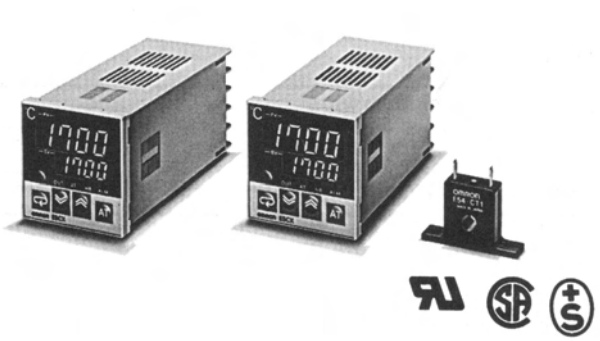
OMRON

TEMPERATURE CONTROLLER

E5CX(-H)

DIN-sized super-compact (48 x 48-mm) Temperature Controller Featuring Advanced PID Control

- Advanced PID control with two degrees of freedom improves stability and response speed.
- Displays both of the process temperature (10.5-mm character height) and set value (7.5-mm character height) together.
- High accuracy with selectable temperature ranges.
- Heater Burnout Alarm Types are also available.



Ordering Information

■ Temperature Controllers

Thermocouple					Temperature resistance thermometer				
Without heater burnout alarm			With heater burnout alarm*		Without heater burnout alarm			With heater burnout alarm*	
Relay output	Voltage output	Current output	Relay output	Voltage output	Relay output	Voltage output	Current output	Relay output	Voltage output
E5CX–RTC	E5CX–QTC	E5CX–CTC	E5CX–RHTC**	E5CX–QHTC**	E5CX–RP	E5CX–QP	E5CX–CP	E5CX–RHP**	E5CX–QHP**

*Heater Burnout Alarm Types provide both a normal alarm and a heater burnout alarm. The total alarm output goes ON, when either the normal alarm or the heater burnout alarm is activated.
**A Current Transformer is not included with the Temperature Controller. Be sure to order it as required.

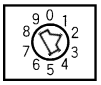
■ Current Transformers

Hole diameter	5.8 mm	12.0 mm
Model	E54–CT1	E54–CT3

Be sure to order with Heater Burnout Alarm Type Temperature Controllers.

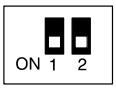
■ Temperature Ranges

Thermocouple Types

Input (switch selectable) 		K (CA) Chromel vs. alumel	J/L (IC) Iron vs. constantan	T/U (CC) Copper vs. constantan	E (CRC) Chromel vs. constantan	B Platinum rhodium 30% vs. platinum rhodium 6%	N Nicrosil vs. nisil	R (PR) Platinum vs. platinum rhodium 13%	S Platinum vs. platinum rhodium 10%
Range	**°C**	–200 to 1,300	–100 to 850	–200 to 400	0 to 600	100 to 1,800	0 to 1,300	0 to 1,700	0 to 1,700
	°F	–300 to 2,300	–100 to 1,500	–300 to 700	0 to 1,100	300 to 3,200	0 to 2,300	0 to 3,000	0 to 3,000
Resolution*		1							

*Main setting and alarm (°C/°F)

Temperature Resistance Thermometer Types

Input (switch selectable) 		PT platinum resistance thermometer (Pt100/JPt100)
Range	**°C**	–99.9 to 450.0
	°F	–99.9 to 800.0
Resolution*		0.1

*Main setting and alarm (°C°F)

Specifications

■ Temperature Controller Ratings

Rated supply voltage	100 to 240 VAC, 50/60 Hz
Operating voltage range	85% to 110% of rated supply voltage
Power consumption	Approx. 6 VA (at 100 VAC) to 10 VA (at 240 VAC)
Input	Thermocouple (K/J/T/E/R/S/B/N/L/U) or temperature resistance thermometer (Pt100/JPt100)
Current Transformer input	See *Current Transformer Ratings*.
Control output	Relay output: SPST–NO; 3 A, 250 VAC (resistive load) Voltage output: 20 mA, 12 VDC (with short-circuit protection) Current output: 4 to 20 mA, max. 600 Ω
Operating mode	ON/OFF or PID with auto-tuning
Alarm output	SPST–NO 1 A, 250 VAC (resistive load)
Setting method	Digital setting via up and down keys
Indication method	Digital indication (character heights: 10.5 mm and 7.5 mm)
Other functions	Upper and lower limits for set value Key protection Input shift Display unit selection (°C/°F) Normal and reverse output selection Watchdog timer function (Detects failures in the CPU and restores the CPU.)

Note: The control output is optically insulated from the internal circuits.

■ Current Transformer Ratings

Max. continuous heater current	50 A
Dielectric strength	1,000 VAC
Vibration	50 Hz (approx. 10G)
Weight	E54–CT1: Approx. 11.5 g; E54–CT3: Approx 50 g

■ Temperature Controller Characteristics

Setting accuracy*	±0.3% of set value or ±1°C, whichever greater, ±1 digit max.
Indication accuracy	Set value coincides with the indicated value, because no relative error exists between both values.
Hysteresis (during ON/OFF control action)	0.0° to 999.9 °C/°F (in units of 0.1°)
Proportional band	0.0° to 999.9 °C/°F (in units of 0.1°)
Integral time (Reset time)	0 to 3,999 s (in units of 1 s)
Derivative time (Rate time)	0 to 3,999 s (in units of 1 s)
Alarm output setting range	Thermocouple: –999° to 9,999°C/°F Platinum resistance thermometer (Pt100/JPt100): –99.9° to 999°C/°F
Control period	Pulse output: 1 to 99 s (in units of 1 s)
Sampling period	500 ms
Output refresh period	Pulse output: 500 ms Current output: 500 ms
Display refresh period	500 ms
Input shift	Thermocouple: –999° to 9,999°C/°F Platinum resistance thermometer (Pt100/JPt100): –99.9° to 999°C/°F
Insulation resistance	20 MΩ min. (at 500 VDC)
Dielectric strength	2,000 VAC 50/60 Hz for 1 minute between terminals of different polarity
Vibration	Malfunction durability: 2 to 55 Hz, 2G 10 min each in X, Y, and Z directions Mechanical durability: 10 to 55 Hz, 0.75-mm double amplitude 2 hrs each in X, Y, and Z directions
Shock	Malfunction durability: 100 m/s^2 3 times each in 6 directions Mechanical durability: 300 m/s^2 3 times each in 6 directions
Ambient temperature	Operating: –10° to 55°C Storage: –25° to 65°C
Humidity	35% to 85%
Memory protection	Non-volatile memory
Enclosure ratings	Front panel: IEC IP50 (dust-proof) Rear case: IEC IP20 Terminals: IEC IP00
Approved standard	UL 508 (File No. E68481) CSA C22.2 No.14 (File No. NR59623)
Case color	Light grey (MUNSELL 5Y7/1)
Weight	160 g

*The accuracy of U at temperatures from –150° to 400°C (–240°C to 700°F) is ±2°C (±3.6°F) ±1 digit. Accuracy is reduced below –150°C (–240°F). The accuracy of R and S from 0° to 200°C (0° to 400°F) is ±3°C (±5.4°F) ±1 digit.

■ Current Transformer Characteristics

Max. heater current	50 A, single-phase
Indication accuracy of heater current	±5% of full scale ±1 digit max.
Heater current setting range	0.1 to 49.9 A* (in units of 0.1A)
Min. detectable ON time	200 ms**

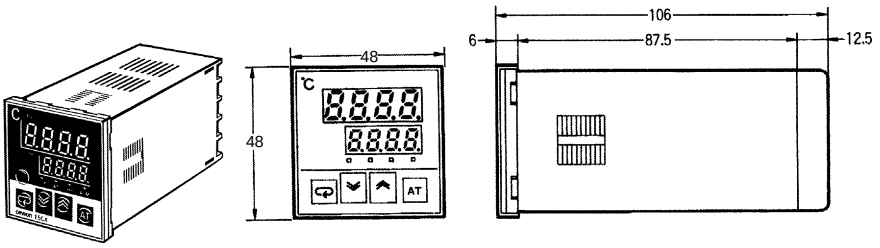
*Heater burnout is not detected when current is set to 0.0 A; the burnout alarm will be automatically turned ON when current is set to 50.0 A.

**When the control output is ON for less than 200 ms, heater burnout is not detected and heater current is not measured.

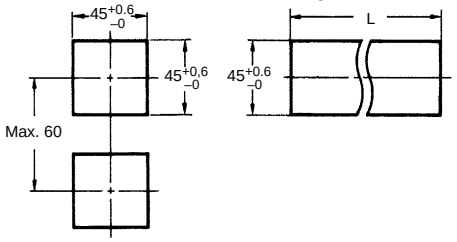
Dimensions

Note: All units are in millimeters.

■ E5CX/E5CX–H



Panel Cutout



Side-by-side Mounting of N Temperature Controllers

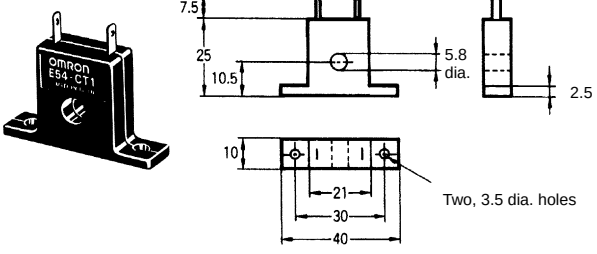
N	2	3	4	5	6
L	93.5 +1 –0	141.5 +1 –0	189.5 +1 –0	237.5 +1 –0	285.5 +1 –0

L=(48 x block –2.5) $^{+1}_{-0}$
for tight side-by-side mounting

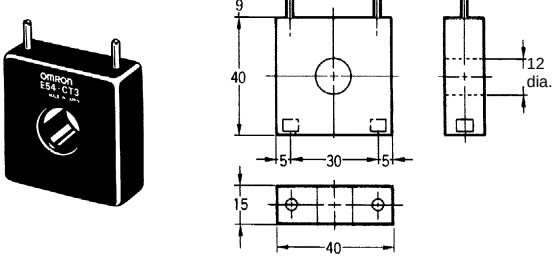
Note: 1. Recommended panel thickness is 1 to 8 mm.
2. Because mounting brackets are attached to the top and bottom of a Temperature Controller, tight side-by-side mounting is possible.

■ Current Transformer

E54–CT1



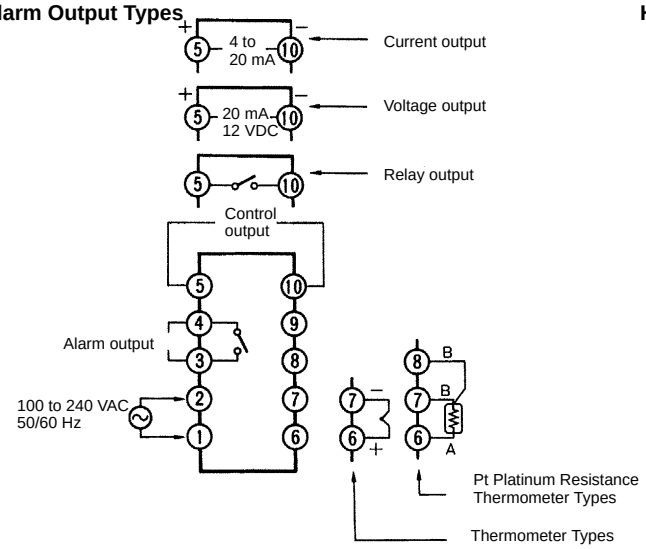
E54–CT3



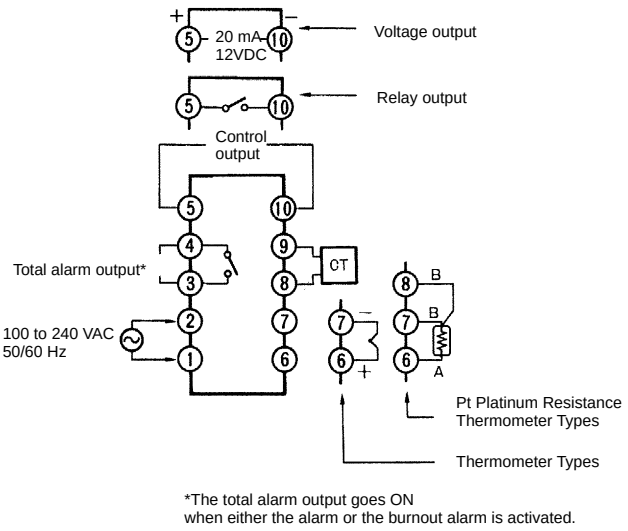
Installation

■ Wiring

Alarm Output Types



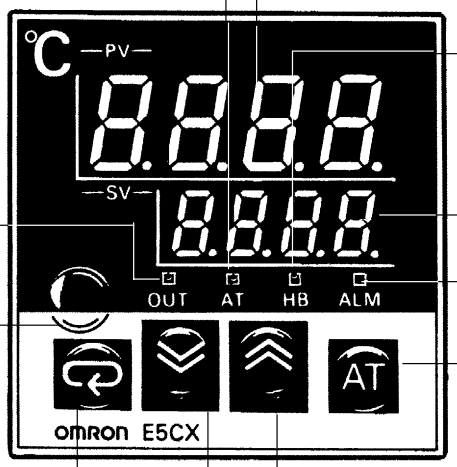
Heater Burnout Types



*The total alarm output goes ON when either the alarm or the burnout alarm is activated.

Note: Ground FG terminal 18 to avoid ambient noise.
Do not connect unused terminals.

Nomenclature



Process Value (PV) Display
Displays not only the process temperature but also indicates the parameter being displayed on the SV display and error messages.

Auto-tuning Indicator
Flashes on and off about every second when auto-tuning is taking place.

Heater Burnout Indicator
Lights when a heater burnout is detected and stays lit until rest. This indicator is provided on the Heater Burnout Alarm Types only.

Set Value (SV) Display
Displays set temperature and other parameters.

Output Indicator
Lights when the control output is ON. This indicator is not attached to the Current Output Types.

Alarm Indicator
Lights when the alarm output is ON.

Level Key
Press for 2 seconds minimum to change levels to set different groups of parameters.

Auto-tuning Key
Press this key for 1 second minimum when PID operation has been designated to start auto-tuning. Press this key for 1 second or more during auto-tuning to stop auto-tuning.

Display Key
Use this key when shifting the display to the next parameter.

Up Key
When pressed, increases the set temperature or other parameters. Successively increases the value when held down.

Down Key
When pressed, decreases the set temperature or other parameters. Successively decreases the value when held down.

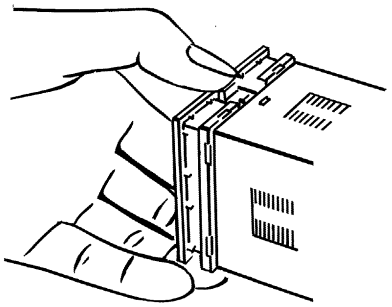
Operation

NOTICE: Always turn off the power supply to the Temperature Controller before changing any switch settings.

■ Accessing Switches and Selectors

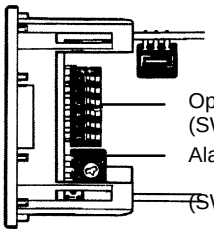
Before supplying power to the Temperature Controller, the selectors and switches shown below must be set to specify the temperature sensor, functions, and alarm mode.

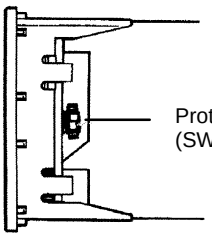
1. Remove the internal mechanism from the housing. Lift the internal mechanism while pressing the hook at the bottom of the front panel.

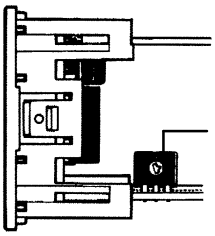


2. The following switches must be set: the temperature sensor selector, the operating mode selector, and the alarm mode selector. There is also a protection switch that can be set to protect settings. The following figure shows the locations of internal switches on the internal mechanism.

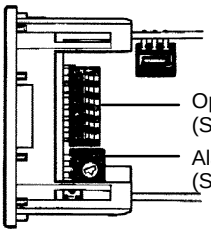
Thermocouple Input Type

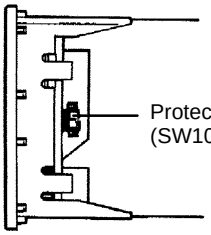


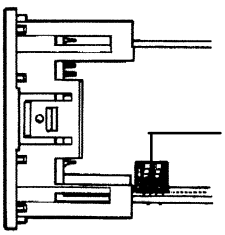




Temperature Resistance Thermometer Input





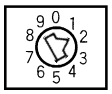


■ Temperature Sensor Selector

Thermometer Input Type (SW201)

This selector determines the temperature sensor to be used. It is set to position 2 before shipment to designate a K-type (chromel-alumel thermocouple) temperature sensor. The following table lists the other possible settings for temperature sensors. Refer to temperature range charts under *Ordering Information* for further information.

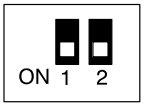
The scale displayed (°C or °F) is set on the operating mode selector.



Switch setting	Temperature sensor code	Temperature range	
		°C	°F
0	R	0 to 1,700	0 to 3,000
1	S	0 to 1,700	0 to 3,000
2	K	–200 to 1,300	–300 to 2,300
3	J	–100 to 850	–100 to 1,500
4	T	–200 to 400	–300 to 700
5	E	0 to 600	0 to 1,100
6	B	100 to 1,800	300 to 3,200
7	N	0 to 1,300	0 to 2,300
8	L	–100 to 850	–100 to 1,600
9	U	–200 to 400	–300 to 700

Temperature Resistance Thermometer Input Type (SW201, pin1)

This switch is set to OFF (JPt 100) at the factory. Turn the switch ON when Pt 100 is used.

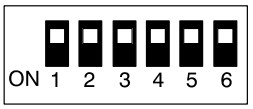


Switch setting	Temperature sensor code	Temperature range	
		°C	°F
OFF	JPt100	–99.9 to 450.0	–99.9 to 800.0
ON	Pt100	–99.9 to 450.0	–99.9 to 800.0

Note: Do not touch pin 2. It is not used.

■ Operating Mode Selector (SW101, FUNCTION)

This DIP switch selects the operational aspects listed in the following table.



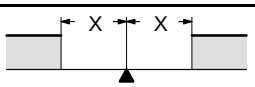
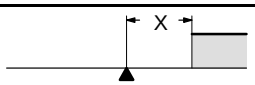
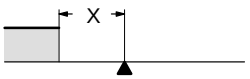
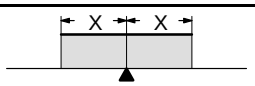
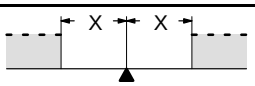
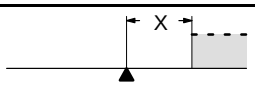
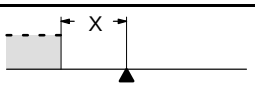
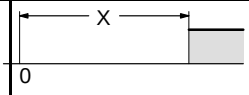
Function	Pin number	Pin setting	Control setting
Operating mode	1	ON	ON/OFF operation
		OFF	PID operation*
Control output	2	ON	Normal (cooling)
		OFF	Reverse (heating)
Input shift	3	ON	Enabled
		OFF	Disabled
Not used.**	4	Leave turned OFF.	
Scale display	5	ON	°F
		OFF	°C
PID display	6	ON	Enabled
		OFF	Disabled

*PID with 2 degrees of freedom

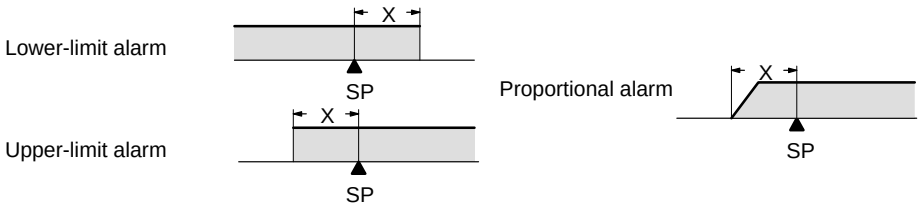
**Always operate with pin 4 OFF. Operating with pin 4 ON could result in malfunction.

■ Alarm Mode Selector (SW205, ALM)

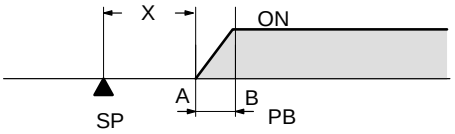
An alarm mode selector is provided. Ten alarm modes, listed in the following table, can be selected using this selector. The selector is set to position 2 before shipment, i.e., the upper-limit alarm mode.

selector setting	Mode (SW102)		Alarm output	Setting range
	Alarm operation	Display		
0	No alarm function	No display	OFF	——
1	Upper- and lower-limit alarms	]--[		Thermocouple: 0° to 9,999° Platinum resistance thermometer: 0° to 999.9°
2	Upper-limit alarm	---[		(See Note 1.) Thermocouple: –999° to 9,999° Platinum resistance thermometer: –99.9° to 999.9°
3	Lower-limit alarm	]---		
4	Inverse upper- and lower-limit alarm	-[]-		Thermocouple: 0° to 9,999° Platinum resistance thermometer: 0° to 999.9°
5	Upper- and lower-limit alarm with standby sequence	]--[		
6	Upper-limit alarm with standby sequence	---[		(See Note 1.) Thermocouple: –999° to 9,999° Platinum resistance thermometer: –99.9° to 999.9°
7	Lower-limit alarm with standby sequence	]---		
8	Event alarm	I--[		
9	Proportional alarm	Pro	See Note 2.	

Note: 1. If a negative value is set as X, operation will be as follows:



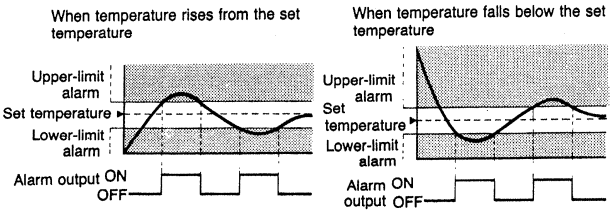
2. The alarm mode selector can be used to select the proportional alarm mode. The proportional alarm function is initiated when the temperature reaches the set alarm point (A in the figure below), which is the lower limit of a proportional band. When the temperature rises to the upper limit of the proportional band (point B in the figure), the alarm output is turned ON. This alarm function is convenient when the main setting is used for heating control, while the proportional alarm function is used for cooling control, so that heating and cooling control actions can be easily performed.



PB: proportional band (fixed to 42°C)
Proportional period is 20 seconds.
The operation of the alarm is not affected by pin 2 of the operating mode selector (SW101).

Standby Sequence

Alarm functions with standby sequence suppress nuisance alarms when the controller is first powered up. As shown in the temperature charts at right, the alarm output is suppressed until the temperature exceeds the alarm band or alarm limit one time.

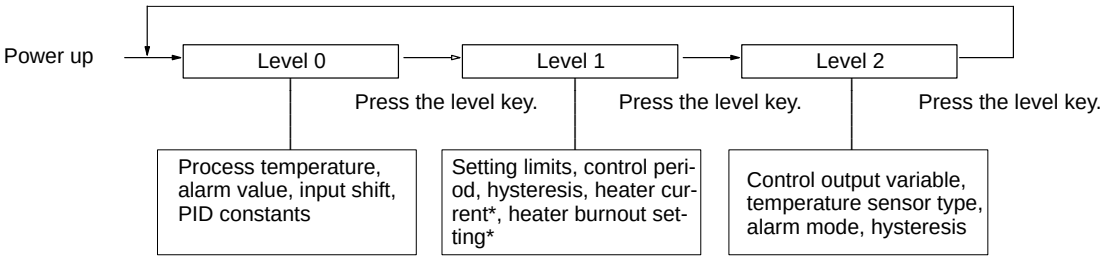


■ Protection Switch (SW103, PROTECT)

When the protection switch is set to the ON position, the level key, up and down keys, and auto-tuning key will not be operated. In effect, the Temperature Controller is write-protected and the set values (such as the alarm value) can be read out only.

■ Inputting Parameters

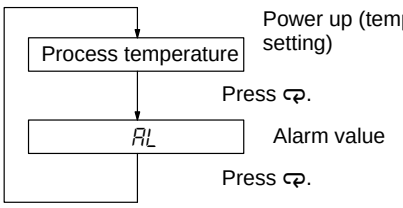
The Temperature Controller has three display levels, 0, 1, and 2, in which only specific parameters can be set. Level 0 is the default and is automatically entered during power up. To change the mode to manipulate a different group of parameters, hold down the level key for 2 seconds or more. The indication level mode changes as shown below.



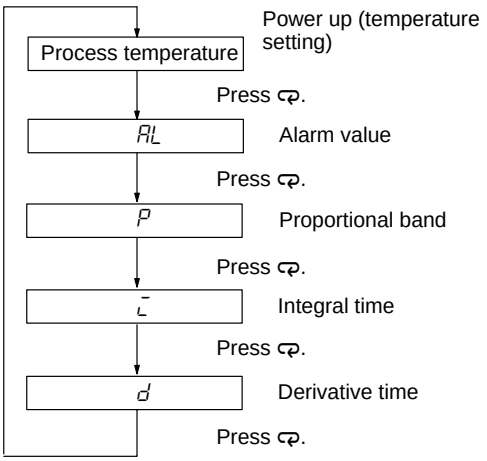
*These are displayed only with Heater Burnout Alarm Types.

Level 0

In this mode, parameters such as the alarm value, PID constants, and the input shift can be set or changed. When these parameters are being set or changed, the new values are displayed on the SV display. The parameter to be manipulated is selected by pressing the display key the required number of times. Note that the PID constants are displayed only when pin 1 on the operating mode selector (SW201) is set to the OFF position and pin 6 to the ON position.



If PID operation has been designated, press the display key again after AL has been displayed. Then the PID constants can be manually set or changed, provided pin 6 on the internal operating mode selector (SW201) has been set to the ON position. The message displayed on the PV display changes as shown below each time the display key is pressed.



Alarm: AL

When AL is displayed on the PV display, the alarm value for alarm output can be set on the SV display. When the temperature exceeds or falls below the set alarm value, the corresponding alarm output is produced and the ALM indicator on the front panel lights. Usually, the alarm value is set as a deviation from the set temperature (set point), but it can also be set as an absolute value when the event alarm mode is selected. Set the alarm value by using the up or down key while AL is displayed. The message is not displayed if the alarm mode selector is set to position 0.

Proportional Band: P

While P is displayed on the PV display, the proportional band (P constant) can be changed using the up or down key. The new value will be displayed on the SV display. The P constant can be set in a range from 0.0° to 999.9°C/°F in units of 0.1°C/°F. The factory setting is 40.0°C/°F.

Integral Time: I

The integral time (I constant) can be changed when I is displayed on the PV display. Use the up or down key to change the I constant. The allowable range is from 0 to 3,999 seconds in units of 1 second. The factory setting is 240 seconds.

Derivative Time: d

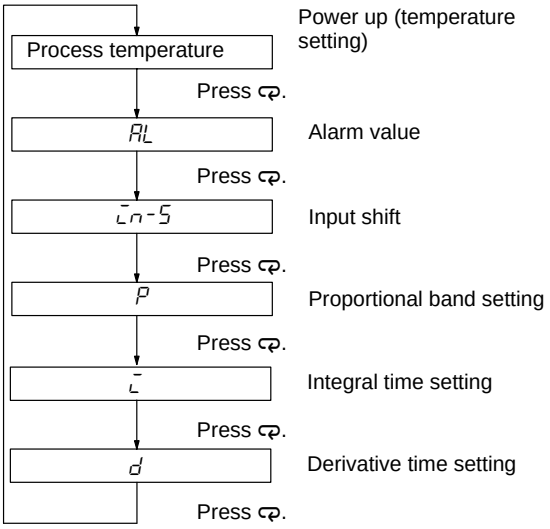
The derivative time (D constant) can be changed when d is displayed on the PV display. Use the up or down key to set or change the D constant. The allowable range is from 0 to 3,999 seconds in units of 1 second. The factory setting is 60 seconds.

Input Shift: In-S

When pin 3 on the internal operating mode selector (SW201) is set to the ON position, the input shift function can be used. This function is used to shift the temperature display from the measured value by a desired value, as illustrated by the examples in the following table:

Input shift value	Temperature measured by sensor	Displayed temperature
0 (without shift)	100°C	100°C
10 (offset by 10°C)	100°C	110°C
–10 (offset by –10°C)	100°C	90°C

This function can be used mainly for fine tuning compensation, while leaving the set temperature unaffected. Select this function by pressing the display key three times in display level 0, as follows:



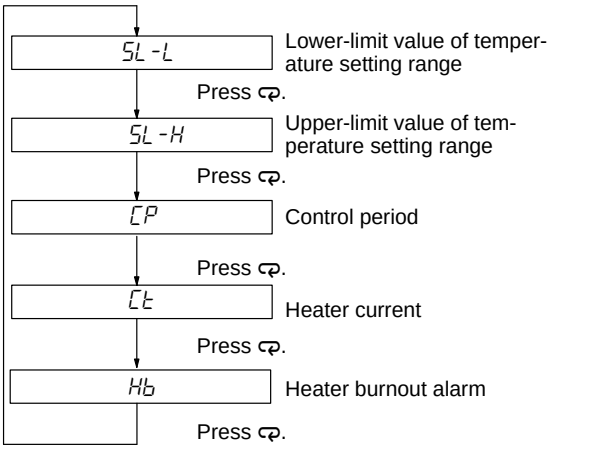
While In-S is displayed on the PV display, the input shift, the value by which the measured temperature is shifted and displayed, can be set and displayed on the SV display. The range in which the input shift can be set differs depending on whether a thermocouple or temperature resistance thermometer is used as the temperature sensor. When a thermocouple is used, the allowable range is from –999 to 9,999°C/°F in units of 0.1°C/°F when a temperature resistance thermometer is used. The input shift function remains effective even if pin 3 on the operating mode selector (SW201) is changed to the OFF position after the input shift value has been set. If the displayed temperature does not need to be shifted, set 0°C/°F in response to In-S.

Level 1

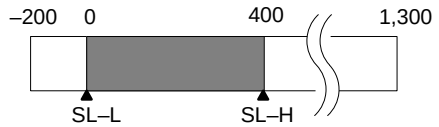
In this level, the upper- and lower-limit values of the temperature range, control period, hysteresis, heater current, and heater burnout alarm can be set.

1. PID Control

When pin 1 on the operating mode selector (SW201) is set to the OFF position (PID action), the temperature setting range limit values, control period, and heater current can be set or changed. Any of these parameters can be selected by pressing display key the required number of times as follows:



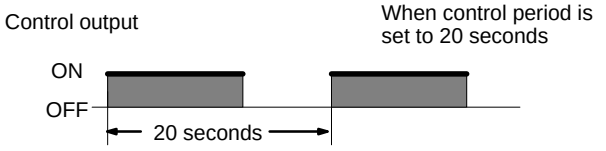
Lower/Upper Limits of Temperature Range: SL-L, SL-H



Basically, the temperature range that can be measured is determined by the temperature sensor to be used. For example, when a K-type (chromel-alumel thermocouple) temperature sensor is selected, the measurable range is from –200°C to 1,300°C. However, this temperature range can be narrowed, say, to 0°C to 400°C. To do this, set the lower-limit value of the temperature setting range, in this case to 0°C, on the SV display by using the up or down key while SL-L is displayed on the PV display. Similarly, set the upper-limit value, 400°C, while SL-H is displayed. If the process temperature falls below the set lower-limit value or exceeds the set upper-limit value, it is displayed on the PV display provided it is within the temperature range of the temperature sensor.

Control Period: CP

To use a control period, pin 1 on the operating mode selector (SW201) must be set to the OFF position. When CP is displayed on the PV display, the control period can be set or changed in a range from 1 to 99 seconds in units of 1 second. The factory setting is 20 seconds. When a Voltage Output Unit is used, it is recommended that the control period be set to 20 seconds or less (ideally, about 2 seconds), so that the control action can be performed more accurately.



Heater Burnout Alarm: CT, Hb

Set a burnout current value to determine disconnections of the heater. First, a current measured in the heater current value mode is displayed in amperes. The normal current value is the current value with the control output ON. Disconnect the heater and read the current value and obtain the set value from the following:

$$\frac{\text{Normal current value + Current value with disconnected heater}}{2}$$

Use display key and set the PV display to Hb. The difference between the normal current and the one with the disconnected heater should be 2.5 A minimum. If it is less than 2.5 A, the operation to detect the disconnection of the heater may be not stable. The value can be set in increments of 0.1 A from 0.0 to 50.0 A.

Resetting Heater Burnout Alarm Output

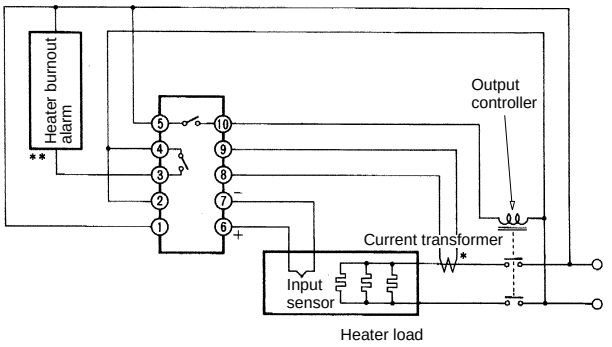
The heater burnout alarm output remains ON after the detection of heater burnout. One of the following two methods can be used to reset this output.

- Set the heater burnout alarm value to 0.0A.
- Turn the power OFF and ON again.

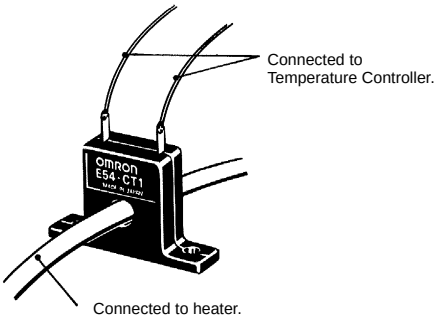
Note 1: Do not allow a current of more than 50 A to flow in the Controller; the maximum continuous heater current is 50 A.

2: Set the value to 0.0 A if the heater burnout alarm is not used, in which case the alarm will not function at all.

Connection Example

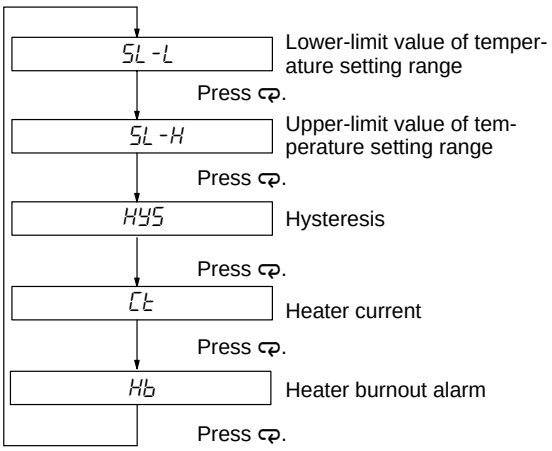


*This wiring must be passed through the hole of the Current Transformer. The Current Transformer can be connected to the sensor in any polarity
**For the Heater Burnout Alarm Types, the total alarm output goes ON when either the normal alarm or the heater burnout alarm is activated.



2. ON/OFF Control

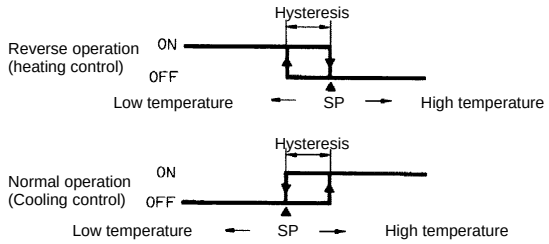
When pin 1 on the operating mode selector (SW201) is set to the ON position, the temperature setting range limit values, hysteresis, heater current, and heater burnout alarm value can be set or changed. Any of these parameters can be selected by pressing display key the required number of times as follows.



Of the above parameters, only the hysteresis, which is described below, differs from the parameters for PID control. Refer to *1. PID Control* for details on other parameters.

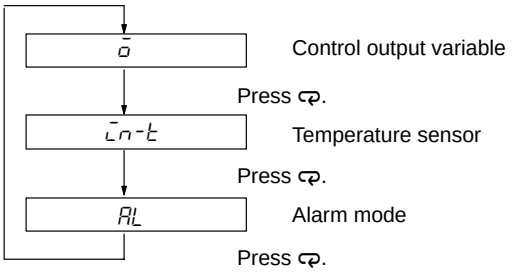
Hysteresis: HYS

The hysteresis value for the ON/OFF control action can be set in a range from 0.0° to 999.9°C/°F while HYS is displayed on the PV display. Use the up or down key to do this. The factory setting is 0.8°C/°F.



Level 2

In level 2 the control output variable, temperature sensor, and mode for alarm output can be monitored. Note that level 2 is a monitoring level only and thus no parameter can be changed. When the level key is depressed for more than 2 seconds after power up, SL-L is displayed on the PV display. After this message has been displayed, holding down the level key again for 2 seconds or more causes o to be displayed on the PV display. When this message has been displayed, the control output variable, selected temperature sensor, and alarm modes can be monitored by pressing the display key as follows:



Control Output Variable: o

When the Temperature Controller enters level 2, the control output amount is displayed on the SV display in a range of 0.0% to 100.0%.

Temperature Sensor: in-t

When in-t is displayed on the PV display, a message identifying the selected temperature sensor, i.e., the present setting of the temperature sensor selector (SW206), is displayed on the SV display. The following table shows the messages that may be displayed.

Thermometer type	
Display	**Sensor**
r Pr	R
S Pr	S
K CA	K
J iC	J
t CC	T
E Cr	E
b Pr	B
n	N
L iC	L
U CC	U

Temperature resistance thermometer types	
Display	**Sensor**
JPt	JPt100
Pt	Pt100

AL (Alarm Mode): AL

While AL is displayed on the PV display in level 2, a message identifying the mode for alarm output or the present setting of the corresponding alarm mode selector (SW102) is displayed on the SV display. The following table shows the possible messages that may appear on the SV display.

Display	Alarm mode
No display	No alarm
]--[	Upper- and lower-limit alarms
---[	Upper-limit alarm
]---	Lower-limit alarm
-[]-	Upper- and lower-limit range alarms
3--E	Upper- and lower-limit alarms with standby sequence
---E	Upper-limit alarm with standby sequence
3---	Lower-limit alarm with standby sequence
1--[	Event alarm
Pro	Proportional alarm

■ Beginning Control Operation

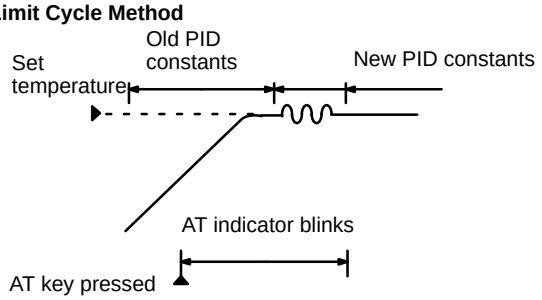
Temperature control is begun for the set values as soon as the power is tuned on, and temperature control is carried out according to the parameters that have been input. To operate the Temperature Controller as soon as all the parameters are input, turn the power off once and then on again.

Auto-tuning

When the AT key is pressed for 1 second or more, the Temperature Controller automatically starts tuning the PID constants. While auto-tuning is taking place, the auto-tuning indicator on the front panel will flash. The Temperature Controller executes control based on the set PID constants (factory set to P = 40°C, I = 240 seconds, and D = 60 seconds) until the temperature of the controlled system reaches the set temperature. After that, the Temperature Controller automatically adjusts the PID constants using the limit cycle method. After the automatic tuning of the PID constants has been completed, the auto-tuning display goes out.

Auto-tuning can be carried out regardless of whether the Temperature Controller is performing reverse (heating) or normal (cooling) operation. To stop auto-tuning, hold down the AT key again for 1 second or more. Automatic tuning can be executed at any time: on power up, while the temperature is rising, and after the control action has stabilized.

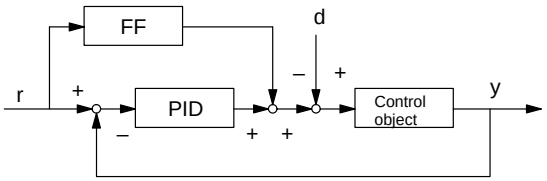
Limit Cycle Method

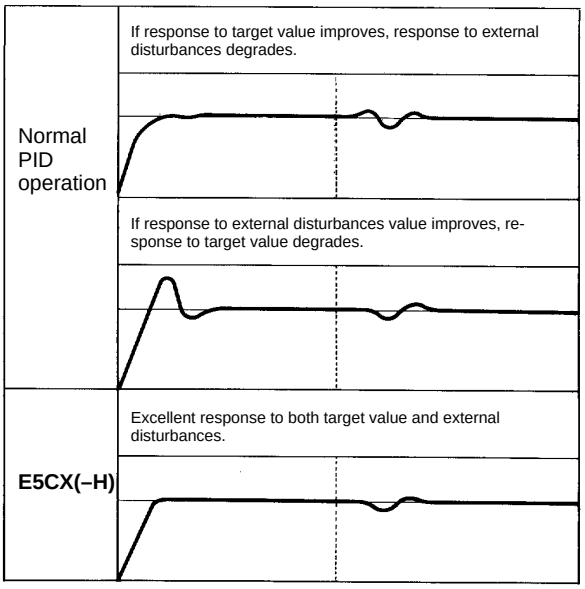


The optimum PID constants are calculated by this method by varying the control output variable and generating external oscillation.

■ Advanced PID Control

Advanced PID control with two degrees of freedom adds a feed-forward (FF) loop to the conventional PID controller. Whereas the conventional PID controller responds to disturbance (d) to quickly achieve stability, it overshoots the target because it lacks sufficient control, as shown below. This is prevented in advanced PID control because the feed-forward loop is not affected by disturbance. Here, the feed-forward loop operates from the target value (r) to achieve fast response without overshooting.





Error Messages

The Temperature Controller is provided with self-diagnostic functions and will display the following error messages on the PV display in case of an error.

Message	Cause	Control output		Alarm output
		With Output Unit other than Current Output Unit	With Current Output Unit	
FFFF	Input temperature has risen beyond the upper limit of the temperature range by more than 20°C	OFF during reverse (heating) operation On during normal (cooling) operation	4 mA during reverse (heating) operation 20 mA during normal (cooling) operation	Sends alarm signal in accordance with the set alarm mode.*
----	Input temperature has fallen below the lower limit of the temperature range by more than 20°C.	On during reverse (heating) operation OFF during normal (cooling) operation	20 mA during reverse (heating) operation 4 mA during normal (cooling) operation	Sends alarm signal in accordance with the set alarm mode.*
S.Err	The thermocouple has burned out. The platinum resistance thermometer has burned out or A and B have been short-circuited.	OFF	Approx. 1 mA	Sends alarm signal in accordance with the set alarm mode. Proportional alarm output is OFF, however.
E111 (flashes)	Memory failure (E111) or A/D converter failure (E333) has occurred. Temperature Controller must be repaired if recovery is not made by turning power off once and one again.	OFF	Approx. 1 mA	OFF

*When the J thermocouple is used, however, this error message is not displayed until the temperature has risen above the set temperature range by more than 70°C.
**When the temperature resistance thermometer is used, this message is displayed when the temperature has fallen to –99.9°C.

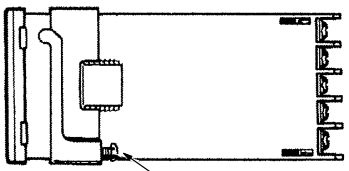
The Temperature Controller displays the following error message in case of a Current Transformer input error.

Message	Cause	Control output	Heater burnout alarm output
FFFF	CT input current is over 50.0 A	Normal	Retains condition there was before FFFF is displayed. Alarm output and sensor abnormality alarm output can function normally.

Precautions

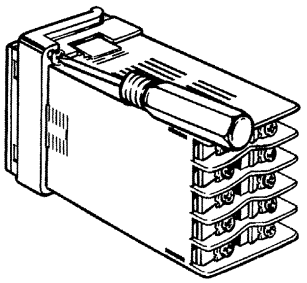
Mounting

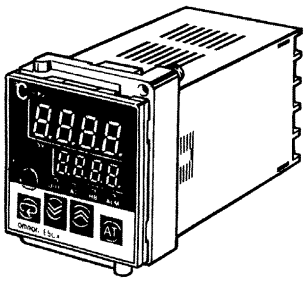
The dimensions of the Temperature Controller conform to DIN 43700.
Recommended panel thickness is 1 to 8 mm.
Do not install the Temperature Controller in a location exposed to excessive dust or corrosive gases. Moreover, avoid locations subject to heavy vibration or shock, water or oil spray, or high temperatures. Isolate the Temperature Controller from equipment that generates strong, high-frequency noises such as high-frequency welders.
Insert the Temperature Controller into a square hole in the panel and insert the adaptor firm the backside to hold the Temperature Controller, and then secure it with a screw.



Removing

Remove the screw from the adaptor and widen the hook. Then Remove the Temperature Controller.





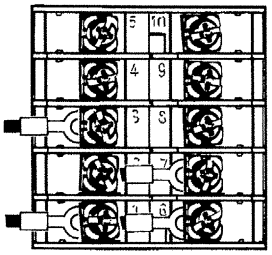
Connection Examples

With Solderless Terminal:

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

Solder-dipped Leads:

Strip 6 to 12 mm of the lead wires and carefully arrange the wire tips. Do not tighten the terminal screw with excessive force. The terminal block of the Temperature Controller is constructed so that the lead wires can be connected to all the terminals from the same direction.



Temperature Sensor Connection

To reduce induced noise, the lead wires connecting the temperature sensor to the Temperature Controller must be separated from power lines and load lines. Use the specified compensating conductors for thermocouples.
Use lead wires having a small resistance for temperature resistance thermometers.

Sequenced Circuits

Several seconds are required until the relay is turned ON after power has been supplied to the Temperature Controller. Therefore, take this time delay into consideration when designing sequenced circuits which incorporate a Temperature Controller.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. H50–E1–1 **In the interest of product improvement, specifications are subject to change without notice.**

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