Limit Controller

SA200L

Instruction Manual

RKC® RKC INSTRUMENT INC.

IMR03H03-E1

NOTICE

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

  : Alternating current

  : Both direct and alternating current

  : Reinforced insulation

  : Safety precaution

  This symbol is used where the instruction manual needs to be consulted for the safety of both the operator and the equipment. Carefully read the cautions in this manual before using the instrument.

Safety Precautions

■ Pictorial Symbols (safety symbols)

Various pictorial symbols are used in this manual to ensure safe use of the product, to protect you and other people from harm, and to prevent damage to property. The symbols are described below.
Be sure you thoroughly understand the meaning of the symbols before reading this manual.

⚠ 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.

⚠ WARNING

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

⚠ CAUTION

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

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.

Symbols

■ Pictorial Symbols (safety symbols)

NOTE : 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

7-segment character

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

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

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

V	W	X	Y	Z	Degree	／	Prime	* (Asterisk)
V	W	X	Y	Z	o	／	'	*

■ Abbreviation symbols

These abbreviations are used in this manual:

Abbreviation symbols	Name	Abbreviation symbols	Name
PV	Measured value	AHS	Transmission output scale high
SV	Limit set value	ALS	Transmission output scale low
PHLd	Peak hold	LCK	Set data lock
bHLd	Bottom hold	SLH	Setting limiter [high limit]
TIME	EXCD time	SLL	Setting limiter [low limit]
ILr	Alarm interlock release	TC (input)	Thermocouple (input)
ALM1	Alarm 1	RTD (input)	Resistance temperature detector (input)
ALM2	Alarm 2	V (input)	Voltage (input)
AO	Transmission output	I (input)	Current (input)
DEV	Deviation	OUT (1, 2)	Output (1, 2)

Document Configuration

There are four manuals pertaining to this product. Please be sure to read all manuals specific to your application requirements.

The following manuals can be downloaded from the official RKC website:
https://www.rkcinst.co.jp/english/download-center/

Manual	Manual Number	Remarks
SA200L Installation Manual	IMR03H01-X☐	This manual is enclosed with instrument. This manual explains the mounting and wiring.
SA200L Quick Operation Manual	IMR03H02-E☐	This manual is enclosed with instrument. This manual explains the basic key operation, mode menu, and data setting.
SA200L Instruction Manual	**IMR03H03-E1**	This manual you are reading now. This manual describes installation, wiring, operation of each function, and troubleshooting.
SA200L Communication Instruction Manual	IMR03H04-E☐	This manual explains RKC communication protocol (ANSI X3.28-1976) and Modbus relating to communication parameters setting.

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

Contents

Page

Page

Page

1 OUTLINE

This chapter describes features, package contents, model code, etc.

1.1 Features

This limit controller has the following features:

Contact input [optional]

The SA200L can switch the following items by contact input.

- Limit output release (DI1)
- Alarm interlock release (DI2)

Communication [optional]

The SA200L can be used at a required speed selected from the six communication speeds.

- 2400 bps
- 4800 bps
- 9600 bps
- 19200 bps
- 38400 bps
- 57600 bps

Transmission output (AO) [optional]

The SA200L can use an analog signal of 0 to 20 mA DC or 4 to 20 mA DC to output the changing state of the following values.

- Measured value (PV)
- Limit set value (SV)
- Deviation (DEV)

Sampling cycle

The SA200L provides two types of sampling cycle to better suit the application requirements.

- 250 ms
- 500 ms

Limit output

The SA200L is supplied with two types of limit actions: High limit and Low limit actions. Select Limit action (High or Low) depending on the application.
[Factory set value: Limit action (high limit)]

1.2 Checking the Product

Before using this product, check each of the following:

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

Accessories	Q'TY	Remarks	
☐ Mounting brackets	2	————	
☐ Mounting screws	2	————	
☐ SA200L Installation Manual (IMR03H01-X☐)	1	Enclosed with instrument	This manual can be downloaded from the official RKC website.
☐ SA200L Quick Operation Manual (IMR03H02-E☐)	1	Enclosed with instrument	

Sold separately	Q'TY	Remarks
☐ Shunt resistor for current input (external resistor) KD100-55	Depending on the order quantity	————
☐ Terminal cover KSA200-56A	Depending on the order quantity	————
☐ **SA200L Instruction Manual (IMR03H03-E1)**	Depending on the order quantity	This manual This manual can be downloaded from the official RKC website.
☐ SA200L Communication Instruction Manual (IMR03H04-E☐)	Depending on the order quantity	This manual can be downloaded from the official RKC website.

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

1.3 Model Code

Check that the product received is correctly specified by referring to the following model code list:
If the product is not identical to the specifications you ordered, please contact RKC sales office or the agent.

■ Suffix code

SA200L □□□−□ □−□∗□ □−□ □ **/A/** □□ **/Y**
(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11)

Specification		(1)	(2) [OUT1]	(3) [OUT2]	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Input type/ Range type	See Input Range Code Table (P. 1-6)	□□□										
Output 1 [OUT1] Output 2 [OUT2]	OUT1: Relay contact output OUT2: No output		M*	N*								
	OUT1: Relay contact output OUT2: Relay contact output		M*	M*								
	OUT1: Current output (0 to 20 mA DC) OUT2: Relay contact output		7*	M*								
	OUT1: Current output (4 to 20 mA DC) OUT2: Relay contact output		8*	M*								
Power supply voltage	24 V AC/DC				3							
	100 to 240 V AC				4							
Alarm 1 [ALM1]	No alarm					N						
	See Alarm Code Table (P. 1-4)					□						
Alarm 2 [ALM2]	No alarm						N					
	See Alarm Code Table (P. 1-4)						□					
Optional function	No function							N				
	RS-485 (RKC communication)							5				
	RS-485 (Modbus)							6				
	Contact input							D				
Waterproof/ Dustproof	No Waterproof/Dustproof								N			
	Waterproof/Dustproof								1			
Case color	Black									A		
Output assignment code	Standard output See Output Assignment Code Table (P. 1-5)										No symbol	
	See Output Assignment Code Table (P. 1-5)										□□	
Version symbol	For Japanese domestic market											No code
	For International market											/Y

* N: No output
M: Relay contact input
7: Current output (0 to 20 mA DC)
8: Current output (4 to 20 mA DC)

Alarm Code Table

Code	Alarm type	Code	Alarm type
A	Deviation high alarm	H	Process high alarm
B	Deviation low alarm	J	Process low alarm
C	Deviation high/low alarm	K	Process high alarm with hold action
D	Band alarm	L	Process low alarm with hold action
E	Deviation high alarm with hold action	V	SV high alarm
F	Deviation low alarm with hold action	W	SV low alarm
G	Deviation high/low alarm with hold action		

Output Assignment Code Table

Code	Output assignment	
	OUT1	**OUT2**
No symbol	● When the OUT1 is relay contact output [Same as code 01]; Limit output (De-energized) *	*OR* output of ALM1 and ALM2 (Energized) *
	● When the OUT1 is current output [Same as code 15]; Transmission output *	Limit output (De-energized) *
01	Limit output (De-energized)	*OR* output of ALM1 and ALM2 (Energized)
02		*AND* output of ALM1 and ALM2 (Energized)
03		ALM1 output (Energized)
04		*OR* output of ALM1 and ALM2 (De-energized)
05		*AND* output of ALM1 and ALM2 (De-energized)
06		ALM1 output (De-energized)
07		No output
08	Limit output (Energized)	*OR* output of ALM1 and ALM2 (Energized)
09		*AND* output of ALM1 and ALM2 (Energized)
10		ALM1 output (Energized)
11		*OR* output of ALM1 and ALM2 (De-energized)
12		*AND* output of ALM1 and ALM2 (De-energized)
13		ALM1 output (De-energized)
14		No output
15	Transmission output	Limit output (De-energized)
16		Limit output (Energized)

* Standard output

Input Range Table

● **Thermocouple (TC) input**

Input type	Code	Range
K	K01	0 to 200 °C
	K02	0 to 400 °C
	K03	0 to 600 °C
	K04	0 to 800 °C
	K05	0 to 1000 °C
	K06	0 to 1200 °C
	K07	0 to 1372 °C
	K08	−199.9 to +300.0 °C
	K09	0.0 to 400.0 °C
	K10	0.0 to 800.0 °C
	K13	0 to 100 °C
	K14	0 to 300 °C
	K17	0 to 450 °C
	K20	0 to 500 °C
	K29	0.0 to 200.0 °C
	K37	0.0 to 600.0 °C
	K38	−199.9 to +800.0 °C
	KA1	0 to 800 °F
	KA2	0 to 1600 °F
	KA3	0 to 2502 °F
	KA4	0.0 to 800.0 °F
	KA9	20 to 70 °F
	KB2	−199.9 to +999.9 °F
J	J01	0 to 200 °C
	J02	0 to 400 °C
	J03	0 to 600 °C
	J04	0 to 800 °C
	J05	0 to 1000 °C
	J06	0 to 1200 °C
	J07	−199.9 to +300.0 °C
	J08	0.0 to 400.0 °C
	J09	0.0 to 800.0 °C
	J10	0 to 450 °C
	J22	0.0 to 200.0 °C
	J23	0.0 to 600.0 °C
	J30	−199.9 to +600.0 °C
	JA1	0 to 800 °F
	JA2	0 to 1600 °F
	JA3	0 to 2192 °F
	JA6	0 to 400 °F
	JA9	−199.9 to +999.9 °F
	JB6	0.0 to 800.0 °F
R	R01	0 to 1600 °C [1]
	R02	0 to 1769 °C [1]
	R04	0 to 1350 °C [1]
	RA1	0 to 3200 °F [1]

Input type	Code	Range
R	RA2	0 to 3216 °F [1]
S	S01	0 to 1600 °C [1]
	S02	0 to 1769 °C [1]
	SA1	0 to 3200 °F [1]
	SA2	0 to 3216 °F [1]
B	B01	400 to 1800 °C
	B02	0 to 1820 °C [1]
	BA1	800 to 3200 °F
	BA2	0 to 3308 °F [1]
E	E01	0 to 800 °C
	E02	0 to 1000 °C
	EA1	0 to 1600 °F
	EA2	0 to 1832 °F
N	N01	0 to 1200 °C
	N02	0 to 1300 °C
	N06	0.0 to 800.0 °C
	NA1	0 to 2300 °F
	NA2	0 to 2372 °F
	NA5	0.0 to 999.9 °F
T	T01	−199.9 to +400.0 °C [2]
	T02	−199.9 to +100.0 °C [2]
	T03	−100.0 to +200.0 °C
	T04	0.0 to 350.0 °C
	TA1	−199.9 to +752.0 °F [2]
	TA2	−100.0 to +200.0 °F
	TA3	−100.0 to +400.0 °F
	TA4	0.0 to 450.0 °F
	TA5	0.0 to 752.0 °F
W5Re/ W26Re	W01	0 to 2000 °C
	W02	0 to 2320 °C
	WA1	0 to 4000 °F
PL II	A01	0 to 1300 °C
	A02	0 to 1390 °C
	A03	0 to 1200 °C
	AA1	0 to 2400 °F
	AA2	0 to 2534 °F
U	U01	−199.9 to +600.0 °C [2]
	U02	−199.9 to +100.0 °C [2]
	U03	0.0 to 400.0 °C
	UA1	−199.9 to +999.9 °F [2]
	UA2	−100.0 to +200.0 °F
	UA3	0.0 to 999.9 °F
L	L01	0 to 400 °C
	L02	0 to 800 °C
	LA1	0 to 800 °F
	LA2	0 to 1600 °F

[1] Accuracy is not guaranteed below 399 °C (751 °F) or less for types R, S and B.

[2] Accuracy is not guaranteed below −100.0 °C (−148.0 °F) or less for types T and U.

● **RTD input**

Input type	Code	Range
Pt100	D01	−199.9 to +649.0 °C
	D02	−199.9 to +200.0 °C
	D03	−100.0 to +50.0 °C
	D04	−100.0 to +100.0 °C
	D05	−100.0 to +200.0 °C
	D06	0.0 to 50.0 °C
	D07	0.0 to 100.0 °C
	D08	0.0 to 200.0 °C
	D09	0.0 to 300.0 °C
	D10	0.0 to 500.0 °C
	DA1	−199.9 to +999.9 °F
	DA2	−199.9 to +400.0 °F
	DA3	−199.9 to +200.0 °F
	DA4	−100.0 to +100.0 °F
	DA5	−100.0 to +300.0°F
	DA6	0.0 to 100.0 °F
	DA7	0.0 to 200.0 °F
	DA8	0.0 to 400.0 °F
	DA9	0.0 to 500.0 °F

Input type	Code	Range
JPt100	P01	−199.9 to +649.0 °C
	P02	−199.9 to +200.0 °C
	P03	−100.0 to +50.0 °C
	P04	−100.0 to +100.0 °C
	P05	−100.0 to +200.0 °C
	P06	0.0 to 50.0 °C
	P07	0.0 to 100.0 °C
	P08	0.0 to 200.0 °C
	P09	0.0 to 300.0 °C
	P10	0.0 to 500.0 °C

● **Voltage/Current inputs**

Input type	Code	Range
0 to 5 V DC	401	0. 0 to 100.0 %
0 to 10 V DC	501	0. 0 to 100.0 %
1 to 5 V DC	601	0. 0 to 100.0 %
0 to 20 mA DC *	701	0. 0 to 100.0 %
4 to 20 mA DC *	801	0. 0 to 100.0 %

* For the current input specification, a resistor of 250 Ω must be connected between the input terminals.

MEMO

2 MOUNTING

This chapter describes mounting cautions, dimensions and mounting procedures.

2.1 Mounting Cautions

⚠ WARNING

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

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

(2) Use this instrument within the following environment conditions:
- Allowable ambient temperature: −10 to +55 °C
- Allowable ambient humidity: 5 to 95 %RH
  (Absolute humidity: MAX.W.C 29.3 g/m^3 dry air at 101.3 kPa)
- Installation environment conditions: Indoor use
  Altitude up to 2000 m

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

(4) Mount this instrument in the panel considering the following conditions:
- Provide adequate ventilation space so that heat does not build up.
- Do not mount this instrument directly above the equipment that generates large amount of heat (heaters, transformers, semi-conductor functional devices, large-wattage resistors.)
- If the ambient temperature rises above 55 °C, cool this instrument with a forced air cooling fan, cooling unit, 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.

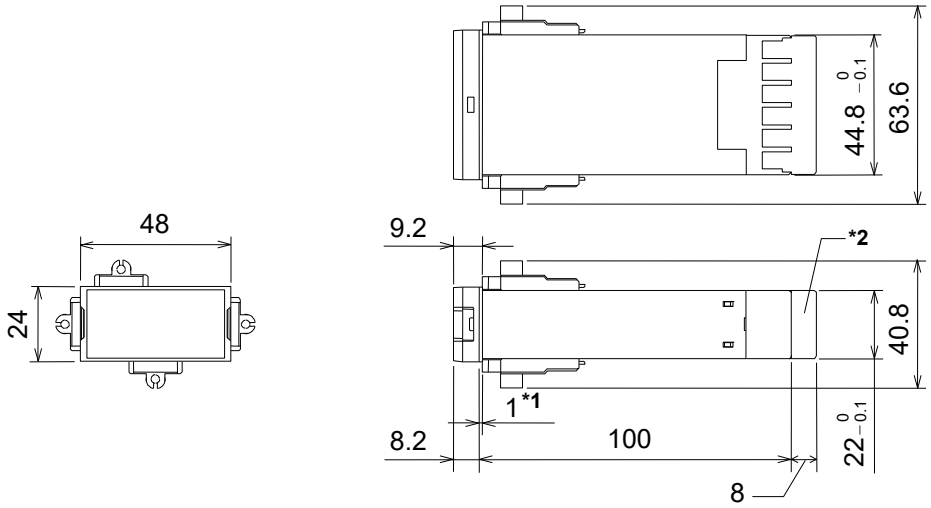
(5) In case this instrument is connected to a supply by means of a permanent connection, a switch or circuit-breaker shall be included in the installation. This shall be in close proximity to the equipment and within easy reach of the operator. It shall be marked as the disconnecting device for the equipment.

2.2 Dimensions

Panel thickness: 1 to 10 mm
(When mounting multiple SA200L controllers close together, the panel strength should be checked to ensure proper support.)

■ External dimensions

(Unit: mm)

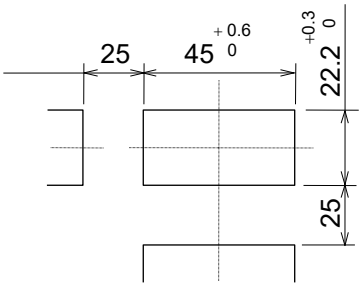


***1**: Rubber gasket (optional)
***2**: Terminal cover (optional)

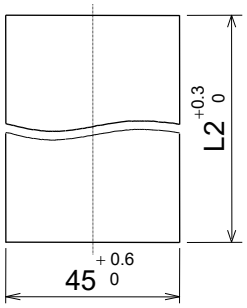
■ Panel cutout dimensions

(Unit: mm)

Individual mounting

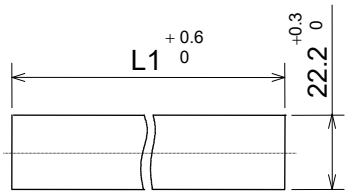


Close vertical mounting



L2 = 24 × *n* − 1.8
n: number of controllers (2 to 6)

Close horizontal mounting



L1 = 48 × *n* − 3
n: number of controllers (2 to 6)

Installation Conditions:
The display cannot be seen from the outside of the visual field range. The visual field range of SA200L is 40 degrees to the upper side, and 30 degrees to the lower side from the center of the display vertically.

2.3 Mounting Procedures

■ Individual mounting

When the instrument is individually mounted, always secure with two mounting brackets either top and bottom or right and left.

1. Prepare the panel cutout as specified in **2.2 Dimensions**.

2. Insert the instrument through the panel cutout.

3. Insert the mounting bracket into the mounting groove of the instrument. (Fig. 1)

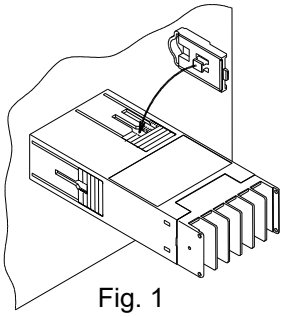


Fig. 1

4. Push the mounting bracket forward with a blade screwdriver until the bracket is firmly secured to the panel. (Fig. 2)

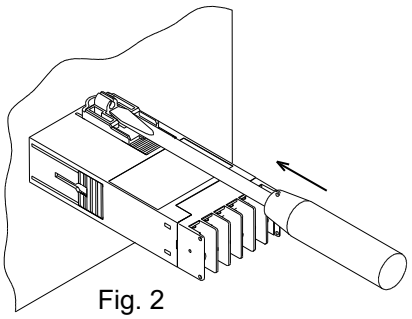


Fig. 2

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

In addition, the mounting assembly also includes two screws which can be used with the brackets to secure the instrument to the panel. See Fig. 3.

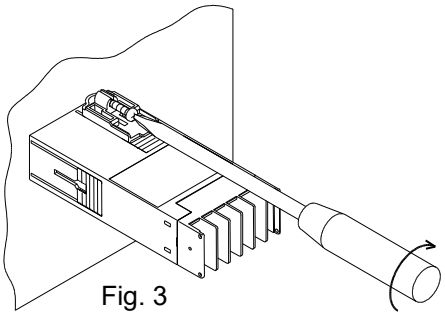


Fig. 3

When using the mounting screws, only turn one full revolution after the screw touches the panel.

The Waterproof/Dustproof optional on the front of the instrument conforms to **IP66** when mounted on the panel. For effective waterproof/dustproof, the gasket must be securely placed between the instrument and the panel without any gap. If gasket is damaged, please contact RKC sales office or the agent.

■ Close mounting

Secure the mounting brackets in the positions as shown in Fig. 4 and Fig. 5.

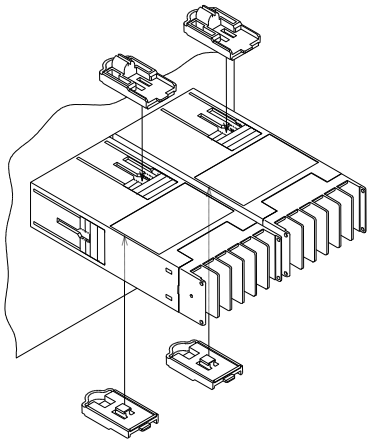


Fig. 4: Close horizontal mounting

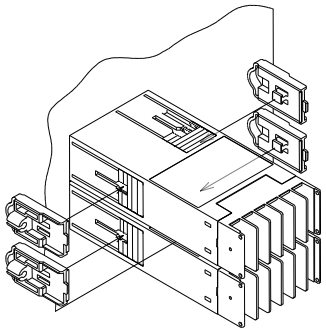


Fig. 5: Close vertical mounting

If the SA200L have waterproof/dustproof options, protection will be compromised and not meet **IP66** by close mounting.

Two SA200L cannot be inserted into a panel cutout of 48 × 48 mm.

MEMO

3 WIRING

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

3.1 Wiring Cautions

⚠ WARNING

- To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.
- To prevent electric shock or instrument failure, turn off the power before connecting or disconnecting the instrument and peripheral equipment.

- For thermocouple input, use the appropriate compensation wire.
- For RTD input, use low resistance lead wire with no difference in resistance between the three lead wires.
- To avoid noise induction, keep input signal wire away from instrument power line, load lines and power lines of other electric equipment.
- Signal connected to Voltage input and Current input shall be low voltage defined as "SELV" circuit per IEC 60950-1.
- 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.

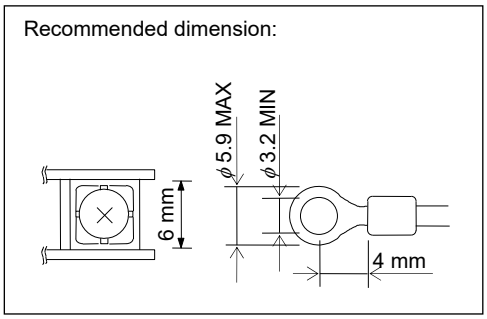
- **Preparation time for contact output**
  Allow approximately 5 seconds for contact output when the instrument is turned on. Use a delay relay when the output line is used for an external interlock circuit.

- Power supply wiring must be twisted and have a low voltage drop.
- This instrument is not provided with an overcurrent protection device. For safety install an overcurrent protection device (such as a fuse) with adequate breaking capacity close to the instrument.
  Fuse type: Time-lag fuse (Approved fuse according IEC 60127-2 and/or UL 248-14)
  Recommended fuse rating: Rated current 0.4 A
- For the current input specification, an external resistor (250 Ω ±0.02 %, 0.25 W or more, ±10 ppm/°C) must be connected between the input terminals. For external resistor (shunt resistor), use the KD100-55 (RKC product). If this resistor is installed, close vertical mounting is not possible.
- For an instrument with 24 V power supply input, supply power from "SELV" circuit defined as IEC 60950-1.
- A suitable power supply should be considered in the end-use equipment. The power supply must be in compliance with a limited-energy circuit (maximum available current of 8 A).
- If the grounded type sensor is used, do not ground output wiring. Do not connect any output wires to the terminals with any other output wires.

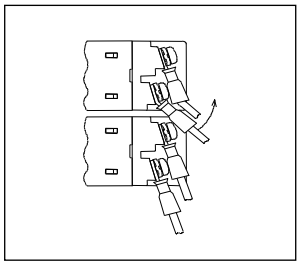
3.2 Restrictions on Wiring

- Always use recommended solderless terminal lugs or equivalent.

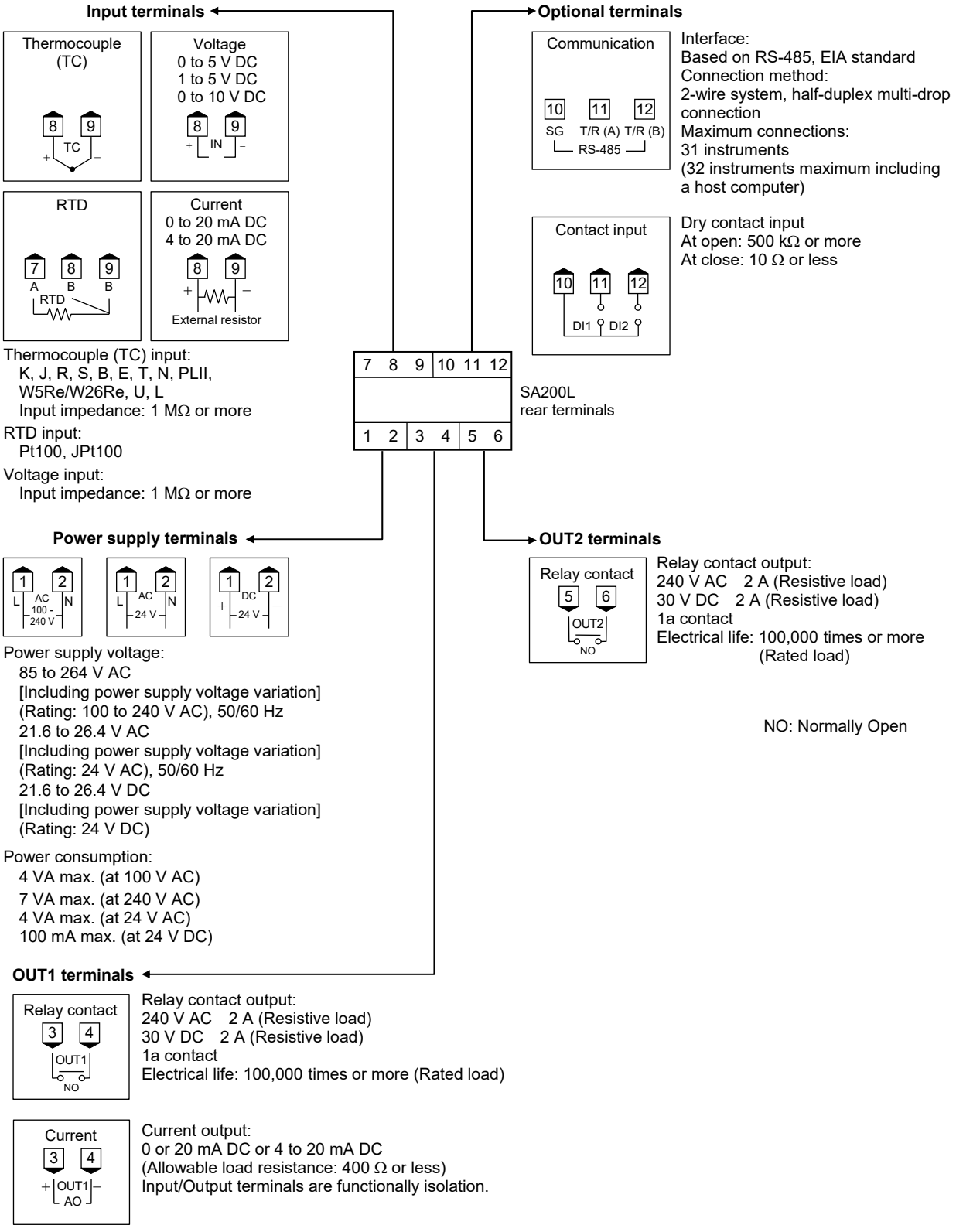
  Screw size: M3 × 6 (With 5.8 × 5.8 square washer)
  Recommended tightening torque: 0.4 N·m (4 kgf·cm)
  Applicable wire: Solid/twisted wire of 2 mm^2
  Recommended solderless terminals: Circular terminal with isolation
  (M3 screw, width 5.5 mm, hole diameter 3.2 mm)



- Make sure that during field wiring parts of conductors cannot come into contact with adjacent conductive parts.
- Always connect external wires starting from the lower terminals (No.1 to 6). Disconnect the wires starting from the upper terminals (No.7 to 12).
- When multiple instruments are vertically closely mounted, do not connect two or more solderless terminal lugs to one terminal.
- If multiple instruments are vertically closely mounted, it is necessary to bend the terminal lugs when they are connected to the lower terminals.



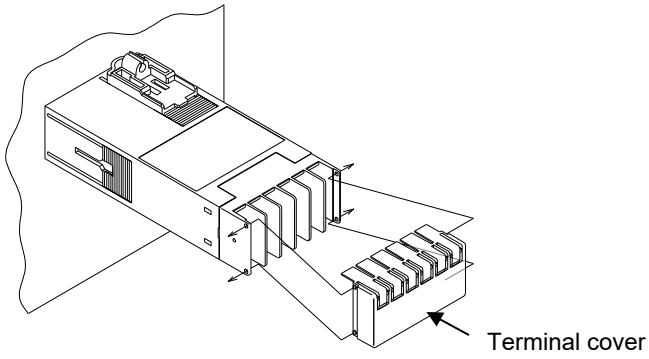
3.3 Terminal Configuration



3.4 Handling of the Terminal Cover

Mount each instrument by referring to the following Figures. If the terminal cover needs to be secured to each of the second and succeeding instruments with these instruments closely mounted including the first instrument, its post-treatment is required.

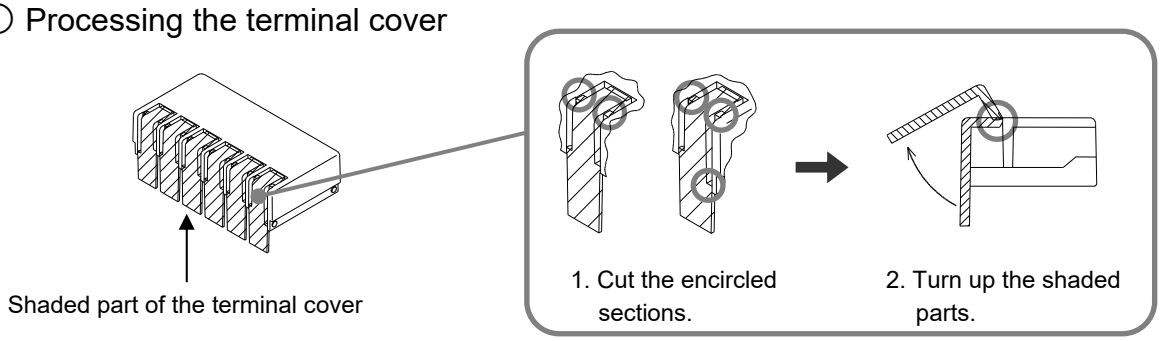
■ Individual mounting/Close horizontal mounting



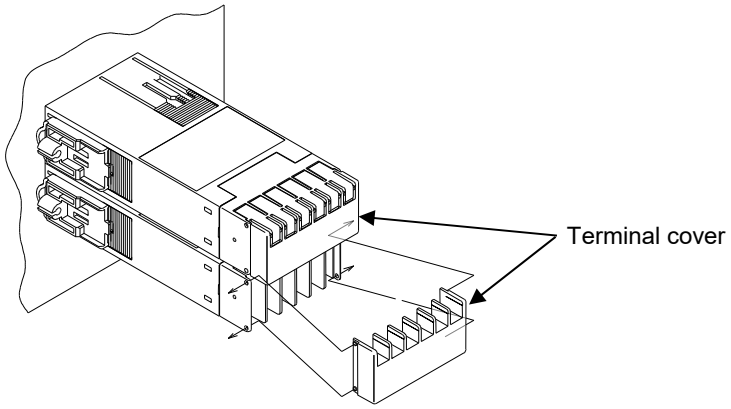
■ Close vertical mounting

Cut off the shaded parts in the following figure. For this post-processing, used a utility knife. The use of edged tools other than a utility knife may damage the terminal cover.

① Processing the terminal cover



② Mounting the terminal cover



MEMO

PARTS DESCRIPTION AND BASIC OPERATION

4

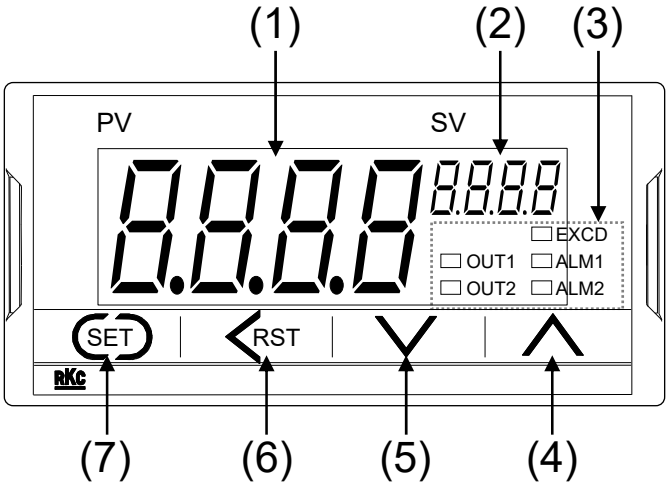
This chapter describes name of parts, setting and modifying values and other basic operations.

4.1 Parts Description

This section describes various display units and the key functions.

NOTE

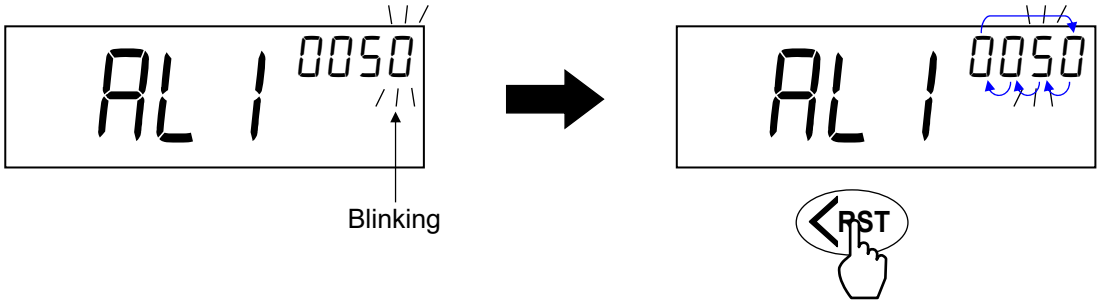
To avoid damage to the instrument, never use a sharp object to press keys.



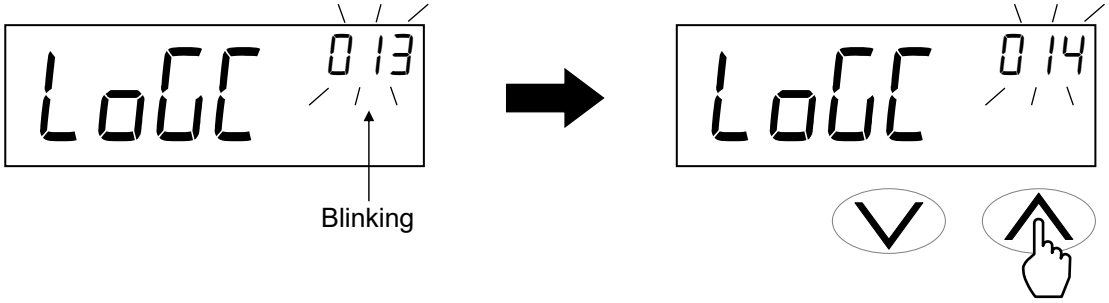
(1)	Measured value (PV) display [Green]		Displays PV or various parameter symbols.
(2)	Set value (SV) display [Red]		Displays Limit set value (SV) or various parameter set values.
(3)	Indication lamps		**EXCD lamp [Red]** Lights while a measured value (PV) exceeds the Limit set value (SV). • When the instrument is configured for the Limit action (High limit), the lamp will light on while the Measured value (PV) is above the Limit set value (SV). • When the instrument is configured for the Limit action (Low limit), the lamp will light on while the Measured value (PV) is below the Limit set value (SV). **Output lamps (OUT1, OUT2) [Green]** OUT1: Lights when Output 1 is turned on. OUT2: Lights when Output 2 is turned on. **Alarm lamps (ALM1, ALM2) [Red]** ALM1: Lights when Alarm 1 is turned on. ALM2: Lights when Alarm 2 is turned on.
(4)	∧	UP key	Increases numerals.
(5)	∨	DOWN key	Decreases numerals.
(6)	<RST	Shift & Reset key	**<: Shift key** Shifts digits when settings are changed. **RST: Reset key** Used to release the limit output and reset the hold value and the EXCD time.
(7)	SET	Set key	Used for calling up parameters and set value registration.

4.2 Changing Set Value

- The blinking digit indicates which digit can be set. Press <RST key to go to a different digit. Every time the <RST key is pressed, the blinking digit moves as follows.

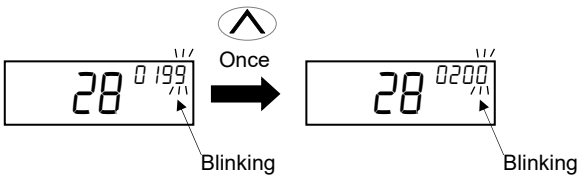


- For selective parameters, all digits will blink. Use the UP or DOWN key to set a number.

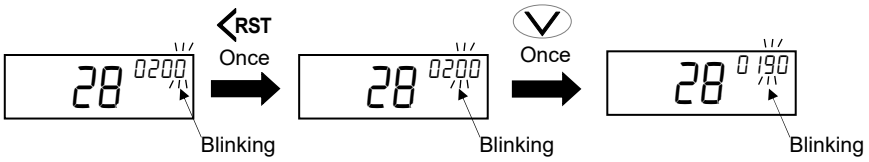


- The set value may be changed by pressing the UP or DOWN key.
  The following is also available when changing the set value

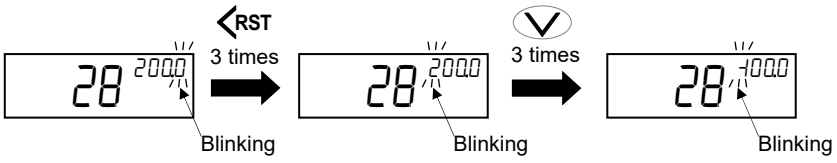
Increase Limit set value (SV) from 199 °C to 200 °C:



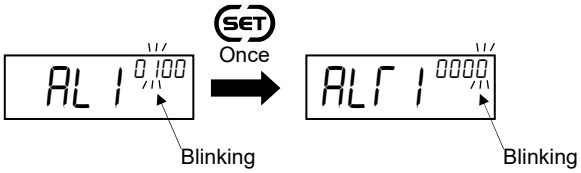
Decrease Limit set value (SV) from 200 °C to 190 °C:



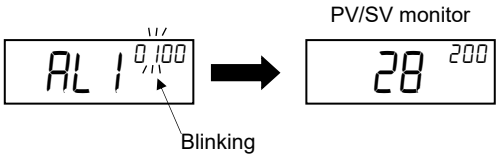
Decrease Limit set value (SV) from 200.0 °C to –100.0 °C:



- **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. The modified data will not be stored only by operating the UP and DOWN keys.



- In case no operation is performed within one minute after the change of the setting, the mode will return to the PV/SV monitor. The modified data will not be registered in this case.



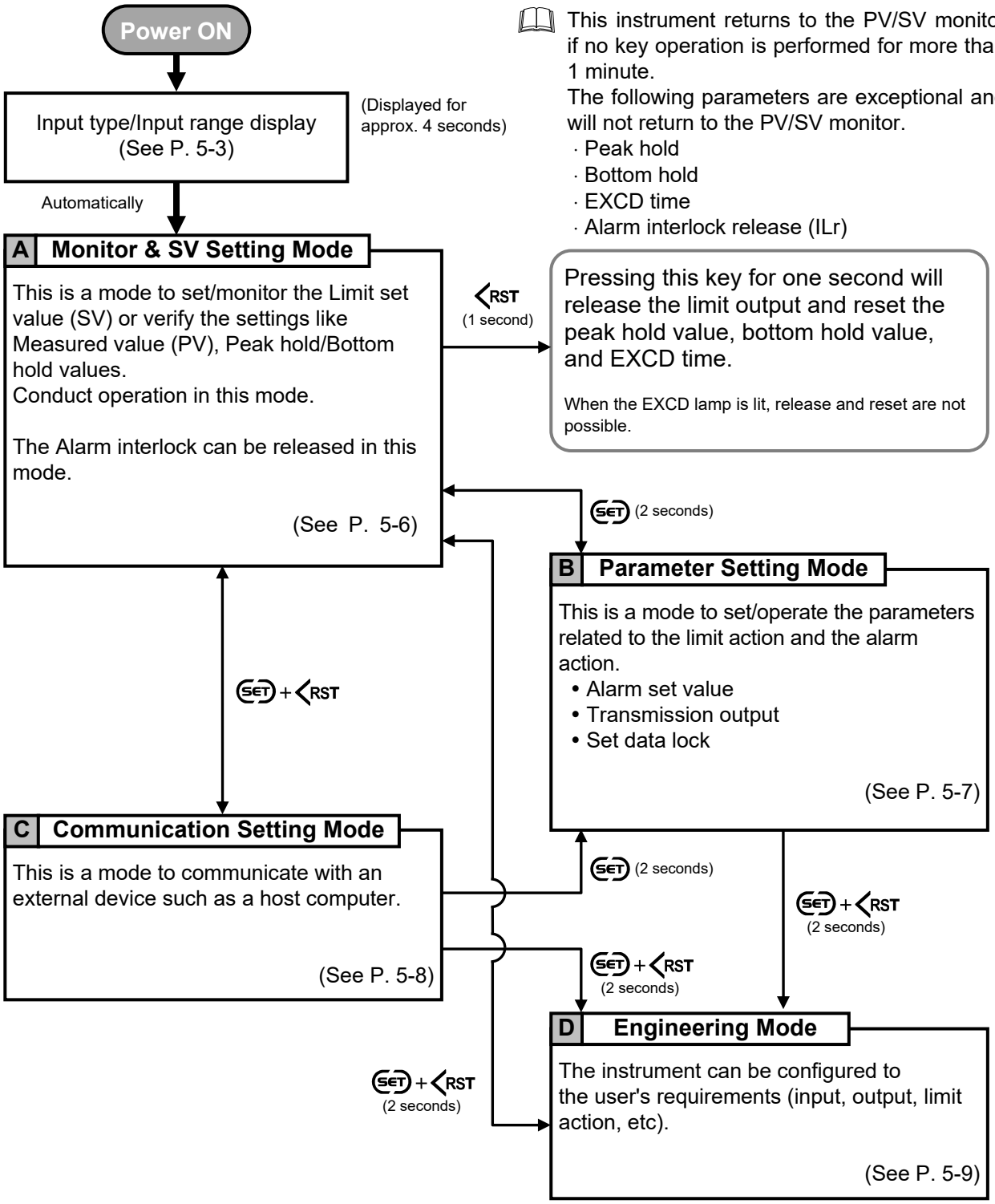
MODE SWITCHING

5

This chapter describes various modes and how to switch between them.

5.1 Switching Between Modes

The instrument has four different modes for operation and setting. Modes can be switched through the key operation of SET and <RST keys.



This instrument returns to the PV/SV monitor if no key operation is performed for more than 1 minute.
The following parameters are exceptional and will not return to the PV/SV monitor.
- Peak hold
- Bottom hold
- EXCD time
- Alarm interlock release (ILr)

The Engineering mode is initially locked. To switch to the Engineering mode, unlock it at “Set data lock (LCK).”

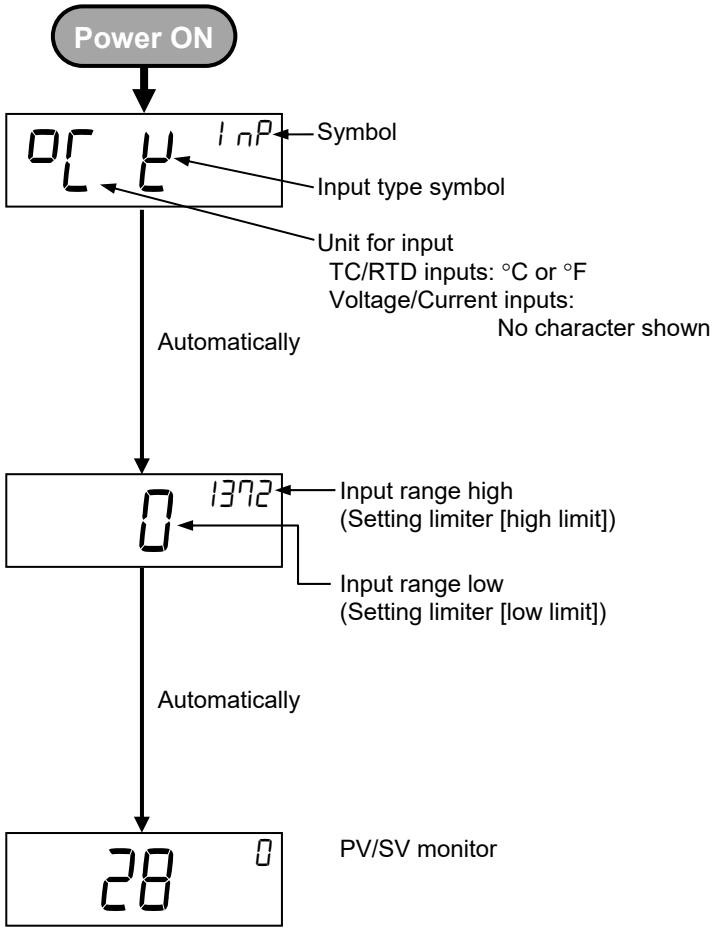
Switching the mode to the Engineering mode from other modes will release the Limit output. The Hold value and the EXCD time will also be reset.

The Limit action and the Alarm action are OFF in the Engineering mode.

■ Input type, Units, and Input range

Immediately after the instrument is powered, the input type, the unit symbol and the input range will be displayed (in 4 seconds).

Example: When a range of 0 to 1372 °C with a thermocouple input (type K)



Input type symbol

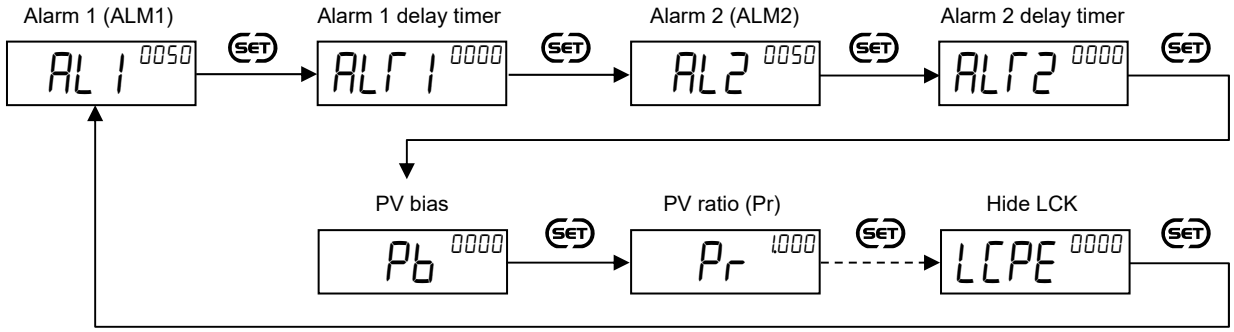
Symbol	Input type
K	Thermocouple K
J	Thermocouple J
r	Thermocouple R
S	Thermocouple S
b	Thermocouple B
E	Thermocouple E
T	Thermocouple T
n	Thermocouple N
P	Thermocouple PLII
C	Thermocouple W5Re/W26Re
U	Thermocouple U
L	Thermocouple L
JP	RTD JPt100
Pt	RTD Pt100
V	Voltage/Current

5.2 Switching Parameters within the Same Mode

■ Monitor & SV setting mode, Parameter setting mode, and Communication setting mode

Every time the SET key is pressed, the screen goes to the next parameter.

Example: Parameter setting mode



The displayed parameter varies depending on the product specifications.

■ Engineering mode

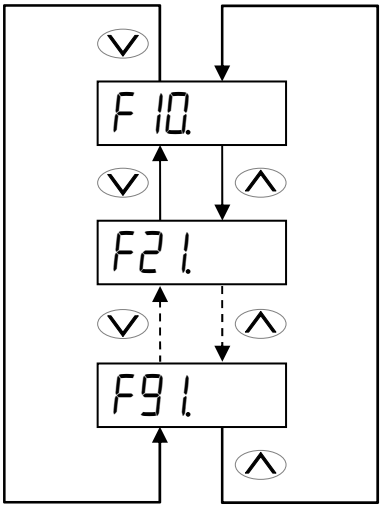
NOTE

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.

When switching to the Engineering mode, it is necessary to release the Engineering mode lock.

● Switching between function blocks

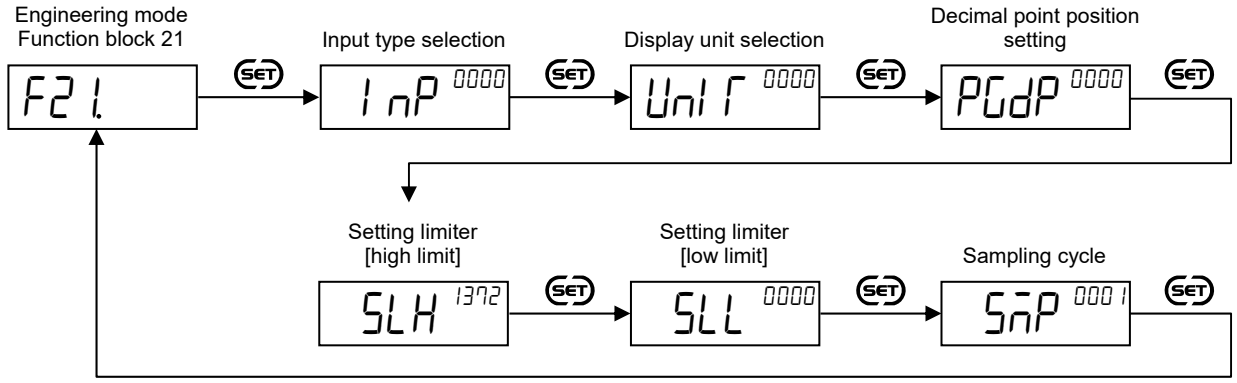
The parameters in the Engineering mode are grouped into function blocks. Each press of the UP key moves the function block one block forward. Each press of the DOWN key moves the function block one block backward.



● Scrolling through parameters

Each press of the SET key advances the parameter to the next within the same function block.

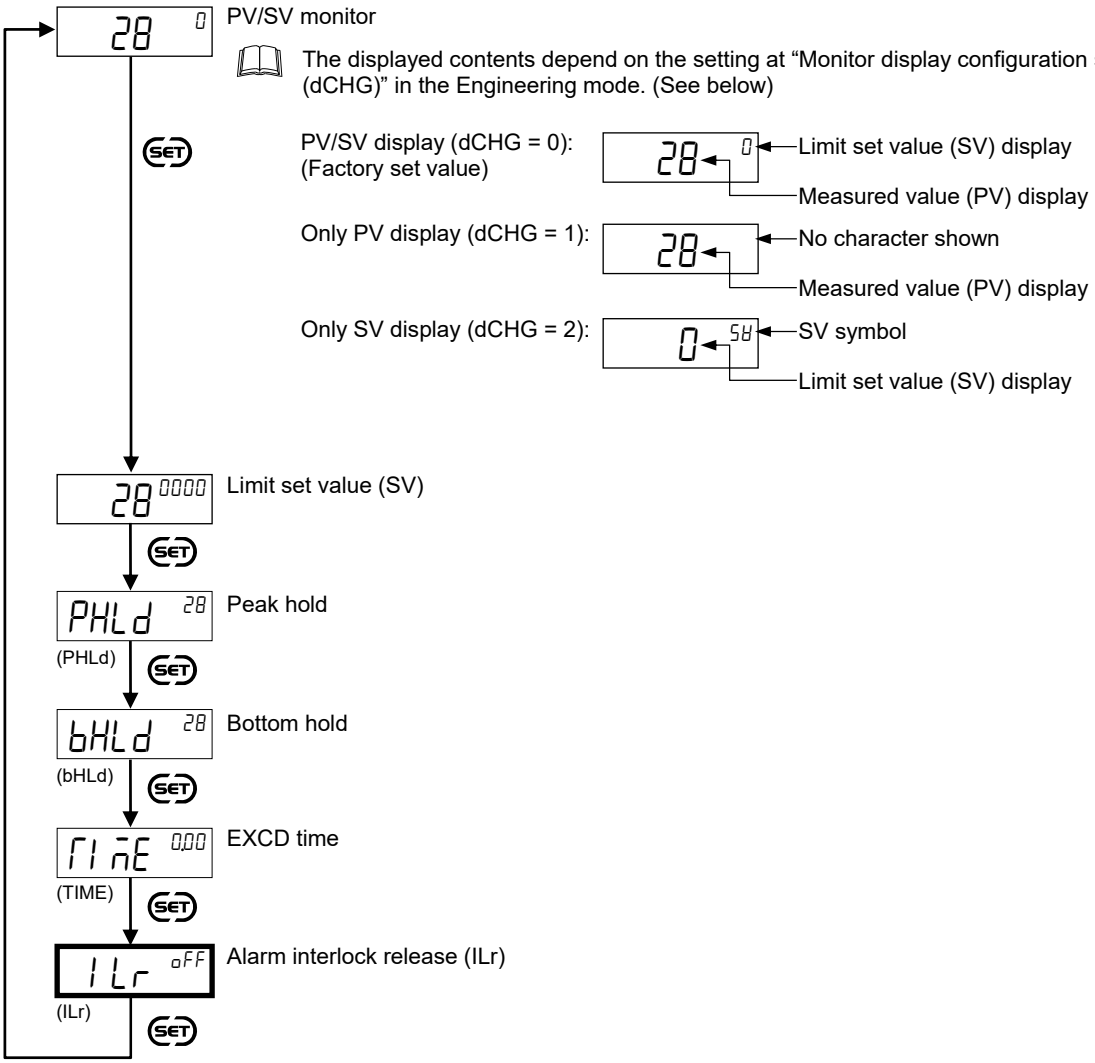
Example: Function block No. 21



5.3 List of Parameter Operations

5.3.1 Monitor & SV setting mode [A]

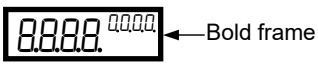
A Monitor & SV Setting Mode



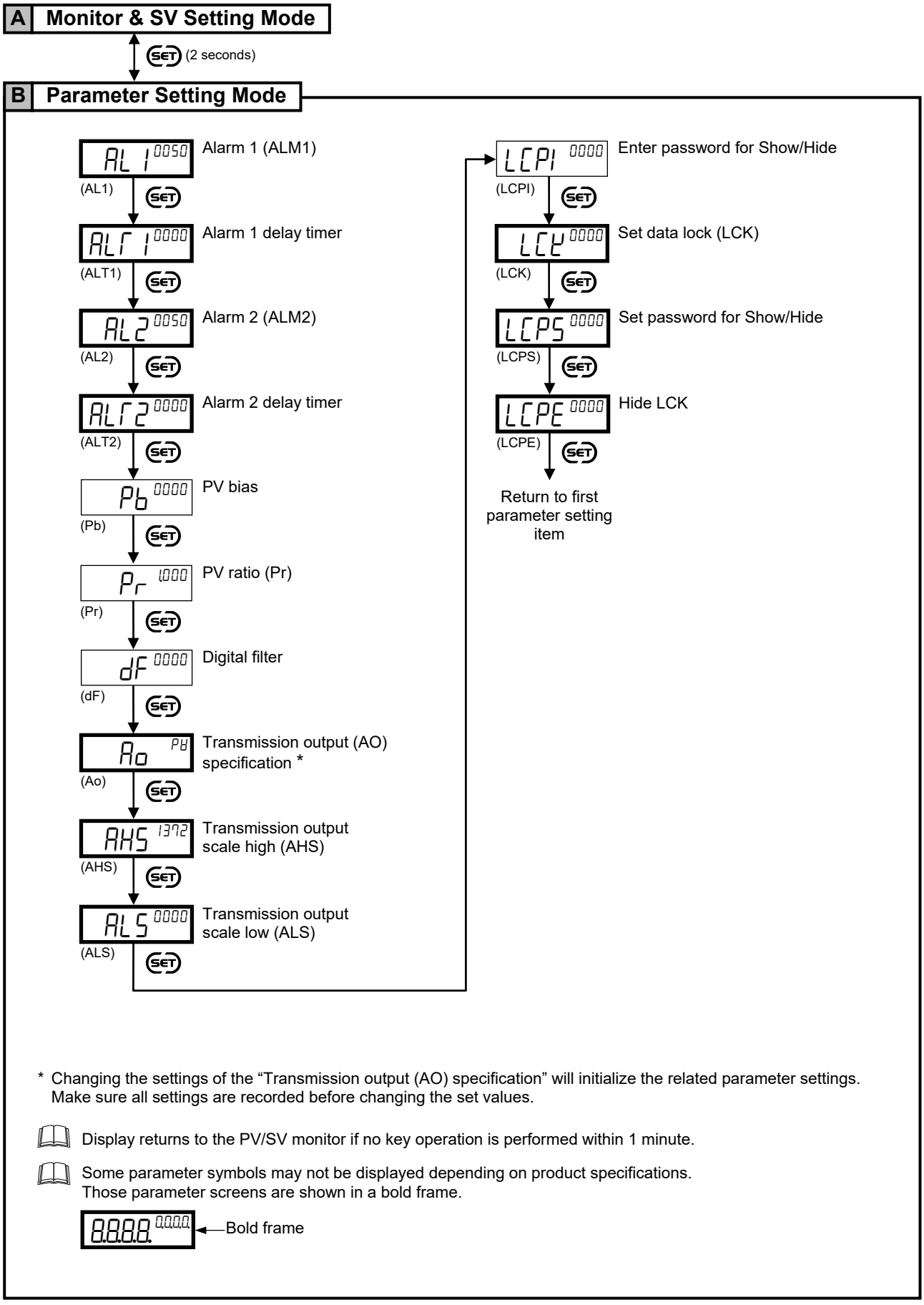
Peak hold, Bottom hold, and EXCD time: Powering off the instrument will reset the values.

Display returns to the PV/SV monitor if no key operation is performed within 1 minute.
The following parameters are exceptional and will not return to the PV/SV monitor.
- Peak hold
- Bottom hold
- EXCD time
- Alarm interlock release (ILr)

Some parameter symbols may not be displayed depending on the specification.
Those parameter screens are shown in a bold frame.



5.3.2 Parameter setting mode [B]



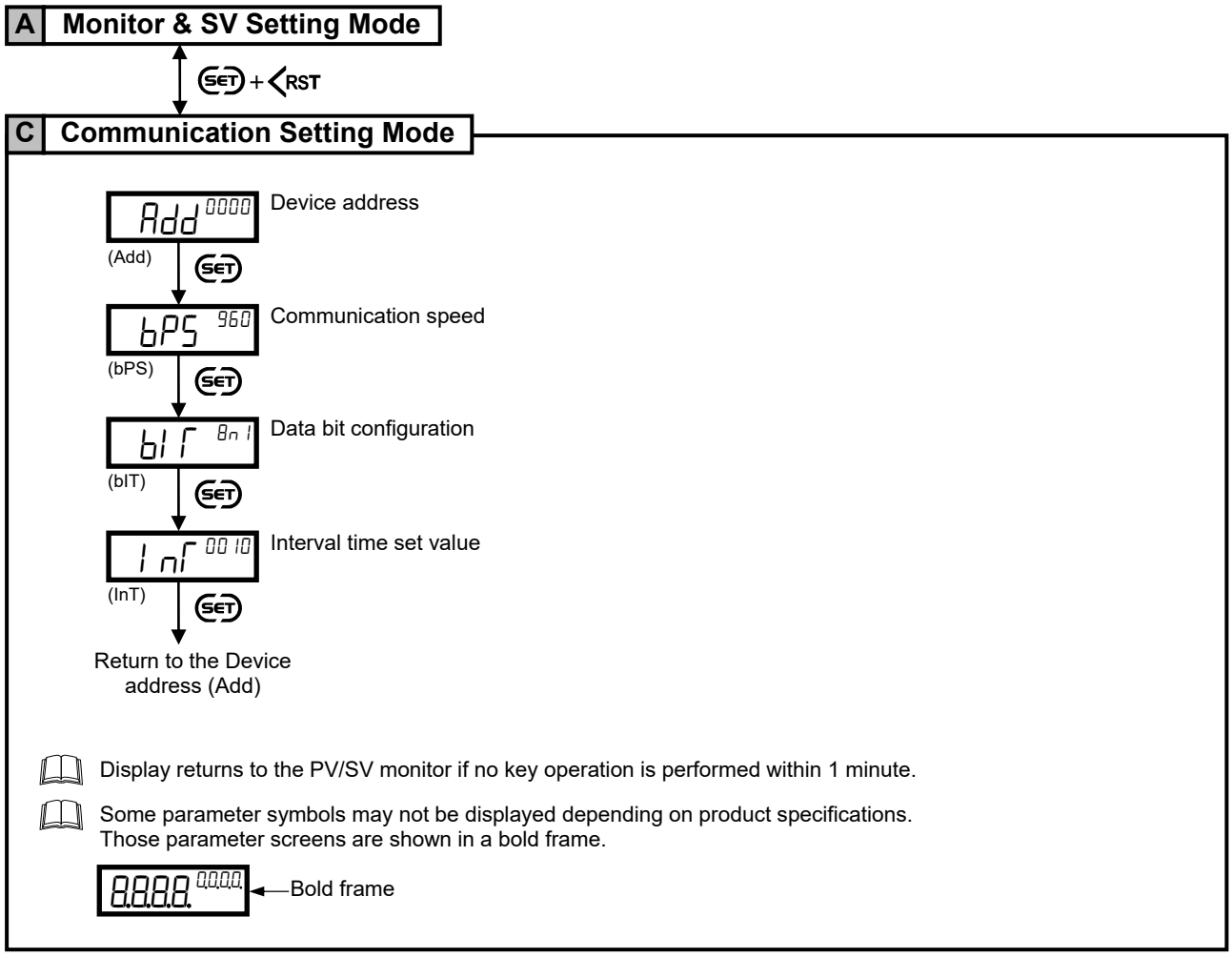
* Changing the settings of the “Transmission output (AO) specification” will initialize the related parameter settings. Make sure all settings are recorded before changing the set values.

Display returns to the PV/SV monitor if no key operation is performed within 1 minute.

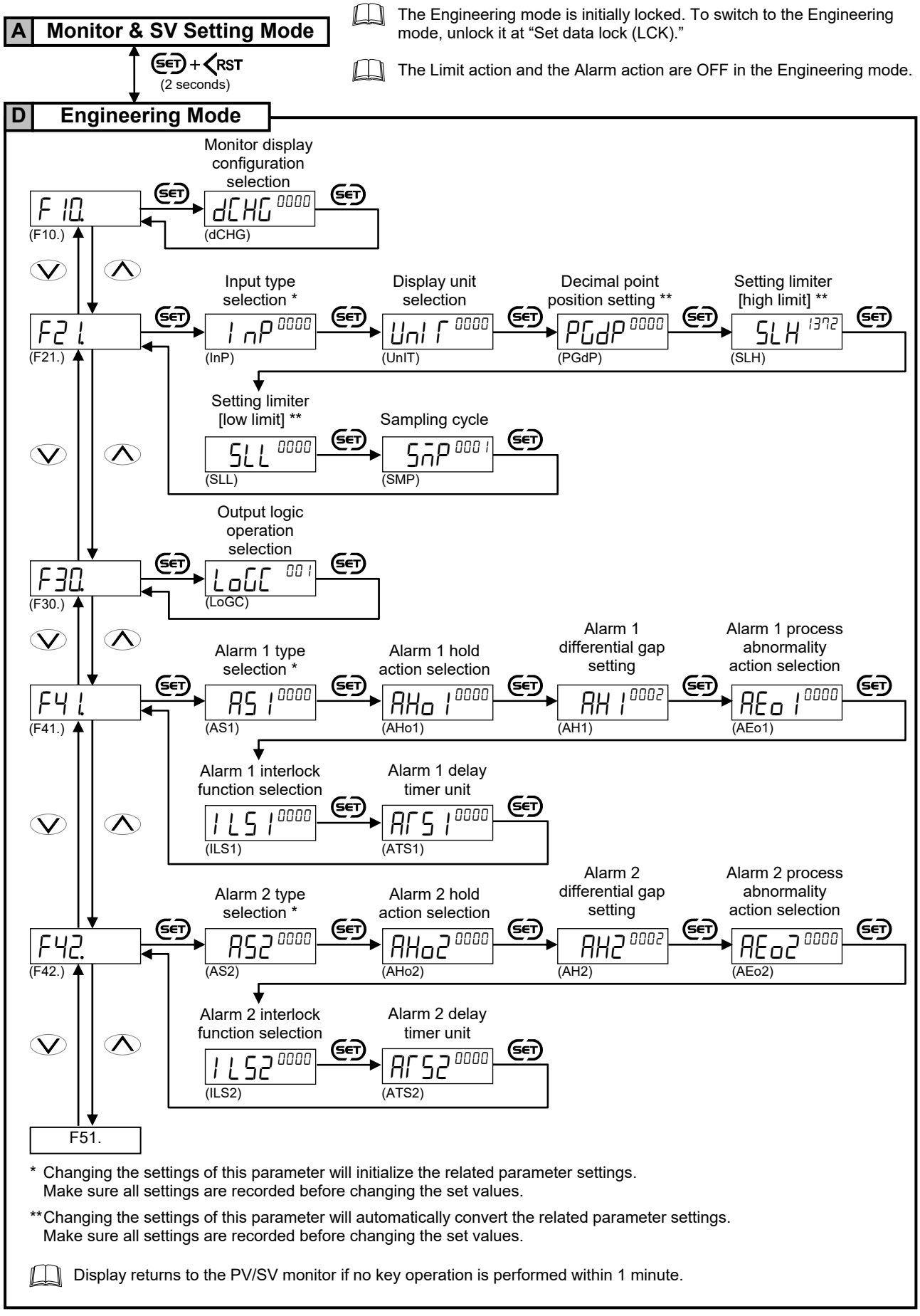
Some parameter symbols may not be displayed depending on product specifications. Those parameter screens are shown in a bold frame.

5.3.3 Communication setting mode [C]

The communication setting mode is displayed when the communication function is specified as an option.



5.3.4 Engineering mode [D]

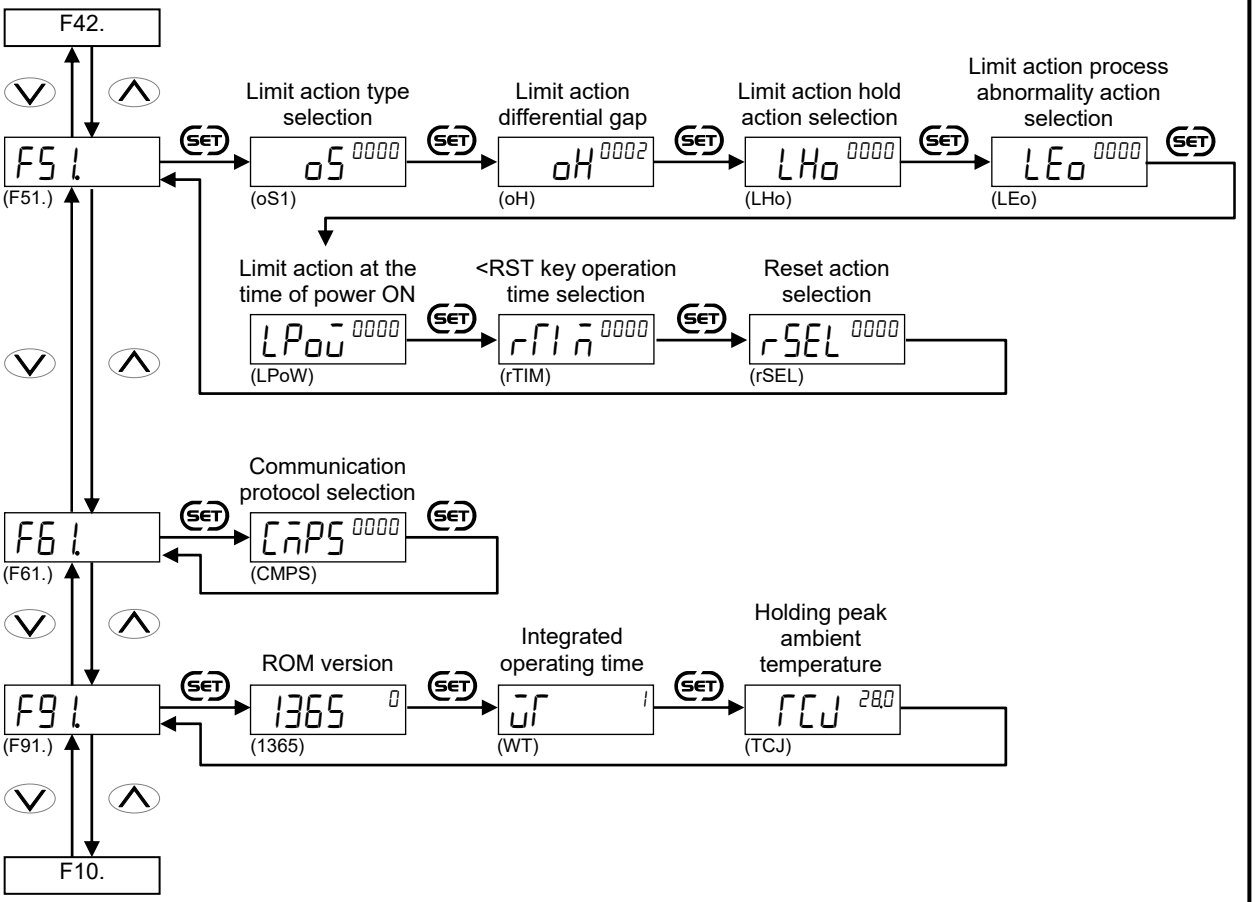


* Changing the settings of this parameter will initialize the related parameter settings.
Make sure all settings are recorded before changing the set values.

** Changing the settings of this parameter will automatically convert the related parameter settings.
Make sure all settings are recorded before changing the set values.

Display returns to the PV/SV monitor if no key operation is performed within 1 minute.

D Engineering Mode



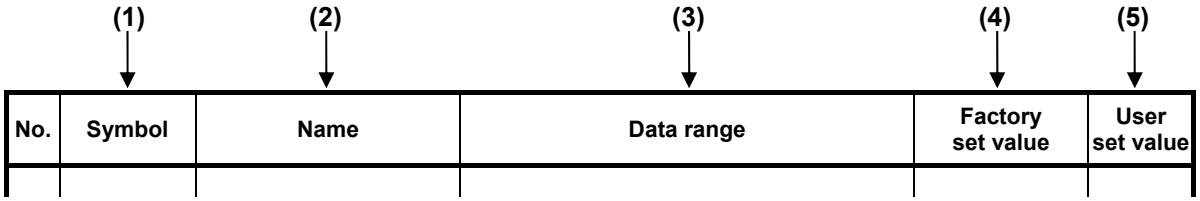
Display returns to the PV/SV monitor if no key operation is performed within 1 minute.

6

PARAMETER LIST

This chapter describes displays, names and data ranges of each parameter.

6.1 How to Read the Table



(1) Symbol: 7-segment parameter symbols shown on the Measured value (PV) display.

(2) Name: Name of parameter

(3) Data range: Data range of parameter

(4) Factory set value: Factory set value of parameters

(5) User set value: Stores parameter values set by the user.
This may be useful when the data is initialized.

6.2 Monitor & SV Setting Mode [A]

No.	Symbol	Name	Data range	Factory set value	User set value
1	—	PV/SV monitor [1]	Measured value (PV) and Limit set value (SV) are displayed. Measured value (PV) display: Within input range * [Setting limiter [low limit] – (5 % of span) to Setting limiter [high limit] + (5 % of span)] Set value (SV) display: Within input range * (Setting limiter [low limit] to Setting limiter [high limit]) * Varies with the setting of the Decimal point position.	—	
	—	PV/SV monitor [1]	Only Measured value (PV) is displayed. Measured value (PV) display: Within input range * [Setting limiter [low limit] – (5 % of span) to Setting limiter [high limit] + (5 % of span)] Set value (SV) display: No display * Varies with the setting of the Decimal point position.	—	
	SV (SV)	PV/SV monitor [1]	Limit set value (SV) and Parameter symbol are displayed. Measured value (PV) display: Within input range * [Setting limiter [low limit] – (5 % of span) to Setting limiter [high limit] + (5 % of span)] Limit set value (SV) is displayed. Set value (SV) display: "SV" is displayed. * Varies with the setting of the Decimal point position.	—	
2	—	Limit set value (SV)	Within input range (Setting limiter [low limit] to Setting limiter [high limit]) Varies with the setting of the Decimal point position.	TC/RTD inputs: 0 (0.0) Voltage/Current inputs: 0.0	
3	PHLd (PHLd)	Peak hold	Within input range (Setting limiter [low limit] to Setting limiter [high limit]) Varies with the setting of the Decimal point position.	—	
4	bHLd (bHLd)	Bottom hold	Within input range (Setting limiter [low limit] to Setting limiter [high limit]) Varies with the setting of the Decimal point position.	—	
5	TIME (TIME)	EXCD time [2]	0.00 to 99.59 (0 minutes 00 seconds to 99 minutes 59 seconds) 100.0 to 999.5 (100 minutes 0 seconds to 999 minutes 59 seconds)	—	
6	ILr (ILr)	Alarm interlock release (ILr) [3]	on: Alarm interlock state oFF: Alarm interlock release For Alarm interlock release, see P.10-10.	—	

[1] Depending on the setting of "Monitor display configuration selection," one of these screens will be displayed.

[2] The display unit shows "- - - -" if time exceeds 1000 minutes.

[3] This parameter is displayed in any one of the following conditions.

- When the "Alarm 1 type selection" is other than "0: Alarm not provided" and when "1: Enable Alarm 1 interlock function" is set at "Alarm 1 interlock function selection."
- When the "Alarm 2 type selection" is other than "0: Alarm not provided" and when "1: Enable Alarm 2 interlock function" is set at "Alarm 2 interlock function selection."

6.3 Parameter Setting Mode [B]

No.	Symbol	Name	Data range	Factory set value	User set value
7	AL 1 (AL1)	Alarm 1 (ALM1) [1]	Process alarm, SV alarm: Same as input range. * (Setting limiter [low limit] to Setting limiter [high limit]) Deviation alarm: −Span to +Span * (However, within −1999 to +9999 digits) * Varies with the setting of the Decimal point position.	TC/RTD inputs: 50 (50.0) Voltage/Current inputs: 5.0	
8	ALT 1 (ALT1)	Alarm 1 delay timer [2, 3]	0 to 9999 seconds	0	
9	AL2 (AL2)	Alarm 2 (ALM2) [4]	Process alarm, SV alarm: Same as input range * (Setting limiter [low limit] to Setting limiter [high limit]) Deviation alarm: −Span to +Span * (However, within −1999 to +9999 digits) * Varies with the setting of the Decimal point position.	TC/RTD inputs: 50 (50.0) Voltage/Current inputs: 5.0	
10	ALT2 (ALT2)	Alarm 2 delay timer [2, 5]	0 to 9999 seconds	0	
11	Pb (Pb)	PV bias	−Span to +Span (However, within −1999 to +9999 digits) Varies with the setting of the Decimal point position.	TC/RTD inputs: 0 (0.0) Voltage/Current inputs: 0.0	
12	Pr (Pr)	PV ratio (Pr)	0.500 to 1.500 times	1.000	
13	dF (dF)	Digital filter	0 to 100 seconds (0: Digital filter OFF)	0	
14	Ao (Ao)	Transmission output (AO) specification [6]	PV: Measured value (PV) SV: Limit set value (SV) dEV: Deviation (DEV)	PV	
15	AHS (AHS)	Transmission output scale high (AHS) [6]	Measured value (PV): Same as input range * [Transmission output scale low to Setting limiter (high limit)] Limit set value (SV): Same as input range * [Transmission output scale low to Setting limiter (high limit)] Deviation (DEV): −Span to +Span * (However, within −1999 to +9999 digits) [Transmission output scale low to +Span] * Varies with the setting of the Decimal point position.	TC/RTD inputs: Input range high or +Span Voltage/Current inputs: 100.0	

[1] This parameter is displayed when any value other than “0: Alarm not provided” is set at “Alarm 1 type selection.”

[2] The actual delay time is the value obtained by multiplying the delay timer value and the delay timer unit value.

[3] This value is displayed when the following conditions are both met:
The “Alarm 1 type selection” is set to other than “0: Alarm not provided” and
The “Alarm 1 delay timer unit” is set to other than “0: Alarm 1 delay timer function OFF”

[4] This parameter is displayed when any value other than “0: Alarm not provided” is set at “Alarm 2 type selection.”

[5] This value is displayed when the following conditions are both met:
The “Alarm 2 type selection” is set to other than “0: Alarm not provided” and
The “Alarm 2 delay timer unit” is set to other than “0: Alarm 1 delay timer function OFF”

[6] This parameter is displayed when the current output (0 to 20 mA DC or 4 to 20 mA DC) is specified as an Output 1 [OUT1].

Parameter Setting Mode [B]

No.	Symbol	Name	Data range	Factory set value	User set value
16	ALS (ALS)	Transmission output scale low (ALS) [1]	Measured value (PV): Same as input range * [Setting limiter [low limit] to Transmission output scale high] Set value (SV): Same as input range * [Setting limiter [low limit] to Transmission output scale high] Deviation (DEV): −Span to +Span * (However, within −1999 to +9999 digits) [−Span to Transmission output scale high] * Varies with the setting of the Decimal point position.	TC/RTD inputs: Input range low or −Span Voltage/Current inputs: 0.0	
17	LCPI (LCPI)	Enter password for Show/Hide	0000 to 9999 [2]	0000	
18	LCK (LCK)	Set data lock (LCK)	0000 to 1111 [3]	0000	
19	LCPS (LCPS)	Set password for Show/Hide	0000 to 9999	0000	
20	LCPE (LCPE)	Hide LCK	0: Unlock 1: Lock	0	

[1] This parameter is displayed when the current output (0 to 20 mA DC or 4 to 20 mA DC) is specified as an Output 1 [OUT1].

[2] The entered password will be reset to "0000" by pressing the SET key.

[3] Details of set data lock function:

The data lock function only prevents setting changes being made from the front keys. Setting changes can still be made through communication transmission.

Table 1

	×: Operable –: Not operable	×: Changeable –: Not changeable		
Setting data	Switch to the Engineering mode	Limit set value (SV)	Alarm setting [a]	Other setting items [b]
0000	—	×	×	×
0001	—	×	×	—
0010	—	×	—	×
0011	—	×	—	—
0100	—	—	×	×
0101	—	—	×	—
0110	—	—	—	×
0111	—	—	—	—
1000	×	×	×	×
1001	×	×	×	—
1010	×	×	—	×
1011	×	×	—	—
1100	×	—	×	×
1101	×	—	×	—
1110	×	—	—	×
1111	×	—	—	—

[a] Alarm (ALM1), Alarm 2 (ALM2), Alarm 1 delay timer, and Alarm 2 delay timer

[b] Setting items except Alarm setting and Limit set value (SV)

The following parameters are not covered by the Set data lock.

- Enter password for Show/Hide
- Hide LCK
- Set data lock (LCK)
- Set password for Show/Hide
- Parameter in the Communication setting mode

6.4 Communication Setting Mode [C]

The Communication setting mode is displayed when RKC communication or Modbus is specified as an optional function at the time of ordering.

No.	Symbol	Name	Data range	Factory set value	User set value
21	Add (Add)	Device address	0 to 99	0	
22	bPS (bPS)	Communication speed	240: 2400 bps 480: 4800 bps 960: 9600 bps 1920: 19200 bps 3840: 38400 bps 5760: 57600 bps	960	
23	bIT (bIT)	Data bit configuration	See Table 2 for Data bit configurations.	8n1	
24	InT (InT)	Interval time set value	0 to 250 ms	10	

Table 2

Set value	Data bit	Parity bit	Stop bit
7n1 (7n1)	7	None	1
7n2 (7n2)	7	None	2
7E1 (7E1)	7	Even	1
7E2 (7E2)	7	Even	2
7o1 (7o1)	7	Odd	1
7o2 (7o2)	7	Odd	2
8n1 (8n1)	8	None	1
8n2 (8n2)	8	None	2
8E1 (8E1)	8	Even	1
8E2 (8E2)	8	Even	2
8o1 (8o1)	8	Odd	1
8o2 (8o2)	8	Odd	2

: Not settable for Modbus

6.5 Engineering Mode [D]

⚠ 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.

NOTE

To switch the mode to the Engineering mode, have the "Set data lock (LCK)" displayed on the screen. (See P. 7-11 to 7-13)

■ Function block 10

No.	Symbol	Name	Data range	Factory set value	User set value
25	F 10. (F10.)	Function block 10	This is the first parameter symbol of Function block 10	—	
26	dCHG (dCHG)	Monitor display configuration selection	0: PV/SV display 1: Only PV display 2: Only SV display	0	

■ Function block 21

No.	Symbol	Name	Data range	Factory set value	User set value
27	F2 1. (F21.)	Function block 21	This is the first parameter symbol of Function block 21	—	
28	InP (InP)	Input type selection	0: Thermocouple K [1] 1: Thermocouple J [1] 2: Thermocouple R [1] 3: Thermocouple S [1] 4: Thermocouple B [1] 5: Thermocouple E [1] 6: Thermocouple N [1] 7: Thermocouple T [1] 8: Thermocouple W5Re/W26Re [1] 9: Thermocouple PL II [1] 10: Thermocouple U [1] 11: Thermocouple L [1] 12: RTD Pt100 [1] 13: RTD JPt100 [1] 14: 0 to 5 V DC or 0 to 20 mA DC [1, 2] 15: 1 to 5 V DC or 4 to 20 mA DC [1, 2] 16: 0 to 10 V DC [1]	Factory set value varies depending on the instrument specification.	

[1] Input type (TC/RTD to voltage/current inputs or voltage/current inputs to TC/RTD) cannot be changed because the hardware is different.

[2] For the current input specification, a resistor of 250 Ω must be connected between the input terminals.

Function block 21

No.	Symbol	Name	Data range	Factory set value	User set value
29	UnIT (UnIT)	Display unit selection	0: °C 1: °F	0	
30	PGdP (PGdP)	Decimal point position setting	0: No digit below decimal point 1: 1 digit below decimal point 2: 2 digits below decimal point 3: 3 digits below decimal point	Factory set value varies depending on the instrument specification.	
31	SLH (SLH)	Setting limiter [high limit]	−1999 to +9999 • See the Table 3 for the setting range of the Setting limiter [high limit]/Setting limiter [low limit] for each input type. • For the input range, see "**Input Range Table**" (P. 1-6). • This instrument sets the input range with the Setting limiter. Please note that changing the Setting limiter will also change the input range.	Factory set value varies depending on the instrument specification.	
32	SLL (SLL)	Setting limiter [low limit]		Factory set value varies depending on the instrument specification.	
33	SMP (SMP)	Sampling cycle	0: 250 ms (0.25 seconds) 1: 500 ms (0.5 seconds)	1	

Table 3

Input type		Setting range
Thermocouple (TC)	K	−199 to +1372 °C (−326 to +2502 °F)
		−199.9 to +999.9 °C (−199.9 to +999.9 °F)
	J	−199 to +1200 °C (−326 to +2192 °F)
		−199.9 to +999.9 °C (−199.9 to +999.9 °F)
	R	0 to 1769 °C (0 to 3216 °F)
	S	0 to 1769 °C (0 to 3216 °F)
	B	0 to 1820 °C (0 to 3308 °F)
	E	0 to 1000 °C (0 to 1832 °F)
	N	0 to 1300 °C (0 to 2372 °F)
		0.0 to 999.9°C (0.0 to 999.9 °F)
	T	−199 to +400 °C (−326 to +752 °F)
		−199.9 to +400.0 °C (−199.9 to +752.0 °F)
	W5Re/W26Re	0 to 2320 °C (0 to 4208 °F)
	PL II	0 to 1390 °C (0 to 2534 °F)
	U	−199 to +600 °C (−326 to +1112 °F)
		−199.9 to +600.0 °C (−199.9 to +999.9 °F)
	L	0 to 900 °C (0 to 1652 °F)
RTD	Pt100 (JIS/IEC) [1]	−199.9 to +649.0 °C (−199.9 to +999.9 °F)
	JPt100 (JIS)	
Voltage [2]	0 to 5 V DC	−1999 to +9999 (programmable scale)
	1 to 5 V DC	
	0 to 10 V DC	
Current [2, 3]	0 to 20 mA DC	−1999 to +9999 (programmable scale)
	4 to 20 mA DC	

[1] **IEC** (International Electrotechnical Commission) is equivalent to **JIS**, **DIN** and **ANSI**.
[2] In case of voltage/current inputs, SLH can be set below SLL.
[3] For the current input specification, a resistor of 250 Ω must be connected between the input terminals.

☞ See **14.1.1 When "Input type selection (InP)" is changed (P. 14-2)**.

■ Function block 30

No.	Symbol	Name	Data range	Factory set value	User set value
34	F30. (F30.)	Function block 30	This is the first parameter symbol of Function block 30	—	
35	LoGC (LoGC)	Output logic operation selection	001: OUT1: Limit output (De-energized) OUT2: *OR* output of Alarm 1 and Alarm 2 (Energized) 002: OUT1: Limit output (De-energized) OUT2: *AND* output of Alarm 1 and Alarm 2 (Energized) 003: OUT1: Limit output (De-energized) OUT2: Alarm 1 output (Energized) 004: OUT1: Limit output (De-energized) OUT2: *OR* output of Alarm 1 and Alarm 2 (De-energized) 005: OUT1: Limit output (De-energized) OUT2: *AND* output of Alarm 1 and Alarm 2 (De-energized) 006: OUT1: Limit output (De-energized) OUT2: Alarm 1 output (De-energized) 007: OUT1: Limit output (De-energized) OUT2: Not output (The Alarm state can be checked via communication or by lamp lighting) 008: OUT1: Limit output (Energized) OUT2: *OR* output of Alarm 1 and Alarm 2 (Energized) 009: OUT1: Limit output (Energized) OUT2: *AND* output of Alarm 1 and Alarm 2 (Energized) 010: OUT1: Limit output (Energized) OUT2: Alarm 1 output (Energized) 011: OUT1: Limit output (Energized) OUT2: *OR* output of Alarm 1 and Alarm 2 (De-energized) 012: OUT1: Limit output (Energized) OUT2: *AND* output of Alarm 1 and Alarm 2 (De-energized) 013: OUT1: Limit output (Energized) OUT2: Alarm 1 output (De-energized) 014: OUT1: Limit output (Energized) OUT2: Not output (The Alarm state can be checked via communication or by lamp lighting) 015: OUT1: Transmission output OUT2: Limit output (De-energized) 016: OUT1: Transmission output OUT2: Limit output (Energized)	Factory set value varies depending on the instrument specification. *	

* Factory set value when an Output assignment code is not specified at the time of ordering:
The output assignment code is set to either of the following according to the output 1 (OUT1) type specified at the time of ordering.
- When OUT1 is a relay contact output: 001
- When OUT1 is a current output (0 to 20 mA DC or 4 to 20 mA DC): 015

■ Function block 41

No.	Symbol	Name	Data range	Factory set value	User set value
36	F41. (F41.)	Function block 41	This is the first parameter symbol of Function block 41	—	
37	AS1 (AS1)	Alarm 1 type selection	0: Alarm not provided 1: SV high alarm 2: SV low alarm 3: Process high alarm 4: Process low alarm 5: Deviation high alarm 6: Deviation low alarm 7: Deviation high/low alarm 8: Band alarm	Factory set value varies depending on the instrument specification.	
38	AHo1 (AHo1)	Alarm 1 hold action selection	0: Without alarm hold action 1: Effective • When the power is turned on. • When the mode is switched from the Engineering mode to other modes. 2: Effective • When the power is turned on. • When the mode is switched from the Engineering mode to other modes. • When the Limit set value (SV) is changed.	Factory set value varies depending on the instrument specification.	
39	AH1 (AH1)	Alarm 1 differential gap setting	0 (0.0) to Span (However, 9999 digits or less) Varies with the setting of the Decimal point position.	TC/RTD inputs: 2 (2.0) Voltage/Current inputs: 0.2	
40	AEo1 (AEo1)	Alarm 1 process abnormality action selection	0: Normal processing 1: Forcibly turned on when abnormal	Alarm 1 not provided: 0 Alarm 1 provided: 1	
41	ILS1 (ILS1)	Alarm 1 interlock function selection	0: Disable Alarm 1 interlock function 1: Enable Alarm 1 interlock function	0	
42	ATS1 (ATS1)	Alarm 1 delay timer unit	0 to 60 seconds (0: Alarm 1 delay timer function OFF)	0	

■ Function block 42

No.	Symbol	Name	Data range	Factory set value	User set value
43	F42. (F42.)	Function block 42	This is the first parameter symbol of Function block 42	—	
44	AS2 (AS2)	Alarm 2 type selection	0: Alarm not provided 1: SV high alarm 2: SV low alarm 3: Process high alarm 4: Process low alarm 5: Deviation high alarm 6: Deviation low alarm 7: Deviation high/low alarm 8: Band alarm	Factory set value varies depending on the instrument specification.	
45	AHo2 (AHo2)	Alarm 2 hold action selection	0: Without alarm hold action 1: Effective • When the power is turned on. • When the mode is switched from the Engineering mode to other modes. 2: Effective • When the power is turned on. • When the mode is switched from the Engineering mode to other modes. • When the Limit set value (SV) is changed.	Factory set value varies depending on the instrument specification.	
46	AH2 (AH2)	Alarm 2 differential gap setting	0 (0.0) to Span (However, 9999 digits or less) Varies with the setting of the Decimal point position.	TC/RTD inputs: 2 (2.0) Voltage/Current inputs: 0.2	
47	AEo2 (AEo2)	Alarm 2 process abnormality action selection	0: Normal processing 1: Forcibly turned on when abnormal	Alarm 2 not provided: 0 Alarm 2 provided: 1	
48	ILS2 (ILS2)	Alarm 2 interlock function selection	0: Disable Alarm 2 interlock function 1: Enable Alarm 2 interlock function	0	
49	ATS2 (ATS2)	Alarm 2 delay timer unit	0 to 60 seconds (0: Alarm 2 delay timer function OFF)	0	

■ Function block 51

No.	Symbol	Name	Data range	Factory set value	User set value
50	F51. (F51.)	Function block 51	This is the first parameter symbol of Function block 51	—	
51	oS (oS)	Limit action type selection	0: Limit action (high limit) 1: Limit action (low limit)	0	
52	oH (oH)	Limit action differential gap	0 (0.0) to Span (However, 9999 digits or less) Varies with the setting of the Decimal point position.	TC/RTD inputs: 2 (2.0) Voltage/ Current inputs: 0.2	
53	LHo (LHo)	Limit action hold action selection	0: Without hold action 1: Effective • When the power is turned on. • When the mode is switched from the Engineering mode to other modes.	0	
54	LEo (LEo)	Limit action process abnormality action selection	0: Normal processing 1: Forced ON at input error [1]	0	
55	LPoW (LPoW)	Limit action at the time of power ON	0: Normal processing 1: Forced ON at power-on [2]	0	
56	rTIM (rTIM)	<RST key operation time selection	0: Press and hold (for one second) 1: Press once	0	
57	rSEL (rSEL)	Reset action selection	0: All data is reset on each monitoring screen [3] 1: Each data is reset on each monitoring screen [3]	0	

[1] The Limit output will be forced ON when the input goes abnormal.

[2] After power is applied, the Limit output is kept ON regardless of the Measured value and this state is maintained until the reset action is taken. This state is maintained until the reset action is taken.

[3] “All data” described in the Data range mean Peak hold value, Bottom hold value, and EXCD time. Parameters cleared in each screen are as follows.

When the set value of the Reset action selection is set to "0."

Screen	Parameters cleared by Reset operation
PV/SV monitor	Limit output, Peak hold value, Bottom hold value, EXCD time
Peak hold	
Bottom hold	
EXCD time	

When the set value of the Reset action selection is set to "1."

Screen	Parameters cleared by Reset operation
PV/SV monitor	Limit output
Peak hold	Limit output, Peak hold value,
Bottom hold	Bottom hold value
EXCD time	Limit output, EXCD time

■ Function block 61

No.	Symbol	Name	Data range	Factory set value	User set value
58	F61. (F61.)	Function block 61	This is the first parameter symbol of Function block 61	—	
59	CMPS (CMPS)	Communication protocol selection	0: RKC standard protocol 1: Modbus protocol	Factory set value varies depending on the instrument specification.	

■ Function block 91

No.	Symbol	Name	Data range	Factory set value	User set value
60	F91. (F91.)	Function block 91	This is the first parameter symbol of Function block 91	—	
61	1365 (1365)	ROM version	Display the version of loading software.	—	
62	WT (WT)	Integrated operating time	0 to 99999 hours	—	
63	TCJ (TCJ)	Holding peak ambient temperature	−256.0 to +256.0 °C	—	

MEMO

7 OPERATION

This chapter describes the operating precautions and operating examples when the instrument is used for the first time.

7.1 Operating Precautions

Before starting the operation, check the following items.

■ Check before turning on the power

NOTE

- **All mounting and wiring must be completed before the power is turned on.**
- **Before turning on the power, check that the power supply voltage applied to the instrument is correct.**
- **Connect the input signal wiring and turn the power on. If the input signal wiring is not complete prior to turning the power on, the instrument determines that burnout has occurred.**

■ Power ON

As soon as the instrument is powered up, operation is started after the display of the input type and the input range. The limit output state at the time of power ON depends on the settings of "Limit action at the time of power ON (LPoW)" in the Engineering mode. The instrument is configured to "normal processing" at the time of shipping. Unless the Measured value (PV) is above or below the Limit set value (SV), the instrument starts operation with the Limit output off. When set to "1: Forced ON at power ON," the instrument starts producing the limit output signal as soon as the instrument is powered on and continues producing the Limit output until the <RST key is pressed. Release the Limit output in this case.

☞ For parameter in the Engineering mode, see **6. PARAMETER LIST (P. 6-1)**.

■ Action at input error

This instrument can be configured to provide an alarm output for handling input failures when the input exceeds (or falls below) the flashing Measured value (PV). At an input error state of this instrument, actions or outputs will be provided according to the setting.

☞ For the action at input error, see **8.5 Changing Error Handling at Input Error (P. 8-10)**.

■ Checking each parameter

The settings for the Limit set value (SV) and all parameters should be appropriate for the monitored object.
The parameters of this instrument can be changed during the operation. However, when the mode is switched to the Engineering mode, the limit and the alarm actions will not be conducted. The limit and the alarm actions will resume when the mode is switched from the Engineering mode to any other mode.

■ Operation at power failure

A power failure of 20 ms or less will not affect the action. When a power failure of more than 20 ms occurs the instrument assumes that the power has been turned off.

■ Alarm hold action

- The alarm hold action is activated in the following cases.
  - When the power is turned on
  - When the Limit set value (SV) is changed
  - When the mode is switched from the Engineering mode to other modes

☞ For details on the alarm hold action, see **10.1.2 Adding hold action to the alarm action (P. 10-6)**.

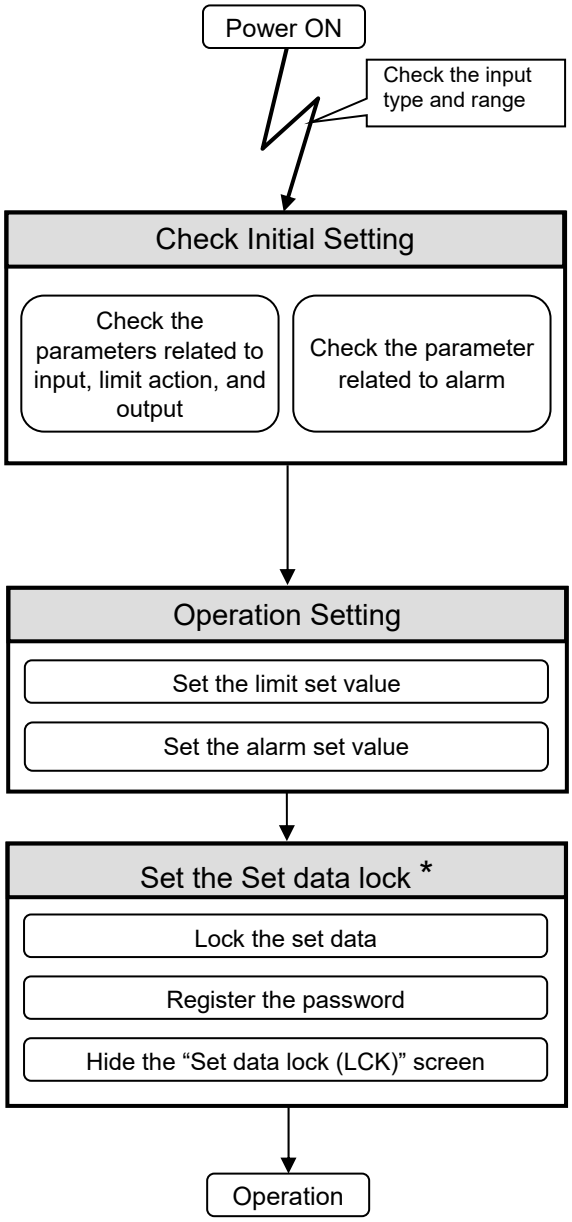
7.2 Setup Procedures

Set up the instrument prior to operating it referring to the following operating procedure. See the following setup example.

Setup example

Model code: SA200L K02—M M—3＊AN—N N / A / 03 / Y

Limit action type:	Limit action (high limit)
Input type/Range:	Thermocouple K, 0 to 400 °C
Alarm 1 [ALM1]:	Deviation high alarm
Alarm 2 [ALM2]:	No alarm
Output assignment code:	03 [OUT1: Limit output (De-energized) OUT2: Alarm 1 output (Energized)]
Limit set value (SV):	200 °C
Alarm 1 set value (ALM1):	–20 °C



☞ Input type and input range can be checked when the power is turned on. To see the information on items, see ■ **Input type, Units, and Input range (P. 5-3)**.

The Input type and alarm type are set as specified at the time of ordering. If necessary, the factory set value can be changed.

☞ To check the initial settings, see **7.3 Initial Setup Before Operation (P. 7-4)**.

☞ To change input type, see **8.1 Changing Input (P. 8-2)**.

☞ To change alarm type, see **10.1 Using Alarm Function (P. 10-2)**.

☞ For operation setting, see the following:

- **7.4 Setting the Limit Set Value (SV) (P. 7-8)**
- **7.5 Setting the Alarm Set Value (P. 7-9)**

☞ Use the “Set data lock” to protect the set data from being changed. See the following for the setting.

- **7.6 Locking the Set Data (P.7-10)**
- **7.7 Hiding the Set Data Lock (LCK) (P. 7-11)**

*** Set the “Set data lock,” if necessary.**

When the conditions for the limit operation are satisfied, the limit output is turned ON. For how to release the limit output, see the following section.

☞ See **7.8 Limit Output Release Operation (P. 7-14).**

7.3 Initial Setup Before Operation

7.3.1 Engineering mode precautions

If necessary, check the parameters before operation to ensure if they are as specified at the time of ordering. Parameters which were not specified when ordered must be set before use.
Some functions may need to be set in the Engineering mode. Read the following part before attempting the setting.

⚠ 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.

📖 The Limit action and the Alarm action are OFF in the Engineering mode.

📖 Switching the mode to the Engineering mode from other modes will release the Limit output. The Hold value and the EXCD time will also be reset.

■ Set value change and registration

- The blinking digit indicates which digit can be set. Every time the <RST key is pressed, the blinking digit moves.
- If all the digits of the set value are blinking, the <RST key is not available.
- **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.
  The modified data will not be stored only by operating the UP and DOWN keys.
- In case no operation is performed within 1 minute after the change of the setting, the mode will return to the PV/SV monitor. The modified data will not be registered in this case.

7.3.2 Checking the initial settings of the setup example (Checking parameters related to the input, limit action, output and alarm)

To check the initial settings of the setup example, check the following parameters.

Setup example

Model code: SA200L K02−M M−3＊AN−N N / A / 03 / Y

Limit action type: Limit action (high limit)
Input type/Range: Thermocouple K, 0 to 400 °C
Alarm 1 [ALM1]: Deviation high alarm
Alarm 2 [ALM2]: No alarm
Output assignment code: 03
OUT1: Limit output (De-energized)
OUT2: Alarm1 (ALM1) output (Energized)

Deviation high [Alarm set value is less than 0.]

(▲: Limit set value (SV) △: Alarm set value
☆: Alarm differential gap)

Parameters to be checked (Engineering mode)

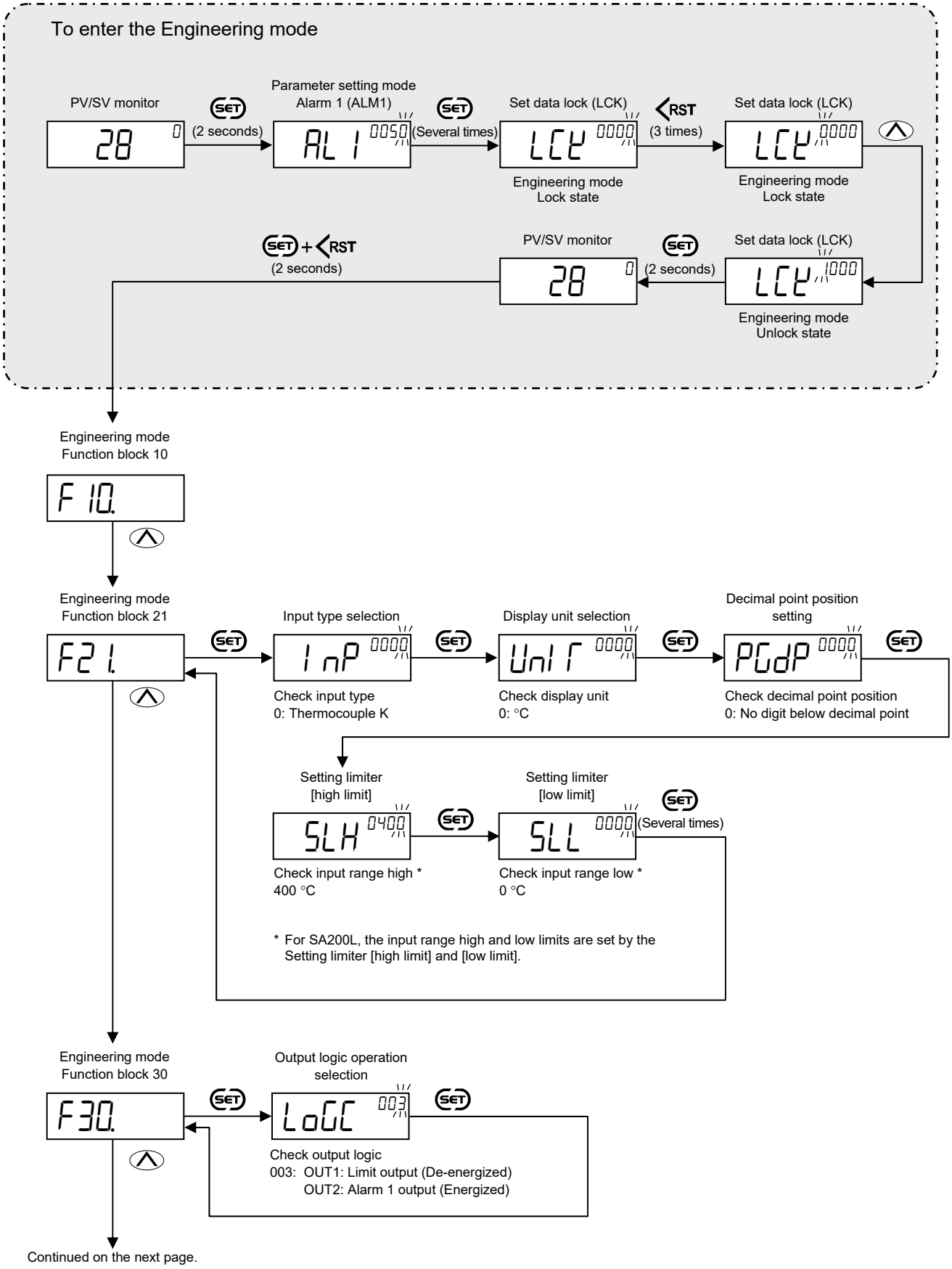
- Checking items

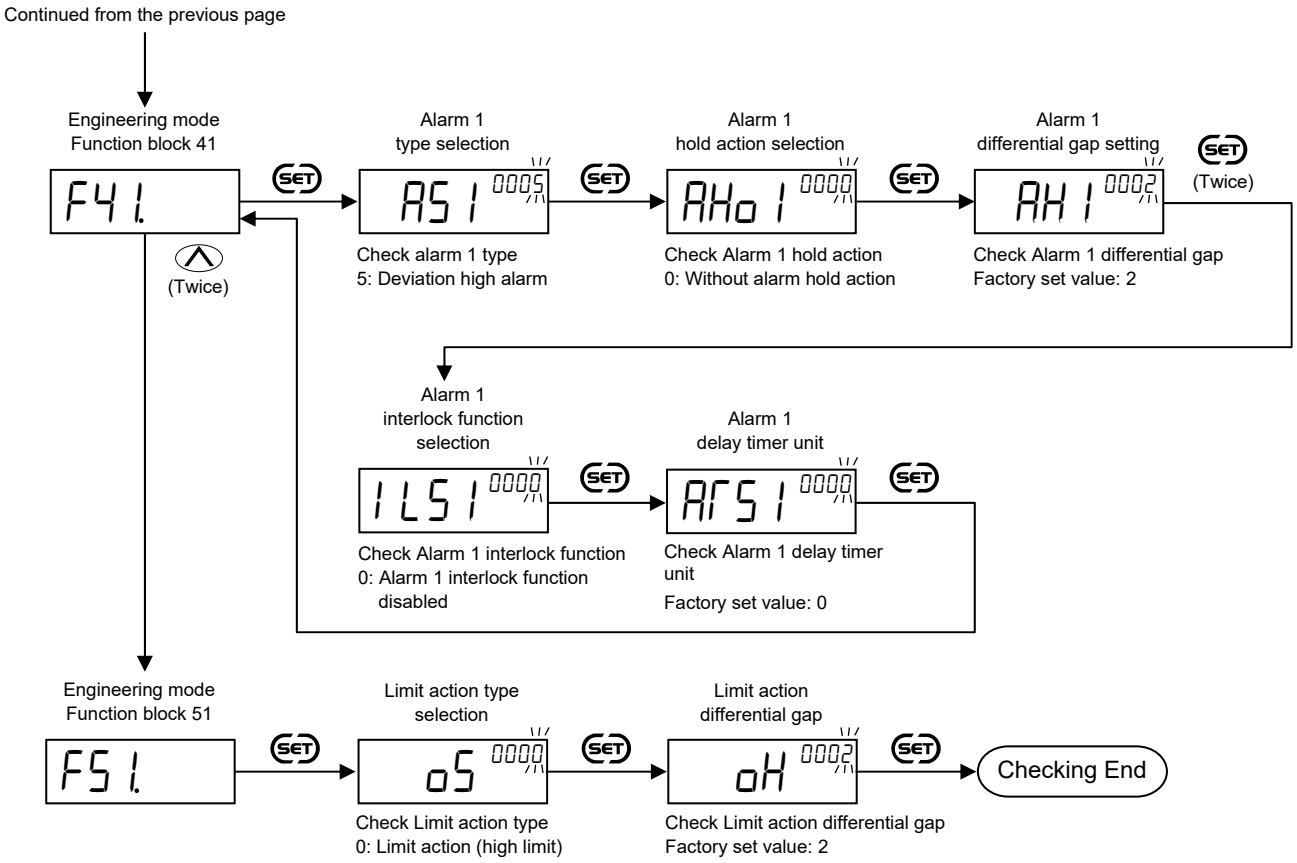
Function block 21 (F2 1.): Input type selection (1 nP)
Display unit selection (Unl Γ)
Decimal point position setting (PGdP)
Setting limiter [high limit] (SLH)
Setting limiter [low limit] (SLL)
Function block 30 (F30.): Output logic operation selection (LoGC)
Function block 41 (F4 1.): Alarm 1 type selection (AS 1)
Alarm 1 hold action selection (AHo 1)
Function block 51 (F5 1.): Limit action type selection (oS)

- Related setting items (Set only when necessary)

Function block 41 (F4 1.): Alarm 1 differential gap setting (AH 1)
Alarm 1 interlock function selection (1 LS 1)
Alarm 1 delay timer unit (AΓS 1)
Function block 51 (F5 1.): Limit action differential gap (oH)

■ Setting procedure




Continued from the previous page
Engineering mode
Function block 41
F41.
(Twice)
Alarm 1
type selection
AS1 0005
Check alarm 1 type
5: Deviation high alarm
Alarm 1
hold action selection
AHo1 0000
Check Alarm 1 hold action
0: Without alarm hold action
Alarm 1
differential gap setting
AH1 0002
(Twice)
Check Alarm 1 differential gap
Factory set value: 2
Alarm 1
interlock function
selection
1LS1 0000
Check Alarm 1 interlock function
0: Alarm 1 interlock function
disabled
Alarm 1
delay timer unit
ArS1 0000
Check Alarm 1 delay timer
unit
Factory set value: 0
Engineering mode
Function block 51
F51.
Limit action type
selection
oS 0000
Check Limit action type
0: Limit action (high limit)
Limit action
differential gap
oH 0002
Check Limit action differential gap
Factory set value: 2
Checking End

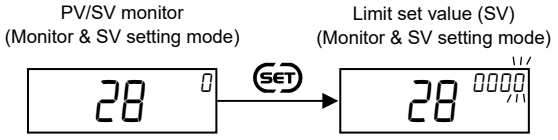
7.4 Setting the Limit Set Value (SV)

After finishing the initial settings, set the Limit set value (SV).

[Setting example: Set the Limit set value (SV) to 200 °C]

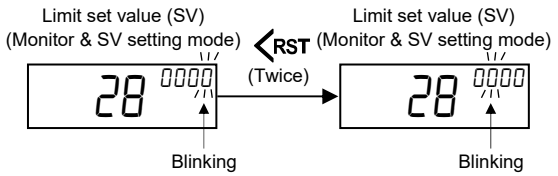
1. Select the Limit set value (SV)

Press the SET key in the PV/SV monitor until the Limit set value (SV) is displayed.



2. Shift the blinking digit to the hundreds digit

Press <RST key to shift the blinking digit to the hundreds digit. The blinking digit indicates which digit can be set.

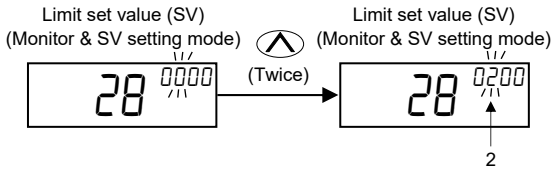


3. Change the numerical value from “0” to “2”

Press the UP key twice to change the numerical value from “0” to “2.”

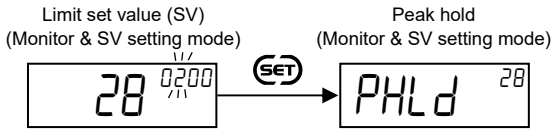
Setting range: Within input range
(Setting limiter [low limit] to Setting limiter [high limit])

Factory set value: 0



4. Store the set value

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



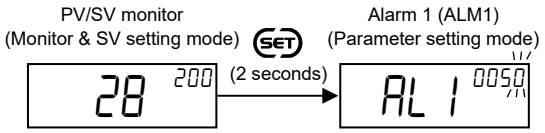
7.5 Setting the Alarm Set Value

After finishing the initial settings, set the alarm set values if they are used.

[Setting example: Set the Alarm 1 (ALM1) to –20 °C]

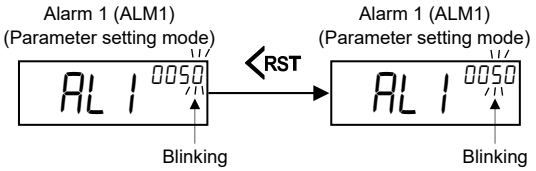
1. Select the Parameter setting mode

Press and hold SET key for 2 seconds at Monitor & SV setting mode until the Parameter setting mode is displayed.



2. Shift the blinking digit to the tens digit

Press the <RST key to shift the blinking digit to the tens digit. The blinking digit indicates which digit can be set.

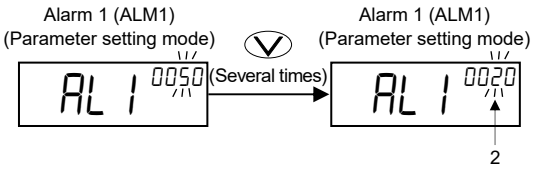


3. Change the numerical value from “5” to “2”

Press the DOWN key to change the numerical value from “5” to “2.”

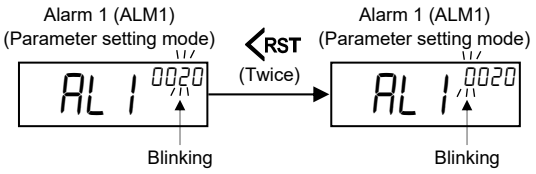
Setting range: Deviation alarm
–Span to +Span
(However, within –1999 to +9999 digits)

Factory set value: 50



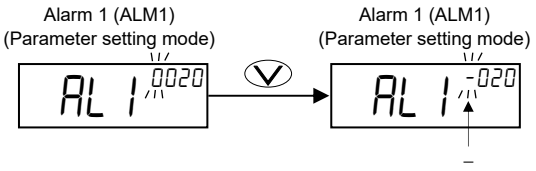
4. Shift the blinking digit to the thousands digit

Press the <RST key to shift the blinking digit to the thousands digit.



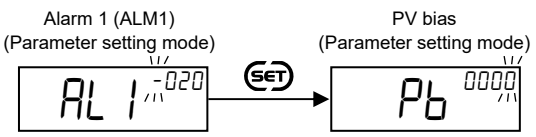
5. Change the numerical value from “0” to “–”

Press the DOWN key to change the numerical value from “0” to “–.”



6. Store the alarm set value

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



7.6 Locking the Set Data

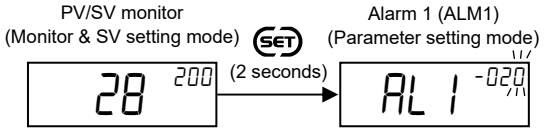
In the following example, all of the parameters except the Limit set value (SV) will be locked.

The following parameters are not covered by the Set data lock.

- Enter password for Show/Hide
- Set data lock (LCK)
- Set password for Show/Hide
- Hide LCK
- Parameters within the Communication setting mode

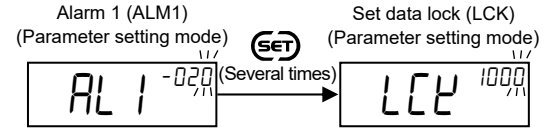
1. Select the Parameter setting mode

Press and hold SET key for 2 seconds at Monitor & SV setting mode until the Parameter setting mode is displayed.



2. Select the "Set data lock (LCK)"

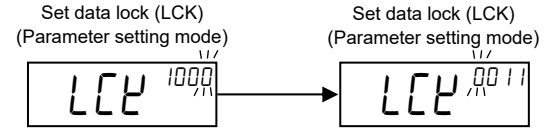
Press the SET key several times until "Set data lock (LCK)" is displayed.



3. Set to "0011"

Enter "0011" using the UP, DOWN, and <RST keys.

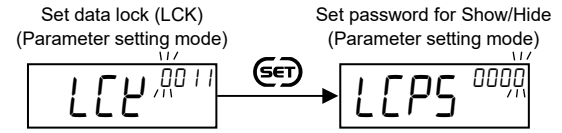
Set value: 0011
[Only the Limit set value (SV) can be changed.]



☞ See **13.1 Restricting Key Operation [Set Data Lock] (P.13-2)** for details of "Set data lock (LCK)."

4. Store the set value

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



7.7 Hiding the Set Data Lock (LCK)

If you don't want the locked data to be unlocked, you can use the "Hide LCK (Set data lock)" function to hide the "Set data lock (LCK)."
The "Set data lock (LCK)" can be hidden by registering a desired password and perform the hide operation.

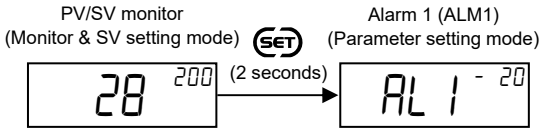
NOTE

Be sure to remember the password or store it in a safe location.

7.7.1 Register the password

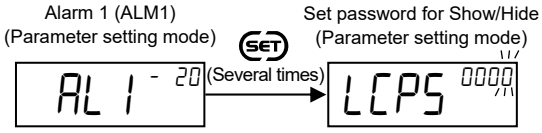
1. Select the Parameter setting mode

Press and hold SET key for 2 seconds at Monitor & SV setting mode until the Parameter setting mode is displayed.



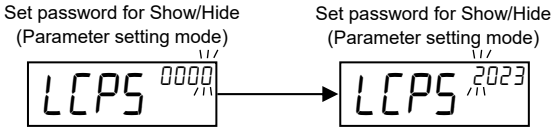
2. Select the "Set password for Show/Hide"

Press the SET key several times until "Set password for Show/Hide" will be displayed.



3. Enter password

Enter your desired password using the UP, DOWN and <RST keys.

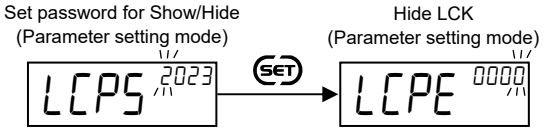


Set password for Show/Hide

Data range: 0000 to 9999
Factory set value: 0000

4. Store the set value

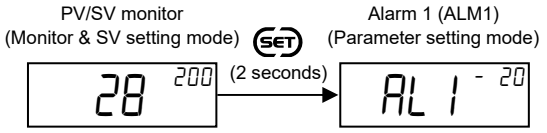
Press the SET key to store the set value. The display changes to the next parameter.



7.7.2 Hiding the Set data lock (LCK)

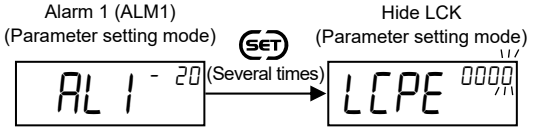
1. Select the Parameter setting mode

Press and hold SET key for 2 seconds at Monitor & SV setting mode until the Parameter setting mode is displayed.



2. Select the "Hide LCK"

Press the SET key several times until "Hide LCK" will be displayed.

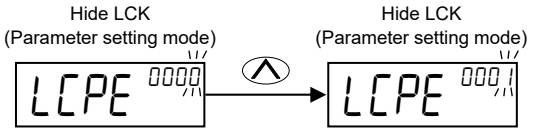


3. Change to "1: Lock"

Press the UP key to change to "1."

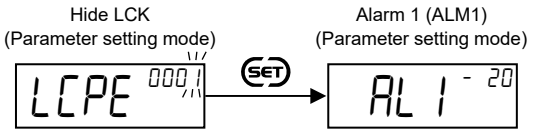
Hide LCK

Data range:	0: Unlock
	1: Lock
Factory set value:	0



4. Hide the parameter

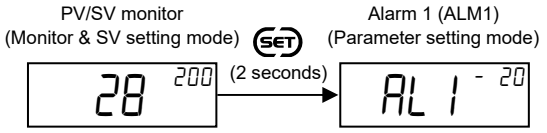
Press the SET key to hide the "Set data lock (LCK)." The "Set password for Show/Hide" and "Hide LCK" will also be hidden. The display changes to the next parameter.



7.7.3 Show LCK (Set data lock) again

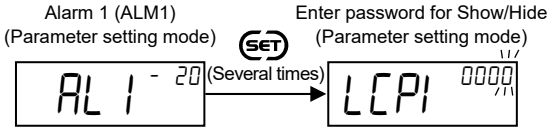
1. Select the Parameter setting mode

Press and hold SET key for 2 seconds at Monitor & SV setting mode until the Parameter setting mode is displayed.



2. Select the "Enter password for Show/Hide"

Press the SET key several times until "Enter password for Show/Hide" is displayed.

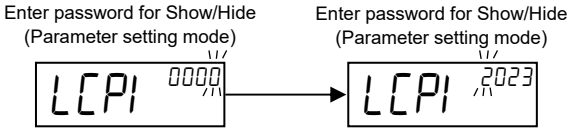


3. Enter the password

Enter the password using the UP, DOWN, and <RST key.

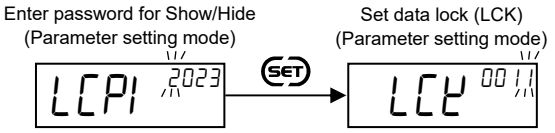
Enter password for Show/Hide

Data range: 0000 to 9999
Factory set value: 0000



4. Show the parameter

Press the SET key to show the "Set data lock (LCK)." The "Set password for Show/Hide" and "Hide LCK" will be also shown. The display changes to the next parameter.



The password you entered at "Enter password for Show/Hide" will be reset to "0000" when you press the SET key to shift to the next set item.

7.8 Limit Output Release Operation

There are three ways to release the limit output as shown below.

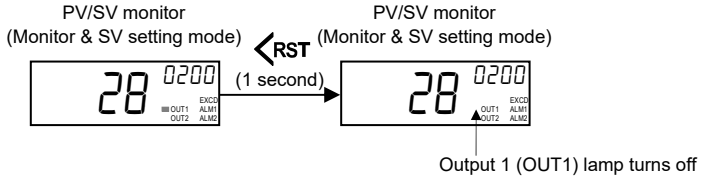
- By key operation
- By contact input (optional)
- By communication (optional)

While the EXCD lamp stays ON, the Limit output cannot be released.

Releasing the Limit output will also reset the hold value and the EXCD time.

● By key operation

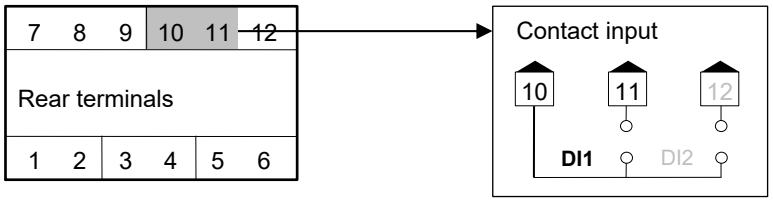
Pressing and holding the <RST key for more than one second in the Monitor & SV setting mode will release the limit output. When the limit output is released, the OUT1 (or OUT2) lamp will turn off.



The time to press the <RST key depends on the setting of "Reset key operation time selection" in the Engineering mode. The key operation can be programmed to allow the release of the Limit output only by pressing the <RST key once.

● By contact input

Limit output can be released according to the open or closed state of the terminal numbers 10 and 11 (DI1).



Terminal No. (DI1)	Release operation
10, 11	Contact closed

● By communication

The following communication data can be used to release the Limit output.

Name	Communication protocol	Communication data	Data range	Factory set value	Attribute
Limit action release	RKC communication	Identifier: **HR**	When the setting of "Set Limit action release signal" is "0": 0: Limit action release When the setting of "Set Limit action release signal" is "1": 1: Limit action release	—	R/W
	Modbus	Address: **2AH**			

8 INPUT FUNCTION

This chapter describes input related functions, setting contents and setting procedure based on the keywords related to inputs.

8.1 Changing Input

Measured input can be changed at following parameters. Set the input according to the sensor and the application.

- **Input type selection**
- **Display unit selection**
- **Decimal point position setting**
- **Setting limiter [high limit]/Setting limiter [low limit]**
- **Sampling cycle**

■ Description of function

Input type

The input type of this instrument can be changed within the same input type group.

TC input type: K, J, R, S, B, E, N, T, W5Re/W26Re, PL II, U, L

RTD input type: Pt100, JPt100

Voltage/Current input type: 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC, 0 to 20 mA DC, 4 to 20 mA DC

For the current input specification, a resistor of 250 Ω must be connected between the input terminals.

Decimal point position

The decimal point position of the Measured value (PV) can be programmed. The decimal point position depends on the input type.

TC input: For input types K, J, N, T, and U: Selectable from no decimal place (0) or one decimal place (0.0).
For input types R, S, B, E, W5Re/W26Re, PL II, and L: Fixed to no decimal place.

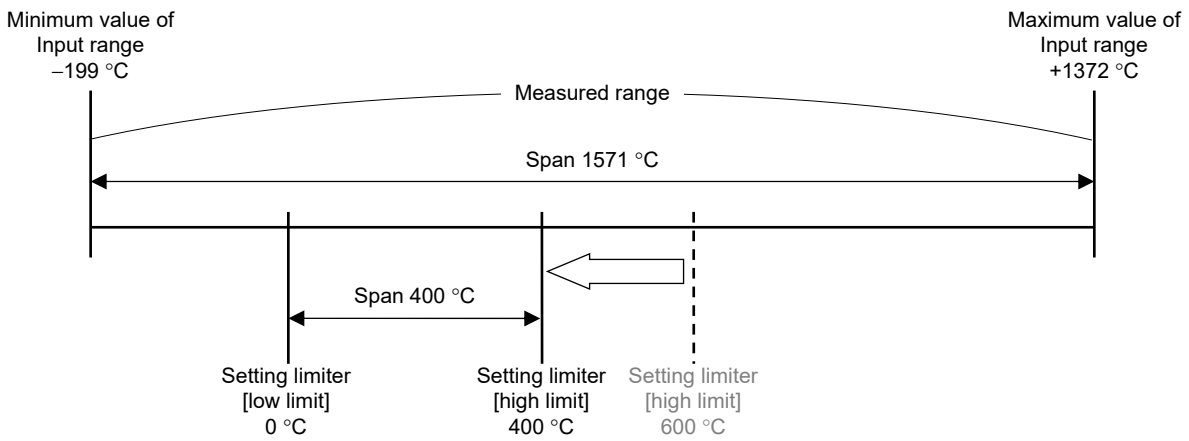
RTD input: Selectable from “No decimal place (0)” or “One decimal place (0.0)”.

Voltage/Current input:
Selectable from “No decimal place (0)” and up to “Three decimal places (0.000)”.

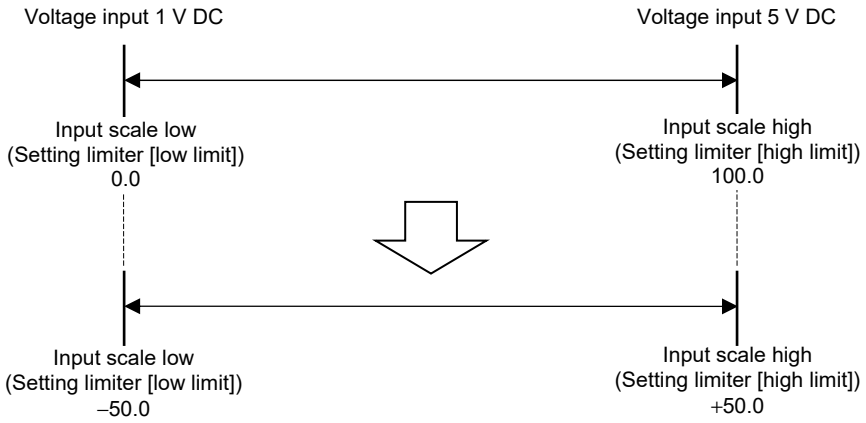
Setting limiter [high limit]/Setting limiter [low limit]

The input range of this instrument can be changed by “Setting limiter [high limit]” and “Setting limiter [low limit].” In the case of temperature input (TC and RTD), input ranges can be changed. In the case of voltage (V) and current (I) inputs, the display range is programmable within −1999 and +9999.

Example of input change 1:
Changing thermocouple K “0 to 600 °C” to “0 to 400 °C” (No digit below decimal point)



Example of input change 2:
In the case of Voltage input (1 to 5 V DC), the input range has been reduced from “0.0 to 100.0” to “–50.0 to +50.0”



Sampling cycle

The sampling time of the Measured input can be selected from 0.5 seconds and 0.25 seconds.

■ Parameter setting

● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F21. (F21.)	InP (InP)	Input type selection	0: Thermocouple K [1] 1: Thermocouple J [1] 2: Thermocouple R [1] 3: Thermocouple S [1] 4: Thermocouple B [1] 5: Thermocouple E [1] 6: Thermocouple N [1] 7: Thermocouple T [1] 8: Thermocouple W5Re/W26Re [1] 9: Thermocouple PL II [1] 10: Thermocouple U [1] 11: Thermocouple L [1] 12: RTD Pt100 [1] 13: RTD JPt100 [1] 14: Voltage 0 to 5 V DC or Current 0 to 20 mA DC [1, 2] 15: Voltage 1 to 5 V DC or Current 4 to 20 mA DC [1, 2] 16: Voltage 0 to 10 V DC [1]	Factory set value varies depending on the instrument specification.
	UnIT (UnIT)	Display unit selection	0: °C 1: °F	0
	PGdP (PGdP)	Decimal point position setting	0: No digit below decimal point 1: 1 digit below decimal point [3] 2: 2 digits below decimal point [4] 3: 3 digits below decimal point [4]	Factory set value varies depending on the instrument specification.

[1] Input type (TC/RTD to Voltage/Current inputs or Voltage/Current inputs to TC/RTD) cannot be changed because the hardware is different.

[2] For the current input specification, a resistor of 250 Ω must be connected between the input terminals.

[3] This option is selectable when the input type is Thermocouple (K, J, N, T, U), RTD, voltage or current.

[4] This option is selectable when the input type is voltage or current.

● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F21. (F21.)	SLH (SLH)	Setting limiter [high limit]	−1999 to +9999 • See Table 1 below for the setting range of the low and high limits of the Setting limiter for each input type. • See "Input range table" (P. 1-6) for the Input range. • This instrument sets the input range with the Setting limiter. Please note that changing the Setting limiter will also change the input range.	Factory set value varies depending on the instrument specification.
	SLL (SLL)	Setting limiter [low limit]		Factory set value varies depending on the instrument specification.
	SMP (SMP)	Sampling cycle	0: 250 ms (0.25 seconds) 1: 500 ms (0.5 seconds)	1

Table 1

Input type		Setting range
Thermocouple (TC)	K	−199 to +1372 °C (−326 to +2502 °F)
		−199.9 to +999.9 °C (−199.9 to +999.9 °F)
	J	−199 to +1200 °C (−326 to +2192 °F)
		−199.9 to +999.9 °C (−199.9 to +999.9 °F)
	R	0 to 1769 °C (0 to 3216 °F)
	S	0 to 1769 °C (0 to 3216 °F)
	B	0 to 1820 °C (0 to 3308 °F)
	E	0 to 1000 °C (0 to 1832 °F)
	N	0 to 1300 °C (0 to 2372 °F)
		0.0 to 999.9°C (0.0 to 999.9 °F)
	T	−199 to +400 °C (−326 to +752 °F)
		−199.9 to +400.0 °C (−199.9 to +752.0 °F)
	W5Re/W26Re	0 to 2320 °C (0 to 4208 °F)
	PL II	0 to 1390 °C (0 to 2534 °F)
	U	−199 to +600 °C (−326 to +1112 °F)
		−199.9 to +600.0 °C (−199.9 to +999.9 °F)
	L	0 to 900 °C (0 to 1652 °F)
RTD	Pt100 (JIS/IEC) [1]	−199.9 to +649.0 °C (−199.9 to +999.9 °F)
	JPt100 (JIS)	
Voltage [2]	0 to 5 V DC	−1999 to +9999 (programmable scale)
	1 to 5 V DC	
	0 to 10 V DC	
Current [2, 3]	0 to 20 mA DC	−1999 to +9999 (programmable scale)
	4 to 20 mA DC	

[1] **IEC** (International Electrotechnical Commission) is equivalent to **JIS**, **DIN** and **ANSI**.

[2] In case of voltage/current inputs, SLH can be set below SLL.

[3] For the current input specification, a resistor of 250 Ω must be connected between the input terminals.

☞ Some parameters may be initialized or the range may be changed when the input type or the scale limiter has been changed. See **14. PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED (P. 14-1)** for details.

8.2 Using Contact Input

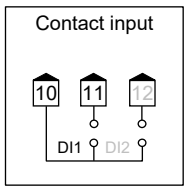
Releasing Limit output and Alarm interlock is possible using the Contact input (optional).

■ Description of function

● Releasing Limit output

Limit output can be released according to the open or closed state of the terminal numbers 10 and 11 (DI1).

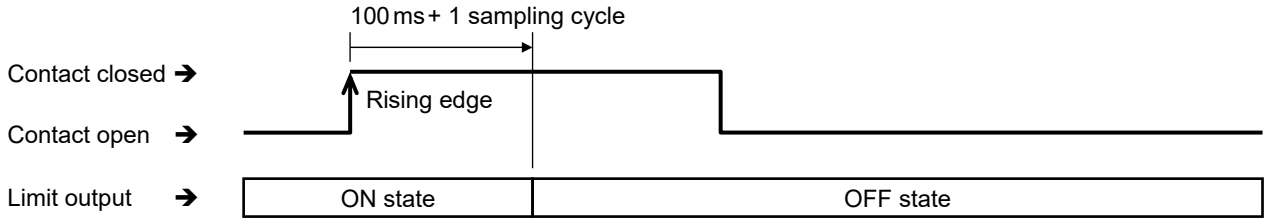
Contact input rear terminals:



Dry contact input
At open: 500 kΩ or more
At close: 10 Ω or less

Open/Close action of Contact: Contact closed: Release Limit output

Switchover timing of releasing Limit output:



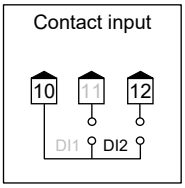
While the EXCD lamp stays ON, the limit output cannot be released.

Releasing the Limit output will also reset the hold value and the EXCD time.

● Alarm interlock release

The Alarm interlock can be released by the contact closure status of terminals 10 and 12 (DI2).

Contact input rear terminals:

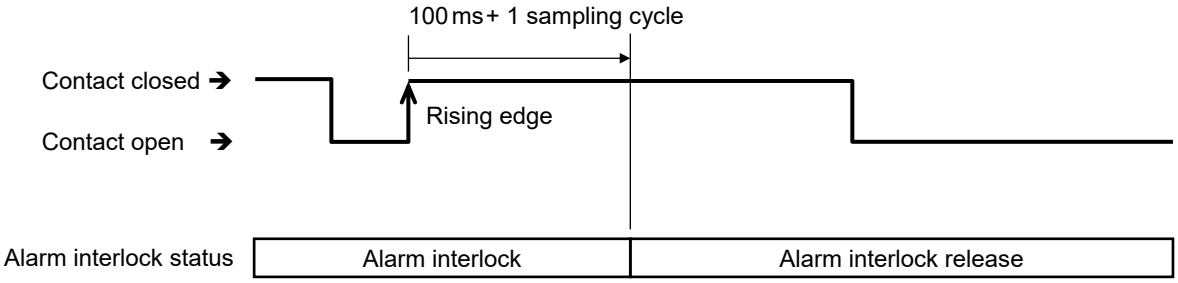


Dry contact input
At open: 500 kΩ or more
At close: 10 Ω or less

Open/Close action of Contact: Contact closed: Release Alarm interlock

The timing to release the alarm interlock:

The alarm interlock is released when the contact is closed (rising edge).



When the instrument is in the alarm status, the Alarm interlock cannot be released.
The alarm interlock state is kept even if alarm interlock release is attempted by the contact input.

8.3 Correcting Input

PV bias and PV ratio can be used for Input correction. 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.

■ Description of function

● PV bias

PV bias adds bias to the Measured value (PV).

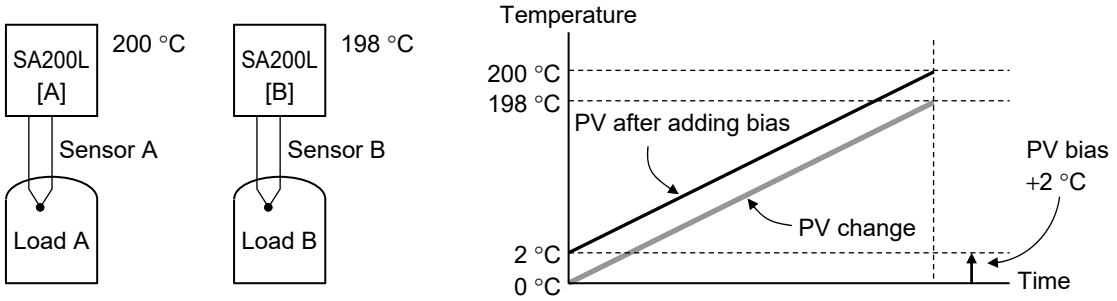
Setting example of PV bias:

When measuring the same type of load by using different sensors, the Measured value (PV) will be displayed differently based on the features of sensors:

SA200L [A]: 200 °C SA200L [B]: 198 °C

To correct the Measured value (PV) of SA200L [B], add bias of +2 °C by PV bias:

Displayed value = Measured value (PV) + PV bias = 198 °C + 2 °C = 200 °C



● PV ratio

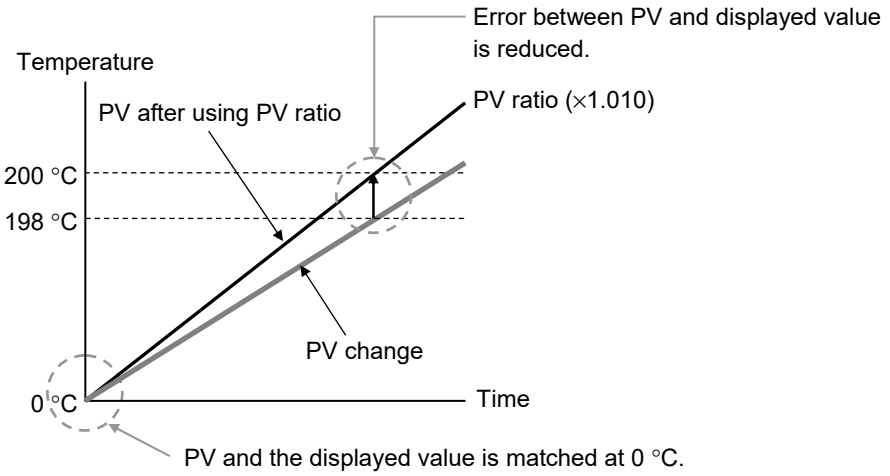
PV ratio is a multiplier to be applied to the Measured value (PV).

Setting example of PV ratio:

PV ratio can be used to display 200 °C by adding 2 °C when the actual Measured value (PV) is 198 °C but the displayed value remains 0 °C when the actual PV is 0 °C. (The displayed value changes from 0 °C to 2 °C by PV bias setting.)

Displayed value = Measured value (PV) × PV ratio = 198 °C × 1.010 = 199.98 °C

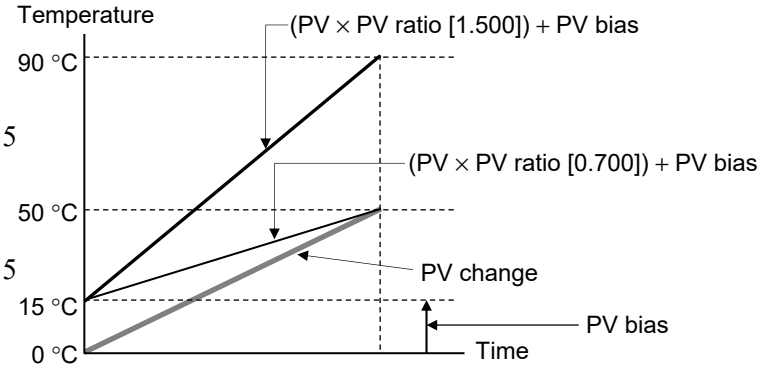
(The display shows 200)



● When setting PV bias and PV ratio at the same time

[Example]
When PV bias = 15 °C
Measured value (PV) = 50 °C
If PV ratio = 0.700
Displayed value = 50 × 0.700 + 15
= 50 °C

PV ratio = 1.500
Displayed value = 50 × 1.500 + 15
= 90 °C



■ Parameter setting

● Parameter setting mode: B

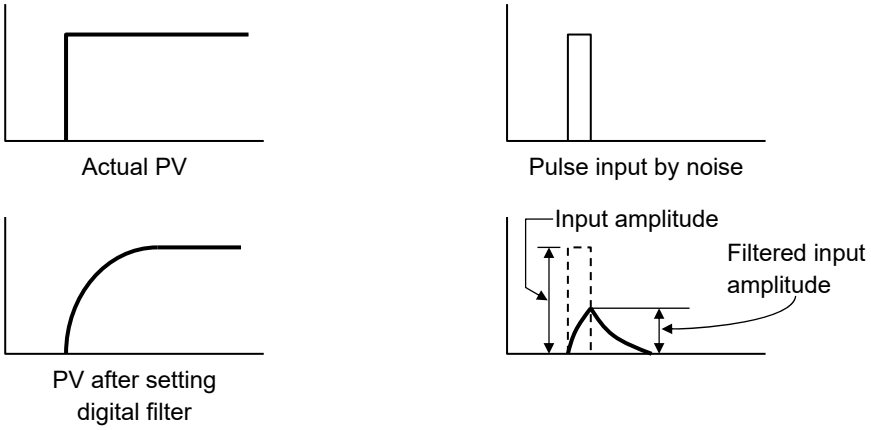
Parameter symbol	Name	Data range	Factory set value
Pb (Pb)	PV bias	−Span to +Span (However, within −1999 to +9999 digits) Varies with the setting of the Decimal point position.	TC/RTD inputs: 0 (0.0) Voltage/ Current inputs: 0.0
Pr (Pr)	PV ratio (Pr)	0.500 to 1.500 times	1.000

8.4 Preventing the Input Flicker

To prevent the input flicker, digital filter with the first-order lag calculation is provided.

■ Description of function

Digital filter is software designed to reduce variance of PV caused by noise. Effect of Input noise can be reduced by setting time constant of digital filter based on the controlled object requirement and its level of noise. Setting a value too small leads to a poor result of digital filter; just as an input response will be poor when setting a value too large.



■ Parameter setting

● Parameter setting mode: B

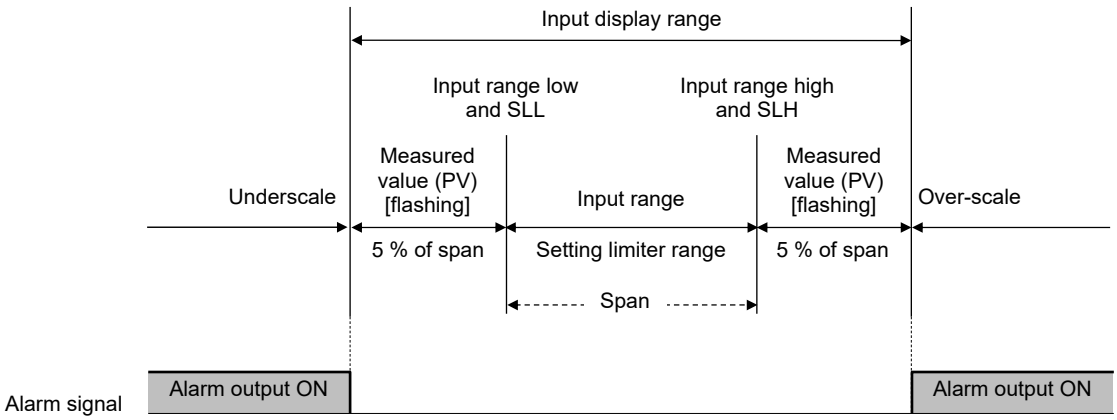
Parameter symbol	Name	Data range	Factory set value
dF (dF)	Digital filter	0 to 100 seconds (0: Digital filter OFF)	0

8.5 Changing Error Handling at Input Error

This chapter guides you to configure the alarm output when an input error such as underscale and over-scale occurred.

■ Description of function

In addition to the normal alarm operation, this function outputs an alarm signal even if an input error (underscale/over-scale) occurs. When set to "1: Forcibly turned on when abnormal," the alarm output is turned ON in the event of underscale or over- scale.



■ Parameter setting

● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F41. (F41.)	AEo1 (AEo1)	Alarm 1 process abnormality action selection	0: Normal processing 1: Forcibly turned on when abnormal	Alarm 1 not provided: 0 Alarm 1 provided: 1
F42. (F42.)	AEo2 (AEo2)	Alarm 2 process abnormality action selection	0: Normal processing 1: Forcibly turned on when abnormal	Alarm 2 not provided: 0 Alarm 2 provided: 1

Normal processing:

Only the alarm action set in the Alarm 1 type selection (AS1) and the Alarm 2 type selection (AS2) is enabled.

Forcibly turned on when abnormal:

Alarms set in Alarm 1 type selection (AS1) and Alarm 2 type selection (AS2) as well as the alarm action when the input is abnormal (underscale/over-scale) will be activated.

9 OUTPUT FUNCTION

This chapter describes output related functions, setting contents and setting procedure based on the key words related to outputs.

9.1 Changing Output Assignment

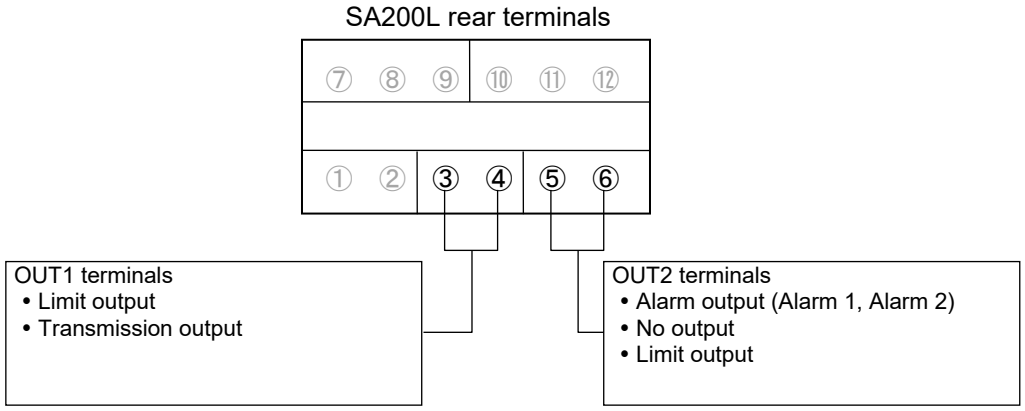
The output types of OUT1 and OUT2 on the SA200L are configurable.

■ Description of function

The following output signals can be assigned to the OUT1 and OUT2 of the SA200L.

- Limit output
- Alarm output (Alarm 1, Alarm 2)
- Transmission output

● Position of output terminals



Transmission output is optional. If the transmission output is not specified at the time of ordering, no output will be produced from the output terminals even if it is assigned.

■ Parameter setting

● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F30. (F30.)	LoGC (LoGC)	Output logic operation selection	001: OUT1: Limit output (De-energized) OUT2: *OR* output of Alarm 1 and Alarm 2 (Energized) 002: OUT1: Limit output (De-energized) OUT2: *AND* output of Alarm 1 and Alarm 2 (Energized) 003: OUT1: Limit output (De-energized) OUT2: Alarm 1 output (Energized) (Alarm 2 can be checked via communication or by lamp lighting) 004: OUT1: Limit output (De-energized) OUT2: *OR* output of Alarm 1 and Alarm 2 (De-energized) 005: OUT1: Limit output (De-energized) OUT2: *AND* output of Alarm 1 and Alarm 2 (De-energized) 006: OUT1: Limit output (De-energized) OUT2: Alarm 1 output (De-energized) (Alarm 2 can be checked via communication or by lamp lighting) 007: OUT1: Limit output (De-energized) OUT2: No output (The Alarm state can be checked via communication or by lamp lighting) 008: OUT1: Limit output (Energized) OUT2: *OR* output of Alarm 1 and Alarm 2 (Energized) 009: OUT1: Limit output (Energized) OUT2: *AND* output of Alarm 1 and Alarm 2 (Energized) 010: OUT1: Limit output (Energized) OUT2: Alarm 1 output (Energized) (Alarm 2 can be checked via communication or by lamp lighting) 011: OUT1: Limit output (Energized) OUT2: *OR* output of Alarm 1 and Alarm 2 (De-energized) 012: OUT1: Limit output (Energized) OUT2: *AND* output of Alarm 1 and Alarm 2 (De-energized) 013: OUT1: Limit output (Energized) OUT2: Alarm 1 output (De-energized) (Alarm 2 can be checked via communication or by lamp lighting) 014: OUT1: Limit output (Energized) OUT2: No output (The Alarm state can be checked via communication or by lamp lighting) 015: OUT1: Transmission output OUT2: Limit output (De-energized) 016: OUT1: Transmission output OUT2: Limit output (Energized)	Factory set value varies depending on the instrument specification.

9.2 Using Transmission Output

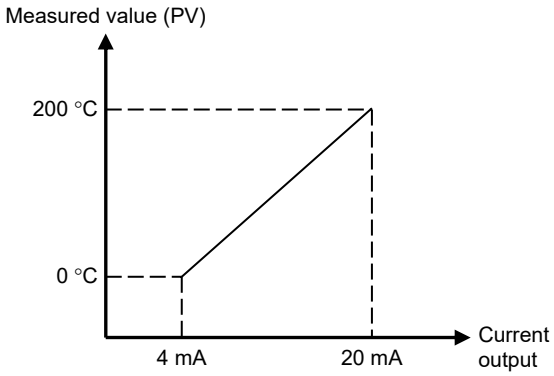
Transmission output can be provided from OUT1.

■ Description of function

The transmission output (analog output) is the function of outputting the state of Measured value (PV), Limit set value (SV), or Deviation value (DEV) as a current signal. It is possible to record the state of Measured value (PV) or Limit set value (SV) when connected to a recorder.

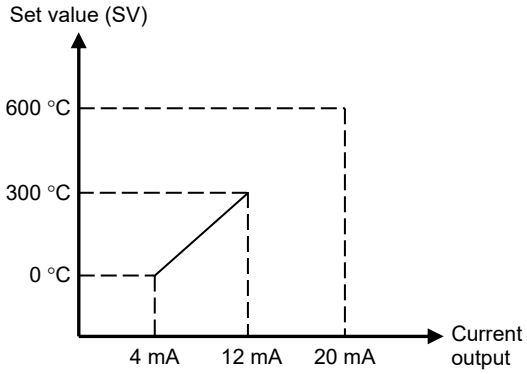
Example 1: Measured value (PV)

Condition:
- Current output type: 4 to 20 mA DC
- Input range: Thermocouple K, 0 to 200 °C
- Transmission output (AO) type: Measured value (PV)
- Transmission output scale high (AHS): 200 °C
- Transmission output scale low (ALS): 0 °C



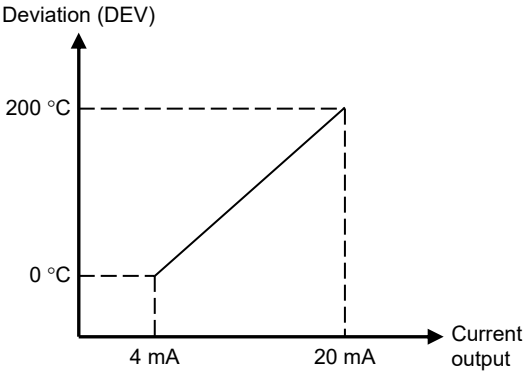
Example 2: Limit set value (SV)

Condition:
- Current output type: 4 to 20 mA DC
- Input range: Thermocouple K, 0 to 600 °C
- Transmission output (AO) type: Limit set value (SV)
- Transmission output scale high (AHS): 600 °C
- Transmission output scale low (ALS): 0 °C
- Limit set value (SV): 300 °C



Example 3: Deviation (DEV)
The deviation of [Measured value (PV) – Limit set value (SV)] is output.

Condition:
- Current output type: 4 to 20 mA DC
- Input range: Thermocouple K, 0 to 200 °C
- Transmission output (AO) type: Deviation (DEV)
- Transmission output scale high (AHS): 200 °C
- Transmission output scale low (ALS): 0 °C



■ Parameter setting

● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F30. (F30.)	LoGC (LoGC)	Output logic operation selection	The output assignment codes for transmission output are 015 and 016. For details of the output assignment code, see **P. 9-3**.	Factory set value varies depending on the instrument specification.

● Parameter setting mode: B

Parameter symbol	Name	Data range	Factory set value
Ao (Ao)	Transmission output (AO) specification	PV: Measured value (PV) SV: Limit set value (SV) dEV: Deviation (DEV)	PV
AHS (AHS)	Transmission output scale high (AHS)	Measured value (PV): Same as input range * (Transmission output scale low to Setting limiter [high limit]) Limit set value (SV): Same as input range * (Transmission output scale low to Setting limiter [high limit]) Deviation (DEV): −Span to +Span * (However, within −1999 to +9999 digits) (Transmission output scale low to +Span) * Varies with the setting of the Decimal point position.	TC/RTD inputs: Input range high or +Span Voltage/ Current inputs: 100.0
ALS (ALS)	Transmission output scale low (ALS)	Measured value (PV): Same as input range * (Setting limiter [low limit] to Transmission output scale high) Limit set value (SV): Same as input range * (Setting limiter [low limit] to Transmission output scale high) Deviation (DEV): −Span to +Span * (However, within −1999 to +9999 digits) (−Span to Transmission output scale high) * Varies with the setting of the Decimal point position.	TC/RTD inputs: Input range low or −Span Voltage/ Current inputs: 0.0

MEMO

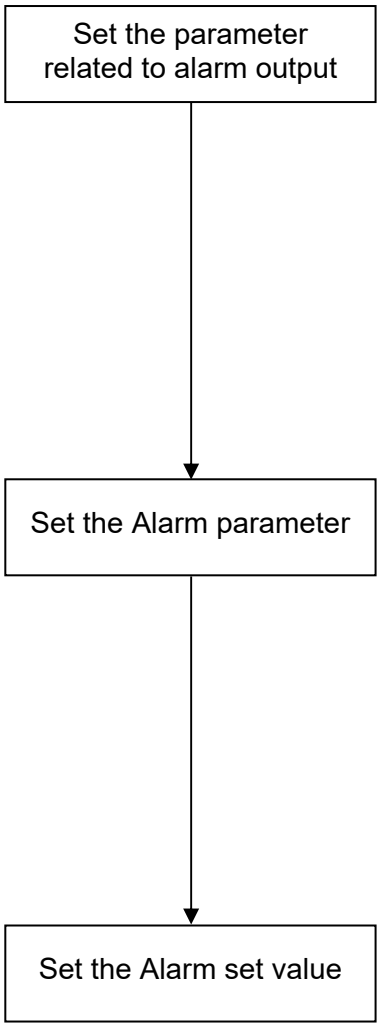
10 ALARM FUNCTION

This chapter describes alarm related functions, setting contents and setting procedure based on the keywords related to alarms.

10.1 Using Alarm Function

■ Setting procedure for alarm function

Set alarm function as follows:



Set the parameter related to Alarm output.

- Output logic operation selection
- Alarm interlock function selection
- Alarm delay timer
- Alarm delay timer unit

☞ For setting procedure of output logic operation selection, see **9.1 Changing Output Assignment (P. 9-2)**.

☞ For alarm interlock, see **10.1.4 Keeping the alarm state (alarm interlock function) (P. 10-9)**.

☞ For alarm delay timer and alarm delay timer unit, see **10.1.5 Preventing alarm from turning on due to a transient abnormal input (Alarm delay timer function) (P. 10-11).**

Set the following parameters:

- Alarm type
- Alarm hold action
- Alarm differential gap

☞ For alarm type, see **10.1.1 Changing alarm type (P. 10-3)**.

☞ For alarm hold action, see **10.1.2 Adding hold action to the alarm action (P. 10-6)**.

☞ For alarm differential gap, see **10.1.3 Setting a differential gap in alarm action (P. 10-8)**.

Set the Alarm set value.

☞ For alarm set value, see **7.5 Setting the Alarm Set Value (P. 7-9)**.

10.1.1 Changing alarm type

There are 8 types of alarm in total.

- **Alarm type**
  - SV high alarm
  - SV low alarm
  - Process high alarm (The alarm hold action can be added.)
  - Process low alarm (The alarm hold action can be added.)
  - Deviation high alarm (The alarm hold action can be added.)
  - Deviation low alarm (The alarm hold action can be added.)
  - Deviation high/low alarm (The alarm hold action can be added.)
  - Band alarm

■ Description of function

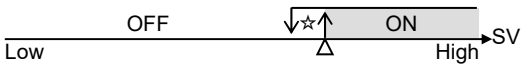
● Set value action

When the Limit set value (SV) reaches the Alarm set value, alarm ON occurs.

ON: Alarm action turned on
OFF: Alarm action turned off (△: Alarm set value ☆: Alarm differential gap)

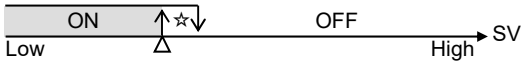
SV high

When the Limit set value (SV) is more than the Alarm set value, the alarm ON occurs.



SV low

When the Limit set value (SV) is less than the Alarm set value, the alarm ON occurs.



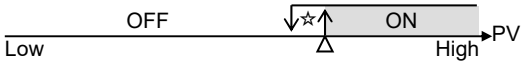
● Input value action

When the Measured value (PV) reaches the Alarm set value, alarm ON occurs.

ON: Alarm action turned on
OFF: Alarm action turned off (△: Alarm set value ☆: Alarm differential gap)

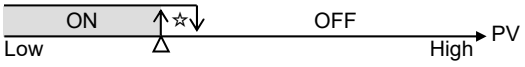
Process high

When the Measured value (PV) is more than the Alarm set value, the alarm ON occurs.



Process low

When the Measured value (PV) is less than the Alarm set value, the alarm ON occurs.



● Deviation action

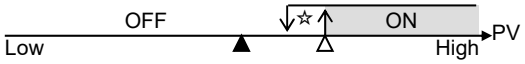
When the deviation [Measured value (PV) − Limit set value (SV)] reaches the Alarm set value, alarm ON occurs.

ON: Alarm action turned on
OFF: Alarm action turned off (▲: Limit set value (SV) △: Alarm set value ☆: Alarm differential gap)

Deviation high

When the deviation [Measured value (PV) − Limit set value (SV)] is more than the Alarm set value, the alarm ON occurs.

(Alarm set value is greater than 0.)



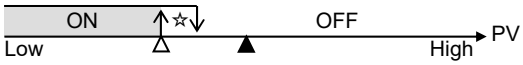
(Alarm set value is less than 0.)

Deviation low

When the deviation [Measured value (PV) − Limit set value (SV)] is less than the Alarm set value, the alarm ON occurs.

(Alarm set value is greater than 0.)

(Alarm set value is less than 0.)



Deviation high/low

When the absolute deviation |Measured value (PV) − Limit set value (SV)| is more/less than the Alarm set value, the alarm ON occurs.

Band

When the absolute deviation |Measured value (PV) − Limit set value (SV)| is within the Alarm set value, the alarm ON occurs.

■ Parameter setting

● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F41. (F41.)	AS1 (AS1)	Alarm 1 type selection	0: Alarm not provided 1: SV high alarm 2: SV low alarm 3: Process high alarm 4: Process low alarm 5: Deviation high alarm 6: Deviation low alarm 7: Deviation high/low alarm 8: Band alarm	Factory set value varies depending on the instrument specification.
F42. (F42.)	AS2 (AS2)	Alarm 2 type selection	0: Alarm not provided 1: SV high alarm 2: SV low alarm 3: Process high alarm 4: Process low alarm 5: Deviation high alarm 6: Deviation low alarm 7: Deviation high/low alarm 8: Band alarm	Factory set value varies depending on the instrument specification.

10.1.2 Adding hold action to the alarm action

On this instrument hold action can be added to the Alarm action.

Some alarm actions may not be available with hold action. Setting hold action on the alarm that is not available with hold action will just be ignored.

See "● **Alarm type" (P. 10-3)** for those alarms that are available with hold action.

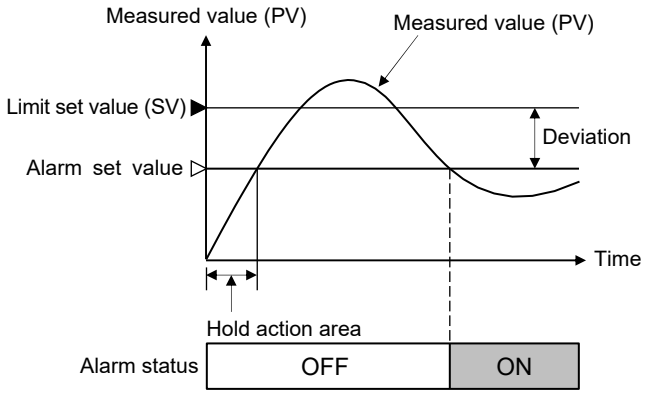
■ Description of function

● Hold action

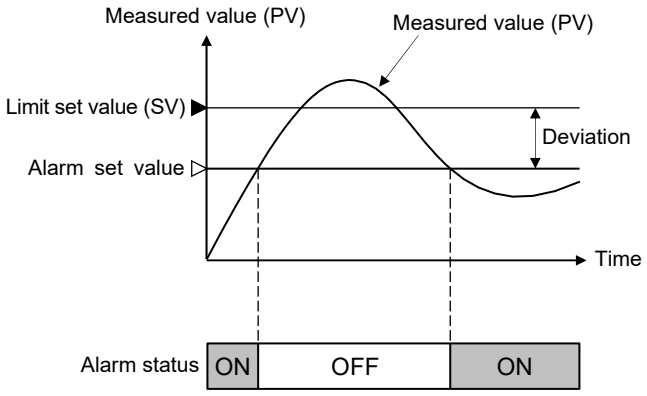
When the following operation is conducted, the Hold action deactivates the Event function until the Measured value (PV) leaves the event state once. The Hold action is released when the Measured value (PV) enters the Event OFF area.

- When the power is turned on
- When the Limit set value (SV) is changed
- When the mode is switched from the Engineering mode to other modes.

[With hold action]



[Without hold action]



■ Parameter setting

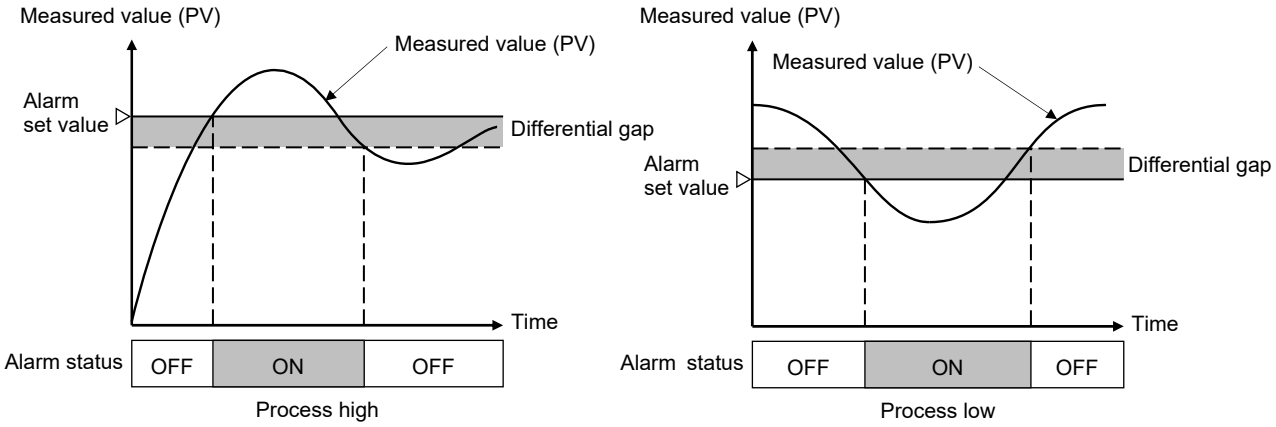
● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F41. (F41.)	AHo1 (AHo1)	Alarm 1 hold action selection	0: Without alarm hold action 1: Effective • When the power is turned on. • When the mode is switched from the Engineering mode to other modes. 2: Effective • When the power is turned on. • When the mode is switched from the Engineering mode to other modes. • When the Limit set value (SV) is changed.	Factory set value varies depending on the instrument specification.
F42. (F42.)	AHo2 (AHo2)	Alarm 2 hold action selection	0: Without alarm hold action 1: Effective • When the power is turned on. • When the mode is switched from the Engineering mode to other modes. 2: Effective • When the power is turned on. • When the mode is switched from the Engineering mode to other modes. • When the Limit set value (SV) is changed.	Factory set value varies depending on the instrument specification.

10.1.3 Setting a differential gap in alarm action

■ Description of function

It prevents chattering of alarm output due to the measured value fluctuation around the Alarm set value.



■ Parameter setting

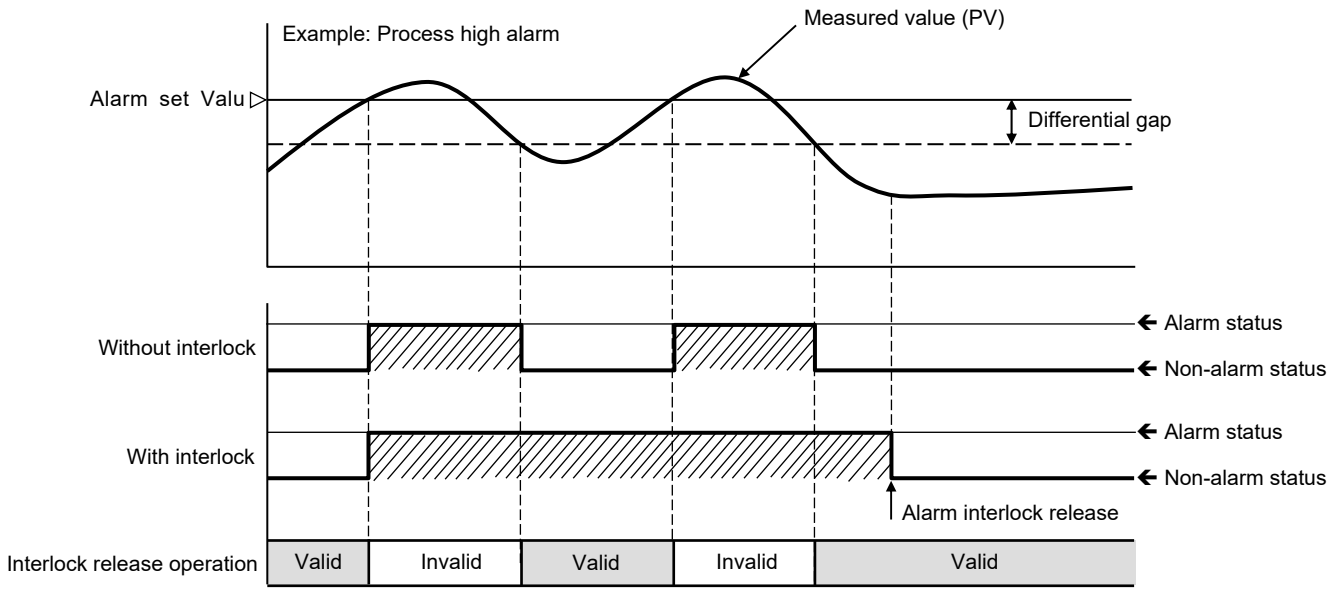
● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F41. (F41.)	AH1 (AH1)	Alarm 1 differential gap setting	0 (0.0) to Span (However, 9999 digits or less) Varies with the setting of the Decimal point position.	TC/RTD inputs: 2 (2.0) Voltage/ Current inputs: 0.2
F42. (F42.)	AH2 (AH2)	Alarm 2 differential gap setting		TC/RTD inputs: 2 (2.0) Voltage/ Current inputs: 0.2

10.1.4 Keeping the alarm state (alarm interlock function)

■ Description of function

This is the action of holding the alarm ON state even if the measured value is out of the alarm zone after entering the alarm zone once to be set to the alarm ON state. This interlock is released by key operation, contact input, or via communication.



In the following case, the Alarm interlock function is released.

- When the power is turned on (However, if an alarm state is generated soon after the power is applied, the alarm interlock will turn on again.)
- When the mode of this instrument is switched to the Engineering mode
- When the alarm hold state

The interlock is not released in the following cases.

- When the monitored value such as a Measured value (PV) or a Limit set value (SV) is in the alarm zone
- When the monitored value such as a Measured value (PV) or a Limit set value (SV) is in the Alarm differential gap

■ Parameter setting

● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F41. (F41.)	ILS1 (ILS1)	Alarm 1 interlock function selection	0: Disable Alarm 1 interlock function 1: Enable Alarm 1 interlock function	0
F42. (F42.)	ILS2 (ILS2)	Alarm 2 interlock function selection	0: Disable Alarm 2 interlock function 1: Enable Alarm 2 interlock function	0

■ Alarm interlock release operation

There are three ways to release the alarm interlock as shown below.

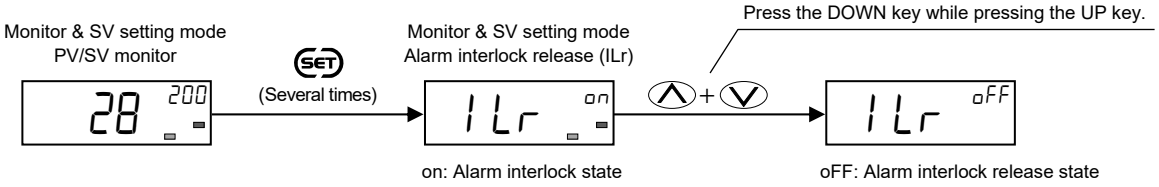
- By key operation
- By contact input (optional)
- By communication (optional)

NOTE

Release the alarm interlock when the Alarm is off.

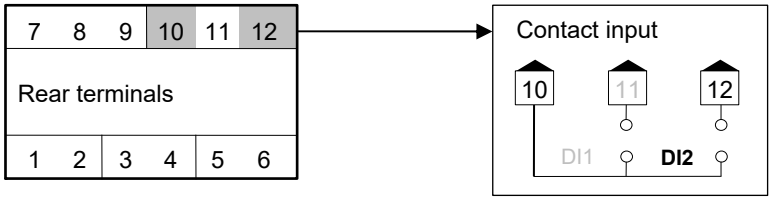
● By key operation

The alarm interlock can be released by the "Alarm Interlock release (ILr)" in the Monitor & SV setting mode.



● By contact input

The interlock state can be released by closing the DI2 contact.



Terminal No. (DI2)	Release operation
10, 12	Contact closed

● By communication

The following communication data can be used to release the interlock.

Communication type	Name	Communication data	Data range	Factory set value	Attribute
RKC communication	Alarm interlock release	Identifier: **IR**	0: Alarm interlock release *	—	R/W
Modbus		Address: **0AH**			

* The interlock is released by setting the "0." In the read state, becomes "1."

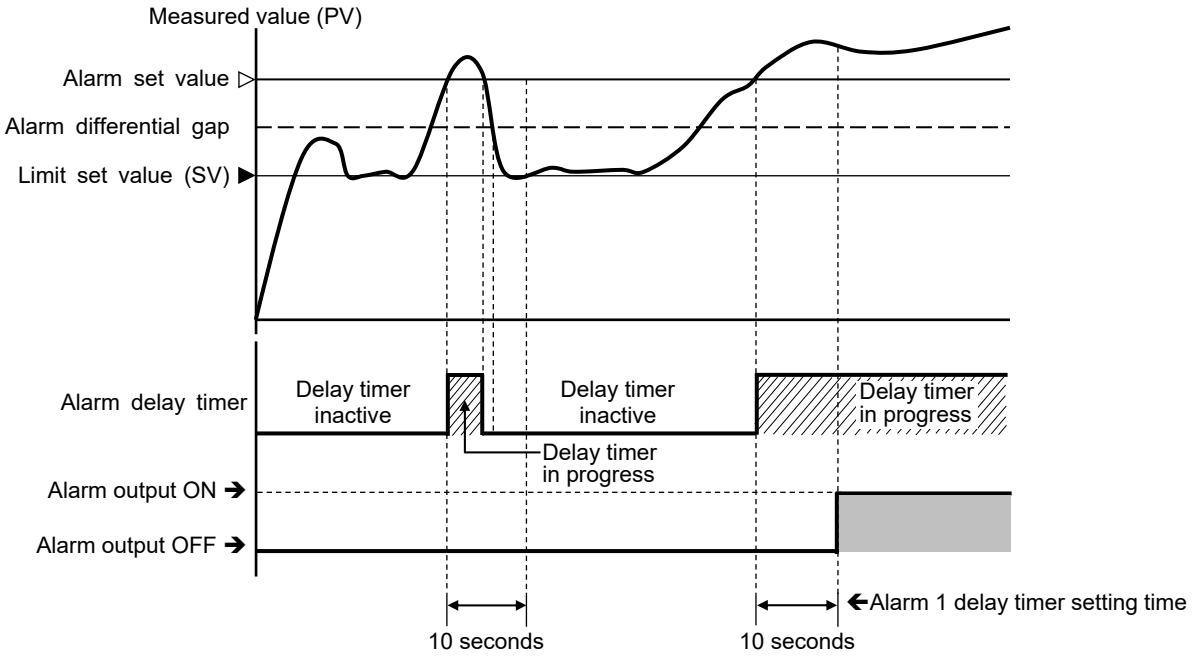
10.1.5 Preventing alarm from turning on due to a transient abnormal input (Alarm delay timer function)

■ Description of function

The alarm delay timer function is used to activate the alarm delay timer if an alarm occurs to turn on the alarm output when the alarm state continues even after a lapse of the alarm delay timer set time. In addition, if the alarm state is released while the alarm delay timer is being activated, the alarm output is not turned on. The actual delay time is the value obtained by multiplying the delay timer value and the delay timer unit value.

Operation example: Alarm 1 delay timer: 2 seconds
Alarm 1 delay timer unit: 5 seconds

Alarm 1 delay timer (2 seconds) multiplied by (Alarm 1 delay timer unit) (5 seconds) = 10 seconds



The alarm delay timer function is activated also for any of the following.
- When set to the alarm state simultaneously with the power turned on.
- When the mode is switched from the Engineering mode to other modes.

When in the alarm hold state, the alarm output is not turned on even after a lapse of the alarm delay timer set time.

The alarm delay timer is reset for any of the following.
- When power failure occurs while the alarm delay timer is being activated.
- When switched to the Engineering mode while the alarm delay timer is being activated.

■ Parameter setting

● Parameter setting mode: B

Parameter symbol	Name	Data range	Factory set value
ALr 1 (ALT1)	Alarm 1 delay timer	0 to 9999 seconds *	0
ALr2 (ALT2)	Alarm 2 delay timer	0 to 9999 seconds *	0

* The actual delay time is the value obtained by multiplying the delay timer value and the delay timer unit value. These parameters will not be displayed when either “Alarm 1 delay timer unit” or “Alarm 2 delay timer unit” is zero.

● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F41. (F41.)	Ar S 1 (ATS1)	Alarm 1 delay timer unit	0 to 60 seconds 0: Alarm 1 delay timer function OFF	0
F42. (F42.)	Ar S2 (ATS2)	Alarm 2 delay timer unit	0 to 60 seconds 0: Alarm 2 delay timer function OFF	0

11 LIMIT ACTION FUNCTION

This chapter uses the keywords related to the limit action to explain the function, setting contents, and setting operations.

11.1 Changing Limit Action

■ Setting procedure for limit action

Set limit action as follows:

Set the parameter related to output

Set the parameter related to output.

- Output logic operation selection

☞ For setting procedure of output logic operation selection, see **9.1 Changing Output Assignment (P. 9-2)**.

Set the limit action parameter

Set the following parameters:

- Limit action type selection
- Limit action differential gap
- Limit action hold action selection
- Limit action process abnormality action selection
- Limit action at the time of power ON

☞ For "Limit action type selection," see **11.2 Modifying Limit Action (P. 11-3)**.

☞ For "Limit action differential gap," see **11.3 Modifying Limit Action Release Point (P. 11-4)**.

☞ For "Limit action hold action selection, " see **11.4 Suppressing the Limit Action Soon After the Power-on (P. 11-5)**.

☞ For "Limit action process abnormality action selection," see **11.5 Turning on the Limit Output at Input Error (P. 11-6)**.

☞ For "Limit action at the time of power ON," see **11.6 Starting the Instrument with the Limit Output ON State (P. 11-7)**.

Set the Limit set value (SV)

Set the Limit set value (SV).

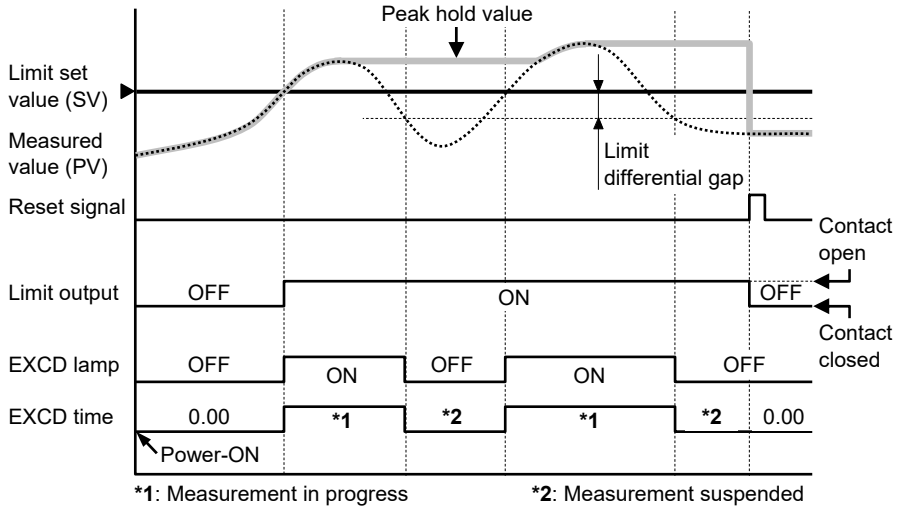
☞ For alarm set value, see **7.4 Setting the Limit Set Value (P. 7-8)**.

11.2 Modifying Limit Action

See the following 2 types of limit action:
- Limit action (high limit)
- Limit action (low limit)

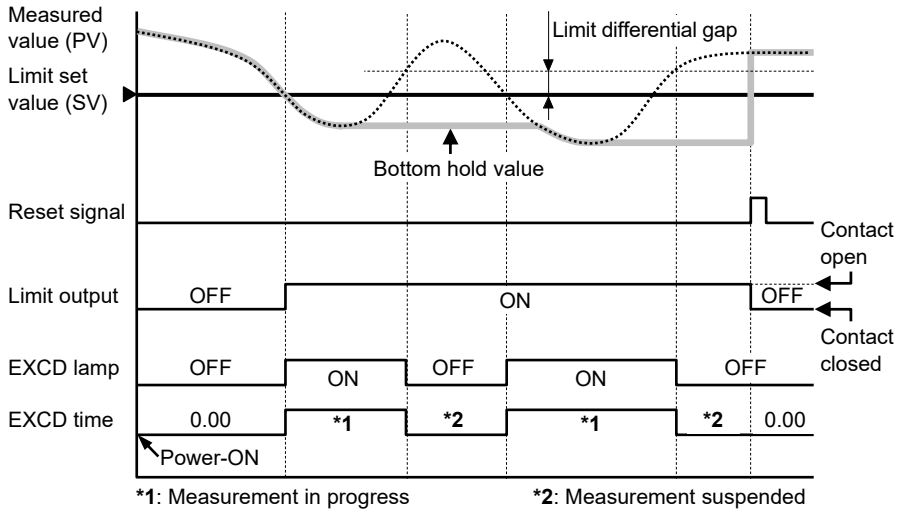
■ Limit action (high limit)

The Limit output turns on when the Measured value (PV) exceeds the Limit set value (SV).



■ Limit action (low limit)

The Limit output turns on when the Measured value (PV) falls below the Limit set value (SV).



■ Parameter setting

● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F51. (F51.)	oS (oS)	Limit action type selection	0: Limit action (high limit) 1: Limit action (low limit)	0

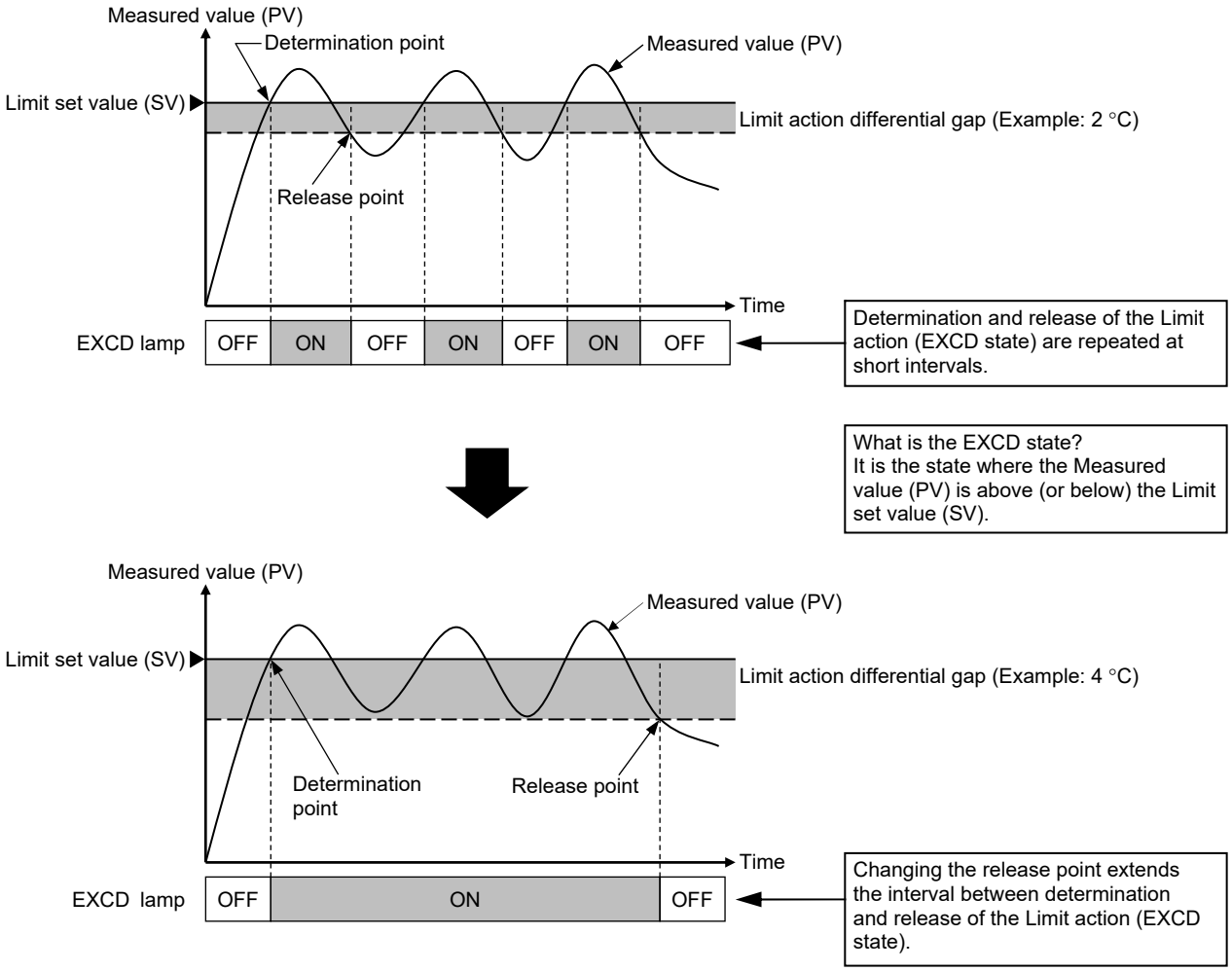
11.3 Modifying Limit Action Release Point

Adjusting the Limit action differential gap enables changing the Limit action release point.

■ Description of function

When the Measured value (PV) is around the Limit set value (SV), the limit action (EXCD state) is repeatedly detected and released at short intervals due to the input fluctuation. In such a case, determination intervals can be made longer by changing the release point of the Limit action (EXCD state).

Example: Limit action (high limit)



■ Parameter setting

● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F5 1. (F51.)	oH (oH)	Limit action differential gap	0 (0.0) to Span (However, 9999 digits or less) Varies with the setting of the Decimal point position.	TC/RTD inputs: 2 (2.0) Voltage/Current inputs: 0.2

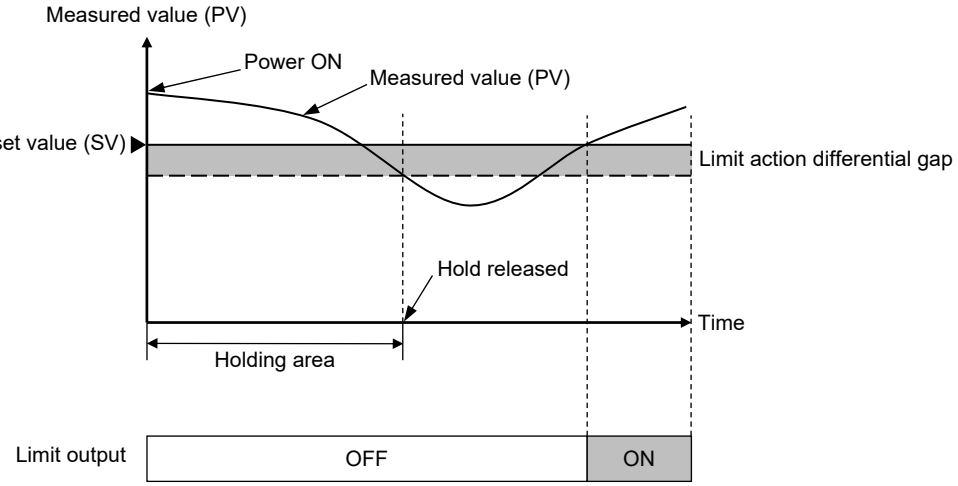
11.4 Suppressing the Limit Action Soon After the Power-on

There is a way to hold the alarm and to prevent the limit output from turning on soon after the instrument is powered on.

■ Description of function

The Limit action hold action selection can suppress the Limit action, when the Measured value (PV) is above or below the Limit set value (SV), until the Measured value (PV) goes out of the Limit area.
The Hold action will be deactivated when the Measured value (PV) leaves the Limit range.

Example: Limit action (high limit)



The Limit output may turn on in the following cases even when the Limit action hold action is activated.

- The Limit action is set to "1: Forced ON at Input error" at the Limit action process abnormality action selection.
- The Limit action is set to "1: Forced ON at power-on" at the Limit action at the time of power ON.

■ Parameter setting

● Engineering mode: D

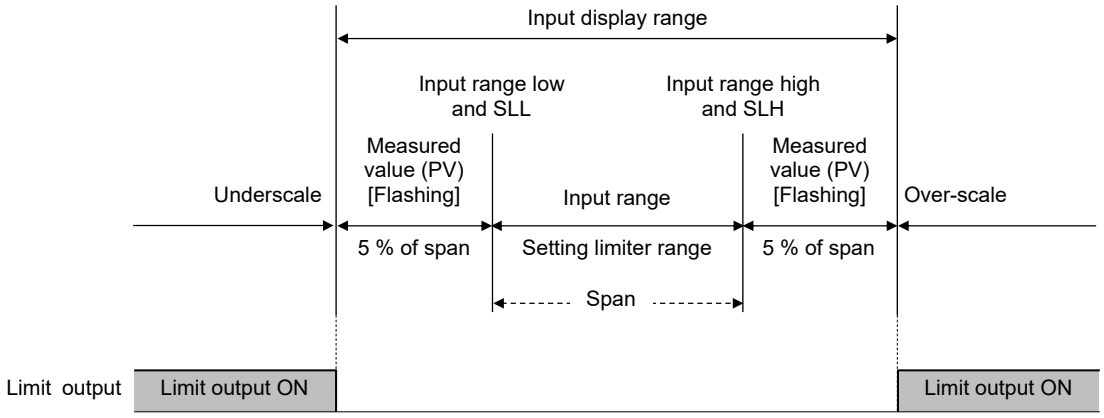
Function block	Parameter symbol	Name	Data range	Factory set value
F51. (F51.)	LHo (LHo)	Limit action hold action selection	0: Without hold action 1: Effective • When the power is turned on. • When the mode is switched from the Engineering mode to other modes.	0

11.5 Turning on the Limit Output at Input Error

The Limit output can be configured to be forced ON in the event of an input error.

■ Description of function

This is a function to force the Limit output ON in the event of an input error (Underscale/Over-scale) even if the conditions for the limit action are not met. For example, when the instrument configured to have a Low limit action has entered the Input error state (Over-scale), the Limit output can be forced ON.



■ Parameter setting

● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F5 1. (F51.)	LEo (LEo)	Limit action process abnormality action selection	0: Normal processing 1: Forced ON at input error	0

Normal processing: When the Measured value (PV) exceeds (or falls below the Limit set value (SV)), the Limit output will be forced ON.

Forced ON at input error: Different from the Normal processing, the Limit output is forced ON in the event of Underscale or Over-scale.

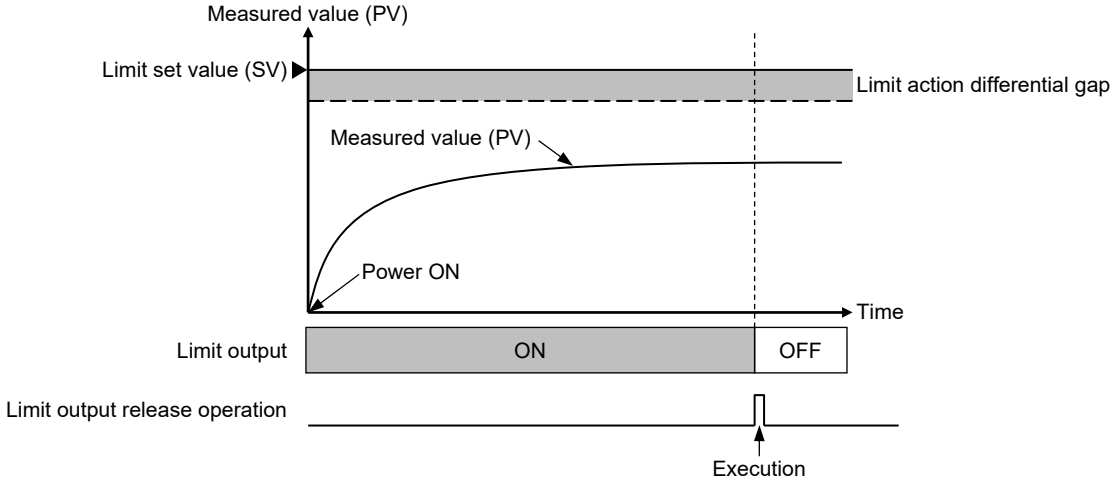
11.6 Starting the Instrument with the Limit Output ON State

The instrument can be powered on with the Limit output ON.

■ Description of function

This is a function to start the instrument with the Limit output forcibly ON regardless of the Measured value (PV) state when the instrument is recovered from a power failure. This function may be suitable when the power is recovered with the outputs such as heater outputs connected to the instrument suppressed. The Limit output ON state is retained until the Reset action is performed. Release the limit output before starting the equipment.

Example: Limit action (high limit)



Relationship between “Limit action at the time power ON” and “Limit action hold action selection”
(If the limit action conditions are met when the power is turned on)

Setting of “Limit action at the time power ON”	0: Normal processing		1: Forced ON at power-on	
Setting of “Limit action hold action selection”	0: Without hold action	1: Effective when the power is turned on	0: Without hold action	1: Effective when the power is turned on
Output state (limit output)	ON	OFF	ON	ON
EXCD lamp state	ON	OFF	ON	OFF

☞ For the “Limit action hold action selection” see **11.4 Suppressing the Limit Action Soon After the Power-on (P. 11-5)**.

■ Parameter setting

● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F51. (F51.)	LPoW (LPoW)	Limit action at the time of power ON	0: Normal processing 1: Forced ON at power-on	0

MEMO

DISPLAY RELATED FUNCTIONS

12

This chapter describes display related functions, setting contents and setting procedure based on the keywords related to Display.

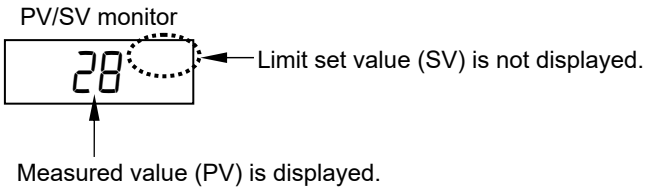
12.1 Hiding the Display of the Measured Value (PV) or Limit Set Value (SV)

The Measured value (PV) or Limit set value (SV) can be hidden.

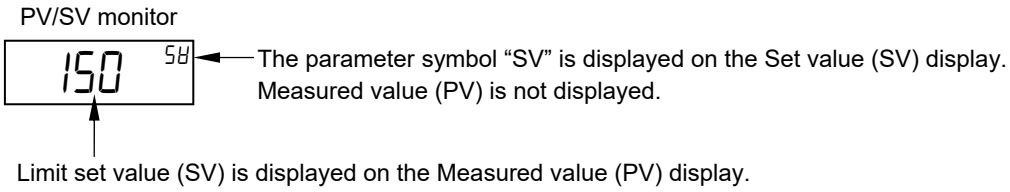
■ Description of function

This function is to prevent the Measured value (PV) or Limit set value (SV) displayed in the Monitor & SV setting mode from being displayed.

Display example: Only PV display



Display example: Only SV display



■ Parameter setting

● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F10. (F10.)	dCHG (dCHG)	Monitor display configuration selection	0: PV/SV display 1: Only PV display 2: Only SV display	0

12.2 Checking Input Peak Value/Bottom Value

This instrument incorporates as standard the Peak/Bottom hold function which allows storing the peak (max) and the bottom (min) Measured values (PV).

■ Description of function

● Peak hold, Bottom hold

The peak hold/bottom hold function is used to store (hold) the peak (max) and the bottom (min) Measured values (PV). Each of these values is updated when the Measured value (PV) becomes more (or less) than the value now being held. However, if the following operation is performed, the value now being held is reset and as a result the Measured value (PV) just when reset becomes the peak hold or bottom hold value.

- When the power of this instrument is turned off/on
- When the Limit output of this instrument is released
- When the mode of this instrument is switched to the Engineering mode

■ Display contents

● Monitor & SV setting mode: A

Parameter symbol	Name	Data range	Factory set value
PHLd (PHLd)	Peak hold	Within input range (Setting limiter [low limit] to Setting limiter [high limit])	—
bHLd (bHLd)	Bottom hold	Varies with the setting of the Decimal point position.	—

12.3 Checking the Instrument Information

When error occurs and when you contact us, you are requested to provide us with the information on the instrument model code and specification. You can check the ROM version on the instrument display. The Integrated operating time and the maximum ambient temperature (Holding peak ambient temperature).

■ Description of function

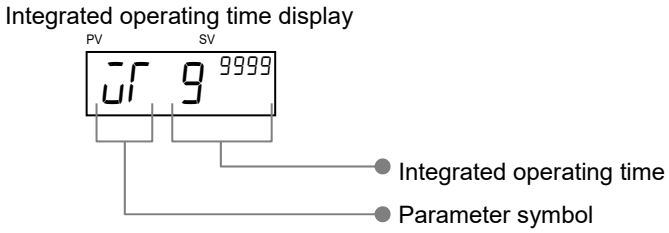
● ROM version

Display the version of loading software.

● Integrated operating time

Display product calculation operating time. However, as the integral time is increments by "1" when the power is turned on or off. The Integrated operating time cannot be reset.

Display range: 0 to 99999 hours
Display resolution: 1 hour



● Holding peak ambient temperature

The maximum ambient temperature on the rear terminal board of the instrument is stored and displayed on the set value (SV) display. The Holding peak ambient temperature cannot be reset.

Display range: –256.0 to +256.0 °C
Display resolution: 0.1 °C

■ Display contents

● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F91. (F91.)	1365 (1365)	ROM version	Display the version of loading software.	—
	WT (WT)	Integrated operating time	0 to 99999 hours	—
	TCJ (TCJ)	Holding peak ambient temperature	–256.0 to +256.0 °C	—

SETTING AND KEY OPERATION

13

This chapter describes setting and key operation related functions, setting contents and setting procedure based on the keywords related to setting and key operation.

13.1 Restricting Key Operation (Set Data Lock)

The Set data lock function limits access of unauthorized personnel to the parameters and prevents parameter change by mistake.

■ Parameter setting

● Parameter setting mode: B

Parameter symbol	Name	Data range	Factory set value
LCK (LCK)	Set data lock (LCK)	0000 to 1111 *	0000

* Details of set data lock function

	×: Operable –: Not operable	×: Changeable –: Not changeable		
Setting data	**Switch to the Engineering mode**	**Limit set value (SV)**	**Alarm setting [1]**	**Other setting items [2]**
0000	–	×	×	×
0001	–	×	×	–
0010	–	×	–	×
0011	–	×	–	–
0100	–	–	×	×
0101	–	–	×	–
0110	–	–	–	×
0111	–	–	–	–
1000	×	×	×	×
1001	×	×	×	–
1010	×	×	–	×
1011	×	×	–	–
1100	×	–	×	×
1101	×	–	×	–
1110	×	–	–	×
1111	×	–	–	–

[1] Alarm 1 (ALM1), Alarm 2 (ALM2), Alarm 1 delay timer, and Alarm 2 delay timer

[2] Setting items except Alarm setting and Limit set value (SV)

The data lock function only prevents setting changes being made from the front keys. Setting changes can still be made through communication transmission.

The following parameters are not covered by the Set data lock.
- Set data lock (LCK)
- Enter password for Show/Hide
- Set password for Show/Hide
- Hide LCK
- Parameter in the Communication setting mode

The Set data lock (LCK) can be hidden. See **7.7 Hiding the Set Data Lock (LCK) (P.7-11)** for how to hide it.

13.2 Changing Operating Action of Shift & Reset Key(<RST)

In this parameter the key pressing time of the Shift & Reset key (<RST) can be zeroed. When "1: Press once" is selected in "<RST key operation time selection," the reset can be achieved by pressing the Shift & Reset key (<RST) without pressing and holding the keys for one second.

■ Parameter setting

● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F51. (F51.)	rTIM (rTIM)	<RST key operation time selection	0: Press and hold (for one second) 1: Press once	0

13.3 Resetting Hold Value and EXCD Time Individually

Releasing the Limit output will also reset the Hold value and the EXCD time. In the Engineering mode the Reset action selection parameter can be configured to reset the Hold value and the EXCD time individually. Selecting "1: Each data is reset on each monitoring screen" allows the Hold value and the EXCD time to be reset individually on each monitoring screen.

■ Parameter setting

● Engineering mode: D

Function block	Parameter symbol	Name	Data range	Factory set value
F51. (F51.)	rSEL (rSEL)	Reset action selection	0: All data is reset on each monitoring screen 1: Each data is reset on each monitoring screen	0

When the "0: All data is reset with each monitoring screen" is selected

Screen	Parameters cleared by Reset operation
PV/SV monitor	Limit output, Peak hold value, Bottom hold value, EXCD time
Peak hold	
Bottom hold	
EXCD time	

When the "1: Each data is reset with each monitoring screen" is selected

Screen	Parameters cleared by Reset operation
PV/SV monitor	Limit output
Peak hold	Limit output, Peak hold value, Bottom hold value
Bottom hold	
EXCD time	Limit output, EXCD time

PARAMETERS THAT ARE INITIALIZED/MODIFIED WHEN SETTING IS CHANGED

14

This chapter describes the parameters that are initialized/modified when setting is changed.

14.1 Parameters to Be Initialized

Changing any of the following parameters will require initialization of the related settings.

NOTE

Make sure all settings are recorded before changing the set values.

NOTE

Check all set values after having changed the settings.

14.1.1 When "Input type selection (I nP)" is changed

The following parameters will be initialized.

Mode		Items	Symbol	Default value	
				TC/RTD inputs	Voltage/Current inputs
Engineering mode	Function block 21.	Decimal point position setting	PGdP	0 (No decimal place)	1 (One decimal place)
		Setting limiter [high limit]	SLH	Maximum settable value	100.0
		Setting limiter [low limit]	SLL	Minimum settable value	0.0
	Function block 41.	Alarm 1 hold action selection	AHo 1	0 (Without alarm hold action)	
		Alarm 1 differential gap setting	AH 1	2	0.2
		Alarm 1 process abnormality action selection	AEo 1	Alarm 1 not provided: 0 (Normal) Alarm 1 provided: 1 (Forcibly turned on)	
	Function block 42.	Alarm 2 hold action selection	AHo2	0 (Without alarm hold action)	
		Alarm 2 differential gap setting	AH2	2	0.2
		Alarm 2 process abnormality action selection	AEo2	Alarm 2 not provided: 0 (Normal) Alarm 2 provided: 1 (Forcibly turned on)	
	Function block 51.	Limit action differential gap	oH	2	0.2
Parameter setting mode		Alarm 1 (ALM1)	AL 1	50	5.0
		Alarm 2 (ALM2)	AL2		
		PV bias	Pb	0	0.0
		PV ratio (Pr)	Pr	1.000	
		Digital filter	dF	0 (off)	
		Transmission output scale high (AHS)	AHS	Input range high	100.0
		Transmission output scale low (ALS)	ALS	Input range low	0.0
Monitor & SV setting mode		Limit set value (SV)	—	0	0.0

14.1.2 When “Alarm 1 type selection (AS1)” is changed

The following parameters will be initialized.

Mode		Items	Symbol	Default value	
				TC/RTD inputs	Voltage/Current inputs
Engineering mode	Function block 41.	Alarm 1 hold action selection	AHo1	0 (Without alarm hold action)	
		Alarm 1 differential gap setting	AH1	2 (2.0)	0.2
		Alarm 1 process abnormality action selection	AEo1	Alarm 1 not provided: 0 (Normal) Alarm 1 provided: 1 (Forcibly turned on)	
Parameter setting mode		Alarm 1 (ALM1)	AL1	50 (50.0)	5.0

14.1.3 When “Alarm 2 type selection (AS2)” is changed

The following parameters will be initialized.

Mode		Items	Symbol	Default value	
				TC/RTD inputs	Voltage/Current inputs
Engineering mode	Function block 42.	Alarm 2 hold action selection	AHo2	0 (Without alarm hold action)	
		Alarm 2 differential gap setting	AH2	2 (2.0)	0.2
		Alarm 2 process abnormality action selection	AEo2	Alarm 2 not provided: 0 (Normal) Alarm 2 provided: 1 (Forcibly turned on)	
Parameter setting mode		Alarm 2 (ALM2)	AL2	50 (50.0)	5.0

14.1.4 When “Transmission output (AO) specification (Ao)” is changed

The following parameters will be initialized.

Mode	Items	Symbol	Default value	
			TC/RTD inputs	Voltage/Current inputs
Parameter setting mode	Transmission output scale high (AHS)	AHS	Input range high	100.0
	Transmission output scale low (ALS)	ALS	Input range low	0.0

14.2 Parameters to Be Automatically Converted

14.2.1 When “Setting limiter [low limit] (SLL)” or “Setting limiter [high limit] (SLH)” is changed

If the setting limiter [high limit] or setting limiter [low limit] is changed as follows, the related set values are changed. (See the table below)

Only for TC/RTD inputs:

- If SLH is set to SLH<SLL, it is changed to SLH=SLL.
  Example: If SLH is set to 100 with SLL set to 200, SLL is changed to 100.
- If SLL is set to SLH<SLL, it is changed to SLH=SLL.
  Example: If SLL is set to 200 with SLH set to 100, SLH is changed to 200.

TC/RTD inputs, voltage/current inputs:

If the setting is made so that the span becomes narrower, there may be a case where the related set value becomes smaller or 0.

Mode		Items	Symbol
Engineering mode	Function block 41.	Alarm 1 differential gap setting	AH1
	Function block 42.	Alarm 2 differential gap setting	AH2
	Function block 51.	Limit action differential gap	oH
Parameter setting mode		Alarm 1 (ALM1)	AL1
		Alarm 2 (ALM2)	AL2
		PV bias	Pb
		Transmission output scale high (AHS)	AHS
		Transmission output scale low (ALS)	ALS
Monitor & SV setting mode		Limit set value (SV)	—

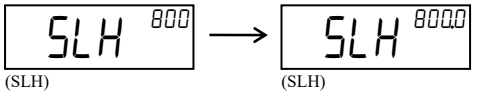
14.2.2 When “Decimal point position setting” is changed

The set value is automatically converted.

- After the position of the decimal point is changed, conduct automatic conversion so that the following values may not be changed.

Mode		Items	Symbol
Engineering mode	Function block 21.	Setting limiter [high limit]	SLH
		Setting limiter [low limit]	SLL
	Function block 41.	Alarm 1 differential gap setting	AH1
	Function block 42.	Alarm 2 differential gap setting	AH2
	Function block 51.	Limit action differential gap	oH
Parameter setting mode		Alarm 1 (ALM1)	AL1
		Alarm 2 (ALM2)	AL2
		PV bias	Pb
		Transmission output scale high (AHS)	AHS
		Transmission output scale low (ALS)	ALS
Monitor & SV setting mode		Limit set value (SV)	—

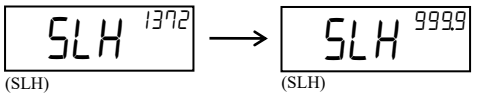
Example: When the position of the decimal point changed from 0 to 1 with SLH set to 800 °C.



(SLH) (SLH) (Changed from 800 to 800.0.)

- If the setting range is not between −1999 and +9999 regardless of the position of the decimal point, it is limited by the range from −1999 to +9999.

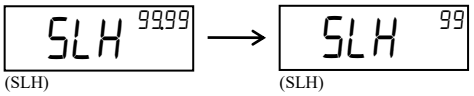
Example: When SLH is 1372 °C with no decimal position, and the decimal position is changed from 0 to 1 (one decimal position), SLH will become 999.9.



(SLH) (SLH)

- If the number of digits below the decimal point is changed in the decreasing direction, the decreased number of digits is omitted.

Example: When SLH is 99.99 with two decimal positions, and the decimal position is changed from 2 to 0, SLH will become 99 by discarding the digits below the decimal point.



(SLH) (SLH)

MEMO

TROUBLE SHOOTING

15

This chapter describes error displays and countermeasures for errors.

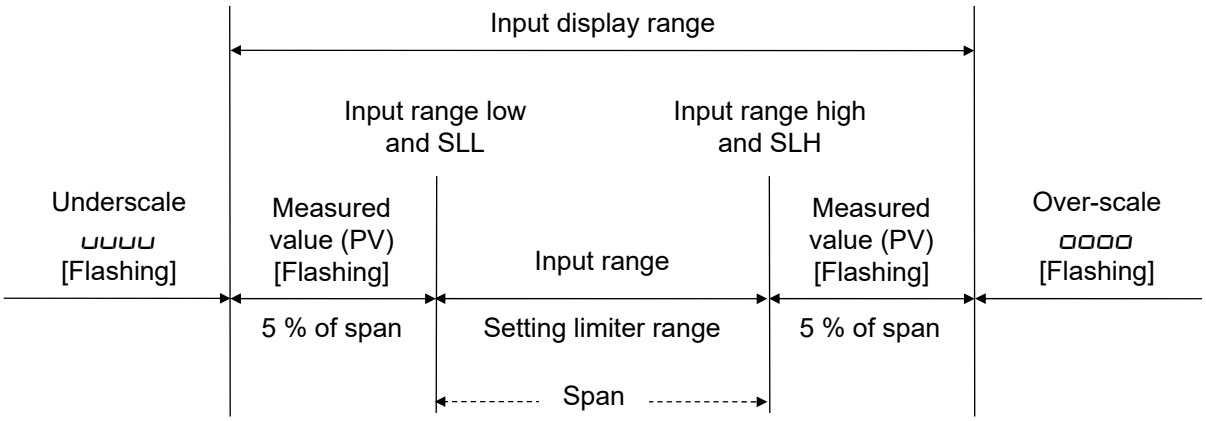
15.1 Error Displays

This Section describes error display when the measured value (PV) exceeds the display range limit and the self-diagnostic error.

■ Input error displays

The table below shows displays, description, actions and solutions when the measured value (PV) exceeds the display range.

Display	Description	Solution
Measured value (PV) [Flashing]	Measured value (PV) is outside of input range.	**⚠ WARNING** To prevent electric shock, always turn off the power before replacing the sensor. Check Input type, Input range and connecting state of sensor. Confirm that the sensor or wire is not broken.
200 OOOO [Flashing]	Over-scale: Measured value (PV) is above the high input display range limit.	
200 UUUU [Flashing]	Underscale: Measured value (PV) is below the low input display range limit.	



SLH: Setting limiter [high limit]
SLL: Setting limiter [low limit]

■ Self-diagnostic error

If an error is detected by the Self-diagnostic function, the PV display shows "Err," and the SV display shows the error code. If two or more errors occur simultaneously, the total summation of these error codes are displayed.

Error code	Description	Action	Solution
1	Adjustment data error	Display: Error display (Err) Limit output: All outputs are OFF Alarm output: All outputs are OFF	Turn off the power once. If an error occurs after the power is turned on again, please contact RKC sales office or the agent.
2	EEPROM error		
4	A/D conversion error		
8	RAM check error		
128	Watchdog timer error		

Example: When the adjustment data error (1) and A/D conversion error (4) occurs simultaneously

The error codes are shown in the SV display.
When two or more errors occur simultaneously, the total summation of these error codes is displayed.

When a power supply voltage error occurs, nothing will be displayed on the screen.
The Limit output and Alarm output will all go off.

15.2 Solutions for Problems

This section explains possible causes and solutions of the errors. For any inquiries or to confirm the specifications of the product, please contact RKC sales office or the agent.

If the instrument needs to replaced, 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.

■ Display related errors

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 is not correct.	Connect power supply correctly by referring to **3.3 Terminal Configuration (P. 3-4)**.
	Power supply terminal contact failure.	Retighten the terminal screws.
	Supply voltage is not correct.	Apply proper power supply voltage by referring to ■ **General specifications (P. 16-7)**.
Display is unstable	Noise source is present near the instrument.	Separate the noise source from the instrument.
		Set the appropriate value at Digital filter according to the input response.
	The terminal block of the instrument (with thermocouple input) is directly exposed to the air flow from an air conditioner.	Do not directly expose the terminal block to the air from the air conditioner.
Measured value (PV) display differs from the actual value	Wrong sensor is used.	Check the instrument specification and use a proper sensor.
	Input type setting is wrong.	Make proper setting by referring to **8.1 Changing Input (P. 8-2)**.
	Connection between the sensor (thermocouple) and the instrument is made with a cable other than compensating wire.	Be sure to use a compensating wire.
	For RTD input, leadwire resistance in three wires between the sensor and the instrument is different from one another.	Use a leadwire with the same resistance among three leadwires.
	PV bias is set.	Set PV bias to "0" by referring to **8.3 Correcting Input (P. 8-7)**. However, this is limited only to when the PV bias setting can be changed.
	PV ratio is set.	Change the PV ratio setting by referring to **8.3 Correcting Input (P. 8-7)**. However, this is limited only to when the PV ratio setting can be changed.

How to check the input

• When the input is configured as Thermocouple input:
Short the input terminals*, and if a temperature around the ambient temperature of the input terminals is displayed, the controller is working properly.

* Input terminals 8-9

• When the input is configured as RTD input:
Insert a 100 Ω resistor across Input terminals A-B.[1] Short terminals between B-B.[2]
If temperature around 0 °C is displayed, the instrument is working fine.

[1] Input terminals 7-8 [2] Input terminals 8-9

• When the input 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.

* Input terminals 8-9

■ Operation related errors

Problem	Possible cause	Solution
No setting change can be made by key operation	Set data is locked.	Release the Set data lock by referring to **7.6 Locking the Set Data (P. 7-10)**, **7.7 Hiding the Set Data Lock (LCK) (P. 7-11)**, and **13.1 Restricting Key Operation (Set Data Lock) (P. 13-2)**. However, only when it is allowed to release it.
Unable to release the Limit output	The EXCD lamp is on. (EXCD state)	See **7.8 Limit Output Release Operation (P. 7-14)** to release.

■ Alarm related errors

Problem	Possible cause	Solution
Alarm function is abnormal	Alarm function is different from the specification.	Change the Alarm action type by referring to **10.1 Using Alarm Function (P. 10-2)** after the instrument specification is confirmed.
	Alarm output relay contact action Energized/De-energized is reversed.	Check the setting details of Energized/De-energized by referring to **9.1 Changing Output Assignment (P. 9-2)**. However, only when the output assignment is allowed to be changed.
	Setting of Alarm differential gap is not appropriate.	Set the appropriate Alarm differential gap by referring to **10.1.3 Setting a differential gap in alarm action (P. 10-8)**.
No output of the Alarm function is turned on	Alarm is not assigned to the output.	Check the contents of Output assignment by referring to **9.1 Changing Output Assignment (P. 9-2)**.

16

SPECIFICATIONS

This chapter describes Specifications.

■ Measured input

Number of input: 1 point

Input type: Thermocouple (TC) input:
K, J, T, S, R, E, B, N (JIS-C1602-2015)
PLII (NBS)
W5Re/W26Re (ASTM-E988-96 [Reapproved 2002])
U, L (DIN43710-1985)
RTD input: Pt100 (JIS-C1604-2013)
JPt100 (Pt100 of JIS-C1604-1981)
3-wire system
Voltage input (high voltage):
0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC
Current input: 0 to 20 mA DC, 4 to 20 mA DC
For the current input specification, an external resistor of 250 Ω must be connected between the input terminals.

Input range: Thermocouple (TC) input

Input type	Measured range
K	−199 to +1372 °C (−326 to +2502 °F) −199.9 to +999.9 °C (−199.9 to +999.9 °F)
J	−199 to +1200 °C (−326 to +2192 °F) −199.9 to +999.9 °C (−199.9 to +999.9 °F)
T	−199 to +400 °C (−326 to +752 °F) [1] −199.9 to +400.0 °C (−199.9 to +752.0 °F) [1]
S	0 to 1769 °C (0 to 3216 °F) [2]
R	0 to 1769 °C (0 to 3216 °F) [2]
E	0 to 1000 °C (0 to 1832 °F)
B	0 to 1820 °C (0 to 3308 °F) [2]
N	0 to 1300 °C (0 to 2372 °F) 0.0 to 999.9°C (0.0 to 999.9 °F)
PLII	0 to 1390 °C (0 to 2534 °F)
W5Re/W26Re	0 to 2320 °C (0 to 4208 °F)
U	−199 to +600 °C (−326 to +1112 °F) [1] −199.9 to +600.0 °C (−199.9 to +999.9 °F) [1]
L	0 to 900 °C (0 to 1652 °F)

[1] Accuracy is not guaranteed below −100.0 °C (−148.0 °F) or less for types T and U.
[2] Accuracy is not guaranteed below 399 °C (751 °F) or less for types R, S and B.

RTD input

Input type	Measured range
Pt100	−199.9 to +649.0 °C (−199.9 to +999.9 °F)
JPt100	−199.9 to +649.0 °C (−199.9 to +999.9 °F)

Voltage (high voltage)/Current input

Input type	Measured range
High voltage	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

For the current input specification, a resistor of 250 Ω must be connected between the input terminals.

Sampling cycle: 0.25 seconds, 0.5 seconds (Selectable)

Influence of signal source resistance (TC input):
Approx. 0.2 μV/Ω (Converted depending on TC types)

Influence of input lead (RTD input):
Approx. 0.01 %/Ω of span (10 Ω or less per wire)

Input impedance:
Low voltage input (TC, RTD): 1 MΩ or more
High voltage input: 1 MΩ or more

Action at input break:

TC input:	Upscale or Downscale (Specify when ordering)
RTD input:	Upscale
Voltage input (high voltage):	Downscale [1, 2]
Current input:	Downscale [1, 2]

[1] Setting limiter [high limit] (SLH) < Setting limiter [low limit] (SLL): Upscale

[2] For the voltage input (high voltage) "0 to 5 V DC," "0 to 10 V DC," and the current input "0 to 20 mA DC," the displayed value is around zero.

Action at input short circuit (RTD input):
Downscale

■ Contact input

Number of input: 2 points (DI1, DI2)

Input method: Dry contact input

OFF (Open state):	500 kΩ or more
ON (Close state):	10 Ω or less

■ Output

Assign output:

Number of output:
Output (OUT): 2 points [Output 1 (OUT1), Output 2 (OUT2)]
Output type:

Output 1 (OUT1)	Relay contact output
	Current output
Output 2 (OUT2)	No output
	Relay contact output

The output type is specified at the time of ordering.
It cannot be changed by the customer after purchase.

Output type:

• Relay contact output (OUT1, OUT2)

Contact type: 1a contact
Contact rating: 240 V AC 2 A (Resistive load)
30 V DC 2 A (Resistive load)
Electrical life: 100,000 times or more (Rated load)

• Current output (OUT1)

Output current: 0 to 20 mA DC
4 to 20 mA DC
Output resolution: 10 bits or more
Allowable load resistance: 400 Ω or less

■ Performance

Reference performance (Performance under the standard performance condition)

• Measured input (PV): Accuracy

Input type	Accuracy
K	±0.3 % of displayed value + 1 digit or ±2 °C (whichever is larger)
J	
T [1]	
E	
U [1]	
L	
N	
S [2]	
R [2]	
PLII	
W5Re/W26Re	
B [2]	
Pt100	±0.3 % of displayed value + 1 digit or ±8 °C (whichever is larger)
JPt100	
Voltage/Current input	±0.3 % of span + 1 digit

[1] Accuracy is not guaranteed below −100.0 °C (−148.0 °F) or less for types T and U.
[2] Accuracy is not guaranteed below 399 °C (751 °F) or less for types R, S and B.

Noise elimination ratio:
Series mode: 60 dB or more (50/60 Hz)
Common mode: 120 dB or more (50/60 Hz)

• Current output: Accuracy: ±0.3 % of span

■ Display

Measured input display (PV):
4-digit 7-segment LED (Green)

Setting display (SV): 4-digit 7-segment LED (Red)

Output display (OUT1, OUT2):
Point light emission LED (Green) × 2 points

Alarm display (ALM1, ALM2):
Point light emission LED (Red) × 2 points

EXCD display: Point light emission LED (Red)

■ Operation keys

Select items/Set parameters:
4 keys (SET , RST , ▽ , △)

Reset operation: key (RST [Press and hold (for one second) or Press once])

■ Host communication

Interface: Based on RS-485, EIA standard

Protocol: RKC communication (ANSI X3.28-1976 subcategories 2.5 and A4)
Modbus –RTU

Connection method: 2-wire system, half-duplex multi-drop connection

Maximum connections: 31 instruments (32 instruments maximum including a host computer)

■ Self-diagnostic function

Self-diagnosis items	Error display	Communication at error
Adjustment data error	Error code 1 (Err 1)	Error code 1 (Err 1)
EEPROM error	Error code 2 (Err 2)	Error code 2 (Err 2)
A/D conversion error	Error code 4 (Err 4)	Error code 4 (Err 4)
RAM check error	Error code 8 (Err 8)	Error code 8 (Err 8)
Power supply voltage is abnormal	Display is OFF	Communication stop
Watchdog timer error	Error code 128 (Err 128)	Communication stop

■ General specifications

Power supply voltage: 100 to 240 V AC type:
85 to 264 V AC [Including power supply voltage variation], 50/60 Hz
(Rated: 100 to 240 V AC)

24 V AC type:
21.6 to 26.4 V AC [Including power supply voltage variation], 50/60 Hz
(Rated: 24 V AC)

24 V DC type:
21.6 to 26.4 V DC [Including power supply voltage variation]
(Rated: 24 V DC)

Power consumption (at maximum load):

100 to 240 V AC type:
4 VA max. (at 100 V AC)
7 VA max. (at 240 V AC)

24 V AC type:
4 VA max. (at 24 V AC)

24 V DC type:
100 mA max. (at 24 V DC)

Insulation resistance:

	①	②	③	④
①Grounding terminal				
②Power supply terminal	20 MΩ or more at 500 V DC			
③Input terminal, Current output terminal	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC		
④Relay output terminal	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC	20 MΩ or more at 500 V DC	

If there is no ground terminal, grounding is done on the control panel.

Functional isolation is provided between input and current output.

Withstand voltage:

Time: 1 min.	①	②	③	④
①Grounding terminal				
②Power supply terminal	1500 V AC			
③Input terminal, Current output terminal	1500 V AC	2300 V AC		
④Relay output terminal	1500 V AC	2300 V AC		

If there is no ground terminal, grounding is done on the control panel.

Functional isolation is provided between input and current output.

Power failure handling: **Power failure:** A power failure of 20 ms or less will not affect the action

Memory backup:

Backed up by non-volatile memory

Number of writing: Approx. 100,000 times

Data storage period: Approx. 10 years

■ Environment Condition

● Operating environmental conditions (normal operating conditions)

Ambient temperature: −10 to +55 °C

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

Vibration: Frequency range: 10 to 150 Hz
Maximum amplitude: 0.075 mm
Maximum acceleration: 9.8 m/s^2
Each direction of XYZ axes

Shock: The instrument is tilted along one bottom edge so that the distance between the opposite edge is 50 mm, or so that the angle made by the bottom and the instrument is 30°, whichever is less severe (X and Y axes)

● Reference operating conditions

Reference temperature: 23 °C ± 2 °C
Temperature variation: ±2 °C/h

Reference humidity: 50 %RH ± 10 %RH

Magnetic field: Geomagnetism

Power supply voltage: Alternating current, Direct current: Reference value ± 1 %

● Transportation and Storage environment conditions

Vibration:

Number of vibration [Hz]	Level		Attenuation slope [dB/oct]
	(m/s^2)^2/Hz	[g^2(1)/Hz]	
3	0.048	(0.0005)	—
3 to 6	—	—	+13.75
6 to 18	1.15	(0.012)	—
18 to 40	—	—	–9.34
40	0.096	(0.001)	—
40 to 200	—	—	–1.29
200	0.048	(0.0005)	—

The effective value of the acceleration is 5.8 m/s^2 [0.59 g (1)] within the number of vibration.
NOTE: (1) g = 9.806658 m/s^2

Shock: Height 60 cm or less

Temperature: −10 to +55 °C

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

■ Mounting and Structure

Mounting method: Panel-mounted
Close horizontal mounting or Close vertical mounting

Case color: Black

Case material: Polycarbonate (Flame retardancy: UL94 V-0)

Panel sheet material: Polyester

Front panel material: Polycarbonate (Flame retardancy: UL94 V-0)

Terminal block material: Modified polyphenylene ether

Mounting bracket material:
Polyacetal

Panel sealing: Based on IP66 (IEC 60529) [optional]

Weight: Approx. 110 g

Dimensions: 48 mm × 24 mm × 100 mm (W × H × Depth behind the panel)
Panel thickness: 8.2 mm (No Waterproof/Dustproof)
9.2 mm (Waterproof/Dustproof)

■ Standard

● Safety standards

UL: UL 61010-1

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

● Other approved standards

CE marking: LVD: EN61010-1
EMC: EN61326-1
RoHS: EN IEC 63000

UKCA marking: Electrical Safety: EN61010-1
EMC: EN61326-1
RoHS: EN IEC 63000

FM: FM3545

● Environment Condition

Protection against electric shock:
Class II (Reinforced insulation)

Overvoltage category: CATEGORY II

Pollution degree: POLLUTION DEGREE 2

Altitude: Altitude up to 2000 m (Indoor use)

Recommended fuse: Fuse type: Time-lag fuse
(Approved fuse according IEC 60127-2 and/or UL 248-14)
Fuse rating: Rated current 0.4 A

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