# SA100L

## General Description

The SA100L is a FM approved high limit or low limit controllers. 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 and digital communications for networking.
SA100L is CE marked, UL/cUL and FM approved.

## Features

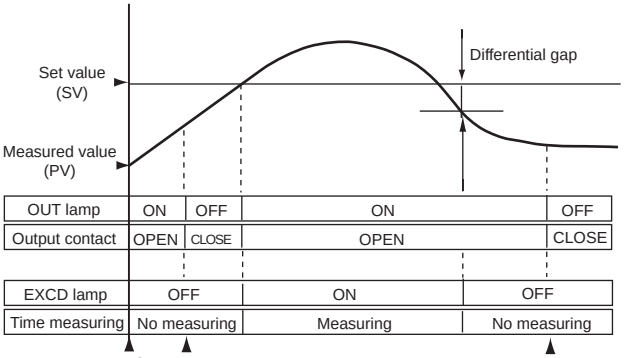
- ☆ Over/Under temperature protection
- ☆ Digital communications
- ☆ Peak temperature measurement
- ☆ Over temperature timer
- ☆ CE marked, UL/cUL and FM approved

### Over/Under Temperature Protection

The SA100L provide you the over/under temperature protection for your equipment or products in process. When the temperature goes above or below the set value (high limit or low limit), the SA100L will interrupt or remove the power from the process. This output can be used for alarm or interrupting power to the heater circuit.
For safety reason, the output will be retained until reset operation is executed even when the measured value goes back to the normal range. Reset operation can be executed by front key operation, communication, or digital input.

The SA100L limit actions can also be configured :
Limit output at power-up : ON/OFF
Alarm output : Energized/de-energized
Limit type : High-limit for over-temperature / Low-limit for under-temperature

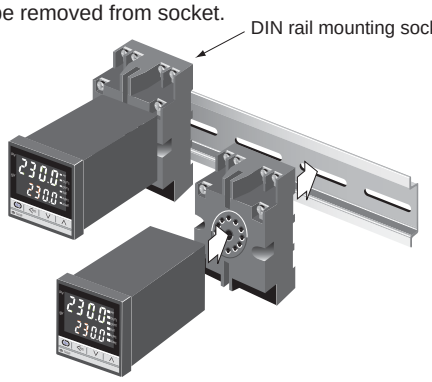
The SA100L measures the time while the measured value goes above/below the set value, and it retains the peak value.



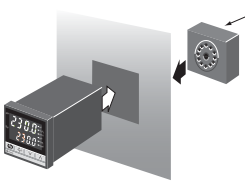

• Output contact is open when power is OFF.(De-energized output)

### 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.

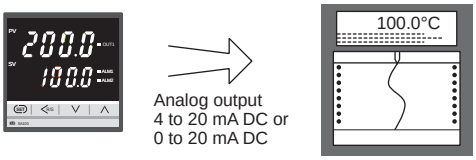



• The rear terminal socket allows the unit to be mounted on a panel board.




### 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 Communications (Optional)

The SA100L 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.

# Specifications

## Input

***Input***

a) Thermocouple : K, J, R, S, B, E, T, N (JIS/IEC), PLII (NBS)
W5Re/W26Re (ASTM), U, L (DIN)
- Influence of external resistance : Approx. 0.2μV/Ω
- Input break action : Up-scale

b) RTD : Pt100 (JIS/IEC), JPt100 (JIS)
- Influence of input lead resistance : Approx. 0.01[%/Ω] of reading
- Maximum 10Ω per wire
- Input break action : Up-scale

c) DC voltage : 0 to 5V, 1 to 5V, 0 to 10V (0.0 to 100.0% Default value)
- DC voltage input can be used for the input of 0 to 20mA (in case of 0 to 5V) and 4 to 20mA (1 to 5V) by attaching 250 Ω shunt resistor (sold separately) to input terminal.
- Refer to the Input and Range Code Table for details.
- Input break action : Down-scale

***Sampling Time***

0.5 sec

***Input digital filter***

0 to 100 sec (OFF when 0 is set.)

***PV Bias***

- span to +span

***PV Ratio***

0.500 to 1.500

## Performance

***Measuring Accuracy***

a) Thermocouple
±(1% of reading + 1 digit) or ±2°C (4°F) whichever is larger
- Accuracy is not guaranteed between 0 and 399°C (0 and 799°F) for type R, S and B.
- Accuracy is not guaranteed less than -100.0°C (-158.0°F) for type T and U.

b) RTD
±(0.3% of reading + 1 digit) or ±0.8°C (1.6°F) whichever is larger

c) DC voltage and DC 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

## Action

***Limit Action***

High limit control
- De-energized or energized output can be selected
- Low limit control is available.
- The control output contact goes OPEN (CLOSED when set to ergized) when measured value exceeds the set value, and it is retained until reset operation is executed. The reset can be made by front key operation, communication, or digital input.
- The state of control output contact when power-up can be configured. The output contact is OPEN when power-up for standard de-energized type.

***Limit Action Output***

Relay contact output, Form A contact, 250V AC, 3A (resistive load)
- Electrical life: 300,000 times or more (rated load)

## Other Standard Functions

***Hold Function***

Memorizes the maximum value and the minimum value.
- Hold value can be reset by front key operation, communication, or digital input.
- Hold value is reset when the controller is turned off.

***Integrated Time Measuring***

Counts up the time during the measured value exceeds the set value (High limit or Low limit).
- Integrated time can be reset by front key operation, communication, or digital input.
- Integrated time is reset when the controller is turned off.

Display :
Less than 100 min : 0 min 00 sec (0.00) to 99 min 59 sec (99.59)
100 min or more : 100 min 0_ sec (100.0) to 999 min 5_ sec (999.5_)
More than 1000 min : " ---- " display

## Optional Functions

***Output***

Can be set for limit control, alarm or retransmission function.
- Output can be set for energized/de-energized action.
- Output can be set for AND/OR logic calculation.

Number of outputs : 2 points

***Output Type***

a) Relay contact output, 240V AC 3A (Resistive load) Form C contact
b) Current output : 0 to 20mA DC (Load resistance : less than 400Ω)
4 to 20mA DC (Load resistance : less than 400Ω)
- Measurement terminals and output terminals are not isolated.

## Optional Functions

***Temperature Alarms***

a) Number of points : 2 points
b) Type : Deviation High, Deviation Low, Deviation High/Low, Band, Process High, Process Low Set value high, Set value low (Hold action is available)
c) Differential gap : 0 to span (Less than 9999 digit)
d) Other function : Selection of action for input abnormality. Alarm timer function, Interlock function.

***Communications***

a) Communication method : RS-485 (2-wire)
c) Protocol : ANSI X3.28 (1976) 2.5 A4, MODBUS
b) Communication speed : 1200, 2400, 4800, 9600, 19200 BPS
c) Bit format
Start bit : 1
Data bit : 7 or 8 • For MODBUS 8 bit only
Parity bit: Without, Odd, or Even
Stop bit : 1 or 2
d) Maximum connection : 31 ( Address can be set from 1 to 99.)

***Contact Input***

a) Number of points : 2 point
b) Input method : Non-voltage contact input
- Resistance at OPEN : 500KΩ or more
- Resistance at CLOSE : 10Ω or less

c) Function :
DI1: Limit Output Reset Function
DI2: Interlock Reset Function

***Retransmission***

Retransmission output is allocated to OUT1.
a) Type : Process value, Set value, Deviation, Manipulated value

***Waterproof/Dustproof***

IP66
- Dustproof and waterproof protection are effective only from the front direction when installed on a panel.

## 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 AC] (50/60Hz common)
c) 21.6 to 26.4V DC (Ripple rate 10% p-p or less) [Rating : 24V DC]

***Power Consumption***

Less than 7VA for standard AC type
Less than 4VA for 24V AC type
Less than 100mA for 24V DC type

***Power Failure Effect***

Not affected by power failure shorter than 20msec, otherwise reset to the initial state.

***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
Data retaining period : Approx. 10 years

***Net Weight***

Approx. 120g

***External Dimensions*** (W x H x D)

48 x 48 x 70mm

## Compliance with Standards

- CE Mark
- UL/cUL Recognized
- FM Approved

# Model and Suffix Code

| Specifications | Model and Suffix Code |
|---|---|
| Model | SA100L (48 x 48 mm,1/16 DIN size, socket mounting type) ☐ ☐ ☐ ☐ – ☐ ☐ ☐ – ☐ ✱ ☐ ☐ – ☐ ☐ ⟋ ☐ ☐ ⟋ Y |
| Control method | PID control with AT (reverse action) F<br>PID control with AT (direct action) D<br>Heat/cool PID control with AT (water cooling) W<br>Heat/cool PID control with AT (air cooling) A |
| Input and Range | See Range and Input Code Table ☐ ☐ ☐ |
| OUT 1 (Control, alarm or retransmission output) | Relay contact output M<br>Voltage pulse output V<br>DC current output : 0 to 20mA 7<br>DC current output : 4 to 20mA 8 |
| OUT 2 (Control or alarm output) | No output N<br>Relay contact output M<br>Voltage pulse output V |
| Power supply voltage | 24V AC/DC 3<br>100 to 240V AC 4 |
| Alarm 1 | No alarm N<br>See Alarm Code Table ☐ |
| Alarm 2 | No alarm N<br>See Alarm Code Table ☐ |
| Communication Contact input | Not supplied N<br>Digital communications : RS-485 (RKC standard) 5<br>Digital communications : RS-485 (MODBUS) 6<br>External contact input D |
| Waterproof/Dustproof | Not supplied N<br>Waterproof/Dustproof protection 1 |
| Output allocation code [1] | Standard output No code ☐ ☐<br>See Output Allocation Code Table |
| Instrument version | Version symbol Y |

1 Standard output :
a) OUT 1 = Relay contact output (Code : M) : Limit control output (De-energized)
OUT 2 = No output
b) OUT 1 = Relay contact output (Code : M) : Limit control output (De-energized)
OUT 2 = Relay contact output (Code : M) : Alarm 1 or OR logic output of Alarm 1 and Alarm 2.
c) OUT 1 = DC current output (Code : 7 or 8) : Retransmission output.
OUT 2 = Relay contact output (Code : M) : Limit control output (De-energized)

## Range and Input Code Table

Thermocouple input (Field-programmable)

| Input | Code | Range |
|---|---|---|
| K (JIS/IEC) | K 01 | 0 to 200℃ |
| | K 02 | 0 to 400℃ |
| | K 03 | 0 to 600℃ |
| | K 04 | 0 to 800℃ |
| | K 05 | 0 to 1000℃ |
| | K 06 | 0 to 1200℃ |
| | K 07 | 0 to 1372℃ |
| | K 13 | 0 to 100℃ |
| | K 14 | 0 to 300℃ |
| | K 20 | 0 to 500℃ |
| | K 17 | 0 to 450℃ |
| | K 08 | -199.9 to 300.0℃ |
| | K 09 | 0.0 to 400.0℃ |
| | K 10 | 0.0 to 800.0℃ |
| | K 29 | 0.0 to 200.0℃ |
| | K 37 | 0.0 to 600.0℃ |
| | K 38 | -199.9 to 800.0℃ |
| | K A1 | 0 to 800℉ |
| | K A2 | 0 to 1600℉ |
| | K A3 | 0 to 2502℉ |
| | K A9 | 20 to 70℉ |
| | K A4 | 0.0 to 800.0℉ |
| | K B2 | -199.9 to 999.9℉ |
| J (JIS/IEC) | J 01 | 0 to 200℃ |
| | J 02 | 0 to 400℃ |
| | J 03 | 0 to 600℃ |
| | J 04 | 0 to 800℃ |
| | J 05 | 0 to 1000℃ |
| | J 06 | 0 to 1200℃ |
| | J 10 | 0 to 450℃ |
| | J 07 | -199.9 to 300.0℃ |
| | J 08 | 0.0 to 400.0℃ |
| | J 09 | 0.0 to 800.0℃ |
| | J 22 | 0.0 to 200.0℃ |
| | J 23 | 0.0 to 600.0℃ |
| | J 30 | -199.9 to 600.0℃ |
| | J A1 | 0 to 800℉ |
| | J A2 | 0 to 1600℉ |
| | J A3 | 0 to 2192℉ |
| | J A6 | 0 to 400℉ |
| | J B6 | 0.0 to 800.0℉ |
| | J A9 | -199.9 to 999.9℉ |
| R [1] (JIS/IEC) | R 01 | 0 to 1600℃ |
| | R 02 | 0 to 1769℃ |
| | R 04 | 0 to 1350℃ |
| | R A1 | 0 to 3200℉ |
| | R A2 | 0 to 3216℉ |

| Input | Code | Range |
|---|---|---|
| S [1] (JIS/IEC) | S 01 | 0 to 1600℃ |
| | S 02 | 0 to 1769℃ |
| | S A1 | 0 to 3200℉ |
| | S A2 | 0 to 3216℉ |
| B [1] (JIS/IEC) | B 01 | 400 to 1800℃ |
| | B 02 | 0 to 1820℃ |
| | B A1 | 800 to 3200℉ |
| | B A2 | 0 to 3308℉ |
| E (JIS/IEC) | E 01 | 0 to 800℃ |
| | E 02 | 0 to 1000℃ |
| | E A1 | 0 to 1600℉ |
| | E A2 | 0 to 1832℉ |
| N (JIS/IEC) | N 01 | 0 to 1200℃ |
| | N 02 | 0 to 1300℃ |
| | N 06 | 0.0 to 800.0℃ |
| | N A1 | 0 to 2300℉ |
| | N A2 | 0 to 2372℉ |
| | N A5 | 0.0 to 999.9℉ |
| T [2] (JIS/IEC) | T 01 | -199.9 to 400.0℃ |
| | T 02 | -199.9 to 100.0℃ |
| | T 03 | -100.0 to 200.0℃ |
| | T 04 | 0.0 to 350.0℃ |
| | T A1 | -199.9 to 752.0℉ |
| | T A2 | -100.0 to 200.0℉ |
| | T A3 | -100.0 to 400.0℉ |
| | T A4 | 0.0 to 450.0℉ |
| | T A5 | 0.0 to 752.0℉ |
| W5Re/W26Re (ASTM) | W 01 | 0 to 2000℃ |
| | W 02 | 0 to 2320℃ |
| | W A1 | 0 to 4000℉ |
| PLII (NBS) | A 01 | 0 to 1300℃ |
| | A 02 | 0 to 1390℃ |
| | A 03 | 0 to 1200℃ |
| | A A1 | 0 to 2400℉ |
| | A A2 | 0 to 2534℉ |
| U [2] (DIN) | U 01 | -199.9 to 600.0℃ |
| | U 02 | -199.9 to 100.0℃ |
| | U 03 | 0.0 to 400.0℃ |
| | U A1 | -199.9 to 999.9℉ |
| | U A2 | -100.0 to 200.0℉ |
| | U A3 | 0.0 to 999.9℉ |
| L (DIN) | L 01 | 0 to 400℃ |
| | L 02 | 0 to 800℃ |
| | L A1 | 0 to 800℉ |
| | L A2 | 0 to 1600℉ |

RTD input (Field-programmable)

| Input | Code | Range |
|---|---|---|
| Pt100 (JIS/IEC) | D 01 | -199.9 to 649.0℃ |
| | D 02 | -199.9 to 200.0℃ |
| | D 03 | -100.0 to 50.0℃ |
| | D 04 | -100.0 to 100.0℃ |
| | D 05 | -100.0 to 200.0℃ |
| | D 06 | 0.0 to 50.0℃ |
| | D 07 | 0.0 to 100.0℃ |
| | D 08 | 0.0 to 200.0℃ |
| | D 09 | 0.0 to 300.0℃ |
| | D 10 | 0.0 to 500.0℃ |
| | D A1 | -199.9 to 999.9℉ |
| | D A2 | -199.9 to 400.0℉ |
| | D A3 | -199.9 to 200.0℉ |
| | D A4 | -100.0 to 100.0℉ |
| | D A5 | -100.0 to 300.0℉ |
| | D A6 | 0.0 to 100.0℉ |
| | D A7 | 0.0 to 200.0℉ |
| | D A8 | 0.0 to 400.0℉ |
| | D A9 | 0.0 to 500.0℉ |
| JPt100 (JIS) | P 01 | -199.9 to 649.0℃ |
| | P 02 | -199.9 to 200.0℃ |
| | P 03 | -100.0 to 50.0℃ |
| | P 04 | -100.0 to 100.0℃ |
| | P 05 | -100.0 to 200.0℃ |
| | P 06 | 0.0 to 50.0℃ |
| | P 07 | 0.0 to 100.0℃ |
| | P 08 | 0.0 to 200.0℃ |
| | P 09 | 0.0 to 300.0℃ |
| | P 10 | 0.0 to 500.0℃ |

Voltage/Current DC input [3] (Field-programmable)

| Input | Code | Range |
|---|---|---|
| 0 to 5V | 4 01 | 0.0 to 100.0% |
| 0 to 10V | 5 01 | 0.0 to 100.0% |
| 1 to 5V | 6 01 | 0.0 to 100.0% |
| 0 to 20mA | 7 01 | 0.0 to 100.0% |
| 4 to 20mA | 8 01 | 0.0 to 100.0% |

1 Type R,S and B input : Accuracy is not guaranteed between 0 and 399°C (0 and 799°F).
2 Type T and U input : Accuracy is not guaranteed less than -100.0°C (-158.0°F).
3 DC current input : A 250 Ω resistor is externally connected at the input terminals.

# Model and Suffix Code

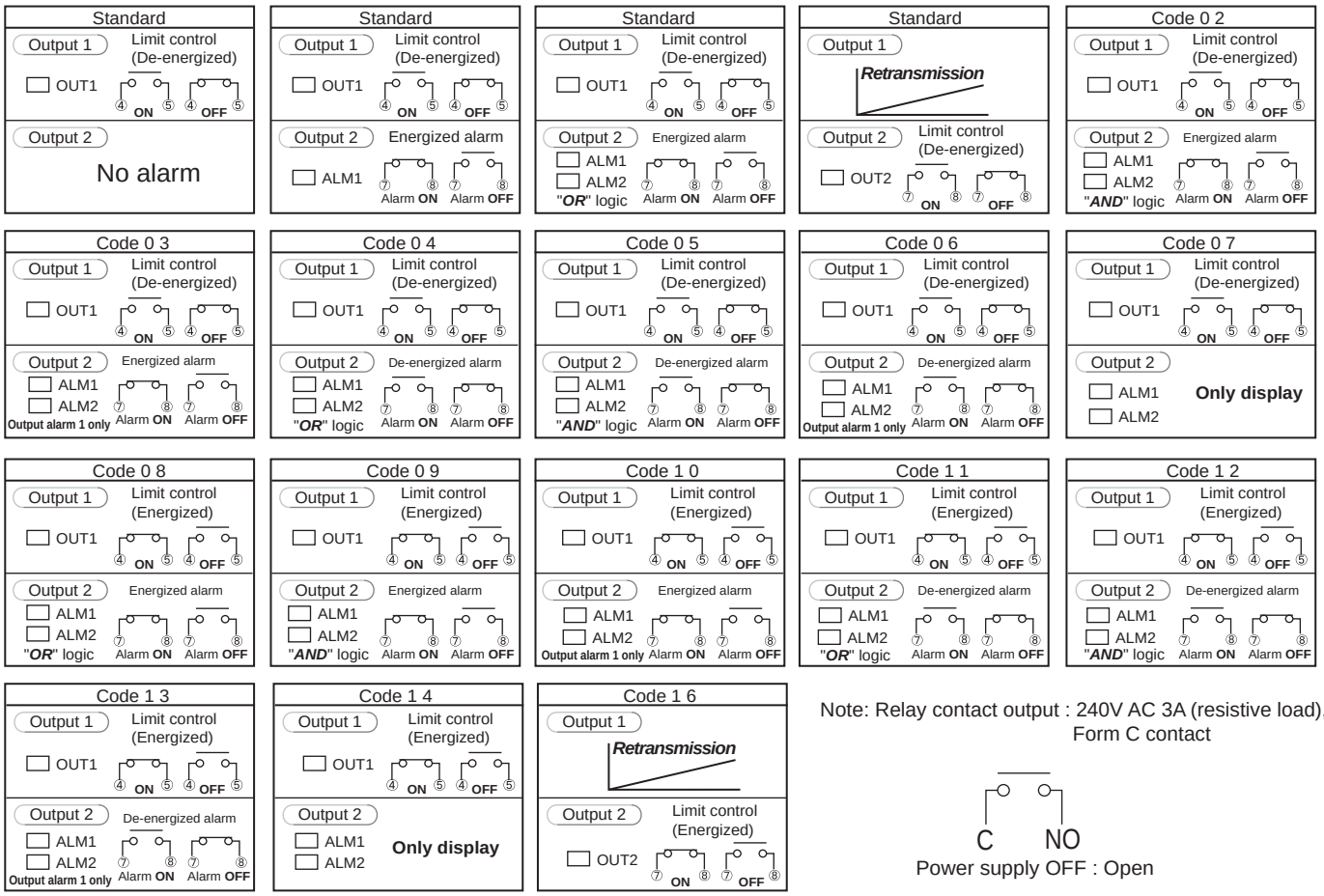
## Alarm Code Table

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A | Deviation High | B | Deviation Low | C | Deviation High/Low | D | Deviation Band |
| E | Deviation High with Hold | F | Deviation Low with Hold | G | Deviation High/Low with Hold | H | Process High |
| J | Process Low | K | Process High with Hold | L | Process Low with Hold | V | Set value High |
| | | W | Set value Low | | | | |

## Output Allocation Code Table

| Code | Specifications | | |
|---|---|---|---|
| | Control methods | Output 1 | Output 2 |
| 0 2 | Limit control + Alarm 1, 2 | Limit Control output (De-energized) | *AND* logic output of Alarm 1 and Alarm 2 (Energized) |
| 0 3 | Limit control + Alarm 1, 2 | Limit Control output (De-energized) | Alarm 1 output (Energized) |
| 0 4 | Limit control + Alarm 1, 2 or only Alarm 1 | Limit Control output (De-energized) | *OR* logic output of Alarm 1 and Alarm 2 (De-energized) |
| 0 5 | Limit control + Alarm 1,2 | Limit Control output (De-energized) | *AND* logic output of Alarm 1 and Alarm 2 (De-energized) |
| 0 6 | Limit control + Alarm 1, 2 [1] | Limit Control output (De-energized) | Alarm 1 output (De-energized) |
| 0 7 | Limit control + Alarm 1, 2 or only Alarm 1 [1] | Limit Control output (De-energized) | No output |
| 0 8 | Limit control + Alarm 1,2 or only Alarm 1 | Limit Control output (Energized) | *OR* logic output of Alarm 1 and Alarm 2 (Energized) |
| 0 9 | Limit control + Alarm 1, 2 | Limit Control output (Energized) | *AND* logic output of Alarm 1 and Alarm 2 (Energized) |
| 1 0 | Limit control + Alarm 1, 2 [1] | Limit Control output (Energized) | Alarm 1 output (Energized) |
| 1 1 | Limit control + Alarm 1, 2 or only Alarm 1 | Limit Control output (Energized) | *OR* logic output of Alarm 1 and Alarm 2 (De-energized) |
| 1 2 | Limit control + Alarm 1,2 | Limit Control output (Energized) | *AND* logic output of Alarm 1 and Alarm 2 (De-energized) |
| 1 3 | Limit control + Alarm 1, 2 [1] | Limit Control output (Energized) | Alarm 1 output (De-energized) |
| 1 4 | Limit control + Alarm 1, 2 or only Alarm 1 [1] | Limit Control output (Energized) | No output |
| 1 6 | Retransmission + Limit control | Retransmission output | Limit Control output (Energized) |

[1] The alarm monitor can only be confirmed by front LCD display or serial communication.




Note: Relay contact output : 240V AC 3A (resistive load), Form C contact



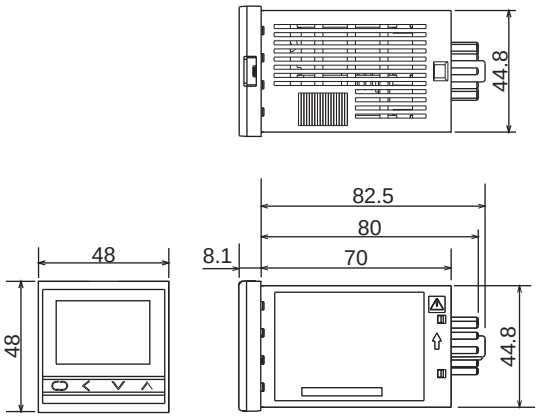

Power supply OFF : Open

## Accessories

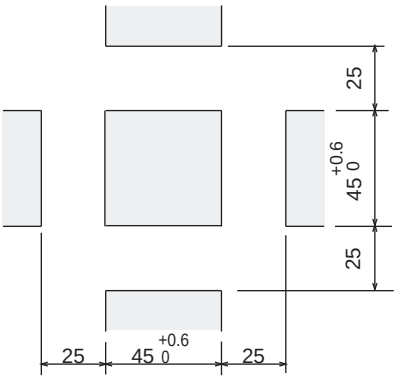
| Name | Model code |
|---|---|
| Shunt resistor for DC current input | KD100-55 |
| Terminal cover | KSA200-56A |

# External Dimensions and Rear Layout

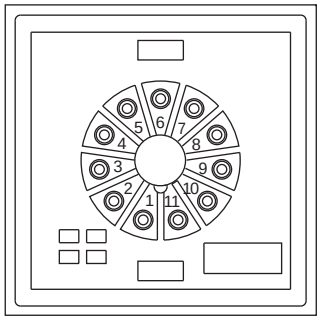
Units : mm




Panel Cutout




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




| PIN | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Contents | + − ① B B A ② + − ③ ① Thermocouple ② RTD ③ Voltage | | | NO C NC ① + − ② ① Relay contact ② Current | | | NO C NC Relay contact | | | L N 100 to 240V AC + − 24V AC/DC | |
| | Measured input | | | Output 1 | | | Output 2 | | | Power supply | |

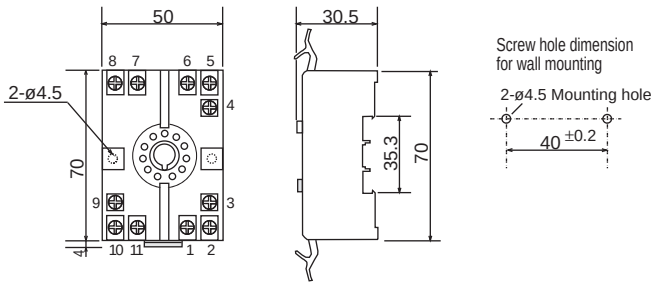
Communication function and contact input are optional.
Connect connector to bottom of instrument.
A connector and connector cable for connecting the input block is necessary to be prepared by the customer.
Housing: XHP-3 (J.S.T. Mfg. Co., Ltd. product)
Recommended cable size: AWG30 to 22
Optional cable with connector is sold separately.
1. With terminating resistor and no connector on open end. (Length : 1m)
Model : W-BO-01-1000
2. Without terminating resistor and no connector on open end. (Length :1m)
(Can be used for contact input.) Model : W-BO-02-1000

| 1 | 2 | 3 |
|---|---|---|
| SG | T/R(A) | T/R(B) |
| RS-485 | | |
| Communications | | |

| 1 | 2 | 3 |
|---|---|---|
| DI1 | | |
| | DI2 | |
| DI1:STEP, DI2:RUN/STOP | | |
| Contact inputs | | |

## • Socket (Optional) External Dimensions

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




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