

# OMRON

## E5CWT

# Temperature Controller


## DIN-sized (48x48mm) Temperature Controller Featuring automatic PID Tuning Function

- Simultaneous PV and SV displays.
- Field-selectable temperature ranges
- Tamper-proof settings, sensor compensation, and controller diagnostics.
- Non-volatile memory.
- Selectable operation mode (ON/OFF or PID).




## Ordering Information

### ■ Thermometer Type

 Temperature range selector		Range	K(CA)			J(IC)
		1000	---	---	---	999
900	---	---	---	---	---	
700	---	---	500	---	---	
500	---	300	---	---	---	
300	---	---	---	---	---	
0	---	0	0	0	0	
Semag ptd 6, 7		OFF, OFF	OFF, ON	ON, OFF	ON, ON	
		6 7	6 7	6 7	6 7	
ON/OFF or PID operation	With Alarm	Indicance Unit	tC			tC
		Contact output	E5CWT-R1KJ / E5CWT-R2K			
		Voltage output	E5CWT-Q1KJ / E5CWT-Q2K			

※ E5CWT-R2K / E5CWT-Q2K ( 2A<sub>RM</sub>) only have K type .

### ■ Temperature Resistance(Platinum-resistance) Thermometer Type

 Temperature range selector		Range	Pt100			
		400	---	---	---	0
200	---	---	---	---	---	
100	---	---	50	---	---	
50	---	---	---	---	---	
0	---	---	---	---	---	
- 100	---	---	---	---	---	
Semag ptd 6, 7		OFF, OFF	OFF, ON	ON, OFF	ON, ON	
		6 7	6 7	6 7	6 7	
ON/OFF or PID operation	With Alarm	Indicance Unit	tC	tC	tC	tC
		Contact output	E5CWT-R1P/ E5CWT-R2P			
		Voltage output	E5CWT-Q1P/ E5CWT-Q2P			

## ■ Ratings

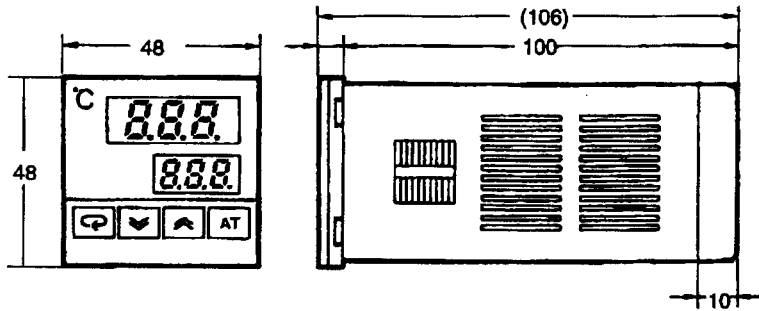
Supply voltage	110/220 VAC,50/60Hz
Operating voltage range	85% to 110% of rated supply voltage
Power consumption	110/220 VAC:Approx,8VA(2 alarm) :Approx,7VA(1 alarm)
Input	Thermocouple(K/J) or platinum resistance thermometer(Pt100)
Control output	Contact output:SPST-NO;3 A at 250 VAC (resistive load) Voltage output(for SSR):20 mA at 12 VDC(with short-circuit protection)
Control mode	ON/OFF or PID control with auto-tuning
Alarm output	Relay output: independent SPST-NO contacts;1 A at 250 VAC(resistive load)
Setting method	Digital setting via Up and Down Keys
Display method	Digital (PV color-red, SV color-green)

## ■ Characteristics

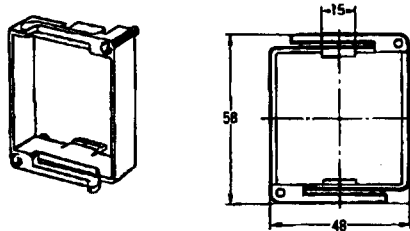
Setting and display	±0.5% full scale ±1 digit max.(The setting and display temperatures coincide because there is no relative error between them.)
Hysteresis	0.2% of full scale (during ON/OFF operation)
Proportional band	0% to 99%
Integral time(Reset time)	0 to 99 minutes
Derivative time(Rate time)	0 to 9.9 minutes
Anti-reset windup(ARW)	0% to 99%
Alarm output setting range	0 to full-scale for all alarm modes except the absolute-value alarm mode
Proportional period	2s/20s (switch-selectable)
Sampling period	500ms(Output change period: 2s, Indication change period: 2s)
Insulation resistance	20MΩ min.(at 500 VDC)
Dielectric strength	2,000 VDC, 50/60 Hz for 1 minute between current-carrying terminals of different polarity
Vibration	Malfunction durability: 2 to 55 Hz,2G 10 minutes each in X,Y, and Z directions Mechanical durability: 10 to 55 Hz,0.75 mm double 2hrs each in X,Y, and Z directions
Shock	Malfunction durability: 100m/s <sup>2</sup> 3 times each in 6 directions Mechanical durability: 300m/s <sup>2</sup> 3 times each in 6 directions
Life expectancy	Mechanical:10,000,000 operations min.(Contact Output Types) Electrical:100,000 operations min.( Contact Output Types)
Ambient operating temperature	-10° To 55 (with no icing)
Ambient storage temperature	-25° To 65 (with no icing)
Ambient humidity	35% to 85%(with no condensation)
Enclosure rating	Front Panel: IEC IP50 Rear Panel : IEC IP20 Terminals : IEC IP00

# Dimensions

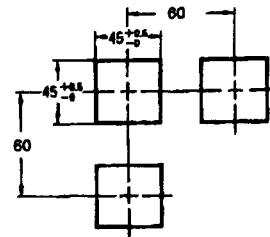
**Note:** All units are in millimeters.



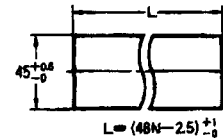
**Mounting adaptor (Included)**



**Panel Cutout**



**Side-by-side mounting of N controllers**



N	2	3	4	5	6
L	93.5 <sup>+1</sup> <sub>-0</sub>	141.5 <sup>+1</sup> <sub>-0</sub>	189.5 <sup>+1</sup> <sub>-0</sub>	237.5 <sup>+1</sup> <sub>-0</sub>	285.5 <sup>+1</sup> <sub>-0</sub>

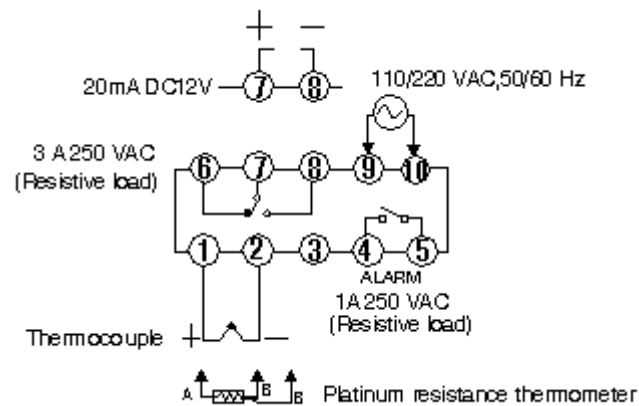
- Note:**
1. Recommended panel thickness is 1 to 4 mm.
  2. Because a mounting adaptor surrounds the Temperature Controller, close side-by-side mounting is possible. Provide a center-to-center distance of at least 60 mm between two adjacent temperature controllers when mounted vertically, and at least 60 mm when horizontally mounted.

## Installation

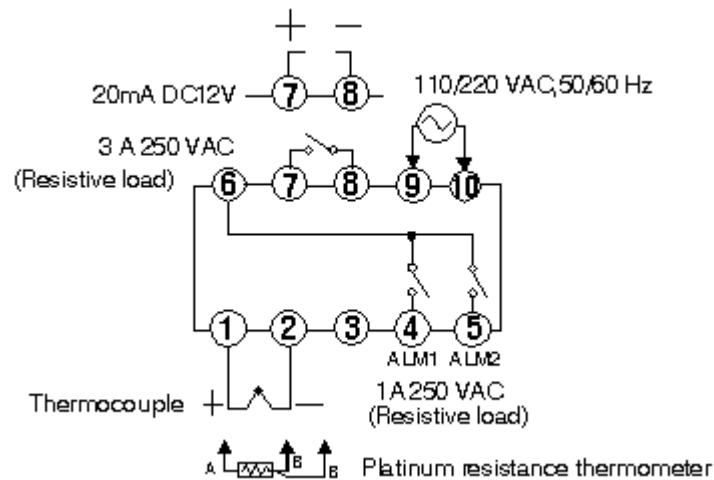
### ■Wiring

The voltage output(20mA,12VDC)is not electrically insulated from internal circuits.

#### 1 Alarm Type



#### 2 Alarm Type



**Note:** The voltage output(20mA at 12VDC)is not insulated from the internal circuitry. When using a thermocouple temperature sensor that incorporates a ground terminal, do not connect terminal 7 or 8 to the ground terminal or accurate temperature control will not be possible due to the short-circuited current that will flow between the ground terminal and terminal 7 or 8.

# Nomenclature

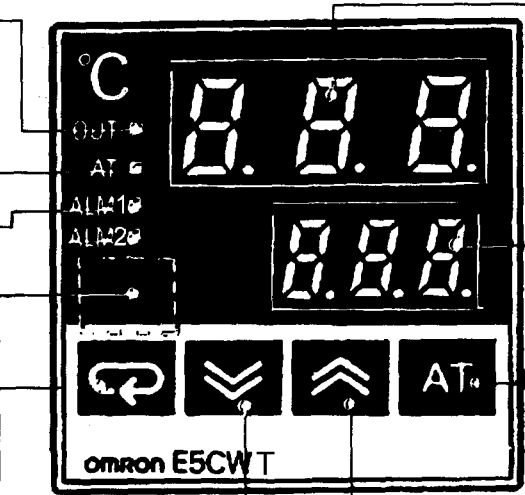
**Control Output Indicator**  
Lights while the control output is ON.

**Auto-tuning Indicator**  
Flashes on and off about every second during auto-tuning operation.

**Alarm Output Indicator**  
Lights when the alarm output is ON.

**Hidden Protection Switch**  
When pressed, this hidden switch enables the up, down, and auto-tuning keys even if the internal protect switch is on.

**Display Key**  
Used to shift the display to the next parameter.



**Process Value (PV) Display**  
Displays the process temperature or the name of the parameter whose set value is displayed in the SV display. Also displays an error indication in the event of malfunction.

**Set Value (SV) Display**  
Displays the temperature set values or other parameters.

**Auto-tuning (AT) Key**  
To enter auto-tuning mode, press this key for 2 seconds during PID operation. To exit auto-tuning mode, press the key for 2 seconds.

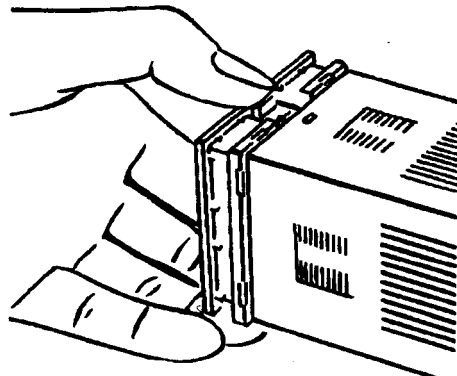
**Down Key**  
Pressed to decrement set temperature or alarm value settings. Value will decrement continuously if key is held down. This key is disabled when the protection switch is ON.

**Up Key**  
Pressed to increment set temperature or alarm value settings. Value will increment continuously if key is held down. This key is disabled when the protection switch is ON.

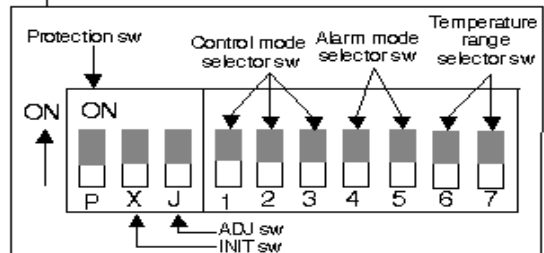
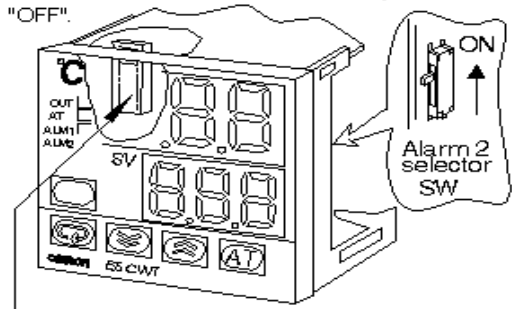
**Note:** Tear off the protective sheet after installation.

## ■ Accessing Switches and Selectors

Various functions of the Temperature Controller are set by the switches provided inside the device. To gain access to these switches, the housing must be removed. Loosen the draw-out screw with a Phillips screwdriver, and slide the housing off.

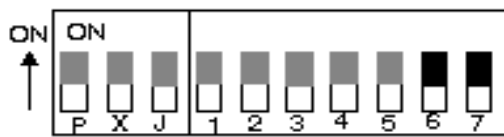


- \* Do not touch INIT SW and ADJ SW  
: These switches are for factory inspection only
- \* The Function selector switch's factory-set are "OFF".



### ■ Setting Procedure

Set the temperature range by setting the temperature range selector to the desired number. Each temperature display range is  $\pm 10\%$  the full scale of the temperature of the temperature range.



#### ● Thermocouple type

Function		Temperature range °C
6	7	
OFF	OFF	0 to 300
OFF	ON	0 to 500
ON	OFF	0 to 999
ON	ON	0 to 300

#### ● Platinum resistance thermometer type

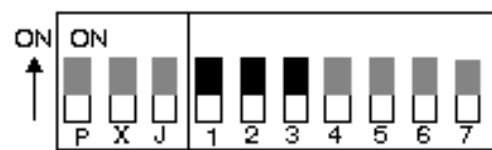
Function		Temperature range °C
6	7	
OFF	OFF	-50 to 50
OFF	ON	-20 to 80
ON	OFF	0 to 200
ON	ON	0 to 400

#### NOTES

- Never set the sw to the positions marked by \*.
- "▶" indicates the factory-set value
- Pt100:100 °C/138.50 °F

### ■ Function Selector

The DIP switch is used to set the operating parameters listed in the following table. All pins are factory-set to OFF.



Control mode		Function		
		1	2	3
Control mode	PID	ON		
	ON/OFF	OFF		
Proportional period	2 sec		ON	
	20 sec		OFF	
Control parameter display	Enable			ON
	Disable			OFF

#### NOTES

- The optimum proportional band is set automatically and offset is adjusted automatically in the PID control.
- To have longer life of the relay, have a proportional period of 20 seconds when relay is used for control.

### Alarm 1 Mode Selector

Alarm modes, listed in the following table, can be selected using the alarm mode selector. ▲ indicates set value for alarm output (following table)

Function		Mode	Alarm output
4	5		
OFF	OFF	No alarm output	OFF
OFF	ON	Upper-lower limit alarm	
ON	OFF	Upper limit alarm	
ON	ON	Lower limit alarm	

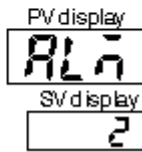
**NOTES**

- "x" is alarm set value and "▲" is set temperature (SP)
- "▶" indicates the factory-set value

### Alarm 2 Mode Selector

Set up the SW as the table before turn on the power. When the display just like the below, then can set up the mode of Alarm 2. When the set up finished wait 2 sec to turn off the power. Reset the mode of Alarm 1 and turn off the Alarm 2 selector SW.

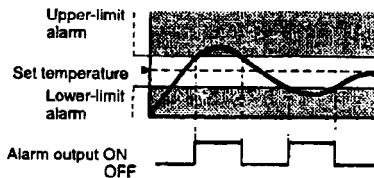
Control mode selector SW		Alarm 2 selector SW
4	5	
OFF	ON	ON



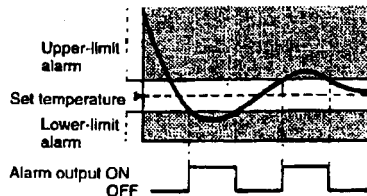
### Standby Sequence

The standby sequence operates when power is applied to the Temperature Controller.

When temperature rises from the set temperature



When temperature falls below the set temperature.



SV display	Mode	Alarm output
0	No alarm	OFF
1	Upper- and lower-limit alarm	
2	Upper-limit alarm	
3	Lower-limit alarm	
4	Upper- and lower-limit range alarm	
5	Upper- and lower-limit range alarm with standby sequence	
6	Upper-limit alarm with standby sequence	
7	Lower-limit alarm with standby sequence	
8	Absolute-value upper-limit alarm	
9	Absolute-value lower-limit alarm	
10	Absolute-value upper-limit alarm with standby sequence	
11	Absolute-value lower-limit alarm with standby sequence	
12	Absolute-value upper-limit alarm with latching function	
13	Upper-limit alarm with latching function	
14	Upper- and lower-limit range alarm with latch function	

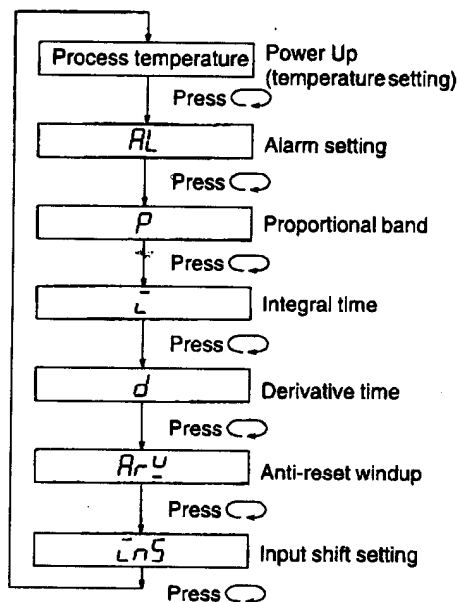
- Note:
1. Refer to page 6 for the standby sequence.
  2. Alarm setting ranges are as follows:  
X: alarm value  
Y: absolute value within selected temperature range

## ■ Setting Procedure: 1 alarm Type

One of the features of this model is a simultaneous display of the PV and SV. You can set the desired SV for the parameter indicated on the PV display.

When power is ON, the process value (PV) indicator displays 0 for 4 seconds before the E5CW starts operating. To set values, use the up and down keys. (The following values are default, set before shipment:  $RL = 0$  (°C/F),  $P = 3$ (%),  $\bar{c} = 4$  (min.),  $d = 4$  (1/10 min.),  $AR\% = 50$  (%))

The value to be set can be selected using the display key. The current parameter is shown in the PV display.



- Note**
1.  $RL$  is skipped without being displayed when the alarm function is not set (when the Alarm mode selector (located internally) is set 0 or 9).
  2.  $P$ ,  $\bar{c}$ ,  $d$ , and  $AR\%$  are skipped without being displayed when operation mode selector 1 (for the ON/OFF mode) is OFF or switch 4 (control parameter display mode) is OFF (these switches are located internally and set to a default of OFF before shipment). Note that even if there is no parameter display, each set value is effective in the PID mode. When  $P$  is 0, the controller is in the ON/OFF mode and  $\bar{c}$ ,  $d$ , and  $AR\%$  are skipped without being displayed.
  3.  $cns$  is skipped without being displayed when switch 4 (control parameter display mode) is OFF. Note, however, that the input value setting is effective.

### Alarm (RL)

An alarm temperature value can be set with  $RL$ . In normal operation, set the deviation range value for the set temperature. If an absolute alarm temperature value is desired, set the absolute value. Use the up and down keys to set the values when  $RL$  is displayed. No characters are displayed when the alarm function is not selected. The default set values for the upper limit alarm and the alarm tempera-

### ■ Auto-tuning

When the Auto-tuning Key is pressed for 2 s or more, the Temperature Controller automatically starts tuning the PID constants. While auto-tuning is in operation, the auto-tuning indicator on the front panel will flash. When the auto-tuning indicator turns off, the auto-tuning is terminated and PID constants are renewed.

- Note:**
1. While auto-tuning is in operation, settings cannot be changed.
  2. When function selector pin 1 is set to OFF (for ON/OFF control operation), auto-tuning can not be executed.

### Proportional Band (P)

When  $P$  is displayed, the up and down keys can be used to set a proportional band in the SV display. The  $P$  value can be set in the range 0% to 99% of the full scale in units of 1%. The default set before shipment is 3%.

### Integral time (Reset time) ( $\bar{c}$ )

When  $\bar{c}$  is displayed, the up and down keys can be used to set a time in the range from 0 to 99 minutes in steps of 1 minute. The default set value before shipment is 4 minutes.

### Derivative time (Rate time) ( $d$ )

When  $d$  is displayed, the up and down keys can be used to set a differential time value in the range from 0.0 to 9.9 minutes in steps of 0.1 minute. The default value before shipment is 0.4 minute. Note that, however, the indicator displays 4 without the decimal.

### Anti-reset Windup (AR%)

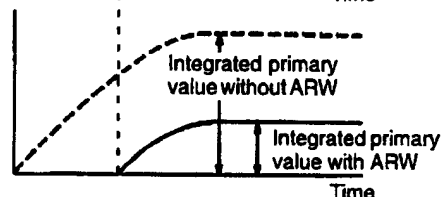
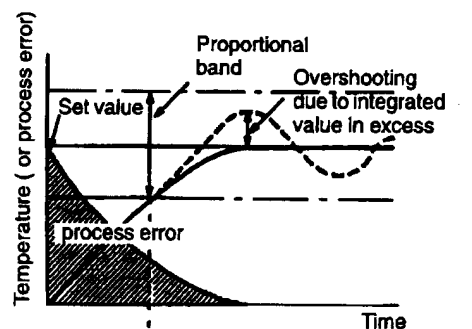
When  $AR\%$  is displayed, the up and down keys can be used to set an anti-reset value in a range from 0% to 99% in steps. The default set value before shipment is 50%.

### Note : ARW Function

An integral value controlling PID or PI operation can be obtained by integrating the process error from the beginning of operation. Therefore when the process temperature reaches about the set temperature, a large value must be integrated, causing overshooting. The ARW function prevents the controller from overshooting by excluding from calculation the process error prior to the lower limit (point A, in controlling heating operations), starting calculation from point A, and in the proportional band, adding the expected convergent value to the integrated value. When the overshooting value is large as a result of controlling, a small ARW value should be set. Note that, however, if the ARW value is too small, more time is required for the controller to reach the set value.

### Input Shift Setting ( $cns$ )

When  $cns$  is displayed, the up and down keys can be used to set an input shift value. Refer to *Setting Procedure: Step 4 Pin 4: Control Parameter Indication* for further details.





**Input Shift:  $\Delta n5$**

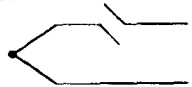
When " $\Delta n5$ " is displayed on the PV display, the input shift value can be changed using the Up and Down Keys. The range is from  $-99^{\circ}$  to  $99^{\circ}\text{C}/^{\circ}\text{F}$  with  $1^{\circ}\text{C}/^{\circ}\text{F}$  increments when the set temperature unit is  $1^{\circ}\text{C}/^{\circ}\text{F}$  and  $-9.9^{\circ}$  to  $9.9^{\circ}\text{C}/^{\circ}\text{F}$   $0.1^{\circ}\text{C}/^{\circ}\text{F}$  increments when the set temperature unit is  $0.1^{\circ}\text{C}/^{\circ}\text{F}$ . Any input shift value that has been set will be valid, even if function selector pin 4 is set to not display parameters. If the displayed temperature does not need to be shifted, set to  $0^{\circ}\text{C}$

Input shift value	Temperature measured by sensor	Displayed temperature
0 (without shift)	$100^{\circ}\text{C}$	$100^{\circ}\text{C}$
10 (offset by $10^{\circ}\text{C}$ )	$100^{\circ}\text{C}$	$110^{\circ}\text{C}$
-10 (offset by $-10^{\circ}\text{C}$ )	$100^{\circ}\text{C}$	$90^{\circ}\text{C}$

**■ Operation in Response to Sensor Failure**

The following tables show the displays and outputs conditions that will result from various breaks and short circuits in sensor wiring.

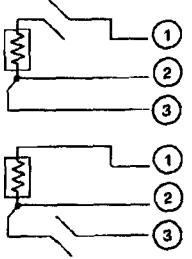
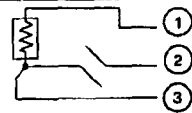
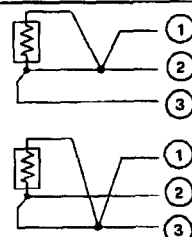
**Thermocouple Types**

Condition	Display	Control output
Break in wiring 	FFF flashes	OFF

**Note:** When the input is short-circuited, the room temperature is displayed.

**Resistance Thermometer Types**

**Note:** The resistance of the platinum resistance thermometer is  $100\ \Omega$  at  $0^{\circ}\text{C}$ . It increases to about  $140\ \Omega$  at  $100^{\circ}\text{C}$ .

Condition	Display	Control output
Break in wiring 	FFF flashes	OFF
	flashes	OFF
Breaks in 2 or 3 wires	FFF flashes	OFF
Short circuit 	flashes	OFF

## Precautions

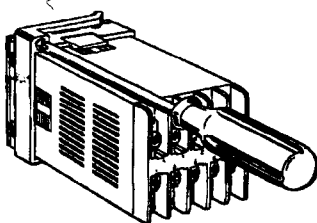
### Installation

- Do not install where subject to corrosive gases, excessive dust, etc.
- Do not install where subject to excessive vibration or shock, contact with water or oil, or high temperatures.
- Do not install in the vicinity of equipment that generates high-frequency noise, such as high-frequency welders.

### Mounting

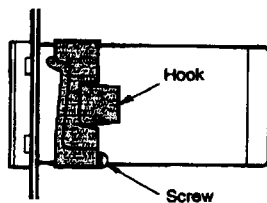
- Insert the temperature controller, back end first, into the hole of the mounting panel.
- Mount the adapter by pushing it forward from the back of temperature controller.
- Push the adapter as close as possible to the front panel of the gap between them. Then, secure the adapter with screws as shown in the figure below.

**Note:** All the models of the E5CW series temperature controllers conform to the DIN 43700 standard. Recommended panel thickness is 1 to 8 mm.



### Removal

- Loosen the screws on the adapter and push the hook open to remove the adapter.

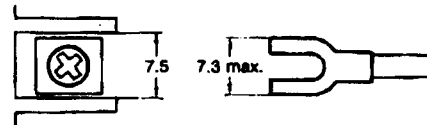


### Wiring

- Do not tighten the terminal screw with excessive force.

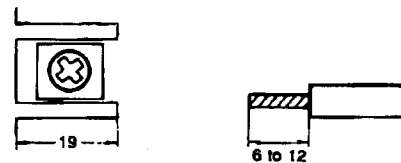
#### Solderless Terminals

- Use M3.5 solderless terminals with the temperature controller's M3.5 self-rising pressure-plate screws.



#### Solder-dipped Leads

- Strip the lead wires 6 to 12 mm and carefully arrange the wire tips.



### Application in Sequenced Circuits

- Several seconds are required from power application until the control output is activated. Be sure to allow an adequate start-up period when using the Temperature Controller in sequenced circuits for temperature control systems.

### Sensor Input Connection

- To prevent the lead wires connecting the sensor to the temperature controller from being affected by noise, separate them from the power lines and load lines.
- Use the specified compensating conductors for the Thermocouple Type temperature controllers.
- Use lead wires with a low resistance for the Resistance-Thermometer (esp., platinum resistance thermometer) type temperature controllers.

### Other Precautions

- The case is not designed to be opened. Do not attempt to open it.
- To clean the case, use a neutral detergent or alcohol. Do not use organic solvents, such as thinners or benzene, or strong acid or alkali.

OMRON ELECTRONICS PTY. LTD  
Australia : Phone 02-9878-6377 Fax. 02-9878-6981

OMRON ELECTRONICS LIMITED  
New Zealand : Phone 64-9-358-4400 Fax. 64-9-358-4411

