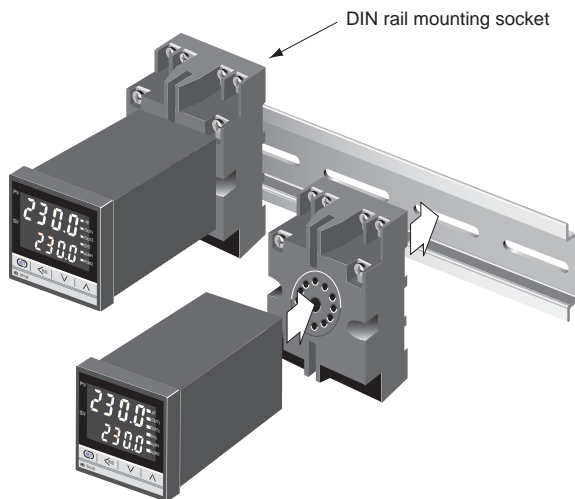# SA100

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.

DIN rail mounting socket

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

Rear terminal socket
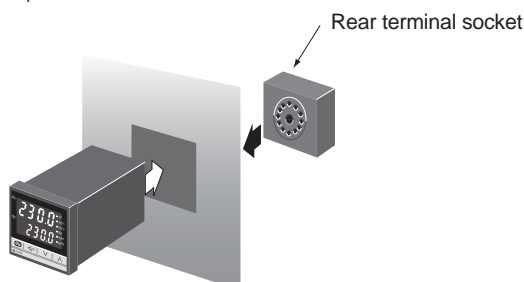
Corresponding to Various Applications

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

OUT1 → Control output
OUT2 → Alarm output

2.Temperature retransmitting controller

OUT1 → Retransmission output
OUT2 → Control output

3.Heat/Cool temperature controller

OUT1 → Heating output
OUT2 → Cooling output

• As a overheat protection unit or alarm unit

1. Overheat protection unit

OUT1 → Control output
* Setting to ON/OFF action by specifying direct action.

2. Overheat protection unit with transmitting function

OUT1 → Retransmission output
OUT2 → Control output
* Setting to ON/OFF action by specifying direct action.

3. Alarm unit

OUT1 → Alarm output
OUT2 → Alarm output

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

PV (measured value) display only

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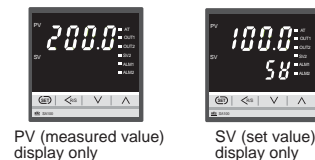
The SV is displayed on PV display. Parameters are displayed on SV display.

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
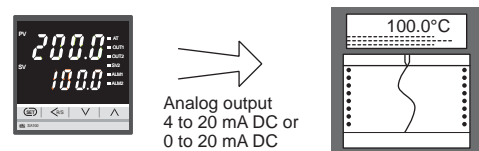
Temperature Controller SA100

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
  (Hold action can be added to deviation and process type)
- Set Value Alarm
  High, Low
- Loop Break Alarm

| Temperature Alarm	△ : SV ▲ : Alarm
Deviation High	OFF → ON △ (Alarm Set Value is a positive (+) setting)
Deviation Low	ON ← OFF ▲ △ (Alarm Set Value is a negative (-) setting)
Deviation High/Low	ON OFF ON ▲ △ ▲ (Alarm Set Value is the absolute deviation value)
Band	OFF ON OFF △ (Alarm Set Value is the absolute deviation value)
Process High	OFF ON ▲
Process Low	ON OFF ▲
Set Value Alarm	△ : SV
Set Value High	OFF ON △
Set Value Low	ON OFF △

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.
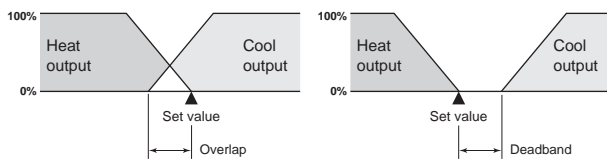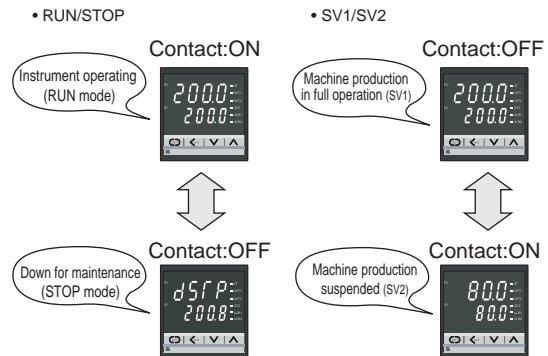

Digital Communications (Optional)

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.

Up to 31 units
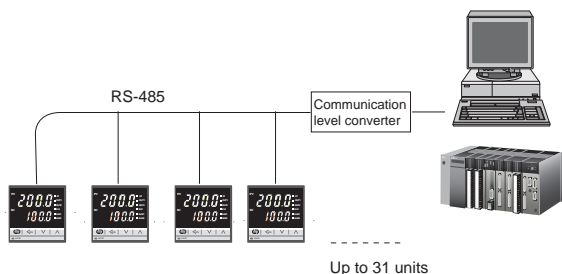
### Digital Contact Input for External Switching (Optional)

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 — Down for maintenance (STOP mode)

• SV1/SV2

Contact:OFF — Machine production in full operation (SV1)

Contact:ON — 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.
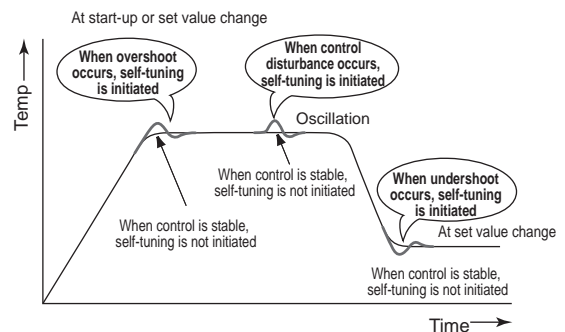
Specifications

Input

Input
a) Thermocouple : K, J, E, T, R, S, B, N (JIS/IEC), PLII (NBS)
   W5Re/W26Re(ASTM), U, L (DIN)
   • Input impedance : Approx.1MΩ
   • Influence of external resistance : Approx. 0.2μV/Ω
   • Input break action : Up-scale
b) RTD :   Pt100(JIS/IEC), JPt100(JIS)
   • Influence of lead resistance : Approx. 0.01[%/Ω] of reading
   • Maximum 10Ω per wire
   • Input break action : Up-scale
   • Input short action : Down-scale
c) DC voltage :   0 to 5V DC, 1 to 5V DC, 0 to 10V DC
d) DC current :   0 to 20mA DC, 4 to 20mA DC
   • For DC current input, connect a 250 Ω resister to the input terminals.
   • Refer to the Input and Range and Input Code Table for details.
   • Input break action : Down-scale
   • Both Heat/Cool control outputs are OFF for Heat/Cool PID action.
   • Reading is around zero for 0 to 5V DC input, 0 to 10V DC input
     and 0 to 20mA DC input.

Sampling Time
0.5 sec.

PV Bias
- span to +span (Within -1999 to 9999)

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

Control

Control Method
a) PID control (with autotuning and self-tuning function)
   • Available for reverse and direct action. (Specify when ordering.)
   • ON/OFF, P, PI and PD control are also selectable.
     ON/OFF action differential gap : 2°C(°F) (Temperature input)
     0.2% (Voltage, current input)
b) Heat/Cool PID control (with autotuning function)
   • Air cooling and water cooling type are available. (Specify when ordering.)

Major Setting Range
Set value :   Same as input range.
Heat side proportional band :1 to span or 0.1 to span
                             (ON/OFF action when P=0)
Cool side proportional band : 0 to 1000% of heat side proportional band
Integral time :   0 to 3600sec.(PD action when I=0)
Derivative time :   0 to 3600sec.(PI action when D=0)
Anti-Reset Windup(ARW) : 1 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 -1999 to 9999)

Outputs

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)
• 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)   (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   (Optional)

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   (Optional)

a) Communication method : Based on RS-485 (2-wire)
b) Communication speed : 2400, 4800, 9600, 19200 BPS
c) Protocol :   ANSI X3.28(1976) 2.5 A4
                          MODBUS
d) 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
e) Communication code :   ASCII(JIS) 7-bit code
f) Maximum connection : 31 (Address can be set from 0 to 99.)

Retransmission Output   (Optional)

Retransmission output is allocated to OUT1.
a)Type :   Process value, Set value, Deviation,
                           Manipulated value
b) Output type :   0 to 20mA DC, 4 to 20mA DC
                           (Load resistance : less than 400Ω)
c)Output resolution :   More than 10bits
   • Measurement terminals and output terminal are not isolated.

Waterproof / Dustproof   (Optional)

Dustproof and waterproof protection : IP66
• Waterproof/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 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 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 : Backed up by non-volatile memory.
                    Number of writing : Approx. 100,000 times

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

Specifications		Model and Suffix Code □ □□□ － □ □ － □ * □ □ － □ □／□□／Y
M o d e l	SA100 (1/16 DIN size, socket mounting type)	
Control method	PID control with AT (reverse action)	F
	PID control with AT (direct action)	D
	Heat/cool PID control with AT (water cooling)	W
	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
	Voltage pulse output	V
	DC current output : 0 to 20mA	7
	DC current output : 4 to 20mA	8
OUT 2 (Control or alarm output)	No output	N
	Relay contact output	M
	Voltage pulse output	V
Power supply voltage	24V AC/DC	3
	100 to 240V AC	4
Alarm 1	No alarm	N
	See Alarm Code Table	□
Alarm 2	No alarm	N
	See Alarm Code Table	□
Communication Contact input	Not supplied	N
	Digital communications : RS-485 (RKC standard)	5
	Digital communications : RS-485 (MODBUS)	6
	External contact input	D
Waterproof / Dustproof	Not supplied	N
	Waterproof / Dustproof protection	1
Output allocation code [1]	Standard output	No code
	See Output Allocation Code Table	□ □
Instrument version	Version symbol	Y

[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)

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℃ (0 and 799℉).
[2] Type T and U input : Accuracy is not guaranteed less than -100.0℃ (-158.0℉).
[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	R	Loop break alarm [1]
V	Set value High	W	Set value Low				

[1] Loop break alarm is not available with Heat/Cool PID control type. Loop break alarm is not available with Alarm 2.

Output Allocation Code Table

Code	Specifications		
	Control methods	Output 1	Output 2
0 3	PID control + Alarm 1	Control output	Alarm 1 output (De-energized)
0 4	PID control + Alarm 1, 2	Control output	*AND* logic output of Alarm 1 and Alarm 2 (Energized)
0 5	PID control + Alarm 1, 2	Control output	*OR* logic output of Alarm 1 and Alarm 2 (De-energized)
0 6	PID control + Alarm 1, 2	Control output	*AND* logic output of Alarm 1 and Alarm 2 (De-energized)
0 7	PID control + Alarm 1, 2 or only Alarm 1 [1]	Control output	No output
0 8	PID control + Alarm 1, 2 [1]	Control output	Only Alarm 1 output (Energized)
0 9	Alarm 1 + Alarm 2 [2]	Alarm 1 output (Energized)	Alarm 2 output (Energized)
1 0	Alarm 1 + Alarm 2 [2]	Alarm 1 output (Energized)	Alarm 2 output (De-energized)
1 1	Alarm 1 + Alarm 2 [2]	Alarm 1 output (De-energized)	Alarm 2 output (De-energized)
1 2	Retransmission + PID control	Retransmission output	Control output
1 3	Retransmission + Alarm 1, 2	Retransmission output	*OR* logic output of Alarm 1 and Alarm 2 (Energized)
1 4	Retransmission + Alarm 1, 2	Retransmission output	*OR* logic output of Alarm 1 and Alarm 2 (De-energized)
1 5	Retransmission + Alarm 1, 2	Retransmission output	*AND* logic output of Alarm 1 and Alarm 2 (Energized)
1 6	Retransmission + Alarm 1, 2	Retransmission output	*AND* logic output of Alarm 1 and Alarm 2 (De-energized)
1 7	Retransmission + Alarm 1	Retransmission output	Alarm 1 output (Energized)
1 8	Retransmission + Alarm 1	Retransmission output	Alarm 1 output (De-energized)
1 9	Heat-Cool PID control	Cool output (DC current output)	Heat output (Relay contact or Voltage pulse output)

[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.

Note: Relay contact output : 250V AC 2A (resistive load), Form A contact

Power supply OFF : Open

Accessories

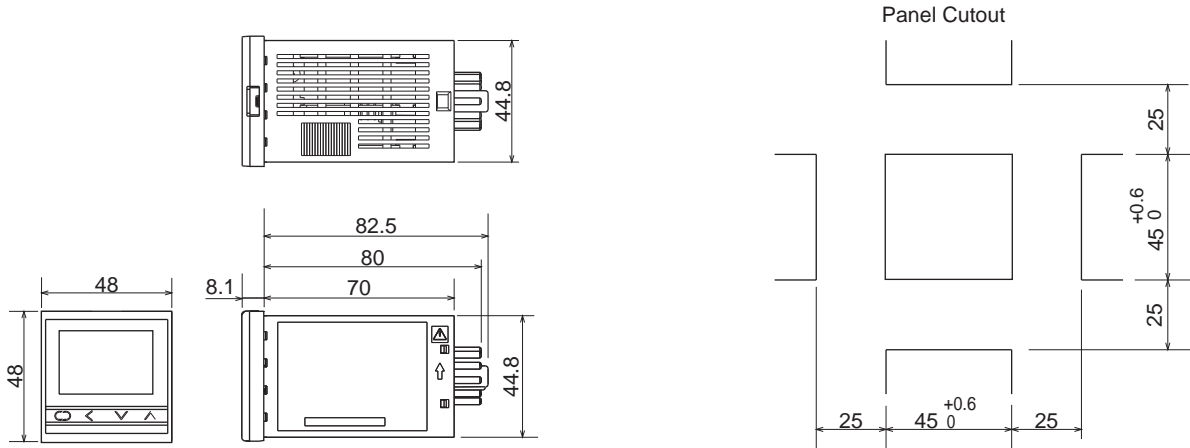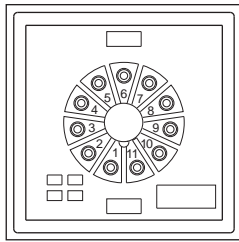| Name	Model code
Shunt resistor for DC current input	KD100-55
Terminal cover	KSA200-56A

Temperature Controller SA100

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 Thermocouple ② RTD ③ Voltage / Current *			① Relay contact ② Voltage pulse ③ DC Current			① Relay contact ② Voltage pulse			L / N 100 to 240V AC + / − 24V AC/DC	
	Measured input			Output 1			Output 2			Power supply	

*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 (J.S.T. Mfg. Co., Ltd. product)
 Recommended cable size: AWG30 to 22

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		
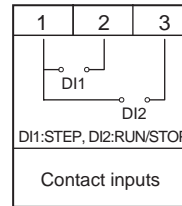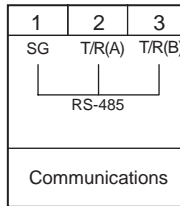
• Socket (Optional) External Dimensions

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

Screw hole dimension
for wall mounting
2-ø4.5 Mounting hole
40 ±0.2
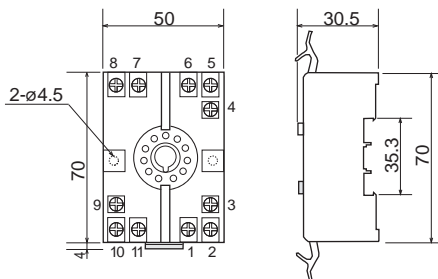
Rear terminal socket type
Model : AT78051 (Matsushita Denko product)