OMRON

Digital Temperature Controllers | E5CN

Compact and Intelligent Temperature Controllers

■ Various temperature inputs: thermocouple, platinum resistance thermometer, non-contact temperature sensor, and analog inputs.

■ Auto-tuning and self-tuning available. Auto-tuning is possible even while self-tuning is being executed.

■ Heating or heating/cooling control is available.

■ Event input allows multiple SP selection and run/stop function.

■ Water-resistant construction (NEMA4X: equivalent to IP66).

■ Conforms to UL, CSA, and IEC safety standards as well as CE marking.
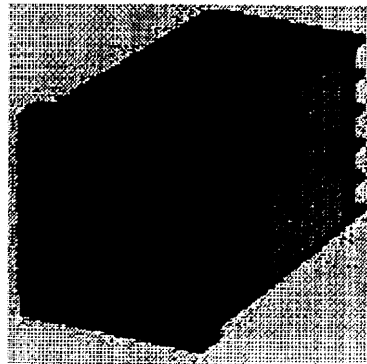
48(W) x 48(H) x 78(D) mm

Ordering Information

■ E5CN Standard Models

Size	Power supply voltage	No. of alarm points	Output	Thermocouple model	Platinum resistance thermometer model
1/16 DIN 48(W) x 48(H) x 78(D) mm	100 to 240 VAC	---	Relay	E5CN-RMTC-500	E5CN-RMP-500
			Voltage output (for driving SSR)	E5CN-QMTC-500	E5CN-QMP-500
			Current	E5CN-CMTC-500	E5CN-CMP-500
		2	Relay	E5CN-R2MTC-500	E5CN-R2MP-500
			Voltage output (for driving SSR)	E5CN-Q2MTC-500	E5CN-Q2MP-500
			Current	E5CN-C2MTC-500	E5CN-C2MP-500
	24 VAC/VDC	---	Relay	E5CN-RMTC-500	E5CN-RMP-500
			Voltage output (for driving SSR)	E5CN-QMTC-500	E5CN-QMP-500
			Current	E5CN-CMTC-500	E5CN-CMP-500
		2	Relay	E5CN-R2MTC-500	E5CN-R2MP-500
			Voltage output (for driving SSR)	E5CN-Q2MTC-500	E5CN-Q2MP-500
			Current	E5CN-C2MTC-500	E5CN-C2MP-500

Note: 1. The heating and cooling function is available for models with two alarm points.

2. Specify the power supply specifications when ordering.

■ E5CN Option Units

The E5CN provides communications or event input functionality when mounted with one of the following Option Units.

Name	Model	Function
Communications Unit	E53-CNH03	RS-485 communication
Event Input Unit	E53-CNHB	Event input

Note: The heater burnout alarm is available by mounting the E53-CNH03 or E53-CNHB Option Unit on the E5CN.

■ Current Transformer (Sold Separately)

Model	E54-CT1	E54-CT3
Hole diameter	5.8 dia.	12.0 dia.

■ Terminal Cover (Sold Separately)

Model	E53-COV10

E5CN ——————————————— **OMRON** ——————————————— E5CN

■ Input Ranges

Platinum Resistance Thermometer Input/Thermocouple Input

	Platinum resistance thermometer input			
Input type	Platinum resistance thermometer			
Name	Pt100		JPt100	
1800				
1700				
1600				
1500				
1400				
1300				
1200				
1100				
1000	850			
900				
800				
700				
600	500.0		500.0	
500				
400				
300				
200		100.0		100.0
100				
0		0.0		0.0
-100				
-200	-200	-199.9		-199.9
Set value		1	2	3	4

	Thermocouple input															
Input type	Thermocouple											ES1A Non-contact Temperature Sensor				Analog input
Name	K	J	T	E	L	U	N	R	S	B	K10 to 70°C	K60 to 120°C	K115 to 185°C	K160 to 260°C	0 to 50 mV
1800								1700	1700	1800					Usable in the following ranges by scaling −1999 to 9999 or −199.9 to 999.9
1700															
1600															
1500															
1400	1300						1300								
1300															
1200															
1100															
1000			850												
900					850										
800															
700				600											
600		500.0					400								
500			400.0	400									260		
400												120	165		
300											70				
200										100					
100															
0		−20.0	−20.0	0		400		0	0		0	0	0	0	
-100			−100		−100										
-200	-200			-200		-200	-200								
Set value		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Applicable standards by input type are as follows:

K, J, T, E, N, R, S, B: JIS C1602-1995
L: Fe-CuNi, DIN 43710-1985
U: Cu-CuNi, DIN 43710-1985
JPt100: JIS C1604-1989, JIS C1606-1989
Pt100 JIS C1604-1997, IEC751

Shaded ranges indicate default settings.

E5CN ————————————————— **OMRON** ——————————————— E5CN

Specifications

■ Ratings

Supply voltage	100 to 240 VAC, 50/60 Hz	24 VAC, 50/60 Hz/24 VDC
Operating voltage range	85% to 110% of rated supply voltage	
Power consumption	7 VA	4 VA/3 W
Sensor input	Thermocouple: K, J, T, E, L, U, N, R, S, B Platinum resistance thermometer: Pt100, JPt100 Non-contact temperature sensor: K10 to 70°C, K60 to 120°C, K115 to 165°C, K160 to 260°C Voltage input: 0 to 50 mV	
Control output	Relay output	SPST-NO, 250 VAC, 3 A (resistive load), electrical life: 100,000 operations	
	Voltage output	12 VDC (PNP), max. load current: 21 mA, with short-circuit protection circuit	
	Current output	4 to 20 mA DC, load: 600 Ω max., resolution: approx. 2,600	
Alarm output	SPST-NO, 250 VAC, 1 A (resistive load), electrical life: 100,000 operations	
Control method	2-PID or ON/OFF control	
Setting method	Digital setting using front panel keys	
Indication method	7-segment digital display and single-lighting indicator Character height: PV: 9.9 mm; SV: 6.4 mm	
Other functions	According to Controller model	
Ambient temperature	−10 to 55°C (with no condensation or icing)	
Ambient humidity	25% to 85%	
Storage temperature	−25 to 65°C (with no condensation or icing)	

■ Characteristics

Indication accuracy	Thermocouple: (±0.5% of indicated value or ±1°C, whichever greater) ±1 digit max. (see note) Platinum resistance thermometer: (±0.5% of indicated value or ±1°C, whichever greater) ±1 digit max. Analog input: ±0.5% FS±1 digit max. CT input: ±5% FS±1 digit max.	
Hysteresis	0.1 to 999.9 EU (in units of 0.1 EU)	
Proportional band (P)	0.1 to 999.9 EU (in units of 0.1 EU)	
Integral time (I)	0 to 3999 s (in units of 1 s)	
Derivative time (D)	0 to 3999 s (in units of 1 s)	
Control period	1 to 99 s (in units of 1 s)	
Manual reset value	0.0% to 100.0% (in units of 0.1%)	
Alarm setting range	-1999 to 9999 (decimal point position depends on input type)	
Sampling period	500 ms	
Insulation resistance	20 MΩ min. (at 500 VDC)	
Dielectric strength	2000 VAC, 50 or 60 Hz for 1min (between different charging terminals)	
Vibration resistance	10 to 55 Hz, 10 m/s² for 2 hours each in X, Y and Z directions	
Shock resistance	300 m/s², 3 times each in 3 axes, 6 directions (relay: 100 m/s²)	
Weight	Approx. 150 g	Mounting bracket: Approx. 10 g
Protective structure	Front panel: NEMA4X for indoor use (equivalent to IP66), rear case: IP20, terminals: IP00	
Memory protection	EEPROM (non-volatile memory) (number of writes: 100,000)	

EMC	Emission Enclosure: EN55011 Group 1 class A
	Emission AC Mains: EN55011 Group 1 class A
	Immunity ESD: EN61000-4-2: 4 kV contact discharge (level 2)
	                8 kV air discharge (level 3)
	Immunity RF-interference: ENV50140: 10 V/m (amplitude modulated,
	                80 MHz to 1 GHz) (level 3)
	                10 V/m (pulse modulated, 900 MHz)
	Immunity Conducted Disturbance: ENV50141: 10 V (0.15 to 80 MHz) (level 3)
	Immunity Burst: EN61000-4-4: 2 kV power-line (level 3)
	                2 kV I/O signal-line (level 4)	

Approved standards	UL3121-1, CSA22.2 No. 14, E.B.1402C Conforms to EN50081-2, EN50082-2, EN61010-1 (IEC61010-1) Conforms to VDE0106/part 100 (Finger Protection), when the terminal cover is mounted.	-

Note: The indication of K thermocouples in the -200 to 1300°C range, and T and N thermocouples at a temperature of -100°C or less, and U
and L thermocouples at any temperature is ±2°C±1 digit maximum. The indication of B thermocouples at a temperature of 400°C or
less is unrestricted.
The indication of R and S thermocouples at a temperature of 200°C or less is ±3°C±1 digit maximum.

E5CN ———————————————————— OMRON ———————————————————— E5CN

Communications Specifications

Transmission path connection	Multiple points
Communications method	RS-485 (two-wire, half duplex)
Synchronization method	Start-stop synchronization
Baud rate	1,200/2,400/4,800/9,600/19,200 bps
Transmission code	ASCII
Data bit length (see note)	7 or 8 bits
Stop bit length (see note)	1 or 2 bits
Error detection	Vertical parity (none, even, odd) Frame check sequence (FCS): with SYSMAC WAY Block check character (BCC): with CompoWay/F
Flow control	Not available
Interface (see note)	RS-485
Retry function	Not available
Communications buffer	40 bytes

Note: The baud rate, data bit length, stop bit length, or vertical parity can be individually set using the communications setting level.

Current Transformer (Sold Separately) Ratings

Dielectric strength	1,000 VAC (1 min)
Vibration resistance	50 Hz 98 m/s^2
Weight	E54-CT1: Approx. 11.5 g E54-CT3: Approx. 50 g
Accessories (E54-CT3 only)	Armature (2) Plug (2)

Heater Burnout Alarm Specifications

| Max. heater current	Single-phase AC: 50 A (see note 1)
Input current readout accuracy	±5%FS±1 digit max.
Heater burnout alarm setting range	0.0 to 50.0 A (0.1 A units) (see note 2)
Min. detection ON time	190 ms (see note 3)

Note: 1. When heater burnout is detected on a 3-phase heater, use the K2CU-F□□A-□GS (with gate input terminal).

2. When the set value is "00 A," the heater burnout alarm will always be OFF. When the set value is "50.0 A," the heater burnout alarm will always be ON.

3. When the control output ON time is less than 190 ms, heater burnout detection and heater current measurement will not be carried out.
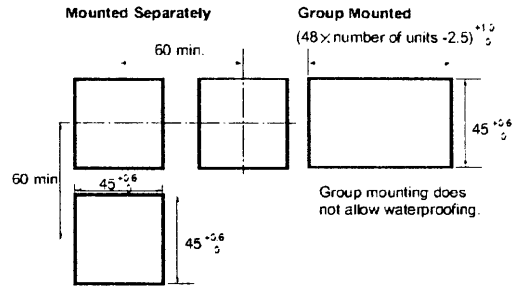
Nomenclature

19
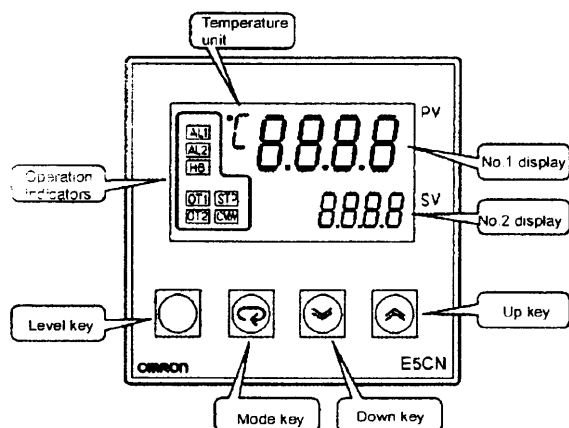
Dimensions

Note: All units are in millimeters unless otherwise indicated.

102
93
9   78

48 x 48

58   44.8 x 44.8   48.8
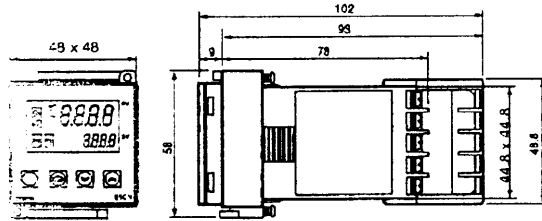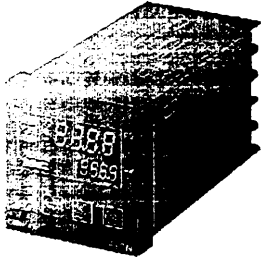
Note: The suffix "500" is added to the model number of each
Controller provided with a E53-COV10 Terminal Cover.

Panel Cutouts

Mounted Separately   **Group Mounted**
(48 × number of units -2.5) $^{+1.0}_{0}$

60 min.

60 min   45 $^{+0.6}_{0}$ 45 $^{+0.6}_{0}$

45 $^{+0.6}_{0}$ Group mounting does
not allow waterproofing.

- Recommended panel thickness is 1 to 5 mm.

- Group mounting is not possible in the vertical direction. (Maintain the specified mounting space between Controllers when they are group mounted.)

- To mount the E5CN so that it is waterproof, apply the waterproof packing to the E5CN.

- When two or more E5CNs are mounted, make sure that the surrounding temperature does not exceed the allowable operating temperature specified in the specifications.
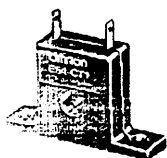
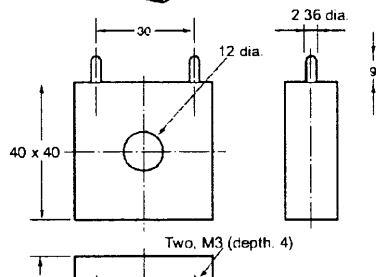## Terminal Cover (Sold Separately)

E53-COV10

48

48.8
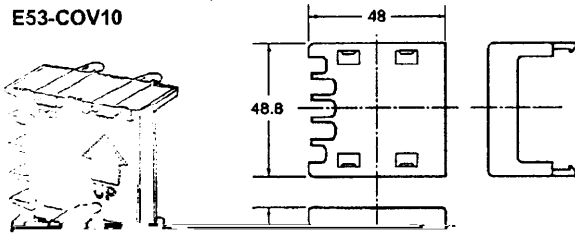
9.1

Current Transformer (Sold Separately)

E54-CT1   **E54-CT3**

21   2.8   2 36 dia.
15   5.8 dia.   30
7.5   12 dia.   9

25   3   40 x 40
10.5

Two, 3.5 dia.   Two, M3 (depth. 4)
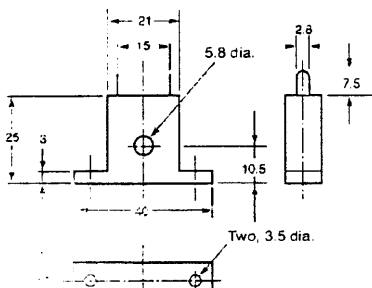
Wiring Terminals

- The voltage output (control output) is not electrically insulated from the internal circuits. When using a grounding thermocouple, do not connect the control output terminals to the ground. If the control output terminals are connected to the ground, errors will occur in the measured temperature values as a result of leakage current.

- Standard insulation is applied to the power supply I/O sections. If reinforced insulation is required, connect the input and output terminals to a device without any exposed current-carrying parts or to a device with standard insulation suitable for the maximum operating voltage of the power supply I/O section.

■ E5CN
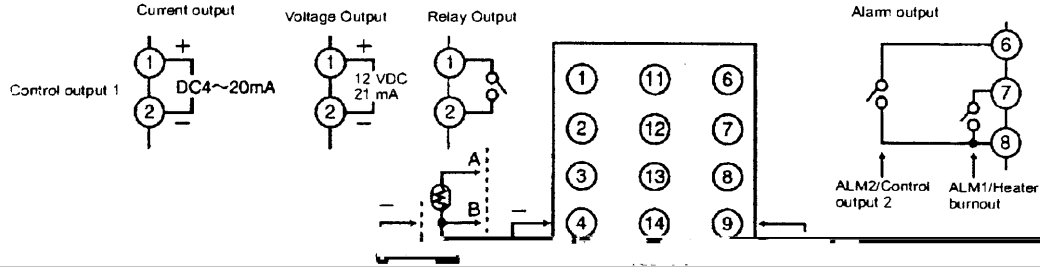
Two input power supplies are available. 100 to 240 VAC or 24 VDC.
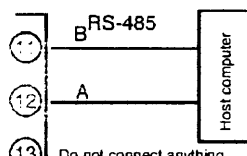
■ E5CN Option Units

E53-CNHB Event Input Unit

Event Input/Heater Burnout Detection
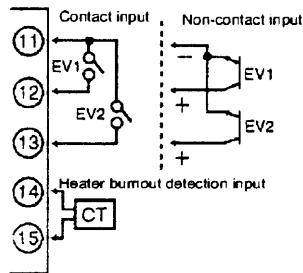
E53-CNH03 Communications Unit

Communications Specification/Heater Burnout Specification

Nomenclature

E5AN

Operation Indicators

1. ALM1 (alarm 1)
   Lights when alarm 1 output is ON.
   ALM2 (alarm 2)
   Lights when alarm 2 output is ON.
   ALM3 (alarm 3)
   Lights when alarm 3 output is ON.

2. HB (heater burnout alarm display)
   Lights when a heater burnout is detected.
   The heater burnout alarm remains ON by setting the
   heater burnout latch. To reset, turn the power supply
   OFF and then ON or set the heater burnout alarm value
   to "0.0A."

3. OUT1, OUT2 (control output 1, control output 2)
   Lights when control output 1 and/or control output 2
   (cool) are ON.
   However, if control output 1 is current output, OUT1 will
   always be unlit.

4. STOP (stop)
   Lights when control of the E5AN has been stopped.
   During control, this indicator lights when an event or the
   run/stop function has become stopped. Otherwise, this
   indicator is out.

5. CMW (communications writing control)
   Lights when communications writing is enabled and is
   out when it is disabled.

Temperature Unit

The temperature unit is displayed when the dis-
play unit parameter is set to a temperature. In-
dication is determined by the currently selected
"temperature unit" parameter set value. When
this parameter is set to "°C," "℃" is displayed, and
when set to "°F," "°F" is displayed.

No. 1 Display

Displays the process value or param-
eter type.

No. 2 Display

Displays the set point, manipulated
variable, or set value (setup) of the
parameter.

Up Key

Each press of this key increases val-
ues displayed on the No.2 display.
Holding down this key continuously
increases values.

Down Key

Each press of this key decreases val-
ues displayed on the No.2 display.
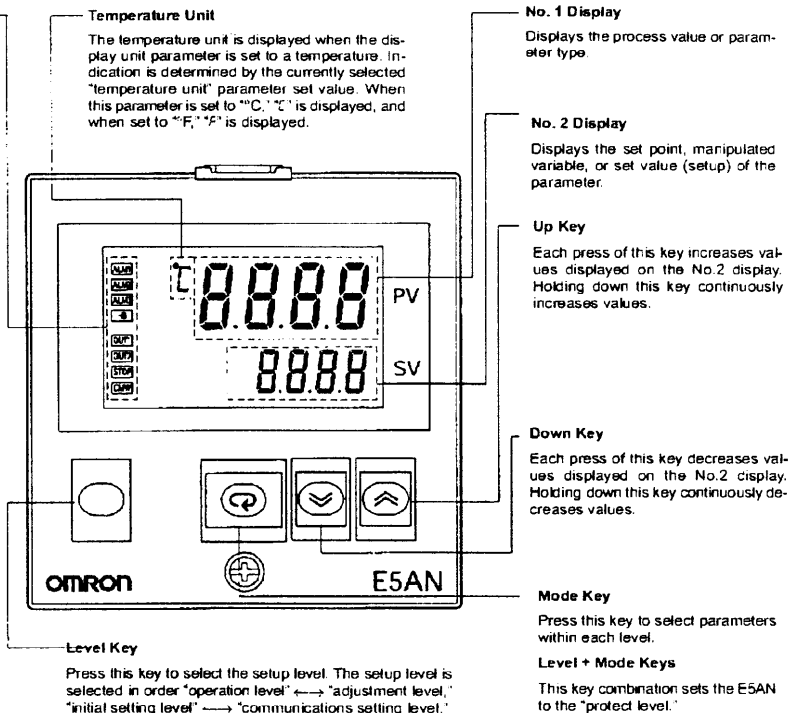Holding down this key continuously de-
creases values.

Mode Key

Press this key to select parameters
within each level.

Level + Mode Keys

This key combination sets the E5AN
to the "protect level."

Level Key

Press this key to select the setup level. The setup level is
selected in order "operation level" ←→ "adjustment level,"
"initial setting level" —→ "communications setting level."

E5EN

Operation Indicators

ALM1 (alarm 1)
Lights when alarm 1 output is ON.
ALM2 (alarm 2)
Lights when alarm 2 output is ON.
ALM3 (alarm 3)
Lights when alarm 3 output is ON.

HB (heater burnout alarm display)
Lights when a heater burnout is detected.
The heater burnout alarm remains ON by setting the

Temperature Unit

The temperature unit is displayed when the dis-
play unit parameter is set to a temperature. In-
dication is determined by the currently selected
"temperature unit" parameter set value. When
this parameter is set to "°C," "℃" is displayed, and
when set to "°F," "°F" is displayed.

No. 1 Display

Displays the process value or param-
eter type.

No. 2 Display

Displays the set point, manipulated
variable, or set value (setup) of the pa-

Operation Indicators

AL1 (alarm 1)
Lights when alarm 1 output is ON.
AL2 (alarm 2)
Lights when alarm 2 output is ON.

2. HB (heater burnout alarm display)
Lights when a heater burnout is detected.
The heater burnout alarm remains ON by setting the heater burnout latch. To reset, turn the power supply OFF and then ON or set the heater burnout alarm value to "0.0A."

OT1 OT2 (control output 1, control output 2)
Lights when control output 1 and/or control output 2 (cool) are ON.
However, if control output 1 is current output, OT1 will always be unlit.

4. STP (stop)
Lights when control of the E5CN has been stopped.
During control, this indicator lights when an event or the run/stop function has become stopped. Otherwise, this indicator is out.

5. CMW (communications writing control)
Lights when communications writing is enabled and is out when it is disabled.

Temperature Unit

The temperature unit is displayed when the display unit parameter is set to a temperature. Indication is determined by the currently selected "temperature unit" parameter set value. When this parameter is set to "°C," "C" is displayed, and when set to "°F," "F" is displayed.

No. 1 Display

Displays the process value or parameter type.

No. 2 Display

Displays the set point, manipulated variable, or set value (setup) of the parameter.

Up Key

Each press of this key increases values displayed on the No.2 display. Holding down this key continuously increases values.
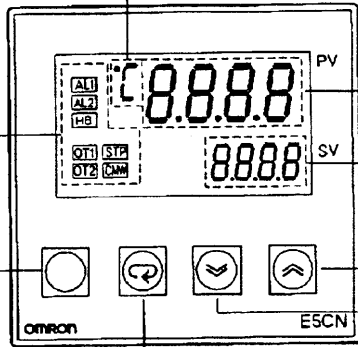
Down Key

Each press of this key decreases values displayed on the No.2 display. Holding down this key continuously decreases values.

Mode Key

Press this key to select parameters within each level.

Level + Mode Keys

This key combination sets the E5CN to the "protect level."

Level Key

Press this key to select the setup level. The setup level is selected in order "operation level" ←→ "adjustment level," "initial setting level' ←→ "communications setting level."

E5GN

Operation Indicators

1. AL (alarm)

Temperature Unit

The temperature unit is displayed when the dis-

Installation

■ E5AN/E5EN

Mounting

1. Insert the E5AN/E5EN into the mounting hole in the panel from the front.
2. Push the mounting bracket along the E5AN/E5EN body from the terminals up to the panel, and secure it temporarily.
3. Tighten the fixing screw on each mounting bracket alternately until the ratchet stops tightening.

E5AN

Panel

Mounting bracket

Drawing Out

For drawing out the Unit, use a suitable Philips screwdriver for the screw located at the bottom on the front panel.

1. While pressing down on the hook located at the top of the front panel, turn the screw (located at the bottom on the front panel) counterclockwise using a Philips screwdriver.
2. Hold both sides of the front panel and draw out the Unit towards you.
3. When inserting the Unit, confirm that the waterproof packing is in place. While pressing down on the hook located at the top of the front panel, turn the screw (located at the bottom on the front panel) clockwise using a Philips screwdriver and tighten to a torque of 0.3 to 0.5 N⋅m. Make sure that electronic parts do not come in contact with the case.

E5CN

Setting Up Option Units

Communications, event input, or heater burnout functions are required, mount the E53-CNH03 Communications Unit or the E53-CNHB Event Input Unit. The heater burnout function is supported by either of these two Option Units.

Option Units

Name	Model	Function
Communications Unit	E53-CNH03	RS-485 communications
Event Input Unit	E53-CNHB	Event inputs

Note: Terminal label: x1

Assembling a Unit

Flat-blade screwdriver (unit: mm)

20 min.
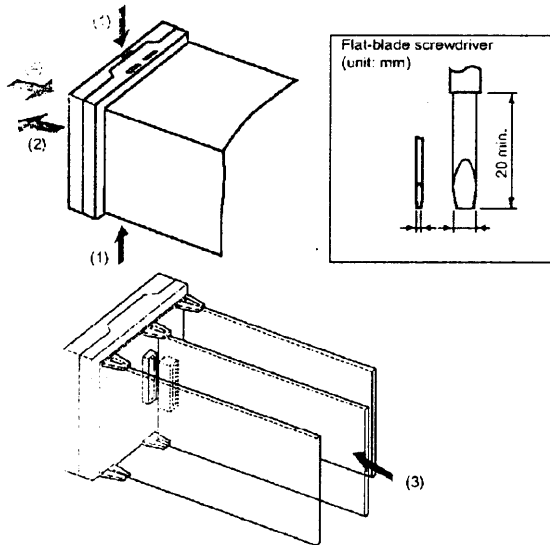
1. Insert the tools (see drawing above) into the slots (one on the top and one on the bottom) and release the hooks.
2. Insert the tool in the space between the front and rear panels and slightly pull out the front panel. Hold the top and bottom of the front panel and pull toward yourself to remove it.
3. Match up the upper and lower claws with the connection points and insert the Option Unit. Mount the Option Unit in the center.
4. Before inserting the Unit, confirm that the waterproof packing is in place. Insert the Unit into the rear case until you hear a click. When inserting the Unit, press down the hooks on the top and bottom of the rear case so that they firmly hook on the inserted Unit. Make sure that electronic parts do not come in contact with the case.

Mounting

Adapter
Panel
Waterproof packing
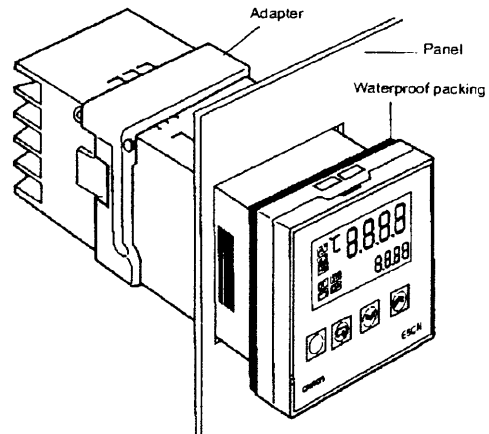
Attaching the E5CN to a Panel

1. Insert the E5CN into the mounting hole in the panel.
2. Push the adapter along the E5CN body from the terminals up to the panel, and secure it temporarily.
3. Tighten the two fixing screws on the adapter. When tightening screws, tighten the two screws alternately keeping the torque to between 0.29 and 0.39 N·m (2.9 kgf·dm to 3.9 kgf·dm).

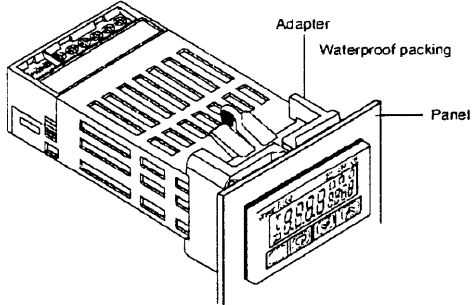### Attaching the Terminal Cover

Make sure that the "UP" mark is facing up, and then fit the Terminal Cover (E53-COV10) into the holes on the top and bottom. A E5CN-□-500 Controller is provided with a Terminal Cover.

■ E5GN

Mounting

1. Insert the E5GN into the mounting hole in the panel from the front.
2. Push the adapter along the E5GN body from the terminals up to the panel, and secure it temporarily.
3. Tighten the two fixing screws on the adapter. When tightening screws, tighten the two screws alternately keeping the torque to within approximately 0.29 to 0.39 N·m.

Adapter
Waterproof packing
Panel

Removing and Attaching the Terminal Plate

The E5GN can be replaced by removing the terminal plate.

1. Press down hard on the fasteners on both sides of the terminals to unlock the terminal plate and pull upwards.
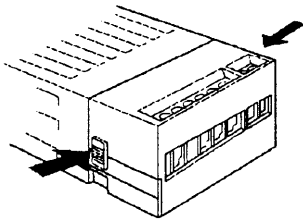
■ Wiring Precautions

E5AN/E5EN/E5CN

- Separate input leads and power lines to protect the E5AN/E5EN/E5CN and its lines from external noise.
- We recommend using solderless terminals when wiring the E5AN/E5EN/E5CN.
- Tighten the terminal screws using a torque between 0.74 and 0.90 N·m.
- Use the following type of solderless terminals for M3.5 screws.

7.2 mm max.

7.2 mm max.
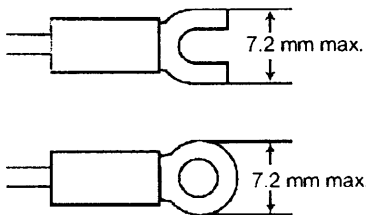
2. Draw out the terminal plate as it is.
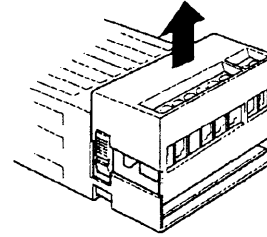
3. Before you insert the terminal plate again, make sure that the pins match the positions of the holes in the terminal plate.
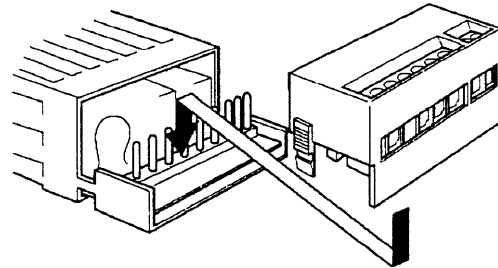
E5GN

- Connect the terminals as specified below.

Terminal No.	Cables	Pin terminals
1 to 6	AWG24 to AWG14	2.1 dia. max.
7 to 9	AWG28 to AWG22	1.3 dia. max.

- The exposed current-carrying part to be inserted into terminals must be 5 to 6 mm.

5 to 6 mm   5 to 6 mm

Electrical wire   Pin terminal
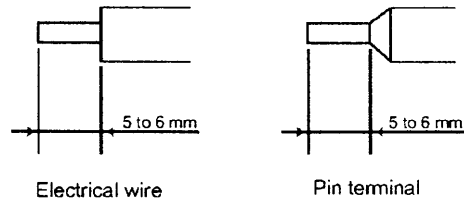
- Tighten the terminal screws to the torque specified below.

Terminal No.	Screw	Maximum tightening torque
1 to 6	M2.6	0.23 to 0.25 N·m
7 to 9	M2	0.12 to 0.14 N·m

31

Operation

¬ Initial Setup

On previous Controllers, sensor input type, alarm type and control period were set on DIP switches. These hardware settings are now parameters in setup menus. The ☐ and ⬅ keys are used to switch between setup menus, and the amount of time that you hold the keys down for determines which setup menu you move to. This section describes two typical examples.

Note: On the E5EN/E5GN, the ☐ Key is the ⬅ Key.

1. ON/OFF Control

Typical Application Examples

┌─── **Changing Parameters** ───┐

☐ indicates that there is a parameter. Keep on pressing the mode key until the desired parameter is selected.

Changing Set Values

 Use the ▽ or △ keys to change the set value displayed in the setup menu.

Display

E5AN

— No. 1 display
— No. 2 display

E5EN

— No. 1 display
— No. 2 display

E5CN

— No. 1 display
— No. 2 display

E5GN

— No. 1 display
— No. 2 display

Typical Example

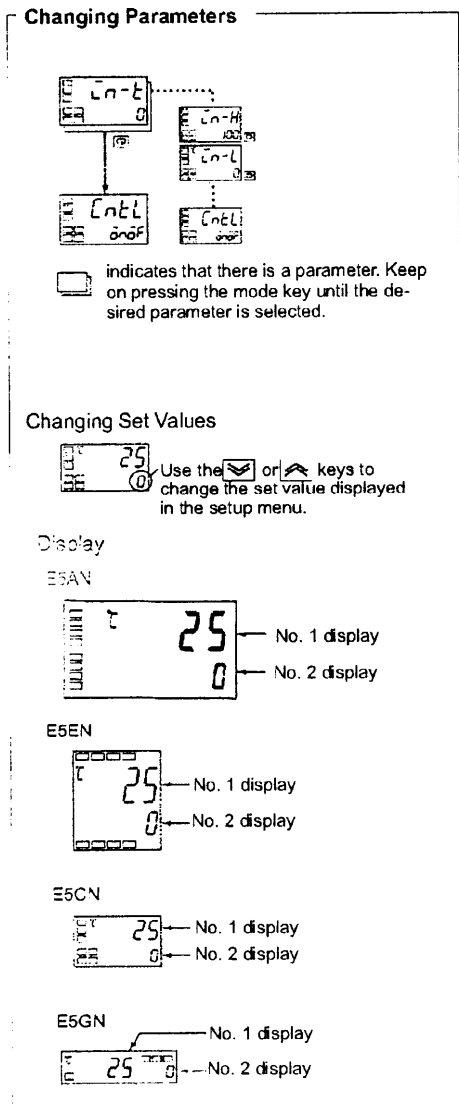| Input type: | 0 K thermocouple -200 to 1300°C |
Control method:	ON/OFF control
Alarm type:	2 upper limit
Alarm value 1:	20°C (For setting deviation)
Set point:	100°C

Change only the alarm value 1 and set point. The rest must be left as default settings.

Setup procedure

Power ON

Power ON

Operation level

Process value/set point

Press ☐ key for at least three seconds. Control stops.

Set input specifications	Check input type.	Input type 0
Set control specifications	Check that control is ON/OFF control.	In ON/OFF control ōnōF
Set alarm type	Check alarm type.	Alarm 1 type 2

Press ☐ key for at least one second. Control starts.

Operation level

Set the set point	Press ▽ △ keys to set set point to "100 C."	Process value/set point 100
Check operation state	Make sure that control is running.	During run rūn / During stop
Set alarm values	Press ▽ △ keys to set alarm value to "20 C."	Alarm value 1

| Start operation | | Start operation |

PID Control Using Auto-tuning

Changing Parameters
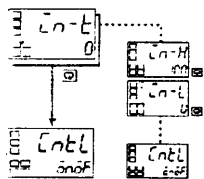
⌐ indicates that there is a parameter. Keep on pressing the mode key until the desired parameter is selected.

Changing Set Values

Use the ∨ or ∧ keys to change the set value displayed in the setup menu.

Display

E5AN

— No. 1 display
— No. 2 display

E5EN

— No. 1 display
— No. 2 display

E5CN

No. 1 display

No. 2 display

E5GN

No. 1 display

No. 2 display

PV/SP

After AT execution.

During AT execution.

While AT is being executed, SP will flash

After AT execution.

During AT execution.

Typical Example

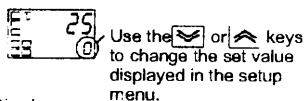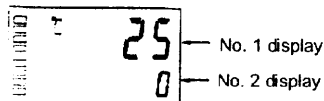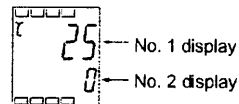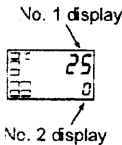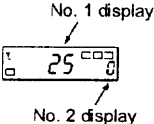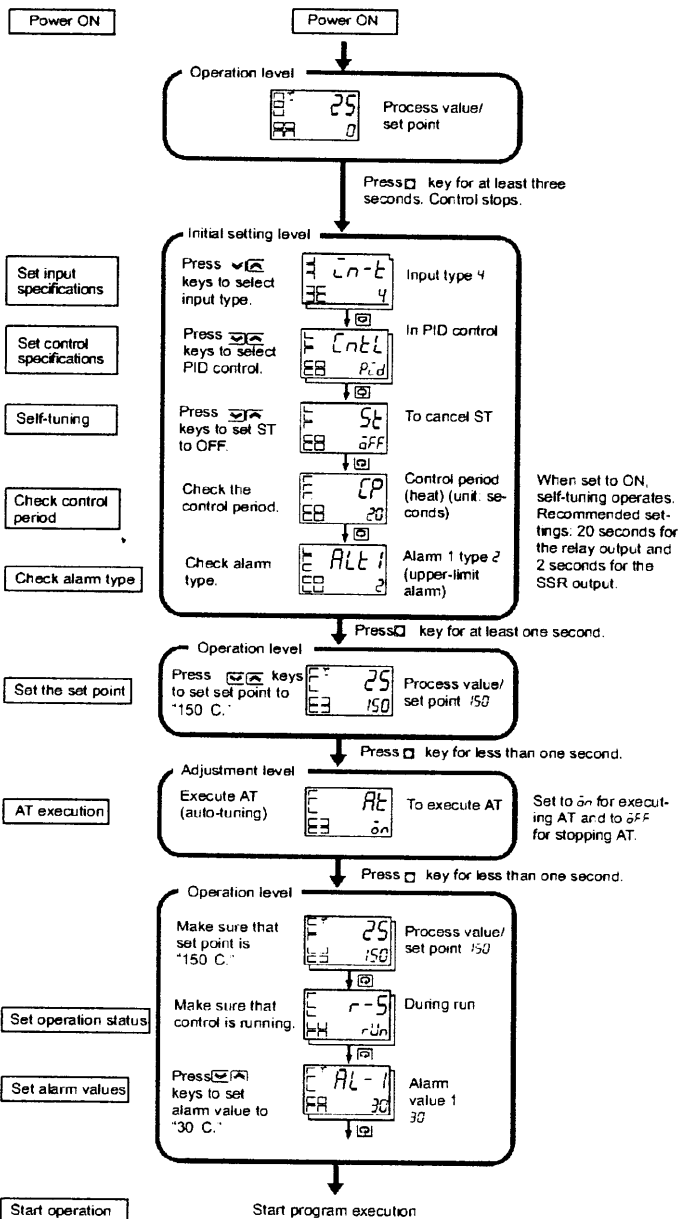|	
Input type:	4 T thermocouple -200 to 400°C
Control method:	PID control
ST (self-tuning):	OFF
Calculate PID constants by AT (auto-tuning).	
Alarm type:	2 upper limit
Alarm value 1:	30°C (For setting deviation)
Set point:	150°C

Setup procedure

Power ON → Power ON

Operation level

Process value/set point

Press □ key for at least three seconds. Control stops.

Initial setting level

- Set input specifications — Press ∨∧ keys to select input type. — Input type 4
- Set control specifications — Press ∨∧ keys to select PID control. — In PID control
- Self-tuning — Press ∨∧ keys to set ST to OFF. — To cancel ST
- Check control period — Check the control period. — Control period (heat) (unit: seconds)
- Check alarm type — Check alarm type. — Alarm 1 type 2 (upper-limit alarm)

When set to ON, self-tuning operates. Recommended settings: 20 seconds for the relay output and 2 seconds for the SSR output.

Press □ key for at least one second.

Operation level

- Set the set point — Press ∨∧ keys to set set point to "150 C." — Process value/set point 150

Press □ key for less than one second.

Adjustment level

- AT execution — Execute AT (auto-tuning) — To execute AT

Set to on for executing AT and to off for stopping AT.

Press □ key for less than one second.

Operation level

- Make sure that set point is "150 C." — Process value/set point 150
- Set operation status — Make sure that control is running. — During run
- Set alarm values — Press ∨∧ keys to set alarm value to "30 C." — Alarm value 1 30

- Start operation — Start program execution

Specification Setting after Turning ON Power ———————

Outline of Operation Procedures

Key Operation

In the following descriptions, all the parameters are introduced in the display sequence. Some parameters may not be displayed depending on the protect settings and operation conditions.
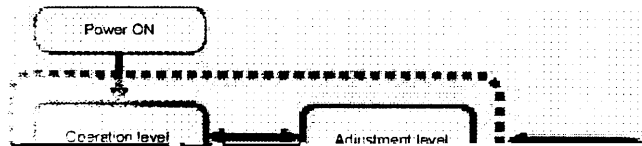
Specification Setting after Turning ON Power

Initial Setting Level

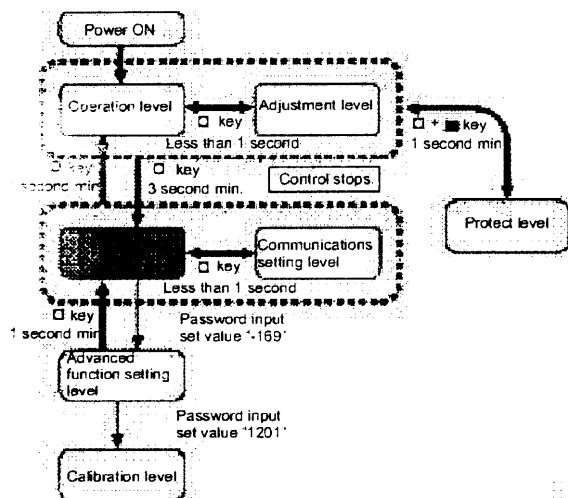This level is used for setting basic specifications of the Temperature Controller. Using this level, set the input type for selecting the input to be connected such as the thermocouple or platinum resistance thermometer and set the range of set point and the alarm mode.

To move from the operation level to the initial setting level, press ☐ key for three seconds or more.

The initial setting level is not displayed when "initial/communications protection" is set to "2." This initial setting level can be used when "initial setting/communications protection" is set to "0" or "1."

The "scaling upper limit," "scaling lower limit," and "decimal point" parameters are displayed when an analog voltage input is selected as the input type.

Initial setting level
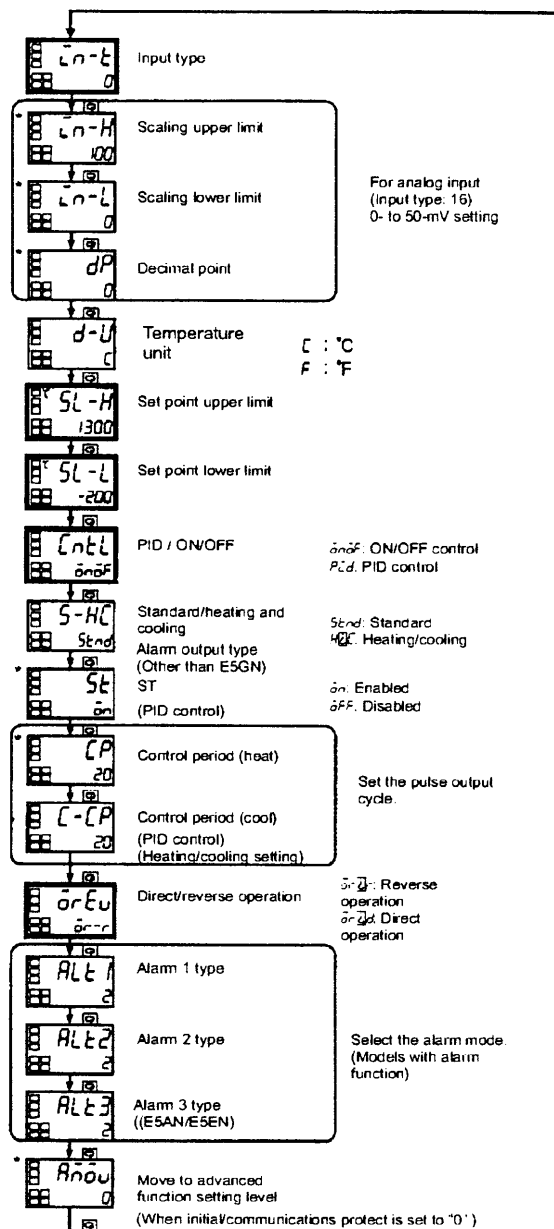
To return to the operation level, press the ☐ key for longer than one second

*   Not displayed as default setting.

35

Input Type

When using a thermocouple input type, follow the specifications listed in the following table.

	Input Type	Specifications	Set Value	Input Temperature Range
Thermocouple input type	Thermocouple	K	▉▉▉	−200 to 1300 (°C) /−300 to 2300 (°F)
			1	−20.0 to 500.0 (°C) /0.0 to 900.0 (°F)
		J	2	−100 to 850 (°C) /−100 to 1500 (°F)
			3	−20.0 to 400.0 (°C) /0.0 to 750.0 (°F)
		T	4	−200 to 400 (°C) /−300 to 700 (°F)
		E	5	0 to 600 (°C) /0 to 1100 (°F)
		L	6	−100 to 850 (°C) /−100 to 1500 (°F)
		U	7	−200 to 400 (°C) /−300 to 700 (°F)
		N	8	−200 to 1300 (°C) /−300 to 2300 (°F)
		R	9	0 to 1700 (°C) /0 to 3000 (°F)
		S	10	0 to 1700 (°C) /0 to 3000 (°F)
		B	11	100 to 1800 (°C) /300 to 3200 (°F)
	Non-contact temperature sensor ES1A	K10 to 70 C	12	0 to 90 (°C) /0 to 190 (°F)
		K60 to 120 C	13	0 to 120 (°C) /0 to 240 (°F)
		K115 to 165 C	14	0 to 165 (°C) /0 to 320 (°F)
		K160 to 260 C	15	0 to 260 (°C) /0 to 500 (°F)
	Analog input	0 to 50mV	16	One of following ranges depending on the results of scaling: 1999 to 9999, 199.9 to 999.9

Note: The initial settings are: 0: −200 to 1300 C/−300 to 2300 F.

When using the platinum resistance thermometer input type, follow the specifications listed in the following table.

	Input Type	Specifications	Set Value	Input Temperature Range
Platinum resistance thermometer input type	Platinum resistance thermometer	Pt100	▉▉▉	−200 to 850 (°C) /−300 to 1500 (°F)
			1	−199.9 to 500.0 (°C)/−199.9 to 900.0 (°F)
			2	0.0 to 100.0 (°C) /0.0 to 210.0 (°F)
		JPt100	3	−199.9 to 500.0 (°C)/−199.9 to 900.0 (°F)
			4	0.0 to 100.0 (°C) /0.0 to 210.0 (°F)

Note: The initial settings are: 0: Pt100 −200 to 850 C/−300 to 1500 F.
The ES1A Non-contact Temperature Sensor is now available.

☐ Alarm 1 and Alarm 2

For the alarm 1 and alarm 2, select alarm types out of the 12 alarm types listed in the following table. (The alarm 3 for E5AN/E5EN, which has three alarms, can also be selected from this table.)

Set Value	Alarm Type	Alarm Output Operation	
		When X is positive	When X is negative
0	Alarm function OFF	Output OFF	
1 *1	Upper- and lower-limit (deviation)		*2
2	Upper-limit (deviation)		
3	Lower-limit (deviation)		
4	Upper- and lower-limit range (deviation)		*3
5	Upper- and lower-limit with standby sequence (deviation)	*5	*4
6	Upper-limit with standby sequence (deviation)		
7	Lower-limit with standby sequence (deviation)		
8	Absolute-value upper-limit		
9	Absolute-value lower-limit		
10	Absolute-value upper-limit with standby sequence		
11	Absolute-value lower-limit with standby sequence		

*1: With set values 1, 4 and 5, the upper and lower limit values can be set independently for each alarm type, and are expressed as "L" and "H."
Following operations are for cases when an alarm set point is "X" or negative.

*2: Set value: 1, upper- and lower-limit alarm
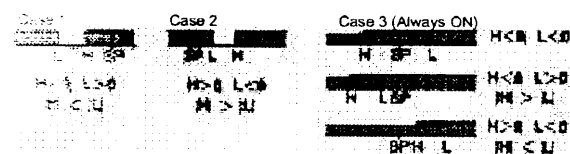
*3: Set value: 4, upper- and lower-limit range

*4: Set value: 5, upper- and lower-limit with standby sequence

Same as for the upper- and lower-limit alarm. However, when the upper-limit and lower-limit hysteresis overlaps: Always OFF
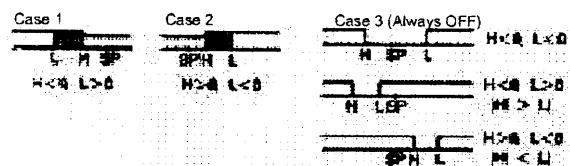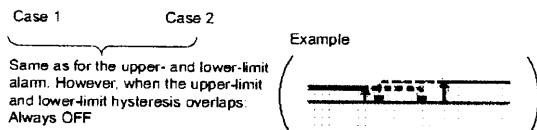
Example: When the alarm is set ON at 110 C/ F or higher.

When an alarm type other than the absolute-value alarm is selected
(For alarm types 1 to 7)
The alarm value is set as a deviation from the set point.

Alarm value
Set point
100°C/°F
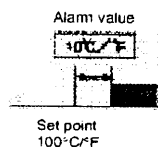
When the absolute-value alarm is selected
(For alarm types 8 to 11)
The alarm value is set as an absolute value from the alarm value of 0 C/F.

Alarm value
0°C/°F
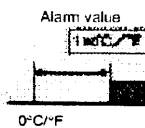
*5: Set value: 5, upper- and lower-limit with standby sequence alarm. Always OFF when the upper limit and lower limit hysteresis

Parameters

Parameters related to setting items for each level are marked in boxes in the flowcharts and brief descriptions are given as required. At the end of each setting item, press the mode key to return to the beginning of each level.

Display

E5AN

No. 1 display
No. 2 display

E5EN

No. 1 display
No. 2 display

E5CN   No. 1 display   E5GN   No. 1 display

No. 2 display   No. 2 display

Operation level
Adjustment level
key
Less than 1 second
+ key
1 second min.
key 3 second min.
Control stops.
Protect level
Communications setting level
key
Less than 1 second
key
1 second
Password input set value "-169"
Advanced function setting level
Password input set value "1201"
Calibration level

Control in progress
Control stopped
Level change

Power ON

Advanced Function Setting Level

key
1 second min.

Initial Setting Level

key
1 second min.

Operation Level

key
Less than 1 second

Adjustment Level

key
3 second min.

key
Less than 1 second

Note: To select advanced function setting level, you must enter the password ("-169") in the initial setting level.

Advanced Function Setting Level

Parameter	Description	Group
`LnLt` `oFF`	Parameter initialize	Resets to the default value.
`Eu-n`	Number of multi-SP uses	Input setting: Multiple SP/RUN/STOP
`Eu-1` `nonE`	Event input assignment 1	
`Eu-2` `StoP`	Event input assignment 2	
`nSPU` `oFF`	Multi-SP uses on oFF	
`SPrt` `oFF`	SP ramp set value	
`rESt` `A`	Standby sequence reset method	
`AL1n` `n-o`	Alarm 1 open in alarm	ON/OFF setting of alarm output 1
`ALH1` `0.2`	Alarm 1 hysteresis	
`AL2n` `n-o`	Alarm 2 open in alarm	ON/OFF setting of alarm output 2
`ALH2` `0.2`	Alarm 2 hysteresis	
`AL3n` `n-o`	Alarm 3 open in alarm	ON/OFF setting of alarm output 3 (E5AN/E5EN only)
`ALH3` `0.2`	Alarm 3 hysteresis	
`HbU` `on`	HBA ON/OFF	
`HbL` `oFF`	Heater burnout latch	
`HbH` `0.1`	Heater burnout hysteresis	
`St-b` `15.0`	ST stable range For setting deviation.	
`ALFA` `0.65`	α 2-PID parameter	
`oL-H` `105.0`	MV upper limit	Limitations to MV
`oL-L` `-5.0`	MV lower limit	
`LnF` `00`	Input digital filter For setting time constant in seconds.	
`PuAd` `oFF`	Additional PV display Displayed first in the operation level	
`o-dP` `oFF`	Manipulated variable display	
`rEt`	Automatic return of display mode	

Initial Setting Level

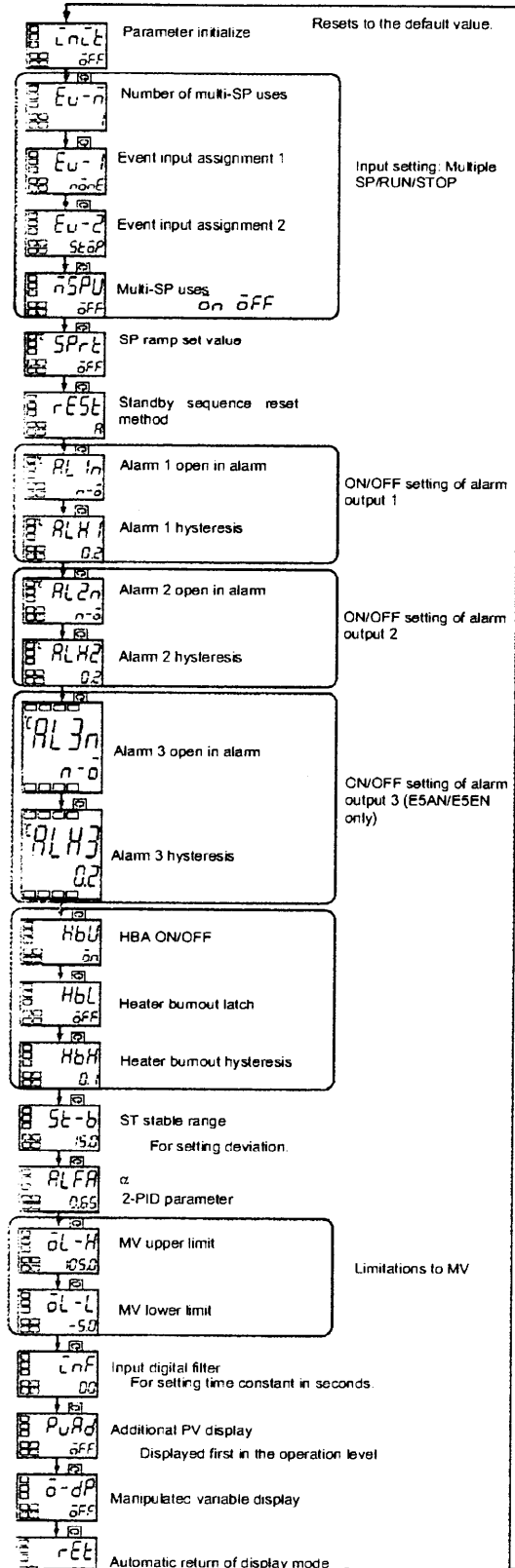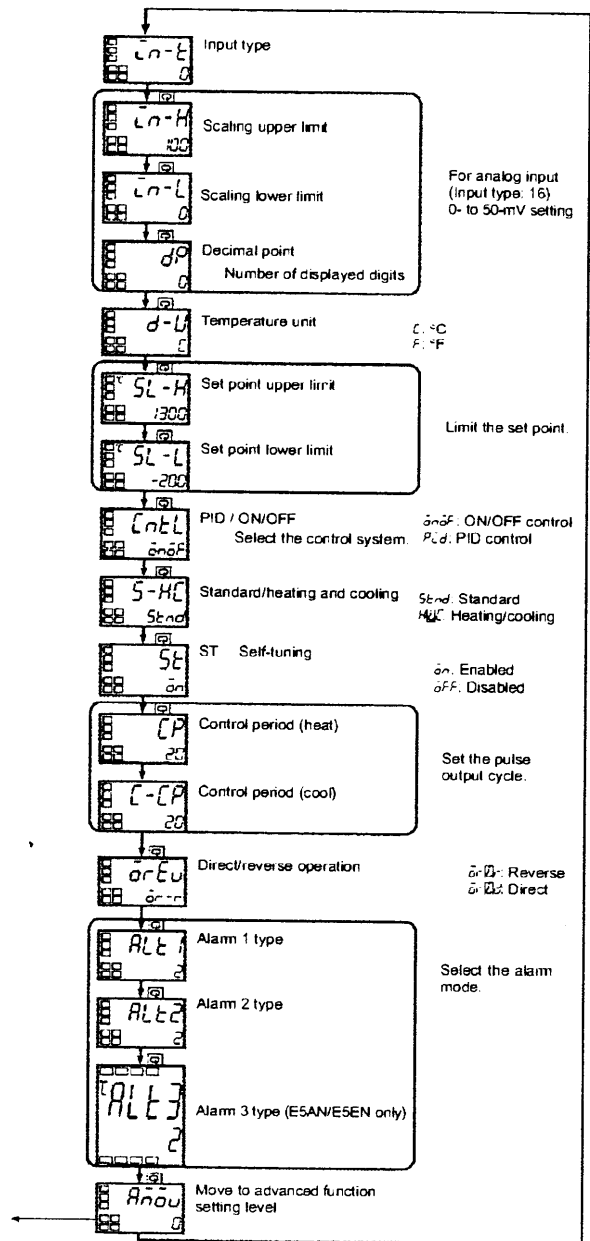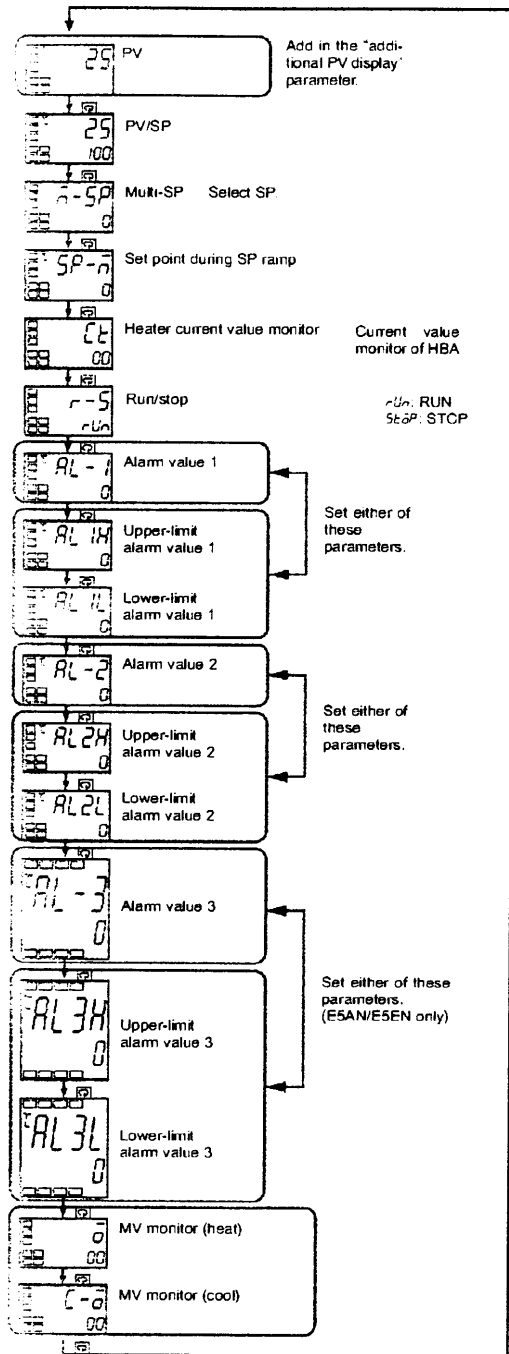| Parameter	Description	Group
`Ln-t` `0`	Input type	
`Ln-H` `100`	Scaling upper limit	For analog input (Input type: 16) 0- to 50-mV setting
`Ln-L` `0`	Scaling lower limit	
`dP` `0`	Decimal point Number of displayed digits	
`d-U` `C`	Temperature unit	C: °C F: °F
`SL-H` `1300`	Set point upper limit	Limit the set point.
`SL-L` `-200`	Set point lower limit	
`CntL` `onoF`	PID / ON/OFF Select the control system.	onoF: ON/OFF control PLd: PID control
`S-HC` `Stnd`	Standard/heating and cooling	Stnd: Standard HUC: Heating/cooling
`St` `on`	ST Self-tuning	on: Enabled oFF: Disabled
`CP` `20`	Control period (heat)	Set the pulse output cycle.
`C-CP` `20`	Control period (cool)	
`orEu` `or-r`	Direct/reverse operation	or-U: Reverse or-d: Direct
`ALt1` `2`	Alarm 1 type	Select the alarm mode.
`ALt2` `2`	Alarm 2 type	
`ALt3` `2`	Alarm 3 type (E5AN/E5EN only)	
`Amou` `0`	Move to advanced function setting level	

Note: To select advanced function setting level, you must enter the password ("-169") in the initial setting level.

Note: These diagrams show all the parameters that may be displayed. Depending on the specifications of the model used, there may be some parameters that are not displayed. The following symbols are used to distinguish between these parameters.
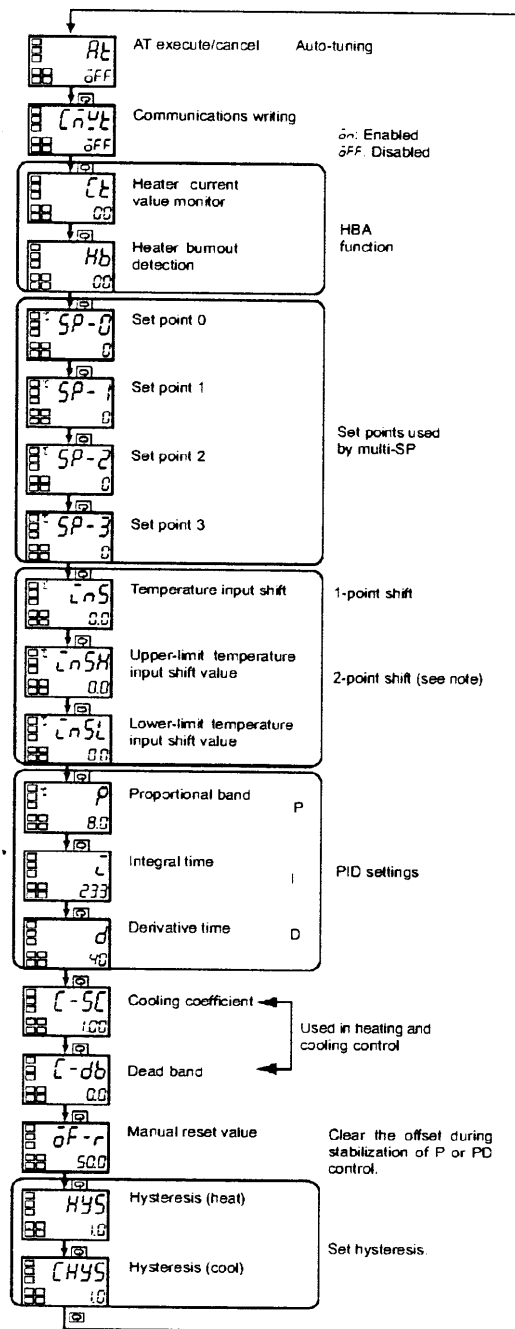
    :   Displayed for all models regardless of the settings of other parameters.

    :   Not displayed for some models.

    :   Depending on the settings of other parameters, may

E5AN/E5EN/E5CN/E5GN ─────── OmROn ─────── E5AN/E5EN/E5CN/E5GN

Operation Level

Display	Parameter	Note
PV		Add in the "additional PV display" parameter.
PV/SP		
Multi-SP	Select SP	
Set point during SP ramp		
Heater current value monitor		Current value monitor of HBA
Run/stop		rUn: RUN / StoP: STOP
Alarm value 1		Set either of these parameters.
Upper-limit alarm value 1		
Lower-limit alarm value 1		
Alarm value 2		Set either of these parameters.
Upper-limit alarm value 2		
Lower-limit alarm value 2		
Alarm value 3		Set either of these parameters. (E5AN/E5EN only)
Upper-limit alarm value 3		
Lower-limit alarm value 3		
MV monitor (heat)		
MV monitor (cool)		

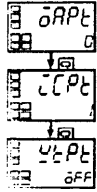The displays for parameters which can be switched (i.e., parameters other than simply numerical ones) show the contents of those parameters.

Adjustment Level

Display	Parameter	Note
AT	AT execute/cancel	Auto-tuning
CnWt	Communications writing	on: Enabled / oFF: Disabled
Ct	Heater current value monitor	HBA function
Hb	Heater burnout detection	
SP-0	Set point 0	Set points used by multi-SP
SP-1	Set point 1	
SP-2	Set point 2	
SP-3	Set point 3	
InS	Temperature input shift	1-point shift
InSH	Upper-limit temperature input shift value	2-point shift (see note)
InSL	Lower-limit temperature input shift value	
P	Proportional band P	PID settings
I	Integral time I	
d	Derivative time D	
C-SC	Cooling coefficient	Used in heating and cooling control
C-db	Dead band	
oF-r	Manual reset value	Clear the offset during stabilization of P or PD control.
HYS	Hysteresis (heat)	Set hysteresis
CHYS	Hysteresis (cool)	

The 2-point shift setting is only possible when the input type is a non-contact temperature sensor.

Note: These diagrams show all the parameters that may be displayed. Depending on the specifications of the model used, there may be some parameters that are not displayed. The following symbols are used to distinguish between these parameters.
   ⊓: Displayed for all models regardless of the settings of other parameters.
   : Not displayed for some models.
   : Depending on the settings of other parameters, may not be displayed.

Protect Level

Operation/adjustment protection
Restricts display and modification of menus in the operation and adjustment levels.

Initial setting/communications protection
Restricts display and modification of menus in the initial setting, operation level and adjustment levels.

Setting change protection
Protects changes to setups by operating the front panel keys.

Operation/Adjustment Protection

The following table shows the relationship between set values and the range of protection.

Level		Set value			
			1	2	3
Operation level	PV	⊏	□	⊐	□
	PV/SP	O	O	O	□
	Other	O	O	X	X
Adjustment level		O	X	X	X

When this parameter is set to "0," parameters are not protected.

Default setting: 0

O : Can be displayed and changed
⊏ : Can be displayed
X : Cannot be displayed and move to other levels not possible

Initial Setting/Communications Protection

This protect level restricts movement to the initial setting level, communications setting level and advanced function setting level.

Set value	Initial setting level	Communications setting level	Advanced function setting level
0	L	L	⅃
1	⊏	⊏	X
2	X	X	X

Default setting: 1

⊏ : Move to other levels possible
X : Move to other levels not possible

Setting Change Protection

This protect level protects setup from being changed by operating the keys on the front panel.

Set value	Description
OFF	Setup can be changed by key operation.
ON	Setup cannot be changed by key operation. (The protect level, can be changed.)

Default setting: OFF

41

Communications Setting Level

Set the E5AN/E5EN/E5CN/E5GN communications specifications in the communications setting level. For setting communications parameters, use the E5AN/E5EN/E5CN/E5GN panel. The communications parameters and their settings are listed in the following table.

Parameter	Displayed characters	Set (monitor) value	Set value
Communications unit No.	U-no	0 to 99	0.1 to 99
Baud rate	PS	1.2/2.4/4.8/9.6/19.2 (kbps)	1.2/2.4/4.8/9.6/19.2
Data bits	n	7/8 (bit)	7/8 (bit)
Stop bits	S t	1/2	1/2 (bit)
Parity	P-t	None, even, odd	non/EvEn/odd

Note: The highlighted values indicate default settings.

Before executing communications with the E5AN/E5EN/E5CN/E5GN, set the communications unit No., baud rate, etc., through key operations as described below. As for other operations, refer to relevant Operation Manual.

1. Press the ☐ key for at least three seconds in the "operation level." The level moves to the "initial setting level."

2. Press the ☐ key for less than one second. The "initial setting level" moves to the "communications setting level."

3. Pressing the ⟲ key advances the parameters as shown in the following figure.

4. Press the ⬈ or ⬊ keys to change the parameter setups.
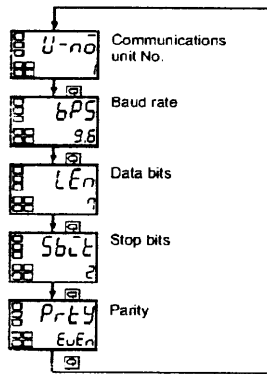
Note: On the E5AN/E5EN/E5GN, the ☐ Key is the ☐ Key.

Set each communications parameter to match those of the communicating personal computer.

Communications Unit No. (U-no)

When communicating with the host computer, the unit number must be set in each Temperature Controller so that the host computer can identify each Temperature Controller. The number can be set in a range from 0 to 99 in increments of 1. The default setting is 1. When using more than one Unit, be careful not to use the same number twice. Duplicate settings will cause malfunction. This value becomes valid when the power is turned OFF and ON again.

Baud Rate (PS)

Use this parameter to set the speed of communications with the host computer. It can be set to one of the following values; 1.2 (1200 bps), 2.4 (2400 bps), 4.8 (4800 bps), 9.6 (9600 bps), and 19.2 (19200 bps).
This setting becomes valid when the power is turned OFF and ON again.

Data Bits (n)

Use this parameter to change the communications data bit length to 7 bits or 8 bits.

Stop Bits (S t)

Use this parameter to change the communications stop bit to 1 or 2.

Parity (P-t)

Use this parameter to set the communications parity to None, Even, or Odd.

⟳ Troubleshooting

When an error occurs, an error code will be displayed on the No. 1 display. Check the contents of an error and take appropriate countermeasures.

No. 1 display	Type of error	Countermeasures
S.rr	Input error	Check the wiring of inputs for miswiring, disconnections, short-circuits, and the input type.
E111	Memory error	First, turn the power OFF then back ON again. If the display remains the same, the Unit must be repaired. If the display is restored, then a probable cause can be external noise affecting the control system. Check for external noise.
----	Display range over	Though not error, this is displayed when the process value exceeds the display range when the control range is larger than the display range.
ɔɔɔɔ		• When less than "-1999" (-199.9) cccc • When larger than "9999" (999.9) ɔɔɔɔ
HB.rr	HB error	First, turn the power OFF then back ON again. If the display remains the same, the E5EN/E5CN/E5GN must be repaired. If the display is restored, then a probable cause can be electrical noise affecting the control system. Check for electrical noise.

Note: Error will be displayed only when the display is set for the PV or PV/SP.

Fuzzy Self-tuning

The fuzzy self-tuning (ST) is a function that automatically calculates an optimum PID constant depending on items to be controlled.

■ Feature

The Temperature Controller determines when to execute this fuzzy self-tuning.

■ Functions

SRT: Performs PID tuning according to the step response method when the SP is changed.

Requirements for SRT Functionality

The ST will be executed according to the step response method when the following conditions are satisfied when operation is started or when the SP is changed.

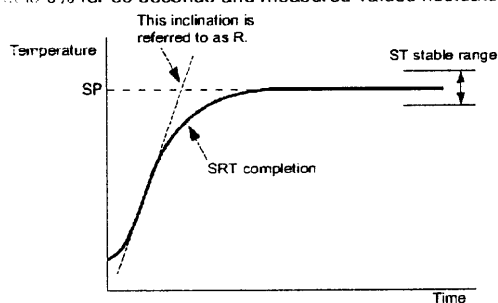| When operation is started	When SP is changed
1. The SP at the startup is different from the SP at the time the previous SRT was executed. (See note.) 2. The temperature upon startup is smaller than the SP in the reverse operation and larger than the SP in the direct operation. 3. Restarting of operation is not due to an input error. Note: The "SP that existed when the previous SRT was executed" refers to the SP used for obtaining the PID constant in the previous SRT.	1. The SP after change is different from the SP at the time the previous SRT was executed. (See note.) 2. In the reverse operation, the value obtained by deducting the SP before change from the SP after change is larger than the ST stable range. In the direct operation, the value obtained by deducting the SP after change from the SP before change is larger than the ST stable range. 3. The SP change width is larger than the current proportional band × 1.27 + 4. 4. The temperature is in the stable state. (It can be in the balanced state if no output is generated when the power is turned ON.)

If the SP is changed while SRT is being executed and if SRT completion conditions are satisfied, no PID change will take place.

Stabilization State

Measured values remain in the stable range for a certain period of time.

Balanced State

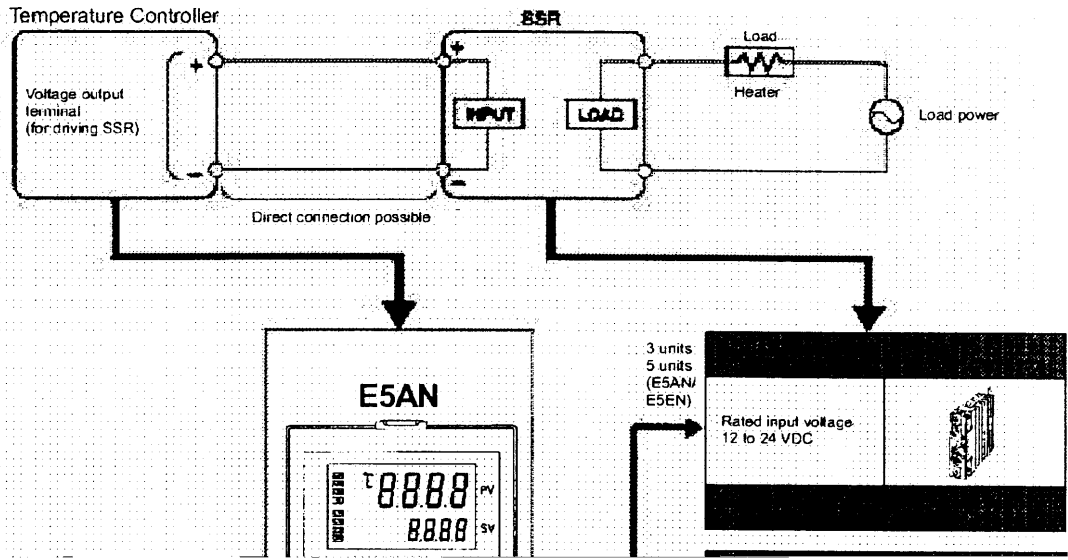Output is 0% for 60 seconds and measured values fluctuate within the width of the stable range.

Peripheral Devices

Temperature Sensor / SSR

Connection Example with SSR

Temperature Controller

SSR

Voltage output terminal (for driving SSR)

INPUT

LOAD

Load

Heater

Load power

Direct connection possible

E5AN

τ 8.8.8.8 PV

8.8.8.8 SV

3 units
5 units
(E5AN/
E5EN)

Rated input voltage
12 to 24 VDC

Responding to All Demands for Temperature Control in Wide Application Range

ES1A Non-contact Temperature Sensor

Replaces the K-type thermocouple with no modification required.

Available soon.

Note: Refer to the ES1A Datasheet (H106) for more details.

Only One-tenth the Size of OMRON's Conventional Model

The ES1A-A is as compact as 14 x 18.6 x 34 (W x H x D) mm and can be built into machines and equipment with ease.

No Power Supply Required

The ES1A Series has electromotive output that is as high as the output of the thermocouple, thus allowing direct connection to the thermocouple input terminal of the Temperature Controller without requiring any external power supply.

Available for High Ambient Temperatures

The ES1A Series performs accurate measurement without being influenced by the ambient temperature. In particular, the ES1A-C with air purge function can operate at an ambient temperature of up to 120°C.

ES1A-A	−25 to 70°C
ES1A-B	−25 to 100°C
ES1A-C with air purge function	−25 to 120°C

G3PB SSC for Three-phase Heaters

Compact, low-cost model for three-phase heater control.

Saves 40% on Installation Space

The G3PB is dedicated to three-phase heater control and saves 40% on installation space compared with three single-phase models mounted closely side-by-side.

Precautions

■ General Precautions

The user must operate the product according to the performance specifications described in the operation manuals.
Before using the product under conditions which are not described here or applying the product to nuclear control systems, railroad systems. aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.
Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

■ Safety Precautions

Definition of Precautionary Information

| ⚠ DANGER | Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. |

| ⚠ WARNING | Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. |

| ⚠ Caution | Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage. |

Installation Precautions

| ⚠ WARNING | Do not attempt to take any Temperature Controller apart while the power is being supplied. Doing so may result in electric shock. |

| ⚠ WARNING | Do not touch any of the terminals or terminal blocks while the power is being supplied. Doing so may result in electric shock. |

| ⚠ WARNING | Do not allow pieces of metal or wire cuttings to get inside the Temperature Controller. Failure to do so may result in malfunction, electric shock or fire. |

| ⚠ WARNING | Do not attempt to disassemble, repair, or modify the Temperature Controller. Any attempt to do so may result in malfunction, fire, or electric shock. |

| ⚠ Caution | Do not use the Temperature Controller in locations subject to flammable gases. Doing so may result in an explosion. |

| ⚠ Caution | The switching capacity and switching conditions will have a great effect on the longevity of the output relays. Use the Temperature Controller within the rated load and do not use the Temperature Controller beyond the number of operations specified under electrical life. Using the Temperature Controller beyond its electrical life may result in contact welding or burning. |

| ⚠ Caution | Do not use the Temperature Controller at loads greater than the rated value. Doing so may result in burning or other damage. |

| ⚠ Caution | Use a power supply voltage within the specified range. Failure to do so may result in burning or other damage. |

| ⚠ Caution | Tighten the terminal screws to the following torques:
E5AN, E5EN, E5CN: 0.74 to 0.90 N m
E5GN: Terminals 1 to 6: 0.23 to 0.25 N m
            Terminals 7 to 9: 0.12 to 0.14 N m
Failure to tighten terminal screws to the correct torque may result in fire or malfunction. |

| ⚠ Caution | Make settings for the Temperature Controller that are suitable for the controlled system. Failure to do so may cause unexpected operation resulting in damage to equipment or personal injury. |

| ⚠ Caution | Prepare a circuit with an overheating prevention alarm and take other safety measures to ensure safe operation in the event of a malfunction. Loss of operational control due to malfunction may result in a serious accident. |

■ Operating Environment Precautions

| ⚠ Caution | In order to ensure the safe operation, observe the following precautions. |

- Do not use the Temperature Controller in the following places:
  - Locations exposed to radiated heat from heating devices
  - Locations subject to direct sunlight
  - Locations subject to temperatures or humidity outside the range specified in the specifications
  - Locations subject to condensation as the result of severe changes in temperature
  - Locations subject to corrosive or flammable gases
  - Locations subject to dust (especially iron dust) or salts
  - Locations subject to exposure to water, oil, or chemicals
  - Locations subject to shock or vibration
- Use and store the Temperature Controller within the rated temperature and humidity specified for each model. When two or more Temperature Controllers are mounted horizontally close to each other or vertically next to one another, the internal temperature will increase due to heat radiated by the Temperature Controllers and the service life will decrease. In such a case, forced cooling by fans or other means of air ventilation will be required to cool down the Temperature Controllers. When providing forced cooling. however, be careful not to cool down the terminal sections alone to avoid measurement errors.
- Allow enough space around the Temperature Controller to ensure proper heat dissipation. Do not block the ventilating holes.
- Check polarities and orientation when connecting terminals. Not doing so may result in malfunction.
- When wiring the E5AN, E5EN, or E5CN, use crimp terminals with the specified dimensions (M3.5, width 7.2 mm max.).
- When wiring the E5GN, use cables of a thickness AWG24 (0.205 mm^2) to AWG 14 (2.081 mm^2) for terminals 1 to 6 and use cables of a thickness AWG28 (0.081 mm^2) to AWG22 (0.326 mm^2) for terminals 7 to 9. The exposed current-carrying part to be inserted into terminals must be 5 to 6 mm.
- Do not use empty terminals.
- To avoid inductive noise, keep the wiring for the Temperature Controller's terminal board away from power cables carry high voltages or large currents. Also, do not wire power lines together with or parallel to Temperature Controller wiring. Using shielded lines to separate pipes and ducts is recommended. Attach surge absorbers or noise filters to peripheral devices that may generate noise, such as inductance devices (e.g., motors, transformers. solenoids, magnetic coils etc.). If using a noise filter with the power supply, in addition to confirming the voltage and the current, mount the power supply as near as possible to the Temperature Controller. Set up the Temperature Controller, along with its power supply, as far away as possible from devices that generate strong, high-frequency waves (high-frequency welders, high-frequency machines etc.) and devices that generate surges.
- Set up the power supply so that the voltage will reach the rated voltage within 2 seconds after turning ON.
- Allow at least 30 minutes for the Temperature Controller to warm up.
- When using auto-tuning, turn ON power for the load (e.g., heater) at the same time as or before supplying power to the Temperature Controller. If power is turned ON for the Temperature Controller before turning ON power for the load, auto-tuning will

not be performed properly and optimum control will not be achieved.

- In order that power can be turned OFF in an emergency by the person operating the Temperature Controller, install the appropriate switches and circuit breakers and label them accordingly.

When starting operation after the Temperature Controller has warmed up, turn OFF the power and then turn it ON again at the same time as turning ON power for the load. (Instead of turning the Temperature Controller OFF and ON again, switching from STOP mode to RUN mode can also be used in this case.)