Temperature Controller SA100

SA100

General Description

The SA100 is a socket mounting type temperature controller and is available for mounting inside the panel or by easily mounting on DIN rail. The SA100 has features such as analog retransmission output, advanced self-tuning, alarms, digital communications for networking and digital contact for SV1/SV2 or RUN/STOP functions.

Features

- Simple mounting on DIN Rail
- Corresponding to various applications
- Analog retransmission output
- Digital communications
- Advanced self-tuning

Simple Mounting on DIN Rail

The SA100 can be simply mounted on a DIN rail with DIN rail mounting socket. The maintenance is also simple, as the unit can be removed from socket.

Corresponding to Various Applications

Two points of output can be used as control, alarm or analog retransmission. The SA100 corresponds to various applications such as temperature controller and overheat protection unit.

- As a temperature controller
  1. Temperature alarm controller
     - SV1: Control output
     - SV2: Alarm output
  2. Temperature retransmitting controller
     - SV1: Transmission output
     - SV2: Control output
  3. Heat/Cool temperature controller
     - SV1: Heating output
     - SV2: Cooling output

- As a overheat protection unit or alarm unit
  1. Overheat protection unit
     - SV1: Control output
     * Setting to ON/OFF action by specifying direct action.
  2. Overheat protection unit with transmitting function
     - SV1: Transmission output
     - SV2: Control output
     * Setting to ON/OFF action by specifying direct action.
  3. Alarm unit
     - SV1: Alarm output
     - SV2: Alarm output

- The change of display for PV/SV can be configurable. For the details of it, contact our sales office.

Analog Retransmission Output (Optional)

An analog output is available so that the process value can be retransmitted an analog signal to a remote instrument such as a recorder or data-logging equipment.

Analog output
4 to 20 mA DC or 0 to 20 mA DC

100.0°C

PV (measured value) display only
SV (set value) display only
The SV is displayed on PV display. Parameters are displayed on SV display.
**Features**

### Alarms (Optional)

Two alarm points can be configured for specific applications.

- **Temperature Alarm**
  - Deviation High, Deviation Low, Deviation High/Low, Band, Process High, Process Low
  (Hold action can be added to deviation and process type)
- **Set Value Alarm**
  - High, Low
- **Loop Break Alarm**

<table>
<thead>
<tr>
<th>Temperature Alarm</th>
<th>Δ SV</th>
<th>Δ Alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deviation High</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>Deviation Low</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Deviation High/Low</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>Process High</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Process Low</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>Set Value High</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>Set Value Low</td>
<td>ON</td>
<td>OFF</td>
</tr>
</tbody>
</table>

### Heat/Cool Control (Optional)

The Heat/Cool PID control features heat and cool outputs for use where process-generated heat exists. This allows the input of overlap or deadband settings which contribute to energy savings.

![Heat/Cool Control Diagram](image)

### Digital Contact Input for External Switching (Optional)

An optional digital contact input is available for RUN/STOP and SV1/SV2 switching. (RUN/STOP switching can also be completed at the front key panel.) This function can be used with the output from a timer, PLC, etc. When the communication feature is selected, the external contact input is not available.

- **RUN/STOP**
  - Contact:ON
  - Instrument operating (RUN mode)
  - Contact:OFF
  - Machine production in full operation (RUN mode)

- **SV1/SV2**
  - Contact:ON
  - Machine production suspended (SV1)
  - Contact:OFF
  - Machine production suspended (SV2)

### Self-Tuning Algorithm

The SA100 offers a new self-tuning feature that is initiated at start-up and when process parameters or conditions change. In these situations, the controller evaluates whether the preset PID parameters should be maintained or replaced by the latest self-tuning parameters to achieve the best control for the process. Self-tuning can be manually turned ON/OFF in the parameter setting mode. This feature is not available with the Heat/Cool control.

In addition to self-tuning, the SA100 has standard autotuning (AT) so that either function can be selected to achieve optimum process control.

![Self-Tuning Algorithm Diagram](image)

### Digital Communications (Optional)

The SA100 offers an optional RS-485 communications interface for networking to computers, PLCs and SCADA software. MODBUS or ANSI protocol can be selected. Up to 32 units, including host computer, can be multi-dropped on one RS-485 communication line. When the communication feature is selected, the external contact input is not available.

![Digital Communications Diagram](image)

Up to 31 units
Temperature Controller SA100

Specifications

Input

- **Input**
  - Thermocouple: K, J, E, T, R, S, B, N (JIS/IEC), PLII (NBS), W5Re/W26Re (ASTM), U, L (DIN)
  - Influence of external resistance: Approx. 0.2%/V/Ω
  - Input impedance: Approx. 1MΩ
  - Influence of lead resistance: Approx. 0.1%/Ω of reading
  - Maximum 10Ω per wire
  - Input break action: Up-scale
  - Input short action: Down-scale

- **Relay contact output**: 240V AC 3A (resistive load), Form C contact
  - Number of outputs: 2 points

- **Air cooling and water cooling type are available. (Specify when ordering.)**
  - **Heat/Cool PID control** (with autotuning function)
    - **ON/OFF action differential gap**: 2°C (°F) (Temperature input)
    - **ON/OFF, P, PI and PD control are also selectable.**

- **Control Method**
  - **PV Bias**
    - ±(0.3% of span + 1 digit)
  - **Temperature input**
    - 0.2% (Voltage, current input)
  - **ON/OFF action differential gap**: 2°C (°F) (Temperature input)
  - **ON/OFF, P, PI and PD control are also selectable.**
  - **Control Method**
  - **Measurement terminals and output terminal are not isolated.**

- **Measurement terminals and output terminal are not isolated.**
  - **Dielectric Strength**
    - 1000V AC for one minute between measured terminals and ground
    - 1500V AC for one minute between power terminals and ground

- **Dustproof and waterproof protection**: IP66

- **Power Consumption**
  - **[Rating : 24V DC]** (50/60Hz common)
    - a) 85 to 264V AC (Including supply voltage variation)
    - b) 2.16 to 26.4V AC (Including supply voltage variation)
      - [Rating : 24V DC] (50/60Hz common)
    - c) 21.6 to 26.4V DC (Ripple rate 10% p-p or less)
      - [Rating : 24V DC]

- **Power Supply**
  - **Non-voltage contact input. (OPEN : 500kΩ or more, CLOSE : 10Ω or less)**
  - **Output type**: 0 to 20mA DC, 4 to 20mA DC

- **Manipulated value**
  - **Type**: Process value, Set value, Deviation, Retransmission output is allocated to OUT1.

- **Communications**
  - **Communication method**: Based on RS-485 (2-wire)
  - **Communication speed**: 2400, 4800, 9600, 19200 BPS
  - **Protocol**: ANSI X3.28 (1976) 2.5 A4

- **Input Rating**
  - **Alarm output can be set for energized/de-energized action.**
  - **Alarm output can be set for ON/OFF action.**
  - **Input break action**: Down-scale
  - **Input break action**: Up-scale
  - **Maximum 10Ω**
  - **Influence of lead resistance**: Approx. 0.01%/Ω/Ω

Output

- **Output**
  - Can be set for control, alarm or retransmission functions.
  - Alarm output can be set for energized/de-energized action.
  - Alarm output can be set for AND/OR logic calculation.
  - **Number of outputs**: 2 points

- **Output Type**
  - **Relay contact output**
    - 240V AC 3A (resistive load), Form C contact
  - **Voltage pulse output**
    - 0/12V DC (Load resistance: more than 600Ω)
  - **Current output**
    - 0 to 20mA, 4 to 20mA DC
      - (Load resistance: less than 400Ω)
  - **Measurement terminals and output terminal are not isolated.**
  - **Measurement terminals and output terminal are not isolated.**

Alarms (Up to 2 points) (Optional)

- **Alarm Type**
  - Deviation High, Deviation Low, Deviation High-Low, Deviation Band Process High, Process Low, Set value High, Set value Low
  - Loop break alarm (LBA)

- **Setting Range**
  - a) Deviation alarm: ±span to +span (Within -1999 to 9999)
  - b) Process alarm: Same as set value (SV).
  - c) Set value alarm: Same as set value (SV).
  - d) Loop break alarm: 0.0 to 200.0 min.

- **Differential Gap**
  - 2°C (°F) or 2.0°C (°F) (Temperature input), 0.2% (Voltage, current input)

Contact Input

- **Number of Inputs**: 2 points

- **Contact Input Type**
  - a) RUN/STOP switching (OPEN : STOP, CLOSE : RUN)
  - b) STEP function (OPEN : SV1, CLOSE : SV2)

- **Input Rating**
  - Non-voltage contact input. (OPEN : 500kΩ or more, CLOSE : 10Ω or less)

Communications

- **Communication method**: Based on RS-485 (2-wire)
  - **Communication speed**: 2400, 4800, 9600, 19200 BPS
  - **Protocol**: ANSI X3.28 (1976) 2.5 A4

Retransmission Output

- **Retransmission output is allocated to OUT1.**
  - **Type**: Process value, Set value, Deviation, Manipulated value
  - **Output type**: 0 to 20mA DC, 4 to 20mA DC
  - **Output resolution**: More than 10bits
    - Measurement terminals and output terminal are not isolated.

Waterproof/Dustproof (Optional)

- **Dustproof and waterproof protection**: IP66
  - Waterproof and dustproof protection only effective from the front in panel mounted installations.

General Specifications

- **Supply Voltage**
  - a) 85 to 264V AC (Including supply voltage variation)
    - [Rating : 100 to 240V AC] (50/60Hz common)
  - b) 21.6 to 26.4V AC (Including supply voltage variation)
    - [Rating : 24V DC] (50/60Hz common)
  - c) 21.6 to 26.4V DC (Ripple rate 10% p-p or less)
    - [Rating : 24V DC]

- **Power Consumption**
  - Less than 4VA (at 100V AC), 4VA (at 240V AC) for standard AC type
  - Less than 4VA for 24V DC type

- **Power Failure Effect**
  - A power failure of 20 ms or less will not affect the control action.
  - If power failure of more than 20 ms occurs, controller will restart.

- **Operating Environments**
  - 0 to 50°C (32 to 122°F), 45 to 85% RH

- **Memory Backup**
  - Backed up by non-volatile memory.
  - Number of writing: Approx. 100,000 times

- **Compliance with Standards**
  - CE Mark
  - UL/cUL Recognized
  - C-Tick Mark

Net Weight: Approx. 120g
External Dimensions: (W x H x D): 48 x 48 x 70mm (1/16 DIN)

Compliance with Standards

CE Mark
UL/cUL Recognized
C-Tick Mark
## Temperature Controller SA100

### Model and Suffix Code

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Model and Suffix Code</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
<td>SA100 (1/16 DIN size, socket mounting type)</td>
</tr>
<tr>
<td><strong>Control method</strong></td>
<td>PID control with AT (reverse action)</td>
</tr>
<tr>
<td></td>
<td>PID control with AT (direct action)</td>
</tr>
<tr>
<td></td>
<td>Heat/cool PID control with AT (water cooling)</td>
</tr>
<tr>
<td><strong>Input and Range</strong></td>
<td>See Range and Input Code Table</td>
</tr>
<tr>
<td><strong>OUT 1</strong> (Control or alarm output)</td>
<td>Relay contact output</td>
</tr>
<tr>
<td></td>
<td>Voltage pulse output</td>
</tr>
<tr>
<td></td>
<td>DC current output: 0 to 20mA</td>
</tr>
<tr>
<td><strong>OUT 2</strong> (Control or alarm output)</td>
<td>No output</td>
</tr>
<tr>
<td></td>
<td>Relay contact output</td>
</tr>
<tr>
<td></td>
<td>Voltage pulse output</td>
</tr>
<tr>
<td><strong>Power supply voltage</strong></td>
<td>24V AC/DC</td>
</tr>
<tr>
<td></td>
<td>100 to 240V AC</td>
</tr>
<tr>
<td><strong>Alarm 1</strong></td>
<td>No alarm</td>
</tr>
<tr>
<td></td>
<td>See Alarm Code Table</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td>Not supplied</td>
</tr>
<tr>
<td><strong>Output allocation code</strong></td>
<td>Standard output</td>
</tr>
<tr>
<td></td>
<td>See Output Allocation Code Table</td>
</tr>
<tr>
<td><strong>Version symbol</strong></td>
<td>No code</td>
</tr>
</tbody>
</table>

1. When standard output is selected with control method F or D, Out 1 will always be the control output and Out 2 will either be unused. Alarm 1 OR OR logic output of Alarm 1 and Alarm 2. Standard output is automatically selected with control method W or A. Out 1 will become heat-side control output and Out 2 will be cool-side control output.

### Range and Input Code Table

#### Thermocouple input (Field-programmable)

<table>
<thead>
<tr>
<th>Input Code</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>K (JIS/IEC)</td>
<td></td>
</tr>
<tr>
<td>J (JIS/IEC)</td>
<td></td>
</tr>
<tr>
<td>R (JIS/IEC)</td>
<td></td>
</tr>
</tbody>
</table>

#### RTD input (Field-programmable)

<table>
<thead>
<tr>
<th>Input Code</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt100 (JIS/IEC)</td>
<td></td>
</tr>
<tr>
<td>J (JIS)</td>
<td></td>
</tr>
</tbody>
</table>

### Voltage/Current DC input ³ (Field-programmable)

<table>
<thead>
<tr>
<th>Input Code</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 5V</td>
<td></td>
</tr>
<tr>
<td>0 to 20mA</td>
<td></td>
</tr>
<tr>
<td>4 to 20mA</td>
<td></td>
</tr>
</tbody>
</table>

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³ Type R and B input: Accuracy is not guaranteed between 0 and 390°C (0 and 799°F).

1. Type T and U input: Accuracy is not guaranteed less than -100.0°C (-158.0°F).

2. DC current input: A 250 Ω resistor is externally connected at the input terminals.
### Alarm Code Table

<table>
<thead>
<tr>
<th>Code</th>
<th>Control methods</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>PID control + Alarm 1</td>
<td>Alarm 1 output (De-energized)</td>
</tr>
<tr>
<td>01</td>
<td>PID control + Alarm 1, 2</td>
<td>AND logic output of Alarm 1 and Alarm 2 (De-energized)</td>
</tr>
<tr>
<td>02</td>
<td>PID control + Alarm 1, 2</td>
<td>OR logic output of Alarm 1 and Alarm 2 (De-energized)</td>
</tr>
<tr>
<td>03</td>
<td>PID control + Alarm 1, 2</td>
<td>AND logic output of Alarm 1 and Alarm 2 (De-energized)</td>
</tr>
<tr>
<td>04</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 1 output (Energized)</td>
</tr>
<tr>
<td>05</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 2 output (Energized)</td>
</tr>
<tr>
<td>06</td>
<td>Alarm 1 + Alarm 2</td>
<td>No output</td>
</tr>
<tr>
<td>07</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 1 output (De-energized)</td>
</tr>
<tr>
<td>08</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 2 output (De-energized)</td>
</tr>
<tr>
<td>09</td>
<td>Alarm 1 + Alarm 2</td>
<td>Only Alarm 1 output (Energized)</td>
</tr>
<tr>
<td>10</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 2 output (Energized)</td>
</tr>
<tr>
<td>11</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 1 output (De-energized)</td>
</tr>
<tr>
<td>12</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 2 output (De-energized)</td>
</tr>
<tr>
<td>13</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 1 output (Energized)</td>
</tr>
<tr>
<td>14</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 2 output (Energized)</td>
</tr>
<tr>
<td>15</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 1 output (De-energized)</td>
</tr>
<tr>
<td>16</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 2 output (De-energized)</td>
</tr>
<tr>
<td>17</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 1 output (Energized)</td>
</tr>
<tr>
<td>18</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 1 output (De-energized)</td>
</tr>
<tr>
<td>19</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 2 output (De-energized)</td>
</tr>
</tbody>
</table>

1. Loop break alarm is not available with Heat/Cool PID control type. Loop break alarm is not available with Alarm 2.
2. Specify control action F to use both outputs as alarms.

### Output Allocation Code Table

<table>
<thead>
<tr>
<th>Code</th>
<th>Control methods</th>
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</thead>
<tbody>
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<td>Alarm 1 + Alarm 2</td>
<td>Alarm 1 output (Energized)</td>
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<tr>
<td>05</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 2 output (Energized)</td>
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<tr>
<td>06</td>
<td>Alarm 1 + Alarm 2</td>
<td>No output</td>
</tr>
<tr>
<td>07</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 1 output (De-energized)</td>
</tr>
<tr>
<td>08</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 2 output (De-energized)</td>
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<td>Alarm 1 + Alarm 2</td>
<td>Only Alarm 1 output (Energized)</td>
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<td>10</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 2 output (Energized)</td>
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<td>Alarm 1 + Alarm 2</td>
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<tr>
<td>16</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 2 output (De-energized)</td>
</tr>
<tr>
<td>17</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 1 output (Energized)</td>
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<tr>
<td>18</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 1 output (De-energized)</td>
</tr>
<tr>
<td>19</td>
<td>Alarm 1 + Alarm 2</td>
<td>Alarm 2 output (De-energized)</td>
</tr>
</tbody>
</table>

1. The alarm monitor can only be confirmed by front LCD display or serial communication.
2. Specify control action F to use both outputs as alarms.

### Accessories

<table>
<thead>
<tr>
<th>Name</th>
<th>Model code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shunt resistor for DC current input</td>
<td>KD100-SS</td>
</tr>
<tr>
<td>Terminal cover</td>
<td>KSA200-56A</td>
</tr>
</tbody>
</table>
**External Dimensions and Rear Layout**

- Panel thickness must be between 1-10mm.
- Mounting frame is optional.

---

**Contents**

<table>
<thead>
<tr>
<th>PIN</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
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<tbody>
<tr>
<td>B</td>
<td>B</td>
<td>A</td>
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<td></td>
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<td>A</td>
<td></td>
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<td></td>
<td></td>
<td>NO</td>
<td>NC</td>
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<td>100 to 240V AC</td>
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<td>24V AC/DC</td>
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<td></td>
<td>Voltage pulse</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Voltage pulse</td>
</tr>
</tbody>
</table>

- *A 250Ω resistor is externally connected at the input terminals.*

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**Socket (Optional) External Dimensions**

**DIN rail mounting socket type**
- Model: ATC180041 (Matsushita Denko product)

**Rear terminal socket type**
- Model: AT78051 (Matsushita Denko product)