Digital Controller
SA200 Instruction Manual

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

**WARNING**
- To prevent injury to persons, damage to instrument and equipment, a suitable external protection device shall be required.
- All wiring must be completed before power is turned on to prevent electric shock, fire or damage to instrument and equipment.
- This instrument must be used in accordance with the specifications to prevent fire or damage to instrument and equipment.
- All wiring must be completed before power is turned on to prevent electric shock, fire or damage to instrument and equipment.
- A: Heat/Cool PID action with autotuning (Air cooling)
- B: Heat/Cool PID action with autotuning (Water cooling)
- C: Process high alarm
- D: Process low alarm

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

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

1. PRODUCT CHECK

<table>
<thead>
<tr>
<th>Feature</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Control action</td>
<td></td>
</tr>
<tr>
<td>F: PID action with autotuning (Reverse action)</td>
<td>(1)</td>
</tr>
<tr>
<td>D: PID action with autotuning (Direct action)</td>
<td>(2)</td>
</tr>
<tr>
<td>W: Heat/Cool PID action with autotuning (Water cooling)</td>
<td>(3)</td>
</tr>
<tr>
<td>A: Heat/Cool PID action with autotuning (Air cooling)</td>
<td>(4)</td>
</tr>
<tr>
<td>(2) Input type/Range code</td>
<td>Refer to: 9. INPUT RANGE TABLE</td>
</tr>
<tr>
<td>(3) Output 1 [OUT1] (Control output or Alarm output)</td>
<td>M: Relay contact output</td>
</tr>
<tr>
<td>V: Voltage pulse output</td>
<td></td>
</tr>
<tr>
<td>(4) Output 2 [OUT2] (Control output or Alarm output)</td>
<td>N: No output</td>
</tr>
<tr>
<td>M: Relay contact output</td>
<td></td>
</tr>
<tr>
<td>V: Voltage pulse output</td>
<td></td>
</tr>
<tr>
<td>(5) Power supply voltage</td>
<td>3: 24 V AC/DC</td>
</tr>
<tr>
<td>4: 100 to 240 V AC</td>
<td></td>
</tr>
<tr>
<td>(6) Alarm 1 [ALM1] and (7) Alarm 2 [ALM2]</td>
<td>N: No alarm</td>
</tr>
<tr>
<td>A: Deviation high alarm</td>
<td></td>
</tr>
<tr>
<td>J: Process low alarm</td>
<td></td>
</tr>
<tr>
<td>B: Deviation low alarm</td>
<td></td>
</tr>
<tr>
<td>K: Process high alarm</td>
<td></td>
</tr>
<tr>
<td>C: Deviation high/low alarm</td>
<td></td>
</tr>
<tr>
<td>L: Process low alarm</td>
<td></td>
</tr>
<tr>
<td>D: Band alarm</td>
<td></td>
</tr>
<tr>
<td>M: Relay alarm</td>
<td></td>
</tr>
<tr>
<td>E: Deviation high alarm</td>
<td></td>
</tr>
<tr>
<td>N: SV high alarm</td>
<td></td>
</tr>
<tr>
<td>F: Deviation low alarm</td>
<td></td>
</tr>
<tr>
<td>O: SV low alarm</td>
<td></td>
</tr>
<tr>
<td>G: Deviation high/low alarm</td>
<td></td>
</tr>
<tr>
<td>(8) Optional function</td>
<td>N: No function</td>
</tr>
<tr>
<td>5: RS-485 (Durex communication)</td>
<td></td>
</tr>
<tr>
<td>6: RS-485 (Modbus)</td>
<td></td>
</tr>
<tr>
<td>(9) Waterproof/Dustproof</td>
<td>No: No waterproof/Dustproof</td>
</tr>
<tr>
<td>1: Waterproof/Dustproof</td>
<td></td>
</tr>
<tr>
<td>(10) Case color</td>
<td>A: Black</td>
</tr>
</tbody>
</table>

(11) Assignment code
- No symbol: Standard output
- 03: PID action [OUT1: Control output]
- OUT1: ALM1 output only
- 04: PID action [OUT1: Control output]
- OUT1: ALM1 output
- OUT2: AND output of ALM1 and ALM2
- 05: PID action [OUT1: Control output]
- OUT1: ALM1, ALM2 output [OUT2: OR output of ALM1 and ALM2]
- 06: PID action [OUT1: Control output]
- OUT1: ALM1, ALM2 output [OUT2: AND output of ALM1 and ALM2]
- 07: PID action [OUT1: Control output]
- OUT2: OR output of ALM1 and ALM2
- 08: PID action [OUT1: Control output]
- OUT1: ALM1 output
- OUT2: ALM2 output
- 09: ALM1 [OUT1: Control output]
- OUT1: ALM1 output
- OUT2: ALM2 output
- 10: ALM2 [OUT1: Control output]
- OUT1: ALM2 output
- OUT2: ALM1 output
- 11: ALM1 [OUT1: Control output]
- OUT1: ALM1 output
- OUT2: ALM2 output
- No self-tuning function is provided in the W or A control action type.
- With hold action
- De-energized
- LBA can be selected for only ALM1.
- Energized

2. MOUNTING

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

2.1 Mounting Cautions

1. (1) This instrument is intended to be used under the following environmental conditions.
   - IEC61010-1
   - [OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2]
2. Use this instrument within the following environmental conditions:
   - Allowable ambient temperature: 0 to 50 °C
   - Allowable ambient humidity: 5 to 95% RH
   - Allowable altitude: 2,000 m
   - Maximum ambient temperature: 29.3 °C
   - Maximum ambient temperature: 29.3 °C

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, magnetic fields or noise.
   - Direct airflow from an air conditioner.
   - Exposure to direct sunlight.
   - Excessive heat accumulation.
4. Mount this instrument in the panel considering the following conditions:
   - Provide adequate ventilation space so that heat does not build up.
   - Do not mount this instrument directly on a panel that generates large amount of heat (heaters, transformers, semi-conductor functional devices, large-wattage resistors.)
**WARNING**

- Voltage pulse

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.

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

**Installation Conditions:**

The display cannot be seen from the outside of the visual field range. The visual field range of SA200 is 40 degrees to the upper side, and 30 degrees to the lower side from the center of the display vertically.

### 2.2 Dimensions

<table>
<thead>
<tr>
<th>Mounting Position</th>
<th>Width (mm)</th>
<th>Height (mm)</th>
<th>Depth (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual mounting</td>
<td>100</td>
<td>25</td>
<td>48</td>
</tr>
<tr>
<td>Close horizontal/mounting</td>
<td>100</td>
<td>25</td>
<td>48</td>
</tr>
<tr>
<td>Close vertical mounting</td>
<td>100</td>
<td>25</td>
<td>48</td>
</tr>
</tbody>
</table>

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

For effective waterproof/dustproof, the gasket must be securely placed between instrument and panel without any gap. If gasket is damaged, please contact Durex sales office or the agent.

- **Close Mounting**

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

If the SA200 have waterproof/dustproof options, protection will be compromised and not meet IP66 by close mounting.

Two units of SA200 cannot be inserted into a panel cutout of 48 × 48 mm.

### 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 pitches to achieve the most effective noise reduction.
  - Always install the noise filter on a grounded panel. Minimize the wiring distance between the noise filter output and the instrument power supply terminals to achieve the most effective noise reduction.
  - Do not connect fuses or switches to the noise filter output wiring as this will reduce the effectiveness of the noise filter.
- Allow approximately 4 seconds of 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 with 24 V power supply is not provided with an overcurrent protection device. For safety install an overcurrent protection device (such as fuse) with adequate breaking capacity close to the instrument.
- Fuse type: Time-lag fuse (Approved fuse according IEC90127-2 and/or UL248-14)
- Recommended fuse rating: Rated current 0.4 A
- For the current input specification, an external resistor (250 Ohm ±0.2 %, 0.25 W) or more, 0.10 ppm/°C) must be connected between the input terminals. For external resistor (shunt resistor), use the KD100-55 (Durex product). If this resistor is installed, close vertical mounting is not possible.
- For an instrument with 24 V power supply input, supply power from “SELV” circuit defined as IEC 60950-1.
- A suitable power supply should be considered in 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 equal.
  - 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, with 5.5 mm, hole diameter 3.2 mm)
- Make sure that during field wiring parts of conductors can not 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

#### Input terminals

- Thermocouple (TC) Voltage input
  - 0 to 5 V DC
  - 0 to 10 V DC
  - 1 to 5 V DC
- RTD Current input
  - 0 to 20 mA DC
  - 4 to 20 mA DC

#### Power supply terminals

- 24 V

#### Optional terminals

- Communication RS-485
- Contact input D11, D12
- Power supply terminals 24 V

#### OUT1 terminals

- NO: Normally Open

#### OUT2 terminals

- NO: Normally Open
Specifications

Input:
- **Input type:**
  - Input impedance: Approx. 1 MΩ
  - RTD: Pt100, JPt100
  - Voltage: 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC
  - Current: 0 to 20 mA DC, 4 to 20 mA DC
  - Sampling cycle: 0.5 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: Input/output terminals are not isolated.
- Voltage: 0/12 V DC (Load resistance 600 Ω or more)
- Contact input (optional): Dry contact input: At open 600 kΩ or more
  - At close 10 Ω or less

Performance:
- Display accuracy: (at the ambient temperature 23 °C ± 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 -199.0 °C [-199.9 to -194.0 °F] (Accuracy is not guaranteed.)

4. PARTS DESCRIPTION

5. SETTING

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

**Power ON**

Automatically in 4 seconds

**PV/SV Display Mode**

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

**Input type and Input Range Display**

When the instrument is powered on, it immediately confirms the input type and input range.

Example:
- When sensor type of input is K thermocouple.
  - Unit for input and SV display: Celsius (°C), Fahrenheit (°F), Voltage/Current: no character shown

**Parameter Setting Mode**

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

**Anti-reset windup (ARW)**

Setting range:
- 0 to 100% of heat-side proportional band (0: Integral action OFF)
  - Factory set value: 100

**Heat-side proportional band (P)**

Setting range:
- 0 to span (-9999 to +9999 digits)
  - Factory set value: 0.0

**Cool-side proportional band (P)**

Setting range:
- 0 to span (-9999 to +9999 digits)
  - Factory set value: 0.0

**Cool-side proportional cycle time**

Setting range:
- 0 to 1000 seconds
  - Factory set value: 100

**Derived time**

Setting range:
- 0 to 3600 seconds (0: ON/OFF action)
  - Factory set value: 240

**Integral time (I)**

Setting range:
- 0 to 300 seconds (0: PD action)
  - Factory set value: 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.
- Return to first parameter setting item

**PV/SV Display Mode**

The controller will display the measured value (PV) and the set value (SV).
- The set value depends on the following parameter settings.
  - Whether the controller is switched to RUN or STOP mode.
  - The controller can display the RUN/STOP function.

**SV Setting Mode**

The blinking digit on the SV display indicates which digit can be set.

Setting range:
- Input range: Automatic
  - Symbol Table

**PV bias**

Setting range:
- 0 to span (-9999 to +9999 digits)
  - Factory set value: 0.0

**Digital filter**

Setting range:
- 0 to 100 seconds (0: Digital filter OFF)
  - Factory set value: 0

**Memory backup**

Backed up by Nonvolatile Memory
- Number of write times: Approx. 100,000 times
- Data storage period: Approx. 10 years

**Power**

- **Power supply voltage:**
  - 55 to 264 V AC (Power supply voltage range), 50/60 Hz
  - 21.6 to 26.4 V AC (Power supply voltage range), 50/60 Hz
  - Rating: 100 to 240 V
  - Rating: 24 V AC
  - Rating: 24 V DC

**Performance:**

- **Contact input (optional):**
  - Dry contact input: At open 600 kΩ or more
  - At close 10 Ω or less
Changing Parameter Settings

Procedures to change parameter settings are shown below.

To store a new value for the parameter, always press the SET key. The display changes to the next parameter and the new value will be stored.
- A new value will not be stored without pressing the 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.

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

(288000) → (288000)

(PV/SV display mode) (SV setting display)

Press the SET key at PV/SV monitor screen until SV setting screen is displayed.

2. Shift the blinking digit

(288000) → (288000)

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

3. Change the set value

(288000) → (288000)

Press the UP key to change the number to 2.

4. Store the set value

(288000) → (288000)

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, 3 and 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 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 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.

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.

<table>
<thead>
<tr>
<th>Contact Input</th>
<th>Terminal No.</th>
<th>RUN</th>
<th>STOP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 – 12</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contact closed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contact open</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.3 Set Data Lock (LCK)

The set data lock restricts parameter settings changes by key operation. This function prevents the operator from making errors during operation.

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.

Requirements for AT cancellation

The AT is canceled if any of the following conditions exist.
• When the AT function is on.
• When the ST function is on.
• When the AT is not in use.

When AT is not in use for 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 AT was activated.

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

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.

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

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

When the ST function is activated, the PID and 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.

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, motor 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 determination range, the LBA will be ON.

Precaution for LBA setting:
- Displayed only for when LBA is selected as Alarm 1.
- No control loop break alarm can be used at Heat/Cool PID control action.
The LBA function cannot be activated when AT function is turned on.
The LBA setting time should be lengthened. If setting time is not correct, twice the value of the Integral time (I).
The time required for the LBA output to turn on includes both the time from the initial occurrence of loop failure and the LBA setting time.
If LBA setting time does not match the controlled object requirements, the LBA setting time should be lengthened. If setting time is not correct, 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*:

<table>
<thead>
<tr>
<th>Alarm area</th>
<th>Non-alarm area</th>
<th>Alarm area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
<td>High</td>
</tr>
</tbody>
</table>

Set value (SV) LBD set value

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

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

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. Durex 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
Press the SET key for 2 seconds to go to the Parameter setting mode from the PV/SV display.

8.2 Engineering Menu
Display flowcharts in engineering mode shown are in the following.

Do not change to 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.

Set the STOP mode.
Press and hold the -R/S key for 1 second

Press and hold the -R/S key while pressing the SET key for 2 seconds

Engineering Mode

PV/SV Display Mode
Press and hold the SET key for 2 seconds

Parameter Setting Mode
Press and hold the -R/S key for 1 second

STOP mode display

Function block symbol displayed 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.

### 8.4 Function Block 10 (F10)

(1) STOP display screen selection (SPCH)

<table>
<thead>
<tr>
<th>Set value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>STOP is displayed on the PV display unit. (TYPE 1)</td>
</tr>
<tr>
<td>0001</td>
<td>STOP is displayed on the SV display unit. (TYPE 2)</td>
</tr>
</tbody>
</table>

* 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.

#### 8.5 Function Block 21 (F21)

(1) Input type selection (INP)

Factory set value varies depending on the input type.

<table>
<thead>
<tr>
<th>Set value</th>
<th>Input type</th>
<th>Input type</th>
<th>Input type</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>R</td>
<td>0011</td>
<td>Thermocouple (TC)</td>
</tr>
<tr>
<td>0002</td>
<td>R</td>
<td>0012</td>
<td>Pt100 (JIS/IEC)</td>
</tr>
<tr>
<td>0003</td>
<td>S</td>
<td>0013</td>
<td>JPt100 (JIS)</td>
</tr>
<tr>
<td>0004</td>
<td>E</td>
<td>0014</td>
<td>0 to 10 VDC</td>
</tr>
<tr>
<td>0005</td>
<td>E</td>
<td>0015</td>
<td>15 to 20 mA DC</td>
</tr>
<tr>
<td>0006</td>
<td>N</td>
<td>0016</td>
<td>0 to 10 VDC</td>
</tr>
<tr>
<td>0007</td>
<td>W5Re/W26Re</td>
<td>0017</td>
<td>Current 1.2</td>
</tr>
<tr>
<td>0008</td>
<td>W5Re/W26Re</td>
<td>0018</td>
<td>0 to 20 mA DC</td>
</tr>
<tr>
<td>0009</td>
<td>PL II</td>
<td>0019</td>
<td>0 to 20 mA DC</td>
</tr>
</tbody>
</table>

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

* For the current input specification, an external resistor of 250 Ω must be connected between the input terminals.
3. Example: When the display range is scaled to 0.0 to 400.0 for a voltage

Set the setting limiter referring to the Input Range Table (P. 8).

Example: Change the decimal point position from "One decimal place

3. Example: Change the Input type from K to J

Factory set value varies depending on the instrument specification.

8.6 Function Block 30 (F30)

● Output logic operation selection (LoGC)

Match the setting with the instrument specification.

Otherwise malfunction may result.

 blended on the selected output allocation code.

- Not displayed when no control output is selected.
- Not displayed when control output corresponds to current output.

Factory set value varies depending on the instrument specification.

<table>
<thead>
<tr>
<th>Set value</th>
<th>OUT1</th>
<th>OUT2</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>Control output</td>
<td>OR output of alarm 1 and alarm 2 (Energized)</td>
<td>PID action + No alarm function *</td>
</tr>
<tr>
<td>002</td>
<td>Heat/Cool PID action *</td>
<td>PID action + Alarm 1 + Alarm 2</td>
<td>Heat/Cool PID action *</td>
</tr>
<tr>
<td>003</td>
<td>Alarm 1 output (De-energized)</td>
<td>PID action + Alarm 1</td>
<td>Alarm 1 output (De-energized)</td>
</tr>
<tr>
<td>004</td>
<td>AND output of alarm 1 and alarm 2 (Energized)</td>
<td>PID action + Alarm 1, alarm 2</td>
<td>AND output of alarm 1 and alarm 2 (De-energized)</td>
</tr>
<tr>
<td>005</td>
<td>OR output of alarm 1 and alarm 2 (De-energized)</td>
<td>PID action + Alarm 1, alarm 2</td>
<td>OR output of alarm 1 and alarm 2 (Energized)</td>
</tr>
<tr>
<td>006</td>
<td>AND output of alarm 1 and alarm 2 (De-energized)</td>
<td>PID action + Alarm 1, alarm 2</td>
<td>AND output of alarm 1 and alarm 2 (Energized)</td>
</tr>
<tr>
<td>007</td>
<td>No output</td>
<td>PID action + Alarm 1, alarm 2 or alarm 1 only</td>
<td>No output</td>
</tr>
<tr>
<td>008</td>
<td>Alarm 1 output (Energized)</td>
<td>PID action + Alarm 1, alarm 2</td>
<td>Alarm 2 output (Energized)</td>
</tr>
<tr>
<td>009</td>
<td>Alarm 2 output (De-energized)</td>
<td>PID action + Alarm 1, alarm 2</td>
<td>Alarm 2 output (Energized)</td>
</tr>
<tr>
<td>010</td>
<td>Alarm 2 output (Energized)</td>
<td>PID action + Alarm 1, alarm 2</td>
<td>Alarm 2 output (De-energized)</td>
</tr>
</tbody>
</table>

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

1) Alarm 1 type selection (A51)
2) Alarm 2 type selection (A52)

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

Factory set value varies depending on the instrument specification.

<table>
<thead>
<tr>
<th>Set value</th>
<th>Description</th>
<th>Set value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>000</td>
<td>Alarm not provided</td>
<td>005</td>
<td>Deviation high alarm</td>
</tr>
<tr>
<td>001</td>
<td>SV high alarm</td>
<td>006</td>
<td>Deviation high alarm</td>
</tr>
<tr>
<td>002</td>
<td>SV low alarm</td>
<td>007</td>
<td>Deviation high/low alarm</td>
</tr>
<tr>
<td>003</td>
<td>Process high alarm</td>
<td>008</td>
<td>Band alarm</td>
</tr>
<tr>
<td>004</td>
<td>PID action + Alarm 1, alarm 2</td>
<td>009</td>
<td>Control loop break alarm (LABA)</td>
</tr>
</tbody>
</table>

Available only with Alarm 1 type

- Standard output when no output code is specified.

● 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 A51 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.

(2) Alarm 1 hold action selection (Aho1)
1) 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.

<table>
<thead>
<tr>
<th>Set value</th>
<th>Description</th>
<th>Set value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>000</td>
<td>Without alarm hold action</td>
<td>001</td>
<td>Effective when the power is turned on, or operation is changed from STOP to RUN</td>
</tr>
<tr>
<td>002</td>
<td>Effective when the power is turned on, or operation is changed from STOP to RUN or the SV is changed.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

● 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 1.
3. Press the SET key to store the new set value. The display goes to the next parameter.

(3) Alarm 1 differential gap (AH1)
1) Alarm 2 differential gap (AH2)

Setting range: TC/RTD inputs, Voltage/Current inputs: 0 (0.0) to span

Factory set value: TC/RTD inputs: 2 °C [F] or 2.0 °C [F]

Voltage/Current inputs: 0.2 % of span

● 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.

8.8 Function Block 43 (F43) 44 (F44)

1) Alarm 3 type selection (A53)
2) Alarm 4 type selection (A54)

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

Factory set value varies depending on the instrument specification.

<table>
<thead>
<tr>
<th>Set value</th>
<th>Description</th>
<th>Set value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>000</td>
<td>Alarm not provided</td>
<td>005</td>
<td>Deviation high alarm</td>
</tr>
<tr>
<td>001</td>
<td>SV high alarm</td>
<td>006</td>
<td>Deviation high alarm</td>
</tr>
<tr>
<td>002</td>
<td>SV low alarm</td>
<td>007</td>
<td>Deviation high/low alarm</td>
</tr>
<tr>
<td>003</td>
<td>Process high alarm</td>
<td>008</td>
<td>Band alarm</td>
</tr>
<tr>
<td>004</td>
<td>PID action + Alarm 1, alarm 2</td>
<td>009</td>
<td>Control loop break alarm (LABA)</td>
</tr>
</tbody>
</table>

Available only with Alarm 1 type

- Standard output when no output code is specified.

● 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 A51 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.

(2) Alarm 1 hold action selection (Aho1)
1) 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.

<table>
<thead>
<tr>
<th>Set value</th>
<th>Description</th>
<th>Set value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>000</td>
<td>Without alarm hold action</td>
<td>001</td>
<td>Effective when the power is turned on, or operation is changed from STOP to RUN</td>
</tr>
<tr>
<td>002</td>
<td>Effective when the power is turned on, or operation is changed from STOP to RUN or the SV is changed.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

● 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 1.
3. Press the SET key to store the new set value. The display goes to the next parameter.

(3) Alarm 1 differential gap (AH1)
1) Alarm 2 differential gap (AH2)

Setting range: TC/RTD inputs, Voltage/Current inputs: 0 (0.0) to span

Factory set value: TC/RTD inputs: 2 °C [F] or 2.0 °C [F]

Voltage/Current inputs: 0.2 % of span

● 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.
8.8 Function Block 51 (F51)

Do not change eS1. Otherwise, it will cause malfunction.

ON/OFF Action differential gap (O/H)

Setting range: TC/RTD inputs, Voltage/Current inputs: 0 (0.0) to span

Factory set value: TC/RTD inputs: 2 °C/[°F] or 2.0 °C/[°F]

Voltage/Current inputs: 0.2% of span

8.9 Exit Engineering Mode

1. Transfer to function block symbol display (F□□) 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

9.1 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>1</td>
<td>Adjustment data error</td>
<td>Display: Error display (Err)</td>
<td>Turn off the power at once.</td>
</tr>
<tr>
<td>2</td>
<td>EEPROM error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A/D conversion error</td>
<td>All output is OFF</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>RAM check error</td>
<td>Alarm output: All output is OFF</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Watchdog timer error</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

The error codes are shown in the SV display.

When two or more errors occur simultaneously, the total summation of these error codes is displayed.

9.2 Over-scale and Underscale

- **Over-scale**
  - **Measured value (PV) is above the high input display range limit.**

- **Underscale**
  - **Measured value (PV) is below the low input display range limit.**

10. INPUT RANGE TABLE

<table>
<thead>
<tr>
<th>TC/RTD</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></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

11. REMOVING THE INTERNAL ASSEMBLY

Removing the internal assembly from the case is rarely required. Should you remove the internal assembly without disconnecting the external wiring, take the following steps:

**WARNING**

- To prevent electric shock or instrument failure, always turn off the power before pulling out the internal assembly.
- To prevent injury or instrument failure, do not touch the internal printed wiring board.

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

To conform to IEC61010-1 requirements for protection from electric shock, the internal assembly of this instrument can only be removed with an approved tool.

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

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

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