)	TC/RTD: 1.0 °C [°F] V/I: 0.1 % of input span		P. 88
Input 1_ON/OFF action differential gap (lower)	1. oHL (1. oHL)		TC/RTD: 1.0 °C [°F] V/I: 0.1 % of input span		P. 88
Input 1_action at input error (high)	1AoVE (1.AoVE)	0: Normal control 1: Manipulated output value at input error	0		P. 89
Input 1_action at input error (low)	1AUnE (1.AUnE)		0		P. 89
Input 1_manipulated output value at input error	1. PSn (1. PSM)	−5.0 to +105.0 %	−5.0		P. 89
Input 1_output change rate limiter (up)	1. orU (1. orU)	0.0 to 1000.0 %/second of manipulated output (0.0: OFF)	0.0		P. 90
Input 1_output change rate limiter (down)	1. ord (1. ord)		0.0		P. 91
Input 1_output limiter high	1. oLH (1. oLH)	Input 1_output limiter low to 105.0 %	105.0		P. 91
Input 1_output limiter low	1. oLL (1. oLL)	−5.0 % to Input 1_output limiter high	−5.0		P. 91
Input 1_power feed forward selection	1. PFF (1. PFF)	0: Unused 1: Used	Unused: 0 Used: 1		P. 92
Input 1_power feed forward gain	1PFFS (1.PFFS)	0.01 to 5.00	1.00		P. 93

■ Function block F52: Control 2

Name	Parameter	Data range	Factory set value	User set value	Page
Input 2_control action type selection	2. oS (2. oS)	0: Direct action 1: Reverse action	1		P. 87
Input 2_ integral/derivative time decimal point position selection	2I ddP (2.I ddP)	0: No decimal place 1: One decimal place 2: Two decimal places	2		P. 87
Input 2_derivative gain	2. dGA (1. dGA)	0.1 to 10.0	6.0		P. 87
Input 2_ON/OFF action differential gap (upper)	2. oHH (2. oHH)	0 to Input span	TC/RTD: 1.0 °C [°F] V/I: 0.1 % of input span		P. 88
Input 2_ON/OFF action differential gap (lower)	2. oHL (2. oHL)	0 to Input span	TC/RTD: 1.0 °C [°F] V/I: 0.1 % of input span		P. 88
Input 2_action at input error (high)	2AoVE (2.AoVE)	0: Normal control 1: Manipulated output value at input error	0		P. 89
Input 2_action at input error (low)	2AUnE (2.AUnE)		0		P. 89
Input 2_manipulated output value at input error	2. PSn (2. PSM)	−5.0 to +105.0 %	−5.0		P. 89
Input 2_output change rate limiter (up)	2. orU (2. orU)	0.0 to 1000.0 %/second of manipulated output (0.0: OFF)	0.0		P. 90
Input 2_output change rate limiter (down)	2. ord (2. ord)		0.0		P. 91
Input 2_output limiter high	2. oLH (2. oLH)	Input 2_output limiter low to 105.0 %	105.0		P. 91
Input 2_output limiter low	2. oLL (2. oLL)	−5.0 % to Input 2_output limiter high	−5.0		P. 91
Input 2_power feed forward selection	2. PFF (2. PFF)	0: Unused 1: Used	Unused: 0 Used: 1		P. 92
Input 2_power feed forward gain	2PFFS (2.PFFS)	0.01 to 5.00	1.00		P. 93

■ Function block F53: Autotuning 1 (AT1)

Name	Parameter	Data range	Factory set value	User set value	Page
Input 1_AT bias	1. ATb (1. ATb)	−Input span to +Input span	0		P. 93
Input 1_AT cycle	1. ATC (1. ATC)	0: 1.5 cycles 1: 2.0 cycles 2: 2.5 cycles 3: 3.0 cycles	1		P. 94
Input 1_AT differential gap time	1. ATH (1. ATH)	0.00 to 50.00 seconds	HA400/900: 0.10 HA401/901: 10.00		P. 95

■ Function block F54: Autotuning 2 (AT2)

Name	Parameter	Data range	Factory set value	User set value	Page
Input 2_AT bias	2. ATb (2. ATb)	−Input span to +Input span	0		P. 93
Input 2_AT cycle	2. ATC (2. ATC)	0: 1.5 cycles 1: 2.0 cycles 2: 2.5 cycles 3: 3.0 cycles	1		P. 94
Input 2_AT differential gap time	2. ATH (2. ATH)	0.00 to 50.00 seconds	HA400/900: 0.10 HA401/901: 10.00		P. 95

■ Function block F55: Position proportioning PID action

Name	Parameter	Data range	Factory set value	User set value	Page
Open/Close output neutral zone	Ydb (Ydb)	0.1 to 10.0 % of output	10.0		P. 96
Open/Close output differential gap	YHS (YHS)	0.1 to 5.0 % of output	0.2		P. 97
Action at feedback resistance (FBR) input error	Ybr (Ybr)	0: Close-side output ON, Open-side output OFF 1: Close-side output OFF, Open-side output OFF 2: Close-side output OFF, Open-side output ON	0		P. 97
Feedback resistance (FBR) input assignment	PoSA (PoSA)	1: Input 1 2: Input 2	1		P. 97
Feedback adjustment	PoS (PoS)	Press and hold the shift key for 5 seconds to start adjustment.	—		P. 98

■ Function block F60: Communication function

Name	Parameter	Data range	Factory set value	User set value	Page
Communication 1 protocol selection	CMPS1 (CMPS1)	0: RKC communication 1: Modbus 1 2: Modbus 2	RKC communication: 0 Modbus: 2		P. 99
Communication 2 protocol selection	CMPS2 (CMPS2)	0: RKC communication 1: Modbus 1 2: Modbus 2 10: CC-Link (1 station occupied 1 time) 11: CC-Link (1 station occupied 4 times) 12: CC-Link (1 station occupied 8 times) 13: CC-Link (4 stations occupied 1 time)	RKC communication: 0 Modbus: 2 CC-Link: 10		P. 99

■ Function block F70: Set value (SV)

Name	Parameter	Data range	Factory set value	User set value	Page
Setting change rate limiter unit time	SVrT (SVrT)	1 to 3600 seconds	60		P. 99
Soak time unit selection	STdP (STdP)	0: 0 hour 00 minutes 00 second to 9 hours 59 minutes 59 seconds 2: 0 minutes 00.00 seconds to 9 minutes 59.99 seconds	2		P. 99

■ Function block F71: Set value 1 (SV1)

Name	Parameter	Data range	Factory set value	User set value	Page
Input 1_setting limiter high	1. SLH (1. SLH)	Input 1_setting limiter low to Input 1_input scale high	Input scale high		P. 100
Input 1_setting limiter low	1. SLL (1. SLL)	Input 1_input scale low to Input 1_setting limiter high	Input scale low		P. 100

■ Function block F72: Set value 2 (SV2)

Name	Parameter	Data range	Factory set value	User set value	Page
Input 2_setting limiter high	2. SLH (2. SLH)	Input 2_setting limiter low to Input 2_input scale high	Input scale high		P. 100
Input 2_setting limiter low	2. SLL (2. SLL)	Input 2_input scale low to Input 2_setting limiter high	Input scale low		P. 100

■ Function block F91: System information display

Name	Parameter	Data range	Factory set value	User set value	Page
ROM version display	roM (roM)	Displays the version of loaded software.	—		P. 101
Integrated operating time display	WT (WT)	0 to 99999 hours	—		P. 101
Holding peak value ambient temperature display	TCJ (TCJ)	−10.0 to +100.0 °C Displays the maximum ambient temperature of the instrument.	—		P. 101
Power feed transformer input value display	HEAT (HEAT)	0.0 to 160.0 % (Displays in the percentage of the rated value.) Displays the input value of a power feed transformer.	—		P. 101

B. Specifications

■ Measured input

Number of inputs: 2 points (Isolated between 2 inputs)
Specify when ordering

Input type:

Voltage (low) group

TC: K, J, T, S, R, E, B (JIS-C1602-1995)
PL II (NBS), N (JIS-C1602-1995)
W5Re/W26Re (ASTM E988-96)

RTD: Pt100 (JIS-C1604-1997)
JPt100 (JIS-C1604-1989, JIS-C1604-1981 of Pt100)
3-wire system and 4-wire system are possible
(Two-input controller is not available with 4-wire RTD.)

Voltage: 0 to 1 V, 0 to 100 mV, 0 to 10 mV

Current: 4 to 20 mA, 0 to 20 mA
Input impedance: 50 Ω

Voltage (high) group

Voltage: 0 to 5 V, 1 to 5 V, 0 to 10 V
Specify when ordering

Input range: Refer to **Input range table (P. 66)**

Sampling cycle: 25 ms

Influence of external resistance:
0.25 μV/Ω (TC input)

Influence of input lead: 0.01 °C/Ω or less 10 Ω or less per wire (RTD input)

RTD sensor current: Approx. 1 mA

Digital filter
First order lag digital filter
Time constant: 0.00 to 10.00 seconds (0.00: OFF)

PV bias: ±Input span

PV ratio: 0.500 to 1.500

Action at input beak:

TC:	Upscale or Downscale
RTD:	Upscale
Voltage (low):	Upscale or Downscale
Voltage (high):	Downscale (Indicates value near 0 V)
Current:	Downscale (Indicates value near 0 mA)

Action at input short circuit:
Downscale (RTD input)

Square root extraction function:
Calculation method: Measured value = $\sqrt{}$ (Input value × PV ratio + PV bias)
Low level cutoff: 0.00 to 25.00 % of input span

■ Non-isolated remote input (Optional) *

*Non-isolated remote input is available with 1-input controller.

Input type: a) 0 to 10 mV, 0 to 100 mV, 0 to 1 V
b) 0 to 5 V, 1 to 5 V, 0 to 10 V
c) 0 to 20 mA, 4 to 20 mA
a) to c): Specify when ordering

Accuracy: ± 0.1 % of input span

■ Feedback resistance (FBR) input (Optional) *

* Feedback resistance input is not isolated from measured input.

Permissible resistance range:
100 to 10 kΩ (Standard: 135 Ω)

Indicating accuracy: ± 0.5 % of input span

■ Current transformer (CT) input (Optional) *

* CT input is not isolated from measured input.

Number of inputs: 2 points
Only one CT input is available when Power feed forward input is selected.
Specify when ordering

CT type: CTL-6-P-N (0 to 30 A)
CTL-12-S56-10L-N (0 to 100 A)
Specify when ordering

Indicating accuracy: ± 0.5 % of input value or 2 A (whichever is larger)
The CT input cannot measure less than 0.4 A.

■ Power feed forward input (Optional)

Sampling cycle: 100 ms (Data change cycle)
Use the external special transformer.

■ Event input (Optional)

Number of inputs: Up to 7 points

Input method: Dry contact input
OPEN (OFF) state: 500 kΩ or more
CLOSE (ON) state: 10 Ω or less

Functions: Memory area selection, RUN/STOP transfer, Remote/Local transfer, Auto/Manual transfer

■ Control action

Number of control points: Up to 2 points
Cascade is connectable

Control method: Brilliant PID control
Direct action, Reverse action or Position proportioning action is available
With Autotuning, Output limiter and Output change rate limiter
Power feed forward function can be added. (Optional)

■ Control loop break alarm (LBA)

LBA time: 0 to 7200 seconds (0: OFF)

LBA deadband: 0 to Input span

■ Heater break alarm (HBA)

Number of points: Up to 2 points (1 point is required for one CT input)
Setting range: 0.0 to 100.0 A (0.0: OFF)
Additional function: Number of heater break alarm delay times setting

■ Output

● OUT1 to OUT3 (Used for control output, event output or transmission output)

Number of outputs: Up to 3 points (Specify when ordering)
OUT3 is isolated from both OUT1 and OUT2.
OUT1 and OUT2 are not isolated from each other except for relay or triac output. When relay or triac output is used, there is isolation between outputs.
There is isolation between input and output.
There is isolation between output and power supply terminals.

Output type:

Relay contact output

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

Voltage pulse output

Output voltage:	0/12 V DC
Allowable load resistance:	600 Ω or more

Current output

Output current:	0 to 20 mA DC, 4 to 20 mA DC (Specify when ordering)
Allowable load resistance:	600 Ω or less

Voltage output

Output type:	0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC (Specify when ordering)
Allowable load resistance:	1 kΩ or more

Triac output

Output method:	AC output (Zero-cross method)
Allowable load current:	0.4 A (Ambient temperature 40 °C or less) Ambient temperature 50 °C: 0.3 A
Load voltage:	75 to 250 V AC
Minimum load current:	30 mA
ON voltage:	1.6 V or less (at maximum load current)

Sensor power supply output (optional) [Only OUT3 is selectable]

Rated voltage:	24 V DC ± 5%
Rated current:	24 mA max.

● OUT4, OUT5 (Used for event output)

Number of outputs: Up to 2 points (Specify when ordering)
When OUT3 is used for a Sensor power supply output (optional), OUT4 and OUT5 are not available.

Output type:

Relay contact output

Contact type:	1a contact
Rating:	250 V AC, 1A (Resistive load)
Electrical life:	300,000 or more (Rated load)

● Transmission output

Number of outputs: Up to 3 points
(Varies depending on the output logic selection setting and output type.)

Output contents: Measured value, Set value, Manipulated output value and Deviation

Scaling range:
Measured value/set value: Same as input range
Manipulated output value: −50 to +105.0 %
Deviation: ±Input span

■ Performance

Display accuracy (At the ambient temperature 23 °C ±2 °C)**:**

TC input (K, J, T, PL II, E)
Less than −100 °C [−148 °F]: ±1.0 °C [±2.0 °F]
Less than −100 to +500 °C [−148 to +932 °F]: ±0.5 °C [±1.0 °F]
500 °C [932 °F] or more: ±(0.1 % of reading+1digit)

TC input (S, R, N, W5Re/W26Re)
Less than −100 °C [−148 °F]: ±2.0 °C [±4 °F]
Less than −100 °C to +1000 °C [−148 to +1832 °F]: ±1.0 °C [±2.0 °F]
1000 °C [1832 °F] or more: ±(0.1 % of reading+1digit)

TC input (B)
Less than 400 °C [752 °F]: ±70.0 °C [±130 °F]
Less than 400 °C to 1000 °C [752 to 1832 °F]: ±1.0 °C [±2.0 °F]
1000 °C [1832 °F] or more: ±(0.1 % of reading+1digit)

RTD input
Less than 200 °C [392 °F]: ±0.2 °C [±4 °F]
200 °C [392 °F] or more: ±(0.1 % of reading+1digit)

Voltage input
±0.1 % of span

Current input
±0.1 % of span

Cold-junction temperature compensation error:
±1.0 °C (At the ambient temperature 23 °C ±2 °C)
±1.5 °C (At the ambient temperature −10 to +50 °C)

Minimum indication resolution:
TC input:
0.1 °C [°F] (The decimal point position of the input range is selectable.)

RTD input:
0.01 °C [°F] (The decimal point position of the input range is selectable.)

Voltage/Current input:
1 to 0.0001 (Programmable)

■ Event output function

Number of calculations: 4 points

Event type: Deviation high, Deviation low, Deviation high/low, Band, Process high, Process low, SV high, SV low, Control loop break alarm (LBA)

Additional function: Hold action (Effective only when deviation or process action is selected)
Event action at input error selection

Setting range:
Deviation: –Input span to +Input span
Process: Input scale low to +Input scale high
SV: Input scale low to + Input scale high

Differential gap: 0 to Input span

■ Multi-memory area function

Number of multi-memory areas:
16 areas

Setting item for multi-memory area function:
Set value (SV), Event 1 setting, Event 2 setting, Event 3 setting,
Event 4 setting, Proportional band setting, Integral time setting,
Derivative time setting, Control response parameter,
Setting change rate limiter (up/down), Soak time setting,
Link area number

■ Communication function (Optional)

• Communication 1

Interface:
Based on RS-232C, EIA standard
Based on RS-485, EIA standard
Specify when ordering

Protocol:
RKC communication (ANSI X3.28-1976 subcategories 2.5 and A4)
Modbus
Specify when ordering

• Communication 2

Interface:
Based on RS-232C, EIA standard
Based on RS-422A, EIA standard
Based on RS-485, EIA standard
Specify when ordering

Protocol:
RKC communication (ANSI X3.28-1976 subcategories 2.5 and A4)
Modbus
PROFIBUS-DP (EN50170)
DeviceNet
CC-Link
Specify when ordering

■ Infrared communication function

Communication method: Half-duplex two-way communication

Communication speed: 9600 bps, 19200 bps

Protocol: RKC communication (ANSI X3.28-1976 subcategories 2.5 and A4)

■ Self-diagnostic function

Check items: CPU power supply voltage monitoring, Adjusted data error, EEPROM error, A/D conversion error, RAM check error, Hardware configuration error, Software configuration error, Watchdog timer error, Program busy

Action at self-diagnostic error:

For CPU power supply voltage monitoring, RAM check error and Software configuration error

Display: All the display is OFF (Operation is impossible)
Output: All the output is OFF
Communication: No response

Other than the above:
Display: Error display (Operation is possible)
Output: All the output is OFF
Communication: Possible

■ Power

Power supply voltage: 90 to 264 V AC [Power supply voltage range], 50/60 Hz (Rating 100 to 240 V AC)

24 V AC ±10 % [Power supply voltage range], 50/60 Hz (Rating 24 V AC)

24 V DC ±10 % [Power supply voltage range]
(Rating 24 V DC)
Specify when ordering

Power consumption:

HA400/401:	16.5 VA max. (at 100 V AC)	22.5 VA max. (240 V AC)
	15.0 VA max. (at 24 V AC)	430 mA max. (24 V DC)
HA900/901:	17.5 VA max. (at 100 V AC)	24.0 VA max. (240 V AC)
	16.0 VA max. (at 24 V AC)	470 mA max. (24 V DC)

■ General specifications

Insulation resistance:
Between measuring terminal and grounding: 20 MΩ or more at 500 V DC
Between power terminal and grounding: 20 MΩ or more at 500 V DC
Between measuring terminal and power terminal: 20 MΩ or more at 500 V DC

Withstand voltage:
Between measuring terminal and grounding: 1 minute at 1000 V AC
Between power terminal and grounding: 1 minute at 1500 V AC
Between power and measuring terminals: 1 minute at 2300 V AC

Power failure:
A power failure of 20 ms or less will not affect the control action.
If power failure of more than 20 ms occurs, controller will reset.
HOT start (1, 2) or COLD start (selectable).

Memory backup:
Backed up by non-volatile memory (EEPROM)
Number of writing: Approx. 100,000 times
Data retaining period: Approx. 10 years
Depending on storage and operating conditions.

Allowable ambient temperature:
−10 to +50 °C (14 to 122 °F)

Allowable ambient humidity:
5 to 95 % RH
Absolute humidity: MAX.W.C 29 g/m^3 dry air at 101.3 kPa

Ambient atmosphere:
There should be neither corrosive gases nor much dust.

Dimensions:
HA400/401: 48 (W) × 96 (H) × 100 (D) mm
HA900/901: 96 (W) × 96 (H) × 100 (D) mm

Weight:
HA400/401: Approx. 360 g
HA900/901: Approx. 460 g

■ Standard

Safety standards:
UL: UL61010A-1
CSA: CAN/CSA-C22.2 No. 1010.1

CE marking:
LVD: EN61010-1
EMC: EN61326-1

C-Tick:
EN55011

Panel sealing:
IP65 (Optional)

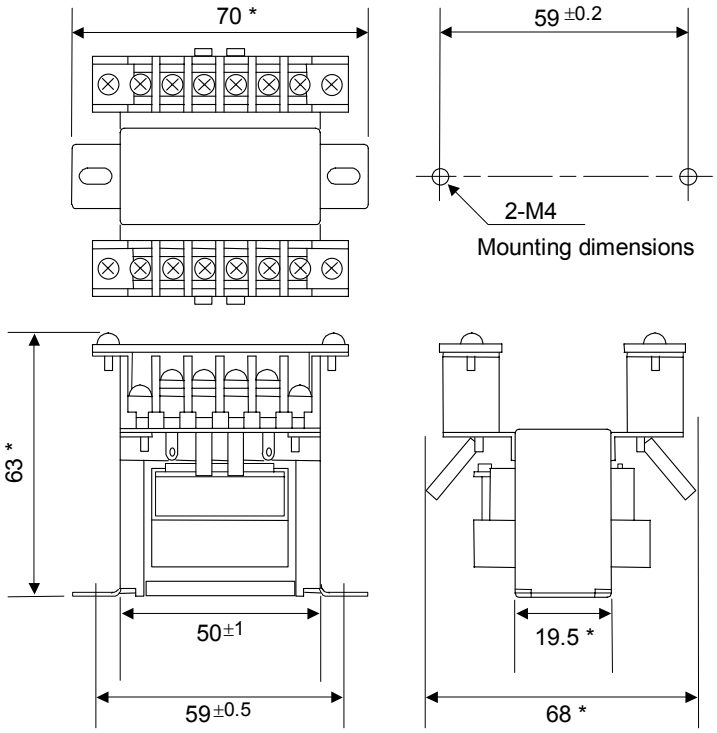
C. Trans Dimensions for Power Feed Forward

■ Model code

PFT-01 (100 to 120 V AC)
PFT-02 (200 to 240 V AC)

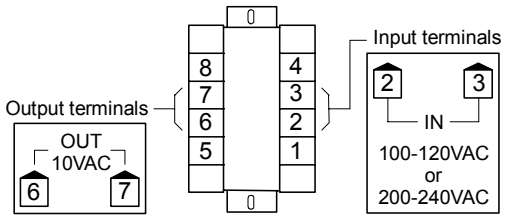
■ Dimensions and mounting dimensions

(Unit: mm)



* Maximum

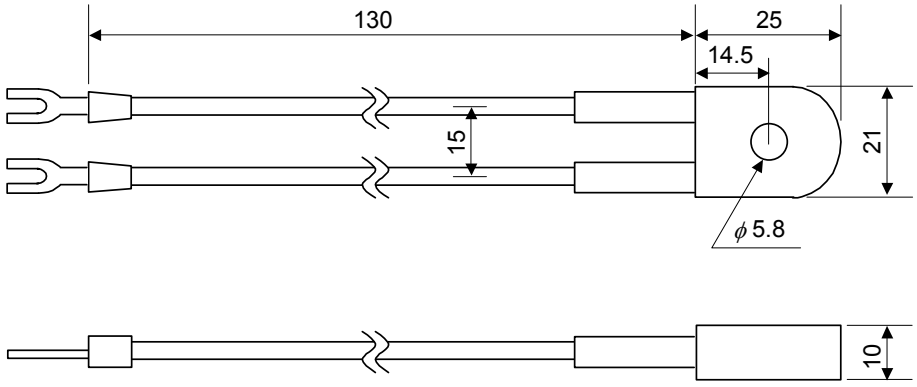
■ Terminal configuration



D. Current Transformer (CT) Dimensions

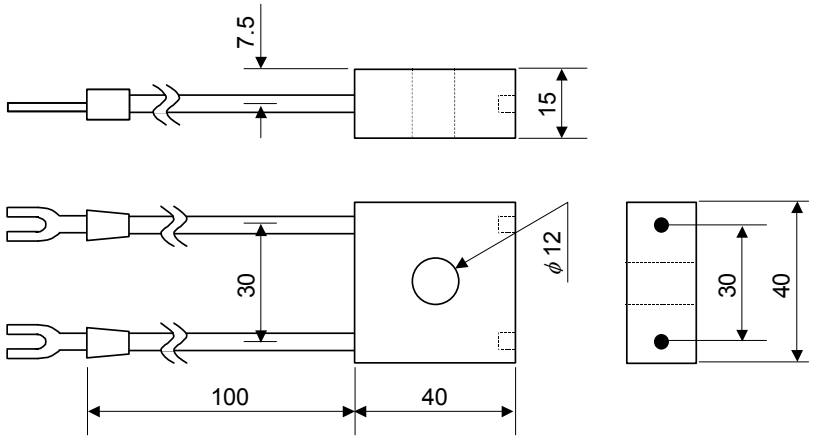
■ CTL-6-P-N (For 0 to 30 A)

(Unit: mm)



■ CTL-12-S56-10L-N (For 0 to 100 A)

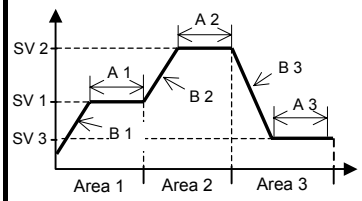
(Unit: mm)



E. Memory Area Data List (Copy this sheet for its use.)

Sheet No.		Memory area No.		Date		Name	

Display		Item	Set value	Memo
Input 1	1. SV	Set value 1 (SV1)		
	1. P	Proportional band 1		
	1. I	Integral time 1		
	1. d	Derivative time 1		
	1. rPr	Control response parameter 1		
	1SVrU	Set value 1 (SV1) change rate limiter (up)		
	1SVrd	Set value 1 (SV1) change rate limiter (down)		
Input 2	2. SV	Set value 2 (SV2)		
	2. P	Proportional band 2		
	2. I	Integral time 2		
	2. d	Derivative time 2		
	2. rPr	Control response parameter 2		
	2SVrU	Set value 2 (SV2) change rate limiter (up)		
	2SVrd	Set value 2 (SV2) change rate limiter (down)		
Common	EV1	Event 1		
	EV2	Event 2		
	EV3	Event 3 (Including LBA and LBD)		
	EV4	Event 4 (Including LBA and LBD)		
	ASr	Area soak time		
	LnkA	Link area number		

Easy program operation	1	2	3	4	5	6	7	8
 A 1 to 3: Soak time B 1 to 3: Setting change rate limiter								
Link area number								
Area soak time								
Setting change rate limiter (up)								
Setting change rate limiter (down)								

MEMO

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◆ Required operations and functions ◆

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