Digital Temperature Controller SA100

SA100

General Description

The SA100 is a socket mounting type temperature controller and is available for mounting inside panel 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 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
     Control output
     Alarm output
  2. Temperature transmitting controller
     Control output
     Output
  3. Heat/Cool temperature controller
     Control output
     Heating output
     Cooling output

☆ As an overheat protection unit or alarm unit
  1. Overheat protection unit
     Control output
     * Setting is ON/OFF action by specifying direct action.
  2. Overheat protection unit with transmitting function
     Control output
     Output
  3. Alarm unit
     Alarm output
     * Setting is ON/OFF action by specifying direct action.

☆ 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.
Digital Temperature Controller SA100

Features

Alarms (Optional)

Two alarm points can be configured for specific applications.

Alarm Type
- Temperature Alarm
- Deviation High, Deviation Low, Deviation High/Low, Band, Process High, Process Low
- Set Value Alarm
- High, Low
- Loop Break Alarm

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.

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 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.

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 SA200 has standard autotuning (AT) so that either function can be selected to achieve optimum process control.
### Digital Temperature Controller SA100

#### Specifications

**Input**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermocouple</td>
<td>K, J, E, T, R, S, B, N (JIS/IEC), P (NBS)</td>
</tr>
<tr>
<td>RTD</td>
<td>Pt100 (JIS/IEC), JPt100 (JIS)</td>
</tr>
<tr>
<td>Voltage</td>
<td>0 to 5V DC, 0 to 10V DC</td>
</tr>
<tr>
<td>Current</td>
<td>0 to 20mA DC, 4 to 20mA DC</td>
</tr>
</tbody>
</table>

**Current Output**

- 0 to 20mA, 4 to 20mA DC
- Span to +span (Within -1999 to 9999)

**Sampling Time**

- 0.5 sec.

**PV Bias**

- span to +span (Within -999 to 9999)

#### Performance

**Measuring Accuracy**

- Thermocouple: ±1% of reading + 1 digit or ±0.002% of span whichever is larger
- Accuracy is guaranteed between 0 and 399°C (0 and 799°F) for type K and B
- Accuracy is not guaranteed less than -100.0°C (-180.0°F) for type T and U
- RTD: ±0.3% of reading + 1 digit or ±0.8°C (1.6°F) whichever is larger
- Accuracy of voltage and current: ±0.3% of span + 1 digit

**Insulation Resistance**

- More than 20MΩ (500V DC) between measured terminals and ground
- More than 20MΩ (500V DC) between power terminals and ground

**Dielectric Strength**

- 1000V AC for one minute between measured terminals and ground
- 1500V AC for one minute between power terminals and ground

**Control**

- PID control (with autotuning and self-tuning function)
- Available for reverse and direct action. (Specify when ordering.)
- ON-OFF, P, PI, and PID control are also selectable.
- ON-OFF action (differential gap: 2°C) (Temperature input: 0.2°C, Voltage, current input)
- Heat/Cool PID control (with autotuning function)
- AI heating and AI cooling type are available. (Specify when ordering.)

**Major Setting Range**

- Set value: Same as input range
- Heat side proportional band: 1 to span or 0 to 1 span
- Cost side proportional band: 0 to 100% of heat side proportional band
- Integral time: 0 to 36000 sec (PID action when I=0)
- Derivative time: 0 to 3600 sec (PI action when D=0)
- Anti Reset Windup (ARW): 0 to 100% of heat side proportional band (Integral action is OFF when ARW=0)
- Proportional cycle time: 1 to 100 sec
- Deadband/Overlap: span to +span (Within -999 to 9999)

**Outputs**

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

**Output Type**

- Relay contact output: 250V AC 2A (positive load), Form C contact
- Voltage pulse output: 0/12V DC (Load resistance: more than 500Ω)
- Measurement terminals and output terminal are not isolated.
- Current output: 0 to 20mA, 4 to 20mA DC (Load resistance: less than 400Ω)
- Measurement terminals and output terminal are not isolated.

#### Alarms (Up to 2 points)

**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**

- Deviation alarm: span to +span (Within -999 to 9999)
- Process alarm: Same as set value (SV)
- Set value alarm: Same as set value (SV)
- Loop break alarm: 0.0 to 200.0 min.

**Differential Gap**

- 2°C (°F) or 2°C (°F) (Temperature input), 0.2% (Voltage, current input)

**Contact Input**

- Number of inputs: 2 points

**Contact Input Type**

- RUN/STOP switching (OPEN : STOP, CLOSE : RUN)
- 8-bit function (OPEN : SV, CLOSE : SV)

**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 A 4 MODBUS
- Bit format: Start bit: 1, Data bit: 7 or 8, With, Odd or Even
- Parity bit: Without, Odd or Even
- Stop bit: 1 or 2
- Communication code: ASCII (JIS) 7-bit code
- Maximum connection: 31 (Address can be set from 0 to 99.)

#### 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

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

#### General Specifications

**Supply Voltage**

- 125 to 265V AC (Including supply voltage variation)
- (Rating: 100 to 240V AC) (50/60Hz common)
- 25.6 to 26.4V DC (Including supply voltage variation)
- (Rating: 24V AC) (50/60Hz common)
- 21.6 to 26.4V DC (Ripple rate 1% p-p or less)
- (Rating: 24V DC)

**Power Consumption**

- Less than 4VA at 100V AC, 7VA at 240V AC for standard AC type
- Less than 4VA for 24V AC type
- Less than 100mA 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**

- Back up by non-volatile memory.

**Because of writing: Approx. 100,000 times**

**Net Weight**

- Approx. 125g

**External Dimensions**

- (W x H x D): 48 x 48 x 70mm (1 1/16 DIN)

#### Compliance with Standards

- CE Mark
- UL Recognized
- C-UL Recognized
- CSA Certified
- Chinese C-Tag
### Digital Temperature Controller SA100

#### Specfications

<table>
<thead>
<tr>
<th>Model and Suffix Code</th>
<th>Model and Suffix Code</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control method</strong></td>
<td>PID control with AT (reverse action)</td>
</tr>
<tr>
<td></td>
<td>Heat/cool PID control with AT (water cooling)</td>
</tr>
</tbody>
</table>

#### Range and Input Code Table

#### Thermocouple input (Field-programmable)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### RTD input (Field-programmable)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Range and Input Code Table

#### Output allocation code

1. Standard output
2. See Output Allocation Code Table
3. No code
4. Version symbol

#### Instrument version

1. When standard output is selected with control method F or G, Out 1 will always be the control output and Out 2 will either be unused, Alarm 1 or Alarm 2.
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.

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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Alarm Code Table

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Deviation High</td>
</tr>
<tr>
<td>B</td>
<td>Deviation Low</td>
</tr>
<tr>
<td>C</td>
<td>Deviation High/Low</td>
</tr>
<tr>
<td>D</td>
<td>Deviation Band</td>
</tr>
<tr>
<td>E</td>
<td>Process Low</td>
</tr>
<tr>
<td>F</td>
<td>Process High</td>
</tr>
<tr>
<td>G</td>
<td>Process High with Hold</td>
</tr>
<tr>
<td>H</td>
<td>Set value High</td>
</tr>
<tr>
<td>I</td>
<td>Set value Low</td>
</tr>
<tr>
<td>J</td>
<td>Loop break alarm</td>
</tr>
</tbody>
</table>

Loop break alarm is not available with Heat/Cool PID control type.

## Output Allocation Code Table

### Code 0 3

<table>
<thead>
<tr>
<th>Code</th>
<th>Control methods</th>
<th>Output 1</th>
<th>Output 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>PID control + Alarm 1</td>
<td>Control output</td>
<td>Alarm 1 output (De-energized)</td>
</tr>
<tr>
<td>1</td>
<td>PID control + Alarm 1, 2</td>
<td>Control output</td>
<td>Alarm 1 output (Energized)</td>
</tr>
<tr>
<td>2</td>
<td>PID control + Alarm 1, 2 or only Alarm 1</td>
<td>Control output</td>
<td>Alarm 2 output (De-energized)</td>
</tr>
<tr>
<td>3</td>
<td>Retransmission + PID control</td>
<td>Retransmission output</td>
<td>Control output</td>
</tr>
<tr>
<td>4</td>
<td>Retransmission + Alarm 1, 2</td>
<td>Retransmission output</td>
<td>Alarm 1 output (De-energized)</td>
</tr>
<tr>
<td>5</td>
<td>Retransmission + Alarm 1, 2 or only Alarm 1</td>
<td>Retransmission output</td>
<td>Alarm 2 output (De-energized)</td>
</tr>
<tr>
<td>6</td>
<td>Retransmission + Alarm 1</td>
<td>Retransmission output</td>
<td>Alarm 1 output (Energized)</td>
</tr>
<tr>
<td>7</td>
<td>Retransmission + Alarm 1, 2</td>
<td>Retransmission output</td>
<td>Alarm 2 output (Energized)</td>
</tr>
<tr>
<td>8</td>
<td>Retransmission + Alarm 1</td>
<td>Retransmission output</td>
<td>Alarm 1 output (De-energized)</td>
</tr>
<tr>
<td>9</td>
<td>Heat-Cool PID control</td>
<td>Heat output (Relay contact output)</td>
<td>Heat output (Relay contact or Voltage pulse output)</td>
</tr>
</tbody>
</table>

### Specifications

**Standard**: Suitable for digital temperature controllers with Heat/Cool PID control type.

**Code 0 4**: No alarm

- **Output 1**
  - PID
  - Alarm 1: Energized alarm
  - Alarm 2: Alarm OFF
- **Output 2**
  - ALM1
  - ALM2
  - Alarm OFF

**Code 0 5**: Only display

- **Output 1**
  - PID
  - Alarm 1: Alarm OFF
  - Alarm 2: Alarm OFF
- **Output 2**
  - ALM1
  - ALM2
  - Alarm OFF

**Code 0 6**: Heat-side

- **Output 1**
  - PID
  - Alarm 1: Alarm OFF
  - Alarm 2: Alarm OFF
- **Output 2**
  - ALM1
  - ALM2
  - Alarm OFF

**Code 0 7**: Cool-side

- **Output 1**
  - PID
  - Alarm 1: Alarm OFF
  - Alarm 2: Alarm OFF
- **Output 2**
  - ALM1
  - ALM2
  - Alarm OFF

**Code 0 8**: Retransmission

- **Output 1**
  - PID
  - Alarm 1: Alarm OFF
  - Alarm 2: Alarm OFF
- **Output 2**
  - ALM1
  - ALM2
  - Alarm OFF

**Code 0 9**: Only display

- **Output 1**
  - PID
  - Alarm 1: Alarm OFF
  - Alarm 2: Alarm OFF
- **Output 2**
  - ALM1
  - ALM2
  - Alarm OFF

**Code 1 0**: Retransmission

- **Output 1**
  - PID
  - Alarm 1: Alarm OFF
  - Alarm 2: Alarm OFF
- **Output 2**
  - ALM1
  - ALM2
  - Alarm OFF

**Code 1 1**: Alarm 1 output

- **Output 1**
  - PID
  - Alarm 1: Alarm OFF
  - Alarm 2: Alarm OFF
- **Output 2**
  - ALM1
  - ALM2
  - Alarm OFF

**Code 1 2**: Alarm 2 output

- **Output 1**
  - PID
  - Alarm 1: Alarm OFF
  - Alarm 2: Alarm OFF
- **Output 2**
  - ALM1
  - ALM2
  - Alarm OFF

**Code 1 3**: Retransmission

- **Output 1**
  - PID
  - Alarm 1: Alarm OFF
  - Alarm 2: Alarm OFF
- **Output 2**
  - ALM1
  - ALM2
  - Alarm OFF

**Code 1 4**: Alarm 1 output

- **Output 1**
  - PID
  - Alarm 1: Alarm OFF
  - Alarm 2: Alarm OFF
- **Output 2**
  - ALM1
  - ALM2
  - Alarm OFF

**Code 1 5**: Alarm 2 output

- **Output 1**
  - PID
  - Alarm 1: Alarm OFF
  - Alarm 2: Alarm OFF
- **Output 2**
  - ALM1
  - ALM2
  - Alarm OFF

**Code 1 6**: Retransmission

- **Output 1**
  - PID
  - Alarm 1: Alarm OFF
  - Alarm 2: Alarm OFF
- **Output 2**
  - ALM1
  - ALM2
  - Alarm OFF

**Code 1 7**: Alarm 1 output

- **Output 1**
  - PID
  - Alarm 1: Alarm OFF
  - Alarm 2: Alarm OFF
- **Output 2**
  - ALM1
  - ALM2
  - Alarm OFF

**Code 1 8**: Alarm 2 output

- **Output 1**
  - PID
  - Alarm 1: Alarm OFF
  - Alarm 2: Alarm OFF
- **Output 2**
  - ALM1
  - ALM2
  - Alarm OFF

**Code 1 9**: Retransmission

- **Output 1**
  - PID
  - Alarm 1: Alarm OFF
  - Alarm 2: Alarm OFF
- **Output 2**
  - ALM1
  - ALM2
  - Alarm OFF

### Note:
- Relay contact output: 250V AC 2A (resistive load), Form A contact
- Power supply OFF: Open

## Accessory

### Name: Shunt resistor for DC current input
- Model code: KD100-55
- Terminal cover: KSA200-56A
Digital Temperature Controller SA100

External Dimensions and Rear Layout

Panel Cutout

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

Panel Cutout

25 0.6
25
45
48
44.8
8.1
70
80
62.5

Contents

<table>
<thead>
<tr>
<th>Contents</th>
<th>Measured input</th>
<th>Output 1</th>
<th>Output 2</th>
<th>Power supply</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100 to 240V AC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24V AC/DC</td>
</tr>
</tbody>
</table>

Contact inputs

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

- Communication function and contact input are optional.
- Connect connector to bottom of instrument.
- A connector and connector cable for connecting the input block is necessary to be prepared by the customer.
- Housing: XHP-3 (U.S.T. Mfg. Co., Ltd. product)
- Recommended cable size: AWG30 to 22

Socket (Optional) External Dimensions

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

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