

Temperature Controller

SA220

Installation Manual

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Thank you for purchasing this RKC product. In order to achieve maximum performance and ensure proper operation of the instrument, carefully read all the instructions in this manual. Please place the manual in a convenient location for easy reference. This manual describes installation, wiring, parts description, and specification of the SA220.

For detailed handling procedures and key operations, refer to separate SA220 Instruction Manual.
The manual can be downloaded from the official RKC website:
<https://www.rkcinst.co.jp/english/download-center/>

⚠

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.

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

NOTICE

- This manual assumes that the reader has a fundamental knowledge of the principles of electricity, process control, computer technology and communications.
- The figures, diagrams and numeric values used in this manual are only for explanation purpose.
- RKC is not responsible for any damage or injury that is caused as a result of using this instrument, instrument failure or indirect damage.
- RKC is not responsible for any damage and/or injury resulting from the use of instruments made by imitating this instrument.
- Periodic maintenance is required for safe and proper operation of this instrument. Some components have a limited service life, or characteristics that change over time.

- Every effort has been made to ensure accuracy of all information contained herein. RKC makes no warranty, expressed or implied, with respect to the accuracy of the information. The information in this manual is subject to change without prior notice.
- 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.
 - ⚡: Both direct and alternating current
 - ⚠: 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.

1. MODEL CODE

SA220

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

(1) Control action

F: PID action with autotuning (Reverse action)
D: PID action with autotuning (Direct action)
W: Heat/Cool PID action with autotuning (Water cooling)
A: Heat/Cool PID action with autotuning (Air cooling)

(2) Input type/Range code: Refer to "■ Input range table."

(3) Output 1 [OUT1] (Control output, Alarm output or Transmission output)
M: Relay contact output 7: Current output (0 to 20 mA DC)
V: Voltage pulse output 8: Current output (4 to 20 mA DC)

(4) Output 2 [OUT2] (Control output or Alarm output)
N: No output M: Relay contact output V: Voltage pulse output

(5) Power supply voltage
5: 24 V AC/DC (without built-in varistor) 6: 24 V AC/DC (with built-in varistor)

(6) Alarm 1 [ALM1] and (7) Alarm 2 [ALM2]
N: No alarm
A: Deviation high alarm
B: Deviation low alarm
C: Deviation high/low alarm
D: Band alarm
E: Deviation high alarm with hold action
F: Deviation low alarm with hold action
G: Deviation high/low alarm with hold action
H: Process high alarm
J: Process low alarm
K: Process high alarm with hold action
L: Process low alarm with hold action
R: Control loop break alarm (LBA) *
S: SV high alarm
W: SV low alarm

* LBA can be selected for only ALM1.

12: Transmission output + PID action [OUT1: Transmission output OUT2: Control output]
13: Transmission output + ALM1, ALM2 [OUT1: Transmission output OUT2: OR output of ALM1 and ALM2 2]
14: Transmission output + ALM1, ALM2 [OUT1: Transmission output OUT2: OR output of ALM1 and ALM2 1]
15: Transmission output + ALM1, ALM2 [OUT1: Transmission output OUT2: AND output of ALM1 and ALM2 2]
16: Transmission output + ALM1, ALM2 [OUT1: Transmission output OUT2: AND output of ALM1 and ALM2 1]
17: Transmission output + ALM1 [OUT1: Transmission output OUT2: ALM1 2]
18: Transmission output + ALM1 [OUT1: Transmission output OUT2: ALM1 1]
19: Heat/Cool PID action [OUT1: Cool-side control output OUT2: Heat-side control output]
1 De-energized 2 Energized

- Accessories
 - Mounting brackets..... 2
 - Mounting screws..... 2
 - SA220 Installation Manual (English: IMR03F01-E1)..... 1
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Input range table

TC/RTD input

Type	Range	Code	Range	Code
J	0 to 200 °C	J 01	0 to 400 °C	J 02
	0 to 600 °C	J 03	0 to 800 °C	J 04
	0 to 1000 °C	J 05	0 to 1200 °C	J 06
	−199.9 to +300.0 °C	J 07	0.0 to 400.0 °C	J 08
	0.0 to 800.0 °C	J 09	0 to 450 °C	J 10
	0.0 to 200.0 °C	J 22	0.0 to 600.0 °C	J 23
	−199.9 to +600.0 °C	J 30	0 to 800 °F	J A1
	0 to 1600 °F	J A2	0 to 2192 °F	J A3
	0 to 400 °F	J A6	−199.9 to +999.9 °F	J A9
	0.0 to 800.0 °F	J B6		
R	0 to 1600 °C ¹	R 01	0 to 1769 °C ¹	R 02
	0 to 1350 °C ¹	R 04	0 to 3200 °F ¹	R A1
S	0 to 1600 °C ¹	S 01	0 to 1769 °C ¹	S 02
	0 to 3200 °F ¹	S A1	0 to 3216 °F ¹	S A2
B	400 to 1800 °C	B 01	0 to 1820 °C ¹	B 02
	800 to 3200 °F	B A1	0 to 3308 °F ¹	B A2
E	0 to 800 °C	E 01	0 to 1000 °C	E 02
	0 to 1600 °F	E A1	0 to 1832 °F	E A2
N	0 to 1200 °C	N 01	0 to 1300 °C	N 02
	0.0 to 800.0 °C	N 06	0 to 2300 °F	N A1
T	−199.9 to +400.0 °C ²	T 01	−199.9 to +100.0 °C ²	T 02
	−100.0 to +200.0 °C	T 03	0.0 to 350.0 °C	T 04
W5Re/ W26Re	0 to 2000 °C	W 01	0 to 2320 °C	W 02
	0 to 4000 °F	W A1		
PLII	0 to 1300 °C	A 01	0 to 1390 °C	A 02
	0 to 1200 °C	A 03	0 to 2400 °F	A A1
U	−199.9 to +600.0 °C ²	U 01	−199.9 to +100.0 °C ²	U 02
	0.0 to 400.0 °C	U 03	−199.9 to +999.9 °F ²	U A1
	−100.0 to +200.0 °F	U A2	0.0 to 999.9 °F	U A3

¹ Accuracy is not guaranteed between 0 to 399 °C (0 to 751 °F) for type R, S and B.
² Accuracy is not guaranteed less than −100.0 °C (−148.0 °F) for type T and U.

TC/RTD input

Type	Range	Code	Range	Code
L	0 to 400 °C	L 01	0 to 800 °C	L 02
	0 to 800 °F	L A1	0 to 1600 °F	L A2
Pt100	−199.9 to +649.0 °C	D 01	−199.9 to +200.0 °C	D 02
	−100.0 to +50.0 °C	D 03	−100.0 to +100.0 °C	D 04
	−100.0 to +200.0 °C	D 05	0.0 to 50.0 °C	D 06
	0.0 to 100.0 °C	D 07	0.0 to 200.0 °C	D 08
	0.0 to 300.0 °C	D 09	0.0 to 500.0 °C	D 10
	−199.9 to +999.9 °F	D A1	−199.9 to +400.0 °F	D A2
	−199.9 to +200.0 °F	D A3	−199.9 to +100.0 °F	D A4
	−199.9 to +300.0 °F	D A5	0.0 to 100.0 °F	D A6
	0.0 to 200.0 °F	D A7	0.0 to 400.0 °F	D A8
	0.0 to 500.0 °F	D A9		
JPt100	−199.9 to +649.0 °C	P 01	−199.9 to +200.0 °C	P 02
	−100.0 to +50.0 °C	P 03	−100.0 to +100.0 °C	P 04
	−100.0 to +200.0 °C	P 05	0.0 to 50.0 °C	P 06
	0.0 to 100.0 °C	P 07	0.0 to 200.0 °C	P 08
	0.0 to 300.0 °C	P 09	0.0 to 500.0 °C	P 10

Voltage/Current inputs

Type	Range	Code
0 to 5 V DC	0.0 to 100.0 %	4 01
0 to 10 V DC	0.0 to 100.0 %	5 01
1 to 5 V DC	0.0 to 100.0 %	6 01
0 to 20 mA DC	0.0 to 100.0 %	7 01
4 to 20 mA DC	0.0 to 100.0 %	8 01

2.2 Dimensions

Dimension

Unit mm

48

9.2

44.8

63.6

8.2

100

22

40.8

14.5

* Rubber gasket (optional)

Panel cutout dimensions

Individual mounting

Close vertical mounting

Close horizontal mounting

For mounting of the SA220, panel thickness must be between 1 to 10 mm. When mounting multiple SA220s close together, the panel strength should be checked to ensure proper support.

Installation Conditions:

The display cannot be seen from the outside of the visual field range. The visual field range of SA220 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

1. Prepare the panel cutout as specified in 1.2 Dimensions.

2. Insert the instrument through the panel cutout.

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

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

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

Fig. 1

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

Fig. 2

In addition, the mounting assembly also include two screws which can be used with the brackets to secure the instrument to the panel. Refer to 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 (Checked and confirmed its compliance through the internal test at RKC) when mounted on the panel. For effective waterproof/dustproof, the gasket must be securely placed between instrument and panel without any gap. If gasket is damaged, please contact RKC sales office or the agent.

Close Mounting

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

Fig. 4

Fig. 5

If the SA220s have waterproof/dustproof options, protection will be compromised and not meet IP66 by close mounting.

Two SA220s cannot be inserted into a panel cutout of 48 × 48 mm.

3.1 Wiring Cautions

- For thermocouple input, use the appropriate compensation wire.
- For RTD input, use low resistance lead wire with no difference in resistance between the three 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.

SPECIFICATIONS

Input

Thermocouple (TC) input: K, J, R, S, B, E, T, N, PLII, W5Re/W26Re, U, L
Input impedance: Approx. 1 MΩ
RTD: Pt100, JPt100
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
Sampling cycle: 0.25 seconds or 0.5 seconds
Input range: Refer to Input range table

Control method
PID control (ON/OFF, P, PI, or PD actions is available)

Outputs
Output 1 [OUT1]
Relay contact output: 30 V AC/DC, 2 A (Resistive load) 1a contact
Electrical life: 100,000 times or more (Rated load)
Voltage pulse output: 0/12 V DC (Allowable load resistance: 600 Ω or more)
Input/output terminals are not isolated.
Current output: 0 to 20 mA DC or 4 to 20 mA DC
(Allowable load resistance: 400 Ω or less)
Input/output terminals are not isolated.
Output 2 [OUT2]
Relay contact output: 30 V AC/DC, 2 A (Resistive load) 1a contact
Electrical life: 100,000 times or more (Rated load)
Voltage pulse output: 0/12 V DC
(Allowable load resistance: 600 Ω or more)
Input/output terminals are not isolated.

Contact input (optional)
Dry contact input: At open: 500 kΩ or more
At close: 10 Ω or less
Function: D11 (STEP): At open: SV1
At close: SV2
D12 (RUN/STOP): At open: STOP
At close: RUN

(8) Optional function

N: No function 5: RS-485 (RKC communication) 6: RS-485 (Modbus) D: Contact input (RUN/STOP, STEP)

(9) Waterproof/Dustproof

N: No Waterproof/Dustproof 1: Waterproof/Dustproof

(10) Case color

N: White A: Black

(11) Output assignment code

No symbol: Standard output

- PID action
OUT1: Control output
OUT2: "No alarm," "ALM1 (Energized)" or "OR output of ALM1 and ALM2 (Energized)"
- Heat/Cool PID action
OUT1: Heat-side control output
OUT2: Cool-side control output

03: PID action + ALM1
[OUT1: Control output OUT2: ALM1 output 1]

04: PID action + ALM1, ALM2
[OUT1: Control output OUT2: AND output of ALM1 and ALM2 2]

05: PID action + ALM1, ALM2
[OUT1: Control output OUT2: OR output of ALM1 and ALM2 1]

06: PID action + ALM1, ALM2
[OUT1: Control output OUT2: AND output of ALM1 and ALM2 1]

07: PID action + ALM1, ALM2 or ALM1 only
[OUT1: Control output OUT2: No output (The alarm state can be checked via communication or by lamp lighting)]

08: PID action + ALM1, ALM2
[OUT1: Control output OUT2: ALM1 output 2 (ALM2 can be checked via communication or by lamp lighting)]

09: ALM1 + ALM2
[OUT1: ALM1 output 2 OUT2: ALM2 output 2]

10: ALM1 + ALM2
[OUT1: ALM1 output 2 OUT2: ALM2 output 1]

11: ALM1 + ALM2
[OUT1: ALM1 output 1 OUT2: ALM2 output 1]

1 De-energized 2 Energized

2. MOUNTING

⚠

WARNING

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

2.1 Mounting Cautions

(1) This instrument is intended to be used under the following environmental conditions. (IEC 61010-1) [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/m³ dry air at 101.3 kPa)

● Installation environment conditions: Indoor use
Altitude up to 2000 m

(3) Avoid the following conditions when selecting the mounting location:

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

(4) Mount this instrument in the panel considering the following conditions:

- Provide adequate ventilation space so that heat does not build up.
- Do not mount this instrument directly above the equipment that generates large amount of heat (heaters, transformers, semi-conductor functional devices, large-wattage resistors).
- If the ambient temperature rises above 55 °C, cool this instrument with a forced air fan, cooler, etc. Cooled air should not blow directly on this instrument.
- In order to improve safety and the immunity to withstand noise, mount this instrument as far away as possible from high voltage equipment, power lines, and rotating machinery.
 - High voltage equipment: Do not mount within the same panel.
 - Power lines: Separate at least 200 mm.
 - Rotating machinery: Separate as far as possible.

(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.

3.3 Connector Configurations

CN3 connector

CN4 connector *

CN1 connector 1, 2, 3

CN2 connector

¹ Pin No. 3 and 4 are internally shorted.
² When connecting two or more controllers in parallel to supply power, connect the number needed to achieve operation with an allowable current of wire under 2 A or less.
³ The CN1 connector is half covered with a sticker to prevent misinsertion. Remove the sticker when connecting the plug for power supply.

4. PARTS DESCRIPTION

Diagram of the instrument face with numbered callouts (1) to (7) pointing to various components: (1) Measured value (PV) display, (2) Set value (SV) display, (3) Indication lamps, (4) UP key, (5) DOWN key, (6) Shift & R/S key, (7) Set key.

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

Callout	Description
(1)	Measured value (PV) display [Green]
(2)	Set value (SV) display [Orange]
(3)	Indication lamps
(4)	UP key
(5)	DOWN key
(6)	Shift & R/S key
(7)	Set key

Input Type and Input Range Display
When the instrument is powered on, it immediately confirms the input type and input range.

Example: When sensor type of input is K thermocouple.

Diagram showing the input type and range display sequence. It starts with the input type symbol (e.g., 'C' for Celsius) and the input range low (e.g., '0.1372').

Unit for input and SV display (Celsius: °C Fahrenheit: °F, Voltage/Current: no character shown)

Input type symbol *

Symbol

Input range low

Input range high

* Input Type Symbol Table

Symbol	U	V	C	S	B	E	T	N	P	L	I	U	L	U	P	P	B
Input type	K	J	R	S	B	E	T	N	P	L	I	U	L	U	P	P	B

PV/SV Display Mode
The controller will display the Measured value (PV) and the Set value (SV).
• If the STEP function is provided, the SV display will show the Set value (SV1) or STEP set value (SV2) depending on whether the Contact input is opened or closed.
• The controller can be switched to RUN mode or STOP mode.

SV Setting Mode
The blinking digit on the SV display indicates which digit can be set.
Setting range: Within input range
Factory set value: TC/RTD inputs: 0 (0.0) °C [°F]
Voltage/Current inputs: 0.0 %
If the STEP function is provided, the following parameter symbols are displayed on the PV.
Set value (SV1): SV1
STEP set value (SV2): SV2

5. SETTING

Operation Menu

Power ON
Input Type/Input Range Display
Automatically (in 4 seconds)

A PV/SV Display Mode
SET key (2 seconds) → **C Parameter Setting Mode**

B SV Setting Mode
SET key → Set value (SV) setting [Without STEP function]
SET key → Set value (SV1) setting [With STEP function]
SET key → STEP set value (SV2) setting

D Communication Setting Mode
SET key and <R/S key (1 second) → **E Engineering Mode**

Parameter Setting Mode (C)

- Control loop break alarm (LBA)**
Setting range: 0.0 to 200.0 minutes
Factory set value: 8.0
- LBA deadband (LBD)**
Setting range: 0 to span
Factory set value: TC/RTD inputs: 0 (0.0)
Voltage/Current inputs: 0.0
- Alarm 1 (ALM1)**
Setting range: Process alarm, SV alarm: Same as input range
Deviation alarm: -span to + span (Within -1999 to +9999 digits)
Factory set value: TC/RTD inputs: 50 (50.0)
Voltage/Current inputs: 5.0
- Alarm 2 (ALM2)**
Setting range: Process alarm, SV alarm: Same as input range
Deviation alarm: -span to + span (Within -1999 to +9999 digits)
Factory set value: TC/RTD inputs: 50 (50.0)
Voltage/Current inputs: 5.0
- Autotuning (AT)**
Setting range: on: AT start or execution
off: AT end or cancel
Factory set value: off
- Self-tuning (ST)**
Setting range: on: Self-tuning ON
off: Self-tuning OFF
Factory set value: off
- Heat-side proportional band (P)**
Setting range: 0 to span (9999 digits or less)
0 or 0.0: ON/OFF action
Factory set value: TC/RTD inputs: 30 (30.0)
Voltage/Current inputs: 3.0
- Integral time (I)**
Setting range: 0 to 3600 seconds (0: PD action)
Factory set value: 240
- Derivative time (D)**
Setting range: 0 to 3600 seconds (0: PI action)
Factory set value: 60
- Anti-reset windup (ARW)**
Setting range: 0 to 100 % of Heat-side proportional band (0: Integral action OFF)
Factory set value: 100
- Heat-side proportioning cycle time**
Setting range: 1 to 100 seconds
Factory set value: Relay contact output: 20
Voltage pulse output: 2
- Cool-side proportional band**
Setting range: 1 to 1000 % of Heat-side proportional band
Factory set value: 100
- Overlap/Deadband**
Setting range: -span to +span (Within -1999 to +9999 digits)
Factory set value: TC/RTD inputs: 0 (0.0)
Voltage/Current inputs: 0.0

Return to first parameter setting item

Transmission output (AO) specification *

Symbol **	Contents of Output
PV	Measured value (PV) [Factory set value]
SV	Set value (SV)
DEV	Deviation (DEV)
MV	Manipulated output value (MV)

Transmission output scale high (AHS) *
Setting range: Measured value (PV): Same as input range
Set value (SV): Same as input range
Deviation (DEV): -span to +span (Within -1999 to +9999 digits)
Manipulated output value (MV): 0.0 to 100.0 %
Factory set value: TC/RTD inputs: Input range high
Voltage/Current inputs: 100.0

Transmission output scale low (ALS) *
Setting range: Measured value (PV): Same as input range
Set value (SV): Same as input range
Deviation (DEV): -span to +span (Within -1999 to +9999 digits)
Manipulated output value (MV): 0.0 to 100.0 %
Factory set value: TC/RTD inputs: Input range low
Voltage/Current inputs: 0.0

* Parameters for Transmission output (AO) specification, Transmission output scale high (AHS) and Transmission output scale low (ALS) are displayed only in the following cases:
• when output 1 (OUT1) is set for current output
• when output 1 (OUT1): Transmission output is selected in the Output logic operation selection (F30)
** Symbol is displayed on the set value (SV) display. Set by the UP or DOWN key.

Set data lock (LCK)
Setting range: 0 (Unlock) 1 (Lock)
Refer to Lock Level Table
Factory set value: 0000

Lock Level Table

Set value	Parameter which can be changed
0000	All parameters [Factory set value]
0001	SV, Alarms (ALM1, ALM2)
0010	All parameters except for Alarms (ALM1, ALM2)
0100	All parameters except for SV
0011	SV
0101	Alarms (ALM1, ALM2)
0110	All parameters except for SV and Alarms (ALM1, ALM2)
0111	No parameters (All locked)

Some parameter symbols may not be displayed depending on the specification.
The setting range is from -1999 to +9999 regardless of the position of the decimal point.

Changing parameter settings
Procedures to change parameter settings are shown below.

To store a new value for the parameter, always press the SET key.
The display changes to the next parameter and the new value will be stored.
- A new value will not be stored without pressing SET key after the new value is displayed on the display.
- After a new value has been displayed by using the UP and DOWN keys, the SET key must be pressed within one minute, or the new value is not stored and the display will return to the PV/SV display mode.

When the set data is locked, the digits on the SV display are brightly lit and the set value cannot be changed. The locked parameters can be released at "Set data lock (LCK)" in the Parameter setting mode.

Change the Set value (SV)
Example: Change the Set value (SV) from 0 °C to 200 °C

1. Select the SV setting mode
Press the SET key at PV/SV display mode until SV display mode is displayed.

2. Shift the blinking digit
Press the <R/S key to blink the hundreds digit. The blinking digit indicates which digit can be set.

3. Change the Set value (SV)
Press the UP key to change the number to 2.

4. Store the Set value (SV)
Press the SET key to store the new set value. The display returns to the PV/SV display mode.

Change the Alarm set value
Example: Change the Alarm 1 (ALM1) from 50 °C to 200 °C

1. Select the Parameter setting mode
Press and hold the SET key for 2 seconds in the PV/SV display mode state to transfer to Parameter setting mode.

2. Shift the blinking digit
Press the <R/S key to blink the tens digit. The blinking digit indicates which digit can be set.

3. Change the Alarm set value
Press the UP key to change the number to 0. The digit is shifted to the higher digit and the number at the hundreds digit becomes "1."

4. Store the Alarm set value
Press the SET key to store the new set value. The display changes to the next parameter.

Change parameters other than the Set value (SV) and Alarm set value
The changing procedures are the same as those of example 2. to 4. in the above
• **Change the Set value (SV).** Pressing the SET key after the setting end shifts to the next parameter. When no parameter setting is required, return the instrument to the PV/SV display mode.

RUN/STOP
RUN/STOP can be selected by contact input (optional) other than the key operation.

Conditions when changed to STOP mode:
• Control, Alarm: Control OFF, Alarm OFF
OUT1 output OFF (OPEN),
OUT2 output OFF (OPEN)
• Output: The AT is canceled (The PID constants are not updated)

RUN/STOP transfer by key operation
Each press of the <R/S key for one second in the PV/SV display mode will allow switching between RUN and STOP.

RUN/STOP transfer by contact input
RUN/STOP can be switched according to the open or closed state of the connector input DI2 (CN4 connector).

Autotuning (AT) start/stop
Autotuning (AT) automatically measures, calculates and sets the optimum PID and LBA constants. The following conditions are necessary to carry out AT and the conditions which will cause the AT to stop.

Caution for using the Autotuning (AT):
When a temperature change (UP and/or Down) is 1 °C or less per minute during AT, AT may not be finished normally. In that case, adjust the PID values manually. Manual setting of PID values may also be necessary if the set value is around the ambient temperature or is close to the maximum temperature achieved by the load.

This instrument has one each of Integral time (I) and Derivative time (D). In the case of heat/cool PID control, these parameters are used on both heating and cooling sides.

Requirements for AT start
Start the AT when all following conditions are satisfied:
- Prior to starting the AT function, end all the parameter settings other than PID and LBA.
- Confirm the LCK function has not been engaged. (LCK must be 0000)

When the AT is finished, the controller will automatically returns to PID control.

Requirements for AT cancellation
The AT is canceled if any of the following conditions exist.
- When the Set value (SV1, SV2) is changed.
- When the power is turned off.
- When the PV bias value is changed.
- When the RUN/STOP mode is changed to the STOP mode.
- When the PV becomes abnormal due to burnout.
- When the AT does not end in 9 hours after autotuning started.
- When power failure longer than 20 ms occurs.

If the AT is canceled, the controller immediately changes to PID control. The PID values will be the same as before the AT was activated.

When the AT is completed, the controller immediately changes to PID control. If the control system does not allow the AT cycling process, set each PID constant manually to meet the needs of the application.

Autotuning (AT) start

1. Select the Parameter setting mode
Press and hold the SET key for 2 seconds in the PV/SV display mode state to transfer to Parameter setting mode.

2. Select the Autotuning (AT) display
Press the SET key several times until Autotuning (AT) display will be displayed.

3. Set Autotuning (AT) to "on"
Press the UP key to set "on."

4. Start the Autotuning (AT)
Press the SET key and Autotuning (AT) will start. The display changes to the next setting item.

During Autotuning (AT), the Autotuning (AT) lamp blinks.

6. ERROR DISPLAYS

Self-diagnostic error

Error No.	Description	Operation at error	Solution
1	Adjustment data error	Display: Error display (Err)	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	Control output: All output is OFF	
4	A/D conversion error	Alarm output: All output is OFF	
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.

Over-scale and Underscale

Diagram showing the input display range and the setting limiter range. The input display range is divided into three sections: Input range low and SLL, Input range, and Input range high and SLH. The setting limiter range is shown as a dashed line within the input range. The input range is divided into three sections: Underscale, Input range, and Over-scale. The input range is further divided into three sections: 5 % of span, Setting limiter range, and 5 % of span. The input range is further divided into three sections: Underscale, Input range, and Over-scale.

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

For the Setting limiter, refer to SA220 Instruction Manual (IMR03F02-EC).

7. REMOVING THE INTERNAL ASSEMBLY

Usually, this instrument is not necessary to remove the internal assembly from the case. When removing the internal assembly without disconnecting the external wiring, take the following steps.

WARNING
To prevent electric shock or instrument failure, only qualified personnel should be allowed to pull out the internal assembly.
To prevent electrical shock or instrument failure, always turn off the power before pulling out the internal assembly.
To prevent injury or instrument failure, do not touch the internal printed wiring board.

Apply pressure very carefully when removing the internal assembly to avoid damage to the frame.

To conform to IEC 61010-1 requirements for protection from electric shock, the internal assembly of this instrument can only be removed with an appropriate tool.

Recommended tool: Slotted screwdriver (Tip width: 3 mm or less)

Unlock the bezel with a slotted screwdriver, by gently pushing outward.

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The first edition: JUN. 2021 [IMQ00]

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JUN. 2021