Thank you very much purchasing our “REX-P48, P96 series”. This manual describes how to use “REX-P48, P96 series” instruments. Please read this manual carefully before using the instruments. Also keep this manual with much care for future reference.

This manual is prepared for all personnel who use “REX-P48, P96 series”. This manual is also written especially for readers who have a fundamental knowledge of electrical engineering, control engineering or communication.

- The contents of this manual may subject to change without prior notice.
- Examples of figures, diagrams and numeric values used in this manual are for a better understanding of the text, but not for assuring the resultant operation.
- The contents of this manual are copy righted; all rights are reserved by RKC INSTRUMENT INC. It is prohibited to reprint or reproduce the whole or a part of this manual without the prior of RKC INSTRUMENT INC.
- “REX-P48, P96 series” and this manual are manufactured and prepared under strict quality control before delivery. However, if any problems arise, please contact us directly or your nearest our sales agent.
- RKC assumes no responsibility for any of the following damages which the user or third party may suffer.
  ① Damage incurred as a result of using this product
  ② Damage caused by product failure which cannot be predicted by RKC
  ③ Other indirect damages
★For safe operation of “REX-P48, P96 series”★

1. “REX-P48, P96 series” must be used under the following conditions.
   “REX-P48, P96 series” is a component type and is used after mounting on an instrument panel. It is thus manufactured as a component destined for the final product, so its high-voltage blocks such as the power terminals are uncovered. Therefore, after it is installed on the final product, the final product supplier must take the necessary measures for the user to prevent touching directly the high-voltage blocks.

2. For correct and safe operation of “REX-P48, P96 series”, always observe the safety precautions described in this manual when performing operations, maintenance and repair work. RKC neither assures responsibility nor provides warranty for problems or accidents occurring if these precautions are not observed.

• For safe operation of “REX-P48, P96 series”, the following “Signal Words” and “Symbol Marks” are used in this manual.

〈Signal Words〉

- **WARNING**: Where there are possible dangers such as electric shock, fire (burns), etc. which could cause loss of life or injury, precautions to avoid such dangers are described.

- **CAUTION**: These describe precautions to be taken if unit damage may result if operating procedures are not strictly followed.

- **NOTE**: Extra notes or precautions are added to operating procedures and explanations.

〈Symbol Marks〉

- ⚠️: This mark is used when great care is needed especially for safety.

- ★: This mark is used to add extra notes, precautions or supplementary explanations to table and figures.
• Wiring precautions
  • If failure or error of this instrument could result in a critical accident of the system, install an external protection circuit to prevent such an accident.
  • In order to prevent instrument damage or failure, protect the power line and the input/output lines from high currents by using fuses with appropriate ratings.

• Power supply
  • In order to prevent instrument damage or failure, supply power of the specified rating.
  • In order to prevent electric shock or instrument failure, do not turn on the power supply until all of the wiring is completed.

• Never use the instrument near inflammable gases.
  • In order to prevent fire, explosion or instrument damage, never use this instrument at a location where inflammable or explosive gases or exist.

• Never touch the inside of the instrument.
  • In order to prevent electric shock or burns, never touch the inside of the instrument. Only RKC service engineers can touch the inside of the instrument to check the circuit or to replace parts. High voltage and high temperature sections inside the instrument are extremely dangerous.

• Never modify the instrument.
  • In order to prevent accident or instrument failure, never modify the instrument.

• Maintenance
  • In order to prevent electric shock, burns or instrument failure, only RKC service engineers may replace parts.
  • In order to use this instrument continuously and safely, conduct periodic maintenance. Some parts used in this instrument have a limited service life and may deteriorate over time.
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1. PREPARATION

1.1 Handling procedure
Conduct necessary work according to the following procedures.

Person who performs the work from unpacking, mounting and wiring.
Please read the operation manual from "Checking the actual product".

Person who operates the instrument.
Please read the operation manual from "Name of parts".

Person who has already mounted the instrument on the equipment and also finished wiring.

Check of product delivered

Check of model codes

Mounting

Wiring

Name of parts

To ①

See on page 2
See on page 3
See on page 5
See on page 9
See on page 15

※For the convenience of explanation, pictures and diagrams for the REX-P98 are used in this operation manual, but there is no difference in operation.
Person who conducts program settings. Please read the operation manual from "Program basic setting".

* Prior to factory shipment, no program is set. Therefore, when operating the instrument for the first time, always set the program.

Person who conducts each parameter settings. Please read the operation manual from "Engineer setting".

**CAUTIONS**

Connect the input signal wiring, and turn ON the power. If the input signal wiring opens, the controller judges the input disconnected to cause the upscale or downscale of measured-value (PV) display.

- Upscale ........ For TC or RTD input
- Downscale ..... For TC (To be specified when ordering), voltage or current input

### 1.2 Check of product delivered

Check that the following items are delivered without damage.

- Mainframe (1 unit)
- Mounting bracket (2 pieces)
- REX-P48/P96 series OPERATION MANUAl (1 copy)
1.3 Check of model codes

Check the model code from the following list to determine if the product delivered is as desired.

- Model code
  REX-P48/P96 model code

  **P48**
  **P96**

  \[1\ 2\ 3\ 4\ 5\ 6\ 7\ 8\ 9\ 10\]

  ① Control action
  F : PID action (reverse)
  D : PID action (direct)
  L : Level PID action (reverse)
  M : Level PID action (direct)
  W : Heating/cooling PID action
  V : Level Heating/cooling PID action

  ② Input type
  See input range table “Model code” on page 4.

  ③ Input range
  See input range table “Model code” on page 4.

  ④ First control output [OUT1]
  M : Relay contact
  V : Voltage pulse
  7 : Current 0 to 20mA DC
  8 : Current 4 to 20mA DC

  ⑤ Second control output [OUT2]
  No symbol
  When control action is F, D, L, M
  M : Relay contact
  V : Voltage pulse
  7 : Current 0 to 20mA DC
  8 : Current 4 to 20mA DC

  ⑥ First alarm,
  ⑦ Second alarm
  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
  Q : Deviation high alarm with re-hold action
  R : Deviation low alarm with re-hold action
  T : Deviation high/low alarm with re-hold action
  V : Set-value high alarm
  W : Set-value low alarm
### Input range table

<table>
<thead>
<tr>
<th>Input type</th>
<th>Model code</th>
<th>Ranges (°C)</th>
<th>Model code</th>
<th>Ranges (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>②</td>
<td>③</td>
<td>②</td>
<td>③</td>
</tr>
<tr>
<td>K</td>
<td>K 22</td>
<td>-199.9 to 999.9°C</td>
<td>K B2</td>
<td>-199.9 to 999.9°F</td>
</tr>
<tr>
<td></td>
<td>K 16</td>
<td>-200 to 1372°C</td>
<td>K B3</td>
<td>-330 to 2500°F</td>
</tr>
<tr>
<td>J</td>
<td>J 14</td>
<td>-199.9 to 999.9°C</td>
<td>J A9</td>
<td>-199.9 to 999.9°F</td>
</tr>
<tr>
<td></td>
<td>J 15</td>
<td>-200 to 1200°C</td>
<td>J B1</td>
<td>-330 to 2182°F</td>
</tr>
<tr>
<td>T</td>
<td>T 01</td>
<td>-199.9 to 400.0°C</td>
<td>T A1</td>
<td>-199.9 to 752.0°F</td>
</tr>
<tr>
<td>R</td>
<td>R 02</td>
<td>0 to 1769°C</td>
<td>R A2</td>
<td>0 to 3216°F</td>
</tr>
<tr>
<td>S</td>
<td>S 02</td>
<td>0 to 1769°C</td>
<td>S A2</td>
<td>0 to 3216°F</td>
</tr>
<tr>
<td>B</td>
<td>B 02</td>
<td>0 to 1820°C</td>
<td>B A2</td>
<td>0 to 3308°F</td>
</tr>
<tr>
<td>E</td>
<td>E 06</td>
<td>-200 to 1000°C</td>
<td>E A5</td>
<td>-330 to 1832°F</td>
</tr>
<tr>
<td>N</td>
<td>N 02</td>
<td>0 to 1300°C</td>
<td>N A2</td>
<td>0 to 2372°F</td>
</tr>
<tr>
<td>PL II</td>
<td>A 02</td>
<td>0 to 1390°C</td>
<td>A A2</td>
<td>0 to 2534°F</td>
</tr>
<tr>
<td>W5Re/W26Re</td>
<td>W 02</td>
<td>0 to 2320°C</td>
<td>W A4</td>
<td>0 to 4208°F</td>
</tr>
<tr>
<td>U</td>
<td>U 08</td>
<td>0 to 600°C</td>
<td>U A4</td>
<td>0 to 1100°F</td>
</tr>
<tr>
<td>L</td>
<td>L 05</td>
<td>0 to 900°C</td>
<td>L A2</td>
<td>0 to 1600°F</td>
</tr>
<tr>
<td>JP100</td>
<td>P 20</td>
<td>-199.9 to 510.0°C</td>
<td>P B6</td>
<td>-199.9 to 950.0°F</td>
</tr>
<tr>
<td>Pt100</td>
<td>D 20</td>
<td>-199.9 to 660.0°C</td>
<td>D A1</td>
<td>-199.9 to 999.9°F</td>
</tr>
</tbody>
</table>

Input type B: Accuracy in the range of 0 to 400°C (0 to 752°F) → Not guaranteed.
Input type N, PL II, W5Re/W26Re: Accuracy in the range of 0 to 32°F → Not guaranteed.

### PRECAUTIONS

For this instrument, the initialized settings such as the input and alarm types, etc. can be changed. Therefore, they might be changed before your receipt of this instrument.
2. MOUNTING

⚠️ WARNING

In order to prevent electric shock or instrument failure, do not turn on the power supply until all of the wiring is completed.

2.1 Cautions for mounting 🔄

Avoid the following when selecting the mounting location.

- Ambient temperature of less than 5°C or more than 40°C.
- Ambient humidity of less than 20% or more than 80% RH.
- 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.
- Should be used indoors where the system is not exposed to direct sunlight.
- Heat to be accumulated radiation heat.
2.2 Dimensions

- REX-P48

Unit: mm

Panel cutout
2.3 Mounting procedures

1. Mount the panel cutout corresponding to the number of units on the panel by referring to panel cutout dimensions.
2. Insert the instrument into the panel from the front side.
3. Engage each mounting bracket with the bracket insertion slots (Fig. 1).
4. Then tighten the mounting bracket setscrew from the rear with a Phillips screwdriver (Fig. 2). Do not overtighten the bracket setscrew.
5. Install a mounting bracket also at the bottom of the case in the same way as 3 and 4 above.

Fig. 1

Fig. 2
3. WIRING

⚠️ WARNING

- In order to prevent electric shock or instrument failure, do not turn on the power supply until all of the wiring is completed.
- If failure or error of this instrument could result in a critical accident of the system, install an external protection circuit to prevent such an accident.
- In order to prevent instrument damage or failure, protect the power line and the input/output lines from high currents by using fuses with appropriate ratings.

3.1 Cautions for wiring ⚠️

(1) For thermocouple input, use the specified compensation wire.

(2) For RTD input, use leads with low resistance and having no resistance differences between the 3 leads.

(3) Conduct input signal wiring away from instrument power, electric equipment power and load lines as much as possible to avoid noise induction.
(4) Conduct instrument power wiring so as not to be influenced by noise from the electric equipment power. If it is assumed that a noise generation source is located near the controller and the controller is influenced by noise, use a noise filter.

1. To obtain a satisfactory noise filter effect, select the most suitable type after due consideration of instrument power supply voltage and filter frequency characteristics.
2. For instrument power wiring, if it is assumed that noise exerts a bad influence upon the controller, shorten the distance between twisted power supply wire pitches. (The shorter the distance between the pitches, the more effective for noise reduction.)
3. Install the noise filter on the panel which is always grounded and minimize the wiring distance between the noise filter output side and the instrument power terminals. Otherwise, the longer the distance wiring, the less effective for noise.
4. Do not install fuses and/or switches on the filter output signal since this may lessen filter effect.

(5) For wiring, use electric wires conforming to the domestic standard of each country.

(6) About 2 sec. are required as the preparation time of contact output during power-ON. Use a delay relay when the output line, is used for an external interlock circuit.
3.2 Rear terminals

**REX-P96, P48**

Conduct wiring by referring to the following diagrams.

* Option

- First alarm
- Second alarm
- Time signal or end output

- ALM1
- ALM2
- TS or END

- Voltage pulse, current output
- Relay contact output

- Cooling-side output (OUT2)
- Control output (OUT1)
**CAUTIONS**

1. Terminals which are not used according to the controller type are all removed.
2. Do not excessively tighten the terminal screws.
   - Recommended tighten torque: 0.4N\*m (4kgf\*cm)
   - Maximum allowance tighten torque: 1.0N\*m (10kgf\*cm)
3. Use the lug with 6.2mm wider or less.
3.3 Wiring example

Heating type: REX-P48L □ □ - M * □ □ - Y 1 □
4. NAME OF PARTS

■ REX-P48

■ REX-P96
<table>
<thead>
<tr>
<th>Name</th>
<th>Details</th>
</tr>
</thead>
</table>
| ① Measured-value (PV) display unit [Green]         | • Displays measured-value (PV).  
• Displays various characters depending on the instrument status.                              |
| ② Set-value (SV) display unit [Orange]             | • Displays set-value (SV).  
• Displays each parameter set-value.  
• Displays various characters depending on the instrument status.                               |
| ③ Segment progress display lamp [Orange]           | • The ascending LED lights while the set value is increasing, the descending LED lights while the set value is decreasing, and the horizontal LED lights during soaking.  
• The alarm setting (option) alarm type is set by the combination of LEDs.  
For details, see Page 62.                                                                 |
| ④ Segment-in-progress display lamp [Orange]        | • The segment No. now under execution or programming lights.                                                                             |
| ⑤ Pattern display lamp [Green]                    | • Displays the execution or setting pattern.                                                                                             |
| ⑥ Run display lamp [Green]                         | • Lights during operation.                                                                                                               |
| ⑦ Control output lamp [Red]                        | • Lights when control output is turned ON.  
• Lights on green when cooling output is turned ON.                                                                                      |
<p>| ⑧ Auto-tuning (AT) lamp [Green]                    | • Flashes during auto-tuning execution.                                                                                                   |
| ⑨ Wait lamp [Orange]                               | • Lights during wait action.                                                                                                             |
| ⑩ ALM 1 lamp [Red]                                 | • Lights with the first alarm turned ON.                                                                                                 |
| ⑪ ALM 2 lamp [Red]                                 | • Lights with the second alarm turned ON.                                                                                                 |
| ⑫ Temperature display lamp [Green]                | • When lit, the setting temperature is displayed on the SV display unit.                                                                 |</p>
<table>
<thead>
<tr>
<th>Name</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time display lamp [Green]</td>
<td>• When lit, the segment remaining time is displayed on the SV display unit.</td>
</tr>
<tr>
<td>Reset key</td>
<td>• Press to stop operation (reset).</td>
</tr>
<tr>
<td>Run key</td>
<td>• Press to execute operation (run).</td>
</tr>
<tr>
<td>Level/time key</td>
<td>• Press to change the display of the setting temperature and remaining time on the SV display unit.</td>
</tr>
<tr>
<td>End key</td>
<td>• Press to set the program, or end registration or erase.</td>
</tr>
<tr>
<td>Pattern1/Pattern 2 change key</td>
<td>• Press to change pattern 1 and pattern 2.</td>
</tr>
<tr>
<td>Set key</td>
<td>• Used to set the program or parameter.</td>
</tr>
<tr>
<td>Set-value increment key/Hold key</td>
<td>• Used to set the program or parameter.</td>
</tr>
<tr>
<td></td>
<td>Pressing this key for more than 1 sec. during operation holds the program.</td>
</tr>
<tr>
<td></td>
<td>Press the key again when releasing the hold.</td>
</tr>
<tr>
<td>Set-value decrement key/Step key</td>
<td>• Press to increase the set value.</td>
</tr>
<tr>
<td></td>
<td>Pressing this key for more than 1 sec. steps the segment.</td>
</tr>
</tbody>
</table>
OPERATION

- Introduction

  - In this manual, diagrams for the REX-P96 are used for explanation, but there is no difference in operation between the REX-P96 and REX-P48.
  
  In addition, for details on the position of each lamp, see "NAME OF PARTS".

- Composition

  **Program setting**
  - Basic section: Basic program setting ................. P19 ~ 22
  - Application section:
    - a) Pattern link setting ...................... P23 ~ 24
    - b) Infinite time setting .................... P25 ~ 26
    - c) Time signal setting ....................... P27 ~ 30
    - d) Pattern end output setting ............ P31 ~ 32

  **Engineer setting**
  - Level 1: Basic parameter setting ...................... P33 ~ 45
  - Level 2: Application parameter setting .............. P46 ~ 50

  **Operation (Run)**
  - Operation during running .......................... P51 ~ 55

  **Initial setting**
  - Change of input, control and alarm type .............. P57 ~ 62
5. OPERATION

5.1 Program basic setting

a) Input type and range display

- **Power ON**

- **Input type display**
  - **Input display character (InP)**
  - **Unit**
    - Table:
      | Display | Character |
      |---------|----------|
      | oc      | °C       |
      | of      | °F       |
  - **Display changes automatically**

- **Input range display**
  - **High input range limit value**
  - **Low input range limit value**

- **Reset status**
  - **Display changes automatically**

<table>
<thead>
<tr>
<th>Input type</th>
<th>Thermocouple</th>
<th>RTD</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>W5Rc</td>
<td>JPt</td>
</tr>
<tr>
<td>J</td>
<td>W5Rc</td>
<td>Pt</td>
</tr>
<tr>
<td>R</td>
<td>W26Rc</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PL II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
b) Operation status transition

**Power ON**

Input type and range display

Display changes automatically

**Reset status**
State where control is suspended. The PV display unit shows the temperature input.

**Operation (Run) status**
Temperature control is performed according to the program setting.

**Program setting status**
State where the program is set.

**Engineer setting status**
Sets alarm set-values and various parameters relating to control such as proportional band (P), integral time (I), derivative time (D), etc.

Key operation
- **RESET**: Press the Reset key
- **RUN**: Press the Run key
- **SET**: Press the Set key

Press set key more than 3 sec.
c) Program basic setting

The procedure for making settings, from selection of the pattern to be set to pattern end registration, is described in the following.

1. Setting pattern selection

Press the \( \text{SET} \) key to select the pattern to be set.

Pattern 1: PTN1
Pattern 2: PTN2

2. Temperature setting

Press the \( \text{SET} \) key to set the desired temperature.

Setting example:

\[ 100 \text{ (100°C)} \]

3. Segment time setting

Press the \( \text{SET} \) key to set the segment time.

Setting example:

\[ 0:100 \text{ (1 hour)} \]

⚠️ Precautions for key operation

• For this instrument, the displayed value changed by the \( \downarrow \text{ or } \uparrow \) key is not registered.

The displayed value thus set and changed is registered for the first time when the \( \text{SET} \) key is pressed.
④ Repetition of temperature and time settings

② Temperature setting and ③ Segment time setting.

⑤ Set the desired final segment time

Press the key to set the segment time.

Setting example:

00:30 (30 min)

⑥ Pattern end registration

Press the key to set pattern end registration.

* Pattern end release

- To release the pattern end, press the key again at the segment which is pattern-end-registered (SV display unit: "End")
5.2 Program application setting

a) Pattern link

If the REX-P96/48 exceeds 8 segments per program, it can be used as 16 segments/pattern by linking two patterns.

1 Confirmation of program end in pattern 1

Press the SET key several times to set the instrument to the final segment end registered state of pattern 1.

2 Pattern link

Press the END key to release the pattern end registered state now registered.

3 Link segment temperature setting

Press the SET key set a link segment temperature.

Setting example: 100 (100°C)

⚠️ Precautions for setting operation

- When the pattern link function is used, the time signal function (option) set for each pattern and the pattern end output (option) setting become invalid, and must be re-set after the link pattern end is registered.
4. **Link pattern setting**

Repeat temperature and segment time setting.

Set to temperature and segment time.

Pattern display:
- PTN 1
- PTN 2

5. **The desired final segment time setting**

Press the \( \rightarrow \) key to set the segment time.

Setting example:
- 00:30
  - (30 min)

6. **Link pattern end registration**

Press the \( \rightarrow \) key to set pattern end registration.
b) **Infinite time setting**

The REX-P96/48 can set an infinite time to the segment to keep the temperature constant. Control continues at the temperature of the segment to which the infinite time is set until the program is reset or is stepped.

*Main point for setting infinite time*

- The segment for which the infinite time can be set is that at which the temperature is kept constant. This means that the time during program setting can be set when the horizontal LED for displaying the segment progress state lights.

*Conditions for suspending infinite time operation*

- Pressing the reset key during infinite time operation resets the program and suspends control. Similarly, control is suspended by resetting the external contact (option).
- Pressing the step key for more than 1 sec. during infinite time operation steps the program to the next segment and suspends infinite time operation. Similarly, control is suspended by stepping the segment by the external contact.

1. **Segment temperature setting**

   Sets the temperature which is to be kept constant. Set to the same segment temperature as that of one segment ahead.
2. Infinite time setting

Keep pressing the \((\text{up})\) key, and if the time exceeds 99 hours and 59 minutes, the infinite time symbol is displayed. "\(\text{F}_1\) \(\leq\)"

3. Pattern setting

Repeat temperature setting and segment time setting, or Pattern end registration

4. Example of infinite time operation (Run) display

Pressing the \((\text{left})\) key during infinite time operation displays "\(\text{F}_1\) \(\leq\)". Pressing the \((\text{level})\) key again returns the above display to the set value.

⚠️ Precautions for setting infinite time

- Infinite time can be set only at the segment where the temperature is kept constant. Infinite time can not be set at a segment where the temperature is increased or decreased. Therefore, the setting can be made from segment 2 (inclusive).
c) Time signal setting

The time signal (TS) outputs the contact for a certain fixed time during program operation.

* Time signal setting example

Temperature

<table>
<thead>
<tr>
<th>Segment 1</th>
<th>Segment 2</th>
<th>Segment 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 hour</td>
<td>1 hour</td>
<td>40 min</td>
</tr>
</tbody>
</table>

* When "No external contact output function" or "Pattern end output" is selected, no time signal settings are displayed.
* In this example, various setting of time signal 2 are omitted, but the setting procedures are the same as the various settings of time signal 1 from (2) to (5).

① Confirmation of pattern end

Press the SET key several times to display the segment which is pattern-end-registered.
② Time signal 1
Start segment setting

Press the  key to set the start segment of time signal 1 to "2".

③ Time signal 1
ON time setting

Press the  key to set the ON time of time signal 1 to 20 min. after segment 2.

④ Time signal 1
End segment setting

Press the  key to set the end segment of time signal 1 to "3".

To next page
5 Time signal 1
OFF time setting

![Image of a digital display showing time setting]

Press the SET key to set the instrument to the OFF time state of time signal 1, then press the SET key to set 40min. after segment 3.

6 Time signal 2
Start segment setting

![Image of a digital display showing time setting]

In this example, no setting is made.

For this setting, set the same setting as the start segment setting of ② time signal 1.

7 Time signal 2
ON time setting

![Image of a digital display showing time setting]

In this example, no setting is made.

For this setting, set the same setting as the ON time setting of ③ time signal 1.
Time signal setting end

Press the key several times to display the time signal setting symbol "F1n".

Time signal display during operating (Running)

The LED which informs the operator of segment progress flashes while the time signal is displayed.
d) **Pattern end output setting**

After the end of program pattern, the pattern end output outputs the contact output during the preset time.

* Pattern end output setting example

**Temperature**

![Diagram showing pattern end setting](image)

- Pattern end setting point
- Time
- Pattern end output
- Setting time: 1 hour

* When pattern "No external contact output function" or "Pattern end output" is selected, no pattern end setting are displayed.
② Pattern end output time setting

Press the \( \text{△}_1 \) key set the time of pattern end output up for an hour.

③ Pattern end output time setting end

Display the pattern end output time symbol "Fin".

☆ Display during pattern end outputting

The "End" display flashes during pattern end display. In addition, pressing the \( \text{LEVEL} \) key displays the remaining time of the pattern end output.
5.3 Engineer setting Level 1: Basic parameter setting

Engineer setting: Level 1 mode is used to set auto-tuning, alarm, various control constants, wait zone or the number of repeat times.

The parameter group (PG) list for level 1 is shown in the following.

**Reset or Run status, Program setting status**

Press the SET key for 3 sec. (By way of the program setting state from the reset or run state.)

**CAUTION** Not display by specifications.
Operation flow

1. Reset status
   - Press SET key for 3 sec. or more

2. Parameter group select status: PG1
   - Press UP key

3. Parameter group select status: PG2
   - Press DOWN key

4. Parameter select status
   - Alarm1: AL1
     - Press SET key

Parameter group select status: PG3
a) Parameter explanation

Parameter group (PG1): Auto-tuning section

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGI</td>
<td>Parameter group 1</td>
<td></td>
<td>The first characters of parameter group (PG1). They are also displayed first when the instrument is set to engineer set mode.</td>
<td></td>
</tr>
<tr>
<td>PG1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT</td>
<td>Auto-tuning</td>
<td>0: Auto-tuning end or stop 1: Auto-tuning start</td>
<td>Turns the auto-tuning ON/OFF</td>
<td>0</td>
</tr>
<tr>
<td>AT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Auto-tuning

Auto-tuning (AT) is function of automatically measuring, computing and setting the optimum PID constants. Auto-tuning execution is valid only during program operation (RUN). In addition, during auto-tuning execution the program stops and temperature hunting occurs as shown in the following diagram. This means the instrument performs measurement and calculation, and is not abnormal.

![Auto-tuning Diagram](image)

* The auto-tuning time varies depending on the control system.

- Auto-tuning (AT) suspension condition
  - When the program is reset.
  - When the program is stepped.
  - When an engineer setting item is changed.
  - When a power failure occurs.
### Parameter group (PG2): Alarm setting section

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG2</td>
<td>Parameter group 2</td>
<td>-</td>
<td>The first characters of parameter group (PG2).</td>
<td></td>
</tr>
<tr>
<td>AL1</td>
<td>First alarm</td>
<td>- Deviation alarm&lt;br&gt; High alarm, low alarm: (-)span to (+)span&lt;br&gt; High and low alarm: (-)span to (+)span&lt;br&gt; Band alarm: (-)span to (+)span&lt;br&gt; Process alarm: same as input range&lt;br&gt; Set-value alarm: same as input range</td>
<td>Sets the first alarm set-value.</td>
<td>50</td>
</tr>
<tr>
<td>AL2</td>
<td>Second alarm</td>
<td>-</td>
<td>Sets the second alarm set-value.</td>
<td>50</td>
</tr>
</tbody>
</table>

### Displays for alarm setting

For alarm setting, the alarm type can be easily determined from the segment progress lamps [Orange] (see 4. Functional description on pages 15 and 16), which light or flash according to the alarm type.

<table>
<thead>
<tr>
<th>Alarm type</th>
<th>Deviation high alarm</th>
<th>Deviation low alarm</th>
<th>Deviation high/low alarm</th>
<th>Band alarm</th>
<th>Process high alarm</th>
<th>Process low alarm</th>
<th>Set-value high alarm</th>
<th>Set-value low alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segment status lamp (When alarm setting)</td>
<td><img src="image" alt="Symbol" /></td>
<td><img src="image" alt="Symbol" /></td>
<td><img src="image" alt="Symbol" /></td>
<td><img src="image" alt="Symbol" /></td>
<td><img src="image" alt="Symbol" /></td>
<td><img src="image" alt="Symbol" /></td>
<td><img src="image" alt="Symbol" /></td>
<td><img src="image" alt="Symbol" /></td>
</tr>
</tbody>
</table>

*When the instrument is provided with the alarm wait action, the LED flashes. However, no alarm wait action is provided for a set-value alarm.
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG3</td>
<td>Parameter group 3</td>
<td></td>
<td>The first characters of parameter group (PG3).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PG3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Proportional band (Heating-side)</td>
<td>0 to span</td>
<td>Set when PI or PID control is performed. For heating/cooling PID action: Proportional band setting on the heating-side.</td>
<td>30 (30.0)</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>0 to 3600 sec.</td>
<td>Eliminates offset occurring in proportional control.</td>
<td>240</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>0 to 3600 sec.</td>
<td>Prevents ripples by predicting output change, thereby improving control stability.</td>
<td>60</td>
</tr>
<tr>
<td>d</td>
<td>Derivative time</td>
<td>0 to 3600 sec.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Anti-reset wind-up (ARW)</td>
<td>0 to 100%</td>
<td>Prevents overshoot and/or undershoot caused by integral action effect.</td>
<td>100</td>
</tr>
<tr>
<td>Ar</td>
<td>Proportioning cycle (Heating side)</td>
<td>1 to 100 sec.</td>
<td>Sets control output cycle when relay contact or voltage pulse output type.</td>
<td>20 : Relay contact 2 : Voltage pulse</td>
</tr>
</tbody>
</table>
Parameter group (PG3): PID setting section

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Pc</td>
<td>Cooling-side proportional band</td>
<td>1 to 100% heating-side proportional band</td>
<td>Sets cooling-side proportional band when heating/cooling PID action is performed.</td>
<td>100</td>
</tr>
<tr>
<td>PC</td>
<td>Deadband/overlap</td>
<td>-10.0 to +10.0% of span</td>
<td>Sets control deadband between heating-side and cooling-side proportional bands. Minus (-) setting results in overlap.</td>
<td>0.0</td>
</tr>
<tr>
<td>* db</td>
<td>Proportioning cycle (Cooling-side)</td>
<td>1 to 100 sec.  (<em>0</em> cannot be set.)</td>
<td>Sets control output cycle when relay contact or voltage pulse output type.</td>
<td>20 : Relay contact 2 : Voltage pulse</td>
</tr>
<tr>
<td>CCYL</td>
<td>ON/OFF action differential gap</td>
<td>0 to 100°C [°F] or 0.0 to 100.0°C [°F]</td>
<td>Sets the differential gap during ON/OFF action.</td>
<td>2 (2.0)</td>
</tr>
<tr>
<td>oH</td>
<td>Manual reset</td>
<td>-50.0 to 50.0%</td>
<td>Corrects the manipulated variable (MV) to eliminate the offset occurring in proportional control.</td>
<td>0.0</td>
</tr>
</tbody>
</table>

* Display only during heating/cooling PID action.
** Display if the control output is relay contact or voltage pulse output.
*** No display during heating/cooling PID action.
### Parameter group (PG4): Wait zone section

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG4</td>
<td>Parameter group 4</td>
<td></td>
<td>The first characters of parameter group (PG4).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ZonU Wait zone (Temperature rise)</td>
<td>0 to 99°C [°F] or 0.0 to 9.9°C [°F] (*0° setting: Function OFF)</td>
<td>If the temperature cannot follow the program progress during temperature rise, this function is used to make the program wait in the present segment but not to move to the next segment. The value thus set is the deviation value from the set value on the low temperature side.</td>
<td>0</td>
</tr>
<tr>
<td>Zond</td>
<td>Wait zone (Temperature fall)</td>
<td>0 to 99°C [°F] or 0.0 to 9.9°C [°F] (*0° setting: Function OFF)</td>
<td>If the temperature cannot follow the program progress during temperature fall, this function is used to make the program wait in the present segment but not to move to the next segment. The value thus set is the deviation value from the set value on the high temperature side.</td>
<td>0</td>
</tr>
</tbody>
</table>

**Diagram:**

- **Temperature:**
  - **Wait zone (Temperature rise):**
    - Measured value (PV)
    - ΔTu/ΔTd: The program waits for this time.
  - **Wait zone (Temperature fall):**
    - ΔTd

- **Set-value (SV):**
  - ΔTu

- **Segments:**
  - Segment No.1
  - Segment No.2
  - Segment No.3

- **Time:**
### Parameter group (PG5): Program repeat section

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG5</td>
<td>Parameter group 5</td>
<td></td>
<td>The first characters of parameter group (PG5).</td>
<td></td>
</tr>
<tr>
<td>rPT</td>
<td>Program execution times setting</td>
<td>1 to 999 times</td>
<td>Sets the number of program execution times. If set to 1000 times or more, the program is executed indefinitely.</td>
<td>1</td>
</tr>
<tr>
<td>rPTM</td>
<td>Repeat times monitor</td>
<td>-</td>
<td>Displays the remaining number of program repeat times during program execution (RUN). Not displayed in the reset state.</td>
<td></td>
</tr>
</tbody>
</table>

![Diagram of temperature pattern](image)
b) Level PID (Option)

The level PID function is used to set PID control constants individually by dividing the fullscale into 4 regions (levels) in order to achieve finer temperature control.

This function is effective especially for a controlled object whose load characteristics differ depending on the temperature region.
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG3</td>
<td>Parameter group 3</td>
<td></td>
<td>The first characters of parameter group (PG3).</td>
<td></td>
</tr>
<tr>
<td>P1</td>
<td>Proportional band (Heating-side)</td>
<td>0 to input span</td>
<td>Set when PI or PID control is performed.</td>
<td>30 (30.0)</td>
</tr>
<tr>
<td>I1</td>
<td>Integral time</td>
<td>0 to 3600 sec.</td>
<td>Eliminates offset occurring in proportional control.</td>
<td>240</td>
</tr>
<tr>
<td>D1</td>
<td>Derivative time</td>
<td>0 to 3600 sec.</td>
<td>Prevents ripples by predicting output change, thereby improving control stability.</td>
<td>60</td>
</tr>
<tr>
<td>Ar1</td>
<td>Anti-reset wind-up (ARW)</td>
<td>0 to 100%</td>
<td>Prevents overshoot and/or undershoot caused by integral action effect.</td>
<td>100</td>
</tr>
<tr>
<td>*Pc1</td>
<td>Cooling-side proportional band</td>
<td>1 to 1000% heating-side proportional band</td>
<td>Sets cooling-side proportional band when heating/cooling PID action is performed.</td>
<td>100</td>
</tr>
</tbody>
</table>

* Displayed only during heating/cooling action.
※ For level PID, parameter group 3 (PG3) has PID 1 to 4 and level setting.
### Parameter group (PG3): Setting of the level

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG3</td>
<td>Parameter group 3</td>
<td></td>
<td>The first characters of parameter group (PG3).</td>
<td></td>
</tr>
<tr>
<td>LEV1</td>
<td>Level 1</td>
<td>The setting limiter low-limit to the setting limiter high-limit. However, if set to the setting limiter low-limit, level 1 becomes invalid.</td>
<td>Sets the boundary controlled by PID1 and PID2 groups.</td>
<td></td>
</tr>
<tr>
<td>LEV2</td>
<td>Level 2</td>
<td>The set-value of Level 1 to the setting limiter high-limit. However, if set to the set-value of Level 1, Level 2 becomes invalid.</td>
<td>Sets the boundary controlled by PID2 and PID3 groups.</td>
<td></td>
</tr>
<tr>
<td>LEV3</td>
<td>Level 3</td>
<td>The set-value of Level 2 to the setting limiter high-limit. However, if set to the set-value of Level 2, Level 3 becomes invalid.</td>
<td>Sets the boundary controlled by PID3 and PID4 groups.</td>
<td></td>
</tr>
<tr>
<td>HCYL</td>
<td>Proportioning cycle (Heating side)</td>
<td>1 to 100 sec. (<em>0</em> cannot be set.)</td>
<td>Sets control output cycle when relay contact or voltage pulse output type.</td>
<td>20: Relay cutout 2: Voltage pulse</td>
</tr>
</tbody>
</table>

**Displayed if the control output is relay contact or voltage pulse output.**

※When the instrument is used in the set before shipment, it is operated using the PID1 constants.
## Parameter group (PG3): Setting of the level

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&amp;</td>
<td>Deadband/overlap</td>
<td>-10.0 to +10.0% of span</td>
<td>Sets control deadband between heating-side and cooling-side proportional bands. Minus (-) setting results in overlap.</td>
<td>0.0</td>
</tr>
<tr>
<td>db</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CCYL</strong></td>
<td>Proportioning cycle (Cooling-side)</td>
<td>1 to 100 sec. (<em>0</em> cannot be set.)</td>
<td>Sets control output cycle when relay contact or voltage pulse output type.</td>
<td>20: Relay contact 2: Voltage pulse</td>
</tr>
<tr>
<td>CCYL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>oH</td>
<td>ON/OFF action differential gap</td>
<td>0 to 100°C [°F] or 0.0 to 100.0°C [°F]</td>
<td>Sets the differential gap during ON/OFF action.</td>
<td>2 (2.0)</td>
</tr>
<tr>
<td>oH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*<strong>Mr</strong></td>
<td>Manual reset</td>
<td>-50.0 to 50.0%</td>
<td>Corrects the manipulated variable (MV) to eliminate the offset occurring in proportional control.</td>
<td>0.0</td>
</tr>
</tbody>
</table>

* Display only during heating/cooling PID action.
** Display if the control output is relay contact output or voltage pulse out.
*** No display during heating/cooling PID action.
c) Set data locking

Parameter group (PG14): Setting data lock section

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG14</td>
<td>Parameter group 14</td>
<td></td>
<td>The first characters of parameter group (PG14).</td>
<td></td>
</tr>
<tr>
<td>LCK</td>
<td>Set data lock level</td>
<td>See to setting contents</td>
<td>Set level which enables set data lock.</td>
<td>0000</td>
</tr>
</tbody>
</table>

• Setting contents

<table>
<thead>
<tr>
<th>Setting</th>
<th>PG1</th>
<th>PG2</th>
<th>PG3</th>
<th>PG4</th>
<th>PG5</th>
<th>PG6</th>
<th>PG7</th>
<th>PG8</th>
<th>PG9</th>
<th>PG10</th>
<th>PG11</th>
<th>PG12</th>
<th>PG13</th>
<th>PG14</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>○</td>
</tr>
<tr>
<td>0001</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>○</td>
</tr>
<tr>
<td>0010</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>○</td>
</tr>
<tr>
<td>0011</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>○</td>
</tr>
<tr>
<td>0100</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>0101</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>▲</td>
<td>○</td>
</tr>
</tbody>
</table>

○ : Enable setting
▼ : Enable setting
*Only monitoring during running.
▲ : Only monitoring
— : No display (No monitoring)

⚠ Operating precautions

• If the contents of parameter groups 11 to 13 are changed, all of the settings return to the default values. Prior to changing the setting, take a note of the program and various constants, and after the setting is changed re-set these constants.
5.4 Engineer setting: Level 2; Application parameter setting

Engineer setting level 2 is used to set start mode, PV bias, setting limit, output limit, analog output.
This parameter can be set when the date set to “0010” by the setting lock (PG14) is released.
The parameter group (PG) list for level 2 is shown in the following.

**Reset status**
Press the (set) key for 3 sec.

- **Basic parameter**
  - PG1 \(\sim5\)
  - PG6 SRAR
  - PG7 BIAS

- **Start mode**
  - P47 SRAR
  - P48 BIAS

- **PV bias**
  - P49 SER

- **Setting limit**
  - P49 OUR

- **Output limit**
  - P50 Ao

- **Analog output**
  - P45 LCE

- **Setting lock**
  - PG14 LCE

Items marked with * are displayed only when the option is selected.
a) Parameter explanation
Parameter group (PG6): Start mode section

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PG6</strong></td>
<td>Parameter group 6</td>
<td></td>
<td>The first characters of parameter group (PG6).</td>
<td></td>
</tr>
<tr>
<td>PG6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **STAT**| Start mode selection | 0: Cold start from reset state  
1: Power-ON start  
Enforced start from the 1st segment  
of pattern 1  
2: Hot start | Selects action at power-ON or power recovery.                     | 0                              |
| PVST   | Start point selection | 0: Zero start  
1: PV start | Selects the start point on the time axis at which the program is started. | 0                              |

* Start mode
This instrument follows the start mode set at power-ON or for a power failure exceeding 4 sec.

* Start point

![Graph showing temperature, measured value, setting value (SV), zero start, and segments for start point selection.](image-url)
Parameter group (PG7): PV bias section

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG7</td>
<td>Parameter group 7</td>
<td></td>
<td>The first characters of parameter group (PG7).</td>
<td></td>
</tr>
<tr>
<td>bias</td>
<td>PV bias</td>
<td>-1999 to 9999°C [°C] or -199.9 to 999.9°C [°F]</td>
<td>Sensor correction is made by adding bias value to measured-value (PV).</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>rr</td>
<td>PV ratio</td>
<td>0.001 to 9.999</td>
<td>Sensor correction is made by multiplying ratio value to measured-value (PV).</td>
<td>1.000</td>
</tr>
</tbody>
</table>

* PV bias and PV ratio

\[
\text{PV displayed value} = \text{Input value} \times \text{PV ratio} + \text{PV bias}
\]

- PV bias
- PV ratio
- PV bias + PV ratio
### Parameter group (PG8): Setting limit section

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG8</td>
<td>Parameter group 8</td>
<td></td>
<td>The first characters of parameter group (PG8).</td>
<td></td>
</tr>
<tr>
<td>SLH</td>
<td>Setting limit (high limit)</td>
<td>Within input range * Setting high limit &gt; Setting low limit</td>
<td>Sets high limit of setting range.</td>
<td>High input limit</td>
</tr>
<tr>
<td>SLL</td>
<td>Setting limit (low limit)</td>
<td>Within input range * Setting high limit &gt; Setting low limit</td>
<td>Sets Low limit of setting range.</td>
<td>Low input limit</td>
</tr>
</tbody>
</table>

### Parameter group (PG9): Output limit section

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG9</td>
<td>Parameter group 9</td>
<td></td>
<td>The first characters of parameter group (PG9).</td>
<td></td>
</tr>
<tr>
<td>oLH</td>
<td>Output limit (high limit)</td>
<td>−5.0 to 105.0% of manipulated output value</td>
<td>High limit of manipulated output value (MV).</td>
<td>105.0</td>
</tr>
<tr>
<td>oLL</td>
<td>Output limit (low limit)</td>
<td></td>
<td>Low limit of manipulated output value (MV).</td>
<td>−5.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>For heating/cooling PID action: Output limit (high limit) on the heating-side output</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>For heating/cooling PID action: Output limit (low limit) on the cooling-side output</td>
<td></td>
</tr>
</tbody>
</table>
## Parameter group (PG10): Analog output section (Option)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PG10</strong></td>
<td>Parameter group 10</td>
<td></td>
<td>The first characters of parameter group (PG10)</td>
<td></td>
</tr>
<tr>
<td><strong>Ao</strong></td>
<td>Analog output specification selection</td>
<td>0: Measured-value (PV) output 1: Set-value (SV) output 2: Manipulated output value (MV)</td>
<td>Selects analog output type.</td>
<td>0</td>
</tr>
<tr>
<td><strong>AHS</strong></td>
<td>High limit analog output range</td>
<td>Specification selection 0, 1: Within input range 2 : 100.0 (Fixed)</td>
<td>Sets high limit of analog output range.</td>
<td>High input limit</td>
</tr>
<tr>
<td><strong>ALS</strong></td>
<td>Low limit analog output range</td>
<td>Specification selection 0, 1: Within input range 2 : 0.0 (Fixed)</td>
<td>Sets low limit of analog output range.</td>
<td>Low input limit</td>
</tr>
</tbody>
</table>

### PRECAUTIONS

The output resolution is more than 10 bits (differs depending on the input type). If the output range is set to more than 10 bits (1024 counts), display skipping may occur when connected to a digital display unit.

Output range = High limit setting – low limit setting
5.5 Operation

a) Execute the program

After completing the program setting and all parameter settings, check that the wiring is correct, then start operation.

① Execute the program

Press the button key to select the pattern to be operated.

Pattern 1: PTN1
Pattern 2: PTN2

② Make sure of the rest of segment time

Press the button key to execute the program.

Pressing the button key during operation displays the remaining time of the segment being executed. Pressing the button key again returns to the setting temperature display.
3 Execute the step

Pressing the $\equiv$ key for more than 1 sec. during operation advances the program segment by 1.

4 Execute the hold

Pressing the $\equiv$ key for more than 1 sec. during operation holds the temperature set-value at that time, and "Hold" and the set value are displayed alternately.

*Press the $\equiv$ key to release the hold.

5 Make sure of the final segment

Pressing the $\equiv$ key during operation flashes the pattern-end-registered segment while the key is pressed.
b) Setting procedure of auto-tuning (AT)

1. Rest status

Press the (RUN) key to select the pattern to be operated.

Pattern 1: PTN1
Pattern 2: PTN2

2. Program execution status

Confirm that the instrument is set to the temperature setting required for auto-tuning when the program executes. Use the step function if necessary.

3. Engineer setting status
Parameter group 1

Call up the auto-tuning item of parameter group 1.
**Auto-tuning setting precautions**

- Program stops during auto-tuning. In addition, temperature hunting occurs by the ON/OFF action.
5.6 External contact input (Option)

After completing the program setting and all parameter settings, check that the wiring is correct, then start operation.

① Reset function (RESET)
If rear terminal Nos. 14 and 15 are closed, the reset function is activated.

② Run function (RUN)
If rear terminal Nos. 14 and 16 are closed, the run function is activated.

③ Step function (STEP)
If rear terminal Nos. 14 and 17 are closed, the step function is activated, but only during program control.

④ Hold function (Hold)
If rear terminal Nos. 14 and 18 are closed, the hold function is activated, but only during program control.

* Reset, run or step is activated by one pulse (more than 0.5 sec.)
Hold is activated only when the contacts are closed.
However, there is a time lag of approx. 1 sec for step-key capture.
The priority order is reset, run, hold and step.

* Input rated

a) Input type: Dry contact input
   ① 500KΩ or more : Open
   ② 10Ω or less : Close
b) Contact current : Approx 3.5mA
c) Contact open voltage : Approx 18VDC or less
d) Wiring distance : 10m or less
### Initial value prior to shipment list (PG1 to 10)

<table>
<thead>
<tr>
<th>PG i</th>
<th>AT</th>
<th>PG5</th>
<th>rPT</th>
<th>PG8</th>
<th>PG3</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG1</td>
<td>0</td>
<td>1</td>
<td>0.0</td>
<td>100</td>
<td>30</td>
</tr>
<tr>
<td>PG2</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AL1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AL2</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PG3</td>
<td>30</td>
<td>0</td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PG6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PG4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZonH</td>
<td>0</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>ZonH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZonL</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZonL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Precautions:** Note that there are some items which are not displayed depending on the specification.
6. INITIAL SETTING

6.1 Initial setting: Parameter setting

The initialize setting is for changing the input, control and alarm types specified when the controller was purchased. Therefore, change this setting carefully on your own responsibility. The parameter group (PG) list for the initialize setting is described in the following.

![Diagram]

- **Operating precautions**
  - If the contents of parameter groups 11 to 13 are changed, all of the settings return to the default values. Prior to changing the setting, take a note of the program and various constants, and after the setting is changed re-set these constants.

Mark *: Does not display when no alarm is provided.
6.2 Release procedures of setting lock

To perform the initialize setting, release the setting lock as follows.

① Reset status

Press the (SET) key for more 3 sec.

② Engineer setting status

Press the key to set the instrument to setting lock parameter group 14.

③ Release the setting lock

Press the (SET) key to release the lock at the initialize setting level.

* Setting lock setting precautions

- After releasing the setting lock and completing the necessary settings, return the display to "0000" by the same procedure as described above.
6.3 Parameter explanation
Parameter group (PG11): Input type section

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG11</td>
<td>Parameter group 11</td>
<td>The first characters of parameter group (PG11).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| °C/°F | °C/°F selection | °C: °C unit  
°F: °F unit | Selects temperature unit | °C |
| InP   | Input type selection | Following under the table | Selects input type | To be specified when ordering |

Input type

<table>
<thead>
<tr>
<th>Input type</th>
<th>Model code</th>
<th>Select</th>
<th>Ranges (°C)</th>
<th>Model code</th>
<th>Select</th>
<th>Ranges (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>K</td>
<td>22</td>
<td>0</td>
<td>K</td>
<td>B2</td>
<td>-199.9 to 999.9°C</td>
</tr>
<tr>
<td></td>
<td>K</td>
<td>16</td>
<td>1</td>
<td>K</td>
<td>B3</td>
<td>-330 to 2500°F</td>
</tr>
<tr>
<td>J</td>
<td>J</td>
<td>14</td>
<td>2</td>
<td>J</td>
<td>A9</td>
<td>-199.9 to 999.9°F</td>
</tr>
<tr>
<td></td>
<td>J</td>
<td>15</td>
<td>3</td>
<td>J</td>
<td>B1</td>
<td>-330 to 2192°F</td>
</tr>
<tr>
<td>T</td>
<td>T</td>
<td>01</td>
<td>4</td>
<td>T</td>
<td>A1</td>
<td>-199.9 to 752.0°F</td>
</tr>
<tr>
<td>R</td>
<td>R</td>
<td>02</td>
<td>5</td>
<td>R</td>
<td>A2</td>
<td>0 to 3216°F</td>
</tr>
<tr>
<td>S</td>
<td>S</td>
<td>02</td>
<td>6</td>
<td>S</td>
<td>A2</td>
<td>0 to 3216°F</td>
</tr>
<tr>
<td>B</td>
<td>B</td>
<td>02</td>
<td>7</td>
<td>B</td>
<td>A2</td>
<td>0 to 3308°F</td>
</tr>
<tr>
<td>E</td>
<td>E</td>
<td>06</td>
<td>8</td>
<td>E</td>
<td>A6</td>
<td>-330 to 1832°F</td>
</tr>
<tr>
<td>N</td>
<td>N</td>
<td>02</td>
<td>9</td>
<td>N</td>
<td>A2</td>
<td>0 to 2372°F</td>
</tr>
<tr>
<td>PL II</td>
<td>A</td>
<td>02</td>
<td>10</td>
<td>A</td>
<td>A2</td>
<td>0 to 2534°F</td>
</tr>
<tr>
<td>W5Re/W26Re</td>
<td>W</td>
<td>02</td>
<td>11</td>
<td>W</td>
<td>A4</td>
<td>0 to 4208°F</td>
</tr>
<tr>
<td>U</td>
<td>U</td>
<td>08</td>
<td>12</td>
<td>U</td>
<td>A4</td>
<td>0 to 1100°F</td>
</tr>
<tr>
<td>L</td>
<td>L</td>
<td>05</td>
<td>13</td>
<td>L</td>
<td>A2</td>
<td>0 to 1600°F</td>
</tr>
<tr>
<td>JPt100</td>
<td>P</td>
<td>20</td>
<td>14</td>
<td>P</td>
<td>B6</td>
<td>-199.9 to 950.0°F</td>
</tr>
<tr>
<td>Pt100</td>
<td>D</td>
<td>20</td>
<td>15</td>
<td>D</td>
<td>A1</td>
<td>-199.9 to 999.9°F</td>
</tr>
</tbody>
</table>

Input type B: Accuracy in the range of 0 to 400°C (0 to 752°F) → Not guaranteed.
Input type N, PLII, W5Re/W26Re: Accuracy in the range or 0 to 32°F → Not guaranteed.
### Parameter group (PG12): Control section

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting range</th>
<th>Description</th>
<th>Initial value prior to shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PG12</strong></td>
<td>Parameter group 12</td>
<td></td>
<td>The first characters of parameter group (PG12).</td>
<td></td>
</tr>
<tr>
<td>PG12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Conf</strong></td>
<td>Direct/Reverse action selection</td>
<td>0 : Reverse action 1 : Direct action</td>
<td>Selects direct or reverse control action.</td>
<td>To be specified when ordering</td>
</tr>
<tr>
<td>ConT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pid</strong></td>
<td>PID/Level PID selection</td>
<td>0 : PID control 1 : Level PID control</td>
<td>Selects PID control or level PID control.</td>
<td>To be specified when ordering</td>
</tr>
<tr>
<td>Pid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EndP</strong></td>
<td>Selects control when program ended</td>
<td>0 : Continuous control 1 : Stop control</td>
<td>Select continuous control/stop control when program ended.</td>
<td>0</td>
</tr>
<tr>
<td>EndP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Parameter Group (PG13): Alarm Type (Option) * Same to Alarm 2

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Setting Range</th>
<th>Description</th>
<th>Initial Value Prior to Shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG13</td>
<td>Parameter group 13</td>
<td></td>
<td>The first characters of parameter group (PG13).</td>
<td></td>
</tr>
<tr>
<td>AS1</td>
<td>First alarm action selection</td>
<td>Refer to alarm action type explanation</td>
<td>Selects first alarm action</td>
<td>To be specified when ordering</td>
</tr>
<tr>
<td>AH01</td>
<td>First alarm hold action selection</td>
<td>0: No hold action</td>
<td>Selects the first alarm hold action</td>
<td>To be specified when ordering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1: Hold action 1:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hold action is valid when the instrument is power-ON or transferred operation mode from STOP to execution (RUN).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2: Hold action 2:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hold action is valid when the instrument is power-ON or transferred operation mode from STOP to execution (RUN) or changed the set-value.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AH1</td>
<td>First alarm differential gap</td>
<td>0 to 10°C [°F]</td>
<td>Sets first alarm differential gap</td>
<td>2 (2.0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0 to 10.0°C [°F]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXC1</td>
<td>First alarm energized/de-energized selection</td>
<td>0: Energized alarm</td>
<td>Selects whether first alarm is set to energized alarm or de-energized alarm.</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1: De-energized alarm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AE01</td>
<td>First alarm action selection at input abnormality</td>
<td>0: Alarm ON when measured value is alarm action range.</td>
<td>Selects first alarm action when measured-value (PV) exceeds input abnormality determination point.</td>
<td>0</td>
</tr>
</tbody>
</table>
# Alarm action type explanation

<table>
<thead>
<tr>
<th>Code</th>
<th>Alarm action type explanation</th>
<th>Display</th>
<th>Code</th>
<th>Alarm action type</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Deviation high alarm</td>
<td>△</td>
<td>2</td>
<td>Deviation low alarm with hold action</td>
<td>△</td>
</tr>
<tr>
<td>2</td>
<td>Deviation low alarm</td>
<td>△</td>
<td>3</td>
<td>Deviation high/low alarm with hold action</td>
<td>LED blinks</td>
</tr>
<tr>
<td>3</td>
<td>Deviation high/low alarm</td>
<td>△</td>
<td>4</td>
<td>Deviation band alarm with hold action</td>
<td>LED blinks</td>
</tr>
<tr>
<td>4</td>
<td>Deviation band alarm</td>
<td>△</td>
<td>5</td>
<td>Process high alarm with hold action</td>
<td>LED blinks</td>
</tr>
<tr>
<td>5</td>
<td>Process high alarm</td>
<td>△</td>
<td>6</td>
<td>Process low alarm with hold action</td>
<td>LED blinks</td>
</tr>
<tr>
<td>6</td>
<td>Process low alarm</td>
<td>△</td>
<td>7</td>
<td>Set-value high alarm</td>
<td>Upper LED blinks</td>
</tr>
<tr>
<td>1</td>
<td>Deviation high alarm with hold action</td>
<td>△</td>
<td>8</td>
<td>Set-value low alarm</td>
<td>Lower LED blinks</td>
</tr>
</tbody>
</table>

△: Main setting  ▲: Alarm setting

* The high/low-limit deviation alarm and within-range deviation alarm become absolute value deviations.
* The code corresponds to the "RS□" (No. for selecting the alarm action type of parameter group 13 (PG13). Also, each figure enclosed with □ in the above table shows the action when the alarm wait action is selected.
* Each display in the above table shows the relevant alarm type when parameter group 2 (PG2) or 13 (PG13) is set. Therefore, it differs from the operation status display that shows the state of program progress.
## 7. DISPLAY AT ABNORMALITY !

- **For input abnormality**

<table>
<thead>
<tr>
<th>Display</th>
<th>Details</th>
<th>Action (Output)</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured-value (PV)</td>
<td>Input abnormality</td>
<td>• Action at input abnormality</td>
<td><img src="image" alt="WARNING" /> In order to prevent electric shock, prior to replacing the sensor, always turn OFF the power.</td>
</tr>
<tr>
<td></td>
<td>Measured-value (PV) exceeds the high input abnormality determination limit or less than the low input abnormality determination limit.</td>
<td>If overscale or downscale occurs in the controller, control output is off, alarm outputs by alarm action selection at input abnormality.</td>
<td></td>
</tr>
<tr>
<td>Flashing</td>
<td></td>
<td></td>
<td>Check input type, range, sensor and sensor connection.</td>
</tr>
<tr>
<td><strong>0000</strong></td>
<td>Overscale</td>
<td>Shipping :</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measured-value (PV) is beyond the effective input range.</td>
<td>Alarm ON when measured value is alarm action range.</td>
<td></td>
</tr>
<tr>
<td>Flashing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>0000</strong></td>
<td>Undertake</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measured-value (PV) is below the effective input range.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flashing</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 8. OUTPUT RATED TABLE

### Output rated table

<table>
<thead>
<tr>
<th>Control output</th>
<th>Relay contact</th>
<th>250V AC, 3A (Resistive load)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage pulse</td>
<td></td>
<td>0/12V DC (Load resistance: 600Ω or more)</td>
</tr>
<tr>
<td>Current</td>
<td></td>
<td>0 to 20mA DC, 4 to 20mA DC (Load resistance: 600Ω or less)</td>
</tr>
<tr>
<td>Alarm output</td>
<td>Relay contact</td>
<td>250V AC, 1A (Resistive load)</td>
</tr>
<tr>
<td>Time signal output</td>
<td>Relay contact</td>
<td>250V AC, 1A (Resistive load)</td>
</tr>
<tr>
<td>Pattern end output</td>
<td>Relay contact</td>
<td>250V AC, 1A (Resistive load)</td>
</tr>
<tr>
<td>Analog output</td>
<td>Voltage</td>
<td>0 to 10mV DC, 0 to 100mV DC (Load resistance: 20kΩ or more)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 to 1V DC, 0 to 5V DC, 0 to 10V DC, 1 to 5V DC (Load resistance: 1kΩ or more)</td>
</tr>
<tr>
<td></td>
<td>Current</td>
<td>0 to 20mA DC, 4 to 20mA DC (Load resistance: 600Ω or less)</td>
</tr>
</tbody>
</table>