1. PRODUCT CHECK

(1) Control action
F: PID action with auto-tuning (Reverse action)
D: PID action with auto-tuning (Direct action)
W: Heat/Cool PID action with auto-tuning (Water-cooler cooling) \(^1\)
A: Heat/Cool PID action with auto-tuning (Air cooling) \(^1\)

(2) Input type/Range code: Refer to 9. INPUT RANGE TABLE

(3) Output 1 (OUT1) [Control output or Alarm output]
M: Relay contact output
L: Voltage pulse output

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

(5) Power supply voltage
3: 24 V AC/DC
4: 100 to 240 V AC

(6) Alarm 1 [ALM1] and (7) Alarm 2 [ALM2]
A: No alarm
B: Deviation high alarm
C: Deviation low alarm
D: Band alarm
E: Deviation high alarm \(^2\)
F: Deviation low alarm \(^2\)
G: Deviation high/low alarm \(^2\)

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

(9) Waterproof/Dustproof
N: No Waterproof/Dustproof
1: Waterproof/Dustproof

(10) Case color
White: A
Black: B

(11) Output assignment code
No symbol: Standard output
3: PID action + ALM1 [OUT1: Control output OUT2: ALM1 output] \(^4\)
04: PID action + ALM1, ALM2 [OUT1: Control output OUT2: AND output of ALM1 and ALM2] \(^6\)
05: PID action + ALM1, ALM2 [OUT1: Control output OUT2: OR output of ALM1 and ALM2] \(^6\)
06: PID action + ALM1, ALM2 [OUT1: Control output OUT2: AND output of ALM1 and ALM2] \(^7\)
07: PID action + ALM1, ALM2 [OUT1: Control output OUT2: OR output of ALM1 and ALM2] \(^7\)
08: PID action + ALM1, ALM2 [OUT1: Control output OUT2: ALM1 output + ALM2 output (can be checked via communication or by lamp) \(^8\)]
09: PID action + ALM1, ALM2 [OUT1: Control output OUT2: ALM1 output + ALM2 output (can be checked via communication or by lamp) \(^8\)]
10: ALM1 + ALM2 [OUT1: ALM1 output OUT2: ALM2 output] \(^9\)
11: ALM1 + ALM2 [OUT1: ALM1 output OUT2: ALM2 output] \(^9\)

(12) Version symbol
No code: For Japanese domestic market / Y: For International market

\(^1\) No self-tuning function is provided in the W or A control action type.
\(^2\) With hold action
\(^3\) LBA can be selected for only ALM1.
\(^4\) Energized
\(^5\) De-energized

2. MOUNTING

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.

(2) Use this instrument within the following environmental conditions:

(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.

Mount this instrument in the panel considering the following conditions:
Proper operation of the instrument.
Energized
De-energized

Mounting brackets: 2
Instruction Manual (IMR01D01-E8): 1
Mounting screws: 2

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.

Proper maintenance is required to keep this instrument in proper operating condition. 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 may 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.
• If the ambient temperature rises above 50 °C, cool this instrument with a forced air, fan, 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 a 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

For mounting of the SA200/201, panel thickness must be between 1 to 10 mm. When mounting multiple SA200/201 close together, the panel strength should be checked to ensure proper support.

Installation Conditions:
The display can not be seen from the outside of the visual field range. The visual field range of SA200/201 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 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)
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 as described in 3. and 4.

3. WIRING

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.
• 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 pairs to achieve the most effective noise reduction.
  – Always install the noise filter on a grounded panel. Minimize the wiring distance between the noise filter output and the instrument power supply terminals, to achieve the most effective noise reduction.
  – Do not connect fuses or switches to the noise filter output wiring as this will reduce the effectiveness of the noise filter.
• Allow approximately 4 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 (50 Ω ± 0.25 %, 0.25 W or more, 100 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, closed 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 end-use equipment. The power supply must be in compliance with a limited-energy circuits (maximum available current of 8 A).
• The input and output terminals for the voltage pulse output are not isolated. Always use an isolating type SSR. 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 mm²
  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. (Fig. 6)

3.3 Terminal Configuration

3.3.1 Input terminals

Thermocouple (TC)
Voltage input
Communication
Voltage pulse
Relay contact

3.3.2 Power supply terminals

Relay contact
Voltage pulse

3.3.3 Optional terminals

3.3.4 Relay contact
Voltage pulse

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4. PARTS DESCRIPTION

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

5. SETTING

![Diagram of a control panel with various settings and parameters](image)

- **Power ON**
  - Input Type/Input Range Display: Automatically in 4 seconds
  - PV/SV Display Mode
  - SV Setting Mode
  - [Without STEP function]
  - Set value (SV1) setting: (With STEP function)
    - Set value (SV2) setting: (STEP function)

- **Communication Setting Mode**
  - SET key (2 seconds)

![Diagram of a display screen showing various parameters and settings](image)

- **Parameter Setting Mode**
  - Control loop break alarm (LBA)
    - Setting range: 0 to 1000 minutes, Factory setting: 8.0
  - LBA deadband (LBD)
    - Setting range: 0 to span, Factory setting: Factory setting: 0.0
  - Alarm 1 (ALM1)
    - Setting range: 0 to span, Factory setting: Factory setting: 90.0
  - Alarm 2 (ALM2)
    - Setting range: 0 to span, Factory setting: Factory setting: 99.0
  - Autotuning (AT)
    - Setting range: Factory setting: 1.0 to 1000 seconds
  - Self-tuning (ST)
    - Setting range: Factory setting: 0 to span, Factory setting: 0.0
  - Heat-side proportional band (PB)
    - Setting range: 0 to span, Factory setting: Factory setting: 80.0
  - Integral time (I)
    - Setting range: 0 to 3600 seconds (0.0: OFF action), Factory setting: 240
  - Derivative time (D)
    - Setting range: 0 to span, Factory setting: Factory setting: 60

- **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.

- **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 input contact is opened or closed.
  - The controller can be switched to RUN 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 setting: Voltage/Current inputs: 0.0 to 10.0

- **Anti-reset windup (ARW)**
  - Setting range: Factory setting: 1 to 100, Factory setting: 100
  - Heat-side proportional band (PB)
  - Setting range: Factory setting: 1 to 1000, Factory setting: 100
  - Cool-side proportional band (PB)
  - Setting range: Factory setting: 1 to 100, Factory setting: 100
  - Digital filter
  - Setting range: Factory setting: 0 to 100 (0: Digital filter OFF), Factory setting: 0

- **Set data lock (LOCK)**
  - Setting range: Factory setting: 0 (Unlock), Factory setting: 1 (Lock)
  - Refer to Lock Level Table

- **Set value**
  - Parameter which can be changed:
    - 0001: All parameters (factory setting)
    - 0002: SV alarms (ALM1, ALM2)
    - 0003: All parameters except for Alarms (ALM1, ALM2)
    - 0004: All parameters except for SV
    - 0005: Alarms (ALM1, ALM2)
    - 0006: All parameters except for SV and Alarms (ALM1, ALM2)
    - 0007: No parameters (All locked)

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**Specifications**

**Input**

- **Input type**
  - Input impedance: Approx. 1 MΩ
  - RTD: Pt100, JPt100
  - Voltage/Current: 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 time: 0.5 seconds
  - Input range: Refer to Input range table

**Control method**

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

**Outputs (OUT1, OUT2)**

- Relay contact output: 240 V AC, 2 A (Resistive load), 1a contact
- Voltage pulse output: 0/12 V DC (Load resistance 600 Ω or more)
- Contact input (optional): Dry contact input: At open 500 kΩ or more

**Performance**

- **Display accuracy**
  - (at the ambient temperature 23 ± 2°C)
  - Thermocouple (TC): ±(0.3 % of display value ±1 digit) or ±(2°C ± 4 °F)
  - R, S and B input: 0 to 399 °C [0 to 751 °F] (Accuracy is not guaranteed.)
  - T and U input: -199.9 to -100.0 °C [-199.9 to -184.0 °F] (Accuracy is not guaranteed.)

**Output ranges**

- Voltage/Current inputs: 3.0 to 5.0, Factory set value: TC/RTD inputs: 30 (30.0)
- Deviation alarm:
  - Heat-side proportional band (PB): Same as input range.
  - Cool-side proportional band (PB): Same as input range.
  - Digital filter span to +span (Within -9999 to +9999 digits)
  - Set data lock (LOCK) span to +span (Within -9999 to +9999 digits)

**Power**

- Power supply voltage: 85 to 264 V AC [Including power supply voltage variation].
  - (Rating: 100 to 240 V AC), 50/60 Hz
  - 21.6 to 26.4 V AC [Including power supply voltage variation].
  - (Rating: 24 V AC), 50/60 Hz
  - 21.6 to 26.4 V DC [Including power supply voltage variation].
  - (Rating: 24 V DC)
- Power consumption:
  - 4 VA max. (at 24 V AC)
  - 7 V max. (at 240 V AC)
  - 4 VA max. (at 24 V DC)
  - 100 mA max. (at 24 V DC)

**Weight**

- Approx. 110 g
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.

- The new value will not be stored without pressing SET key after the new value is displayed on the display.
- After a new value has been displayed by using the UP and DOWN keys, the SET key must be pressed within 1 minute, or the new value is not stored and the display will return to the PV/SV display mode.

1. Change the Set value (SV)

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

1. Select the SV setting mode

When the set data is locked, the digits on the SV display are brightly lit and the set value cannot be changed.

- Change the Set value (SV)

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

1. Select the SV setting mode

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

Press the UP key to change the number to 2.

4. Store the set value

Press the SET key to store the new set value. The display returns to the PV/SV display mode.

Change parameters other than the Set value (SV)
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.

6. OPERATION

6.1 Operating Precautions

(1) All mounting and wiring must be completed before the power is turned on.
(2) The settings for the SV and all parameters should be appropriate for the controlled object.
(3) A power supply switch is not furnished with this instrument. It is ready to operate as soon as the power is turned on. [Factory set value: RUN (operation start)]

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.

A power failure of 20 ms or less will not affect the control action. When a power failure of more than 20 ms occurs, the instrument assumes that the power has been turned off. When power returns, the controller will retain the conditions that existed prior to shut down.

The alarm hold action is activated when the power is turned on or when the SV is changed, including an SV change made with the STEP function.

6.2 RUN/STOP

RUN/STOP can be selected by contact input (optional) other than the key operation. In addition, at STOP the key operation and contact state are displayed on the PV display. Relationships between key operation, RUN/STOP and the characters to indicate the STOP state are shown in the following.

RUN/STOP with Key Operation

RUN STOP

RUN STOP

RUN (Contact closed) STOP (Contact open)

RUN (Contact closed) STOP (Contact open)

1. Contact input: Terminal No.10, 12
2. Characters in parentheses are those shown on the PV display:
   - : Only contact input is in the STOP mode
   - : Both key operation and contact input are in the STOP mode

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

RUN/STOP transfer by key operation

1. Press and hold the <R/S key for 1 second in PV/SV display mode.
2. The mode is changed to STOP from RUN. The PV display shows the characters of showing the relevant STOP state.

Also when changing from STOP to RUN, press and hold the <R/S key for 1 second while in the PV/SV display mode.

RUN/STOP transfer by contact input

RUN/STOP can be selected according to the open or closed state of the terminal numbers 10 to 12.

6.3 Set Data Lock (LCK)
The set data lock restricts parameter setting changes by key operation. This function prevents the operator from making errors during operation.

Set value Parameters 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
- 0111 SV, Alarms (ALM1, ALM2)
- 0110 All parameters except for SV and Alarms (ALM1, ALM2)
- 0111 No parameters (All locked)

Set Data Lock can be changed in both RUN and STOP mode.

Parameters protected by Set Data Lock function are still displayed for monitoring.

6.4 Autotuning (AT)

Autotuning (AT) automatically measures, computes 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.

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.

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.

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.

6.5 Self-tuning (ST)
The ST function is used to automatically calculate and set adaptive PID constants anytime the power is turned on, the SV is changed or the controller detects unstable control conditions.

The ST function should be turned off when the controlled system is affected by rippling that occurs due to periodic external disturbances.

The power to the controlled system must be turned on before the power to the instrument is turned on or SV is changed. This is required when the ST function is on.

To activate the ST function, the following parameters must not be set to zero: P06, I06, D06, ARW=0.

When the Heat/Cool PID action is selected, the ST function cannot be activated.

When the AT function is activated, the ST function cannot be activated.

When the ST function is activated, the PID and the ARW settings can be monitored, but not changed.
7. FUNCTIONS

7.1 PV Bias
The value set in the PV bias is added to the input value (actual measured value) to correct the input value. The PV bias is used to correct the individual variations in the sensors or when there is difference between the Measured values (PV) of other instruments.

7.2 Digital Filter
This is a software filter which reduces input value variations caused by noise. If the time constant of this filter is set appropriately to match the characteristics of the controlled object and the noise level, the effects of input noise can be suppressed. However, if the time constant is too small, the filter may not be effective, while if the time constant is too large, then the input response may actually deteriorate.

7.3 STEP (Optional)
The instrument has two Set values (SV). This STEP function selects these two Set values (SV) by contact input (Terminal No.10, 11).

Contact open: Set value (SV1)
Contact closed: STEP set value (SV2)

7.4 Alarms
Both of the Alarm 1 and Alarm 2 outputs of this instrument are turned on when burnout occurs regardless of any of the following actions taken (high alarm, low alarm, etc.). In addition, when used for any purposes other than these alarms (event, etc.), set ‘0000’ to the process abnormality action selection (AEo1, AEo2) of ‘8.7 Function Block 41 (F41), 42 (F42).’

Each alarm action is shown below.

Deviation high alarm
(Alarm set value is greater than 0)

Deviation low alarm
(Alarm set value is less than 0)

Process high alarm

SV high alarm

Low High

OFF ON

Low High

ON OFF

OFF OFF

ON OFF

SV low alarm

7.5 Control Loop Break Alarm (LBA)
The LBA function is used to detect a load (heater) break or a failure in the external actuator (power controller, magnet relay, etc.), or a failure in the control loop caused by an input (sensor) break.

The LBA function is activated when control output reaches 0 % or 100 %, LBA monitors variation of the Measured value (PV) for the length of LBA time. When the LBA time has elapsed and the PV is still within the alarm limit, the LBA function is activated.

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

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

LBD differential gap

Alarm area

Non-alarm area

Alarm area

Set value (SV) LBD set value

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

7.8 INITIAL 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.

8.1 Go to Engineering Mode
1. Turn on the power to this controller. The instrument goes to the PV/SV display after confirming input type symbol and input range.
2. Press and hold the SET key for 2 seconds to go to the Parameter setting mode from the PV/SV display.
3. Press the SET key until ‘LC’ (Set Data Lock display) will be displayed.
4. The blinking digit indicates which digit can be set. Press -R/S key to move to the thousands digit.
5. Press the UP key to change 0 to 1.
6. Press the SET key to store the new set value. The display goes to the next parameter, and the Engineering mode is unlocked.
7. Press and hold the SET key for 2 seconds to change to the PV/SV display mode.
8. Press and hold the -R/S key for 1 second to change the Operation mode from RUN mode to STOP mode.

Before the setting is changed in engineering mode, it is necessary to set the operation mode to the STOP mode.

The STOP message to be displayed varies depending on the specification.

9. Press and hold the -R/S key for 2 seconds while pressing the SET key to go to the Engineering Mode. Thus, the symbol ‘F10’ for function block is displayed first.

8.2 Engineering Menu

Display flowcharts in engineering mode are shown in the following.

Do not change the section parameters and any parameter in the Engineering mode which is not described in the Engineering menu below. It may result in malfunction or failure of the instrument.

PV/SV Display Mode
- Press and hold the SET key for 2 seconds
- Parameter Setting Mode
- Set the STOP mode.
- Press the -R/S key while pressing the SET key for 2 seconds

Engineering Mode
8.3 Attention Items in Setting

If any of the following settings are changed, the relevant set value is initialized or is automatically converted.

Before changing the set values, record all of them (SV setting mode, Parameter setting mode and Engineering mode).

After changing the set values, always check all of them (SV setting mode, Parameter setting mode and Engineering mode).

When the input type or engineering unit is changed

The set value is initialized.

When the related set value becomes smaller or 0.

If the setting is made so that the span becomes narrower, there may be problems.

For TC/RTD inputs, Voltage/Current inputs:

The set value is automatically converted.

Example: When SLH is 9999 with two decimal positions, and the decimal position is changed from 2 to 0, SLH will become 9999.9 by discarding the digits below the decimal point.

When the type of alarm is changed

The set value is initialized.

When the related set value is changed. (Refer to below)

If any of the following settings are changed, the relevant set value is initialized or is automatically converted.

Engineering mode

Alarm 1 hold action selection
Alarm 1 differential gap
Alarm 1 process abnormality action
Alarm 2 hold action selection
Alarm 2 differential gap
Alarm 2 process abnormality action
ON/OFF action differential gap
Alarm 1 set value
Alarm 2 set value
Control loop break alarm (LBA)
Heat-side proportional band
Cool-side proportional band
Digital filter
Derivative time
Heat-side proportional band
Cool-side proportional band
Alarm 1 provided
Alarm 1 not provided or LBA
Alarm 2 provided
Alarm 2 not provided or LBA
Alarm 1 set value
Alarm 2 set value
Alarm 1 process abnormality action
Alarm 2 process abnormality action
Alarm 1 differential gap
Alarm 2 differential gap
ON/OFF action differential gap
Alarm 1 set value
Alarm 2 set value

Parameter setting mode

Set value (SV) STEP function not provided
Set value (SV1) STEP function not provided
Set value (SV2) STEP function not provided
Set value (SV3) STEP function not provided
Set value (SV4) STEP function not provided
Set value (SV5) STEP function not provided
Set value (SV6) STEP function not provided
Set value (SV7) STEP function not provided
Set value (SV8) STEP function not provided

When the setting is changed

The setting limiter high (SLH) or Setting limiter low (SLL) is changed as follows, the related set values are changed. (Refer to 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 200 with SLH set to 100, SLH is changed to 200.
If SLL is set to SLL < SLH, it is changed to SLH = SLL.
Example: If SLL is set to 100 with SLL set to 200, SLL is changed to 100.

For 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.

When the position of the decimal point 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.

Engineering mode:

Setting limiter high, Setting limiter low, Alarm 1 differential gap, Alarm 2 differential gap, ON/OFF action differential gap

Parameter setting mode:

Alarm 1 set value, Alarm 2 set value, LBA deadband (LBD), Heat-side proportional band, Overlap/Deadband, PV bias

PV/SV display/SV setting mode:

Set value (SV) [STEP function not provided].
Set value (SV1) [STEP function not provided].

Example: When the position of the decimal point changed from 0 to 1 with SLH set to 800.0.

Change the instrument to the function block symbol display F10.

Press the SET key to change from STOP to RUN by the front key can be made.

If Set value is set to 0002, no selection from RUN to STOP can be made, but selection from STOP to RUN can be made.

In addition, RUN/STOP can be selected via communication or by contact input regardless of the SPCH setting.

Displays in the STOP mode become as follows.

(1) Monitor display configuration selection (dCHG)

Choose Settings

Example: Change the display from TYPE 1 to TYPE 2.

1. Change the instrument to the function block symbol display F10.

2. Press the SET key to change to SPCH (STOP display). Then, press the UP key to enter 1 in the units digit of the Set value (SV) display.

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

(2) Monitor display configuration selection (dCHG)

Displays become as follows.

Example: Change the monitor display configuration selection from PV/SV display to Only PV display.

1. Press the SET key at F10 until dCHG (Monitor display configuration selection) is displayed.

2. Press the UP key to change the number to 0.

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

8.4 Function Block 21 (F21)

(1) Input type selection (InP)

Factory set value varies depending on the input type.

Example: When SLH is 9999 with two decimal positions, and the decimal position is changed from 2 to 0, SLH will become 9999.9 by discarding the digits below the decimal point.

When the type of alarm is changed

The set value is initialized.

When the related set value is changed.

The set value is initialized or is automatically converted.

Example: When SLH is 9999 with two decimal positions, and the decimal position is changed from 2 to 0, SLH will become 9999.9 by discarding the digits below the decimal point.

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 1372.9.
8.6 Function Block 30 (F30)

**Output logic operation selection (LoGC)**

Match the setting with the instrument specification. Otherwise malfunction may result.

- No heat-side or cool-side proportional cycle (T or t) corresponding to a Parameter setting mode made may not be displayed depending on the selected output allocation code.
  - Not displayed when no control output is selected.
  - Not displayed when control output is a current output.

Factory set value varies depending on the instrument specification.

### Set value | OUT1 | OUT2 | Remarks
--- | --- | --- | ---
001 | Control output | OR output of Alarm 1 and Alarm 2 (Energized) | PID action | No alarm function |
002 | Heat-side control output | OR output of Alarm 1 and Alarm 2 (Energized) | PID action + Alarm 1 + Alarm 2 |
003 | Control output | AND output of Alarm 1 and Alarm 2 (Energized) | PID action + Alarm 1 + Alarm 2 |
004 | Control output | OR output of Alarm 1 and Alarm 2 (De-energized) | PID action + Alarm 1 + Alarm 2 |
005 | Control output | OR output of Alarm 1 and Alarm 2 (De-energized) | PID action + Alarm 1 + Alarm 2 |
006 | Control output | AND output of Alarm 1 and Alarm 2 (De-energized) | PID action + Alarm 1 + Alarm 2 |
007 | Control output | No output | PID action + Alarm 1 + Alarm 2 |
008 | Control output | Alarm 1 output (Energized) | PID action + Alarm 1 |
009 | Alarm output | Alarm 2 output (Energized) | PID action + Alarm 1 |
010 | Alarm output | Alarm 2 output (De-energized) | PID action + Alarm 1 |
011 | Alarm output | Alarm 2 output (De-energized) | PID action + Alarm 1 |

- Standard output when no output code is specified.

### 8.7 Function Block 41 (F41), 42 (F42)

1. **Alarm 1 type selection (AS1)**
2. **Alarm 2 type selection (AS2)**

Refer to 8.3 Attention Items in Setting (P. 6).

Factory set value varies depending on the instrument specification.

#### Set value | Description | Set value | Description
--- | --- | --- | ---
000 | Alarm not provided | 0005 | Deviation high alarm
001 | SV high alarm | 0006 | Deviation low alarm
002 | SV low alarm | 0007 | Deviation high/low alarm
003 | Process high alarm | 0008 | Band alarm
004 | Process low alarm | 0009 | Control loop break alarm (LABA)

- Available only with Alarm 1 type

### Change Settings

Example: Change the Alarm 1 type from "Deviation high alarm (0005)" to "Deviation low alarm (0006)"

1. Press the SET key at F41 until AS1 is displayed.
2. Press the UP key to change the number to 6.
3. Press the SET key to store the new set value. The display goes to the next parameter.

#### (2) Alarm 1 hold action selection (AHo1)

Alarm 2 hold action selection (AHo2)

The alarm hold action function cannot be added to the SV alarm.

Refer to 8.3 Attention Items in Setting (P. 6).

Factory set value varies depending on the instrument specification.

#### Set value | Description | Set value | Description
--- | --- | --- | ---
000 | Without alarm hold action | 0001 | Effective when the power is turned on, or operation is changed from STOP to RUN.
0002 | Effective when the power is turned on, or operation is changed from STOP to RUN or the SV is changed.

### Change Settings

Example: Change the Alarm 1 hold action selection from "Without alarm hold action (0000)" to "Effective when the power is turned on, or operation is changed from STOP to RUN (0001)"

1. Press the SET key at F41 until AHo1 is displayed.
2. Press the UP key to change the number to 0.
3. Press the SET key to store the new set value. The display goes to the next parameter.

#### (3) Alarm 1 differential gap (AH1)

Alarm 2 differential gap (AH2)

The alarm hold action function cannot be added to the SV alarm.

Refer to 8.3 Attention Items in Setting (P. 6).

Factory set value varies depending on the instrument specification.

#### Set value | Description | Set value | Description
--- | --- | --- | ---
000 | Without alarm hold action | 0000 | Without alarm hold action
0001 | Effective when the power is turned on, or operation is changed from STOP to RUN.
0002 | Effective when the power is turned on, or operation is changed from STOP to RUN or the SV is changed.

### Change Settings

Example: Change the Alarm 1 differential gap from 2 °C to 4 °C

1. Press the SET key at F41 until AH1 is displayed.
2. Press the UP key to change the number to 4.
3. Press the SET key to store the new set value. The display goes to the next parameter.
(4) Alarm 1 process abnormality action selection (AEo1)  
Alarm 2 process abnormality action selection (AEo2)  
It is judged that the input is abnormal when over-scale or underscale occurs.

<table>
<thead>
<tr>
<th>Set value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>Normal processing: The alarm action set by AS1 (Alarm 1 type selection) or AS2 (Alarm 2 type selection) is taken even if the input is abnormal.</td>
</tr>
<tr>
<td>0001</td>
<td>Forcibly turned on when abnormal: The alarm is forcibly turned on regardless of the alarm type set by AS1 or AS2 when the input is abnormal. However, for a voltage input of 0 to 5 V DC or 0 to 10 V DC, or a current input of 0 to 20 mA DC, as over-scale or underscale does not occur when the input breaks, no alarm is turned on.</td>
</tr>
</tbody>
</table>

- Change Settings  
Example: Change the Alarm 1 process abnormality action selection from “Normal processing (0000)” to “Forcibly turned on when abnormal (0001)”.
1. Press the SET key at F41 until oH is displayed.  
2. Press the UP key to change the number to 1.  
3. Press the SET key at F41 until AEo1 is displayed.  
4. Press and hold the SET key for 2 seconds while pressing the R/S key (for type T and U).

8.8 Function Block 51 (F51)  
- Do not change oS1. Otherwise, it will cause malfunction.
- ON/OFF Action differential gap (O/H)  
Setting range: TC/RDT inputs, Voltage/Current inputs: 0 (0.0) to span  
Factory set value: TC/RDT inputs: 2 °C (°F) or 2.0 °C (°F)  
Voltage/Current inputs: 0.2 % of span

- Change Settings  
Example: Change the ON/OFF action differential gap from 2 °C to 4 °C.
1. Press the SET key at F51 until oH is displayed.  
2. Press the UP key to change the number to 4.  
3. Press the SET key to store the new set value. The display goes to the function block symbol (F41).

8.9 Exit Engineering Mode  
1. Transfer to function block symbol display (FDD) after each parameter is set.  
2. Press and hold the -R/S key for 2 seconds while pressing the SET key from any display in the Engineering Mode.  
3. Press and hold the SET key for 2 seconds in the PV/SV display.  
4. Press the SET key until LCK (Set Data Lock display) will be displayed.  
5. The blinking digit indicates which digit can be set. Press the -R/S key to move to the thousands digit.  
6. Press the DOWN key to change 1 to 0.  
7. Press the SET key to store the new set value. The display goes to the next parameter, and the Engineering Mode is locked.

9. ERROR DISPLAYS

- Self-diagnostic error  

<table>
<thead>
<tr>
<th>Error No.</th>
<th>Description</th>
<th>Operation at error</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Adjust. data error</td>
<td>Error display (Err)</td>
<td>System is reset</td>
</tr>
<tr>
<td>A2</td>
<td>EEPROM error</td>
<td>Control output: All input is OFF</td>
<td>Alarming output: All input is OFF</td>
</tr>
<tr>
<td>A3</td>
<td>A/D conversion error</td>
<td>Control output: All input is OFF</td>
<td>Alarming output: All input is OFF</td>
</tr>
<tr>
<td>A4</td>
<td>RAM check error</td>
<td>Control output: All input is OFF</td>
<td>Alarming output: All input is OFF</td>
</tr>
</tbody>
</table>

Example: When the adjustment data error and A/D conversion error occurs simultaneously  

\[ \text{Err} ^ \text{Si} \]

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  

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV (flashing)</td>
<td>Measured value (PV) is outside of input range.</td>
<td>To prevent electric shock, always turn off the power before replacing the sensor.</td>
</tr>
<tr>
<td>[flashing]</td>
<td>Over-scale: Measured value (PV) is above the high input display range limit.</td>
<td>Check Input type, Input range and connecting state of sensor. Confirm that the sensor or wire is not broken.</td>
</tr>
<tr>
<td>[flashing]</td>
<td>Underscale: Measured value (PV) is below the low input display range limit.</td>
<td></td>
</tr>
</tbody>
</table>

10. INPUT RANGE TABLE

<table>
<thead>
<tr>
<th>TC/RDT</th>
<th>Type</th>
<th>Range</th>
<th>Code</th>
<th>Range</th>
<th>Code</th>
<th>Range</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 200 °C</td>
<td>0.0 to 200 °C</td>
<td>01</td>
<td>0 to 400 °C</td>
<td>01</td>
<td>0 to 600 °C</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>0 to 300 °C</td>
<td>0.0 to 300 °C</td>
<td>01</td>
<td>0 to 400 °C</td>
<td>01</td>
<td>0 to 600 °C</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>0 to 450 °C</td>
<td>0.0 to 450 °C</td>
<td>01</td>
<td>0 to 600 °C</td>
<td>01</td>
<td>0 to 1000 °C</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>0 to 199.9 °F</td>
<td>0.0 to 199.9 °F</td>
<td>01</td>
<td>0 to 200 °C</td>
<td>01</td>
<td>0 to 300 °C</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>0 to 350.0 °F</td>
<td>0.0 to 350.0 °F</td>
<td>01</td>
<td>0 to 600 °C</td>
<td>01</td>
<td>0 to 1000 °C</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>0 to 3200 °F</td>
<td>0.0 to 3200 °F</td>
<td>01</td>
<td>0 to 600 °C</td>
<td>01</td>
<td>0 to 1000 °C</td>
<td>01</td>
<td></td>
</tr>
</tbody>
</table>

11. REMOVING THE INTERNAL ASSEMBLY

Normally, 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.

- To prevent electric shock or instrument failure, only qualified personnel should be allowed to pull out the internal assembly.  
- To prevent injury or instrument failure, do not touch the internal printed wiring board.