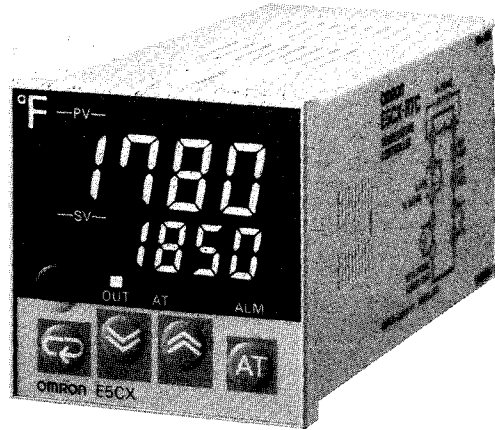


## Temperature Controller

## E5CX(-H)

1/16 DIN, Multi-Range Controller  
Offers Advanced PID Control

- Advanced PID control provides fast, stable response without overshoot
- Large, easy-to-read displays show both process temperature and set value
- High accuracy with selectable temperature ranges
- Heater burnout alarm types are also available
- 3-year warranty



## Ordering Information

### ■ TEMPERATURE CONTROLLERS

Models with heater burnout alarm use a single alarm output for the nine-function temperature alarm and heater burnout alarm. A current transformer is not included with the temperature

controller with heater burnout alarm. Be sure to order it separately, as required. To order models factory-set to Celsius, drop the "F" from the part number.

| Input type   | Heater burnout alarm | Control output type | Part number |
|--------------|----------------------|---------------------|-------------|
| Thermocouple | No                   | Relay output        | E5CX-RTC-F  |
|              |                      | Voltage output      | E5CX-QTC-F  |
|              |                      | Current output      | E5CX-CTC-F  |
|              | Yes                  | Relay output        | E5CX-RHTC-F |
|              |                      | Voltage output      | E5CX-QHTC-F |
|              |                      | Current output      | E5CX-CHTC-F |
| Platinum RTD | No                   | Relay output        | E5CX-RP-F   |
|              |                      | Voltage output      | E5CX-QP-F   |
|              |                      | Current output      | E5CX-CP-F   |
|              | Yes                  | Relay output        | E5CX-RHP-F  |
|              |                      | Voltage output      | E5CX-QHP-F  |
|              |                      | Current output      | E5CX-CHP-F  |

### ■ TEMPERATURE RANGES

#### Thermocouple Types

| Input type<br>(switch selectable) | Thermocouple                      |               |               |             |            |              |            |            |            |
|-----------------------------------|-----------------------------------|---------------|---------------|-------------|------------|--------------|------------|------------|------------|
|                                   | Type K                            | Type J/L      | Type T/U      | Type E      | Type B     | Type N       | Type R     | Type S     |            |
| Temperature 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 |
| Unit of measure                   | 1° C or F, main setting and alarm |               |               |             |            |              |            |            |            |

#### Platinum RTD Types

| Input type<br>(switch selectable) | Platinum RTD                        |              |
|-----------------------------------|-------------------------------------|--------------|
|                                   | 100 Ω                               |              |
| Temperature range                 | °C                                  | -99.9 to 450 |
|                                   | °F                                  | -99.9 to 800 |
| Unit of measure                   | 0.1° C or F, main setting and alarm |              |

■ CURRENT TRANSFORMERS

|               |                  |                   |
|---------------|------------------|-------------------|
| Hole diameter | 5.8 mm (0.23 in) | 12.0 mm (0.47 in) |
| Part number   | E54-CT1          | E54-CT3           |

■ REPLACEMENT PARTS

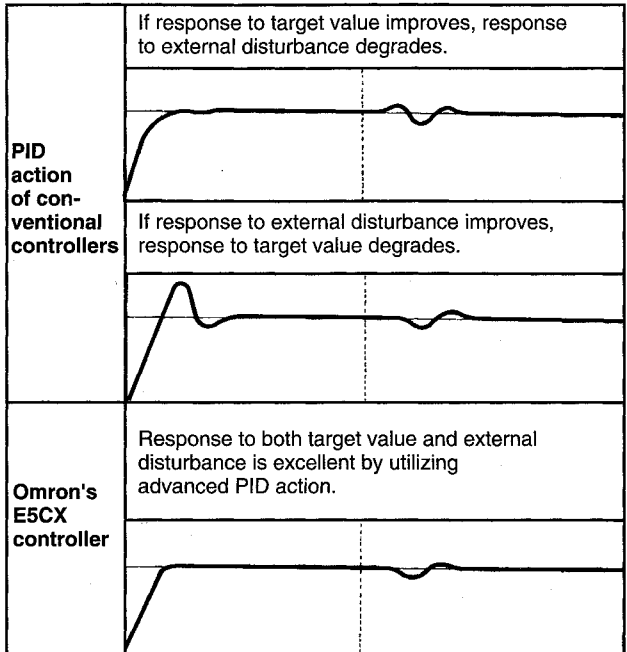
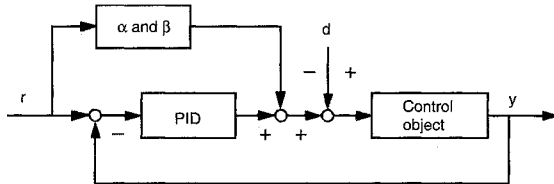
|  |             |
|--|-------------|
| Description  | Part number |
| Adapter for panel mounting (supplied with each unit) | Y92F-30     |

# Advanced PID Control

Omron utilizes an advanced PID algorithm which provides superior control during both start-up and normal operation.

In classic PID, there is a trade-off between having the controller respond quickly and accurately to the initial target value, and also to an external disturbance that may occur after the initial target value has been achieved. PID constants set to maximize performance on start-up often degrade response to external disturbances, and the converse would also be true.

With Omron's PID algorithm, start-up and disturbance response are independent of each other. The controllers' auto-tuning process determines PID constants that are optimum for disturbance response. However, on start-up the algorithm is altered by known values ( $\alpha$  and  $\beta$ ). The resulting control is responsive on start-up and stable during regular operation.



# Specifications

## ■ TEMPERATURE CONTROLLER

|                       |                            |  |   |  |
|-----------------------|----------------------------|--|---|--|
| Part number           |                            | E5CX-□□TC-F  | E5CX-□□P-F  |  |
| Sensor input types    |                            | Thermocouple types K, J, L, T, U, E, B, N, R, S  | Platinum RTD (100 Ω)  |  |
| Supply voltage        |                            | 100 to 240 VAC, 50/60 Hz   |   |  |
| Operating voltage     |                            | 85 to 110% of rated supply voltage   |   |  |
| Power consumption     |                            | Approx. 6 VA at 100 VAC to 10 VA at 240 VAC  |   |  |
| Control output        | Type                       | Relay  | SPST-NO, 3 A, 250 VAC (resistive load), E5CX-R□□                    |  |
|                       |                            | Voltage  | 20 mA, 12 VDC with short-circuit protection, E5CX-Q□□               |  |
|                       |                            | Current  | 4 to 20 mA, 600 Ω max. load, E5CX-C□□                               |  |
|                       | Isolation                  |  | All output units are optically isolated from the internal circuits. |  |
|                       | Hysteresis                 |  | 0.0 to 999.9°C/°F in units of 0.1 (during ON/OFF control action)    |  |
|                       | Update time                | Output   | 500 ms for pulse and current outputs                                |  |
|                       |                            | Display  | 500 ms  |  |
| Alarm output          | Type                       | SPST-NO relay, 1 A, 250 VAC (resistive load)   |   |  |
|                       | Setting range              | Thermocouple: -999 to 9,999°C/°F<br>Platinum RTD: -99.9 to 999°C/°F  |   |  |
| Heater burnout output | Type                       | SPST-NO relay, 1 A, 250 VAC (E5CX-QH□□-F)  |   |  |
|                       | Setting range              | 0.1 to 49.9 A in units of 0.1 A<br>0.0 setting disables the output; 50.0 setting turns output ON continuously  |   |  |
|                       | Minimum detectable ON time | 200 ms; heater current is not measured when the control output is ON less than 200 ms  |   |  |
| Indication accuracy   | General                    | ±0.3% of set value or ±1°, whichever is greater, ±1 digit maximum  |   |  |
|                       | Exceptions                 | Accuracy of type U thermocouples is ±2°C (3.6°F) from -150° to 400°C (-240° to 700°F), ±1 digit. Accuracy is not guaranteed below -150°C (-240°F). The accuracy of types R and S thermocouples is ±3°C (±5.4°F) from 0° to 200°C (32° to 400°F), ±1 digit. |   |  |
|                       | Heater burnout             | ±5% of full scale, ±1 digit maximum of heater current  |   |  |
| Setting accuracy      |                            | Set value coincides with the indicated value, since no relative error exists between both values   |   |  |
| Control modes         | Type                       | ON/OFF or PID with automatic tuning and circuitry to prevent overshoot   |   |  |
|                       | Proportional band          | 0.0 to 999.9°C/°F in units of 0.1  |   |  |
|                       | Reset time                 | 0 to 3,999 seconds in units of 1 second  |   |  |
|                       | Rate time                  | 0 to 3,999 seconds in units of 1 second  |   |  |
|                       | Control period             | Pulse output: 1 to 99 seconds in units of 1 second   |   |  |
|                       | Sampling period            | 500 ms   |   |  |
| Memory protection     |                            | Non-volatile memory (EEPROM)   |   |  |
| Other functions       | Input shift                | Offsets input value and display value to accommodate a sensor input that deviates by a known value.  |   |  |
|                       |                            | Thermocouple range: -999 to 9,999°C/°F<br>Platinum RTD range: -99.9 to 999°C/°F  |   |  |
|                       | Miscellaneous              | Upper and lower set value limits, key protection, °C/°F selectable internally, Normal and Reverse output selection, Watchdog function to detect CPU failure and restore CPU to normal operation.   |   |  |
| Indicators            |                            | Preset Value, 10.5 mm (0.42 in); Set Value, 7.5 mm (0.3 in); LED indicators for others   |   |  |
| Materials             |                            | Plastic case   |   |  |
| Mounting              |                            | Panel mount  |   |  |
| Connections           |                            | Plated steel screw terminals mounted on rear of unit   |   |  |
| Weight                |                            | Approx. 160 g (5.6 oz.)  |   |  |
| Enclosure ratings     | Front panel                | IEC IP50, NEMA 4 with optional cover Y92A-48N  |   |  |
|                       | Rear panel                 | IEC IP20   |   |  |
|                       | Terminals                  | IEC IP00   |   |  |
| Approvals             | UL                         | Recognized, File Number E68481 (all models)  |   |  |
|                       | CSA                        | Certified, File Number LR59623 (all models)  |   |  |
| Ambient temperature   | Operating                  | -10° to 55°C (14° to 131°F)  |   |  |
|                       | Storage                    | -25° to 65°C (-13° to 149°F)   |   |  |
| Humidity              |                            | 35 to 85% RH   |   |  |
| Insulation resistance |                            | 20 MΩ minimum at 500 VDC   |   |  |
| Dielectric strength   |                            | 2,000 VAC, 50/60 Hz for 1 minute between terminals of different polarity   |   |  |
| Vibration             | Mechanical durability      | 10 to 55 Hz 0.75 mm (0.03 in) in X, Y, and Z directions for 2 hours each   |   |  |
|                       | Malfunction durability     | 2 to 55 Hz, 2 G, in X, Y, and Z directions for 10 minutes each   |   |  |
| Shock                 | Mechanical durability      | 300 m/s <sup>2</sup> in 6 directions, 3 times each   |   |  |
|                       | Malfunction durability     | 100 m/s <sup>2</sup> in 6 directions, 3 times each   |   |  |

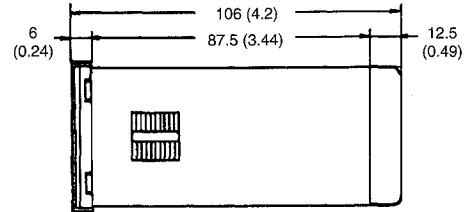
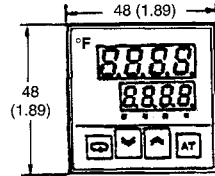
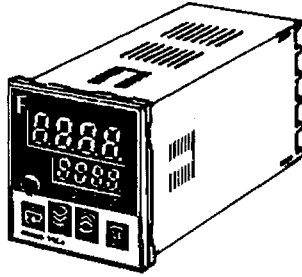
■ CURRENT TRANSFORMER

|                     |  |
|---------------------|--|
| Heater current      | Maximum 50 A continuous service, single-phase                            |
| Weight              | Approx. 11.5 g (0.41 oz.) for E54-CT1; approx. 50 g (1.8 oz) for E54-CT3 |
| Dielectric strength | 1,000 VAC  |
| Vibration           | 50 Hz (approximately 10G)  |

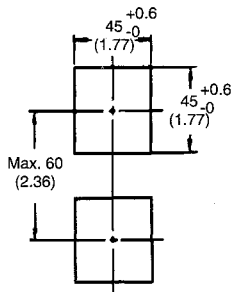
Dimensions

Unit: mm (inch)

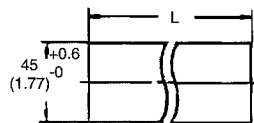
■ E5CX/E5CX-H TEMPERATURE CONTROLLERS



Panel Cutout



Side-by-side Mounting of Several Temperature Controllers



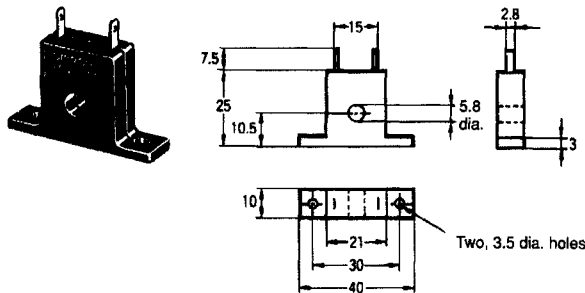
| Controllers | 2                                | 3                                 | 4                                 | 5                                 | 6                                 |
|-------------|----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| 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> |

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

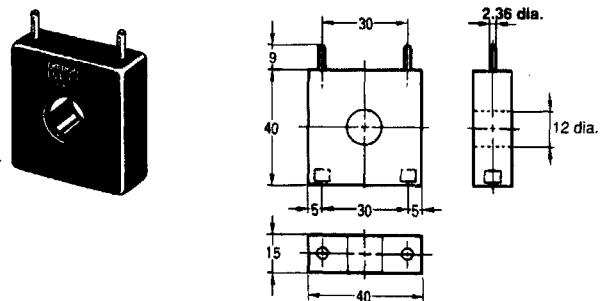
- Note:
1. Recommended panel thickness is 1 to 8 mm (0.04 to 0.31 in).
  2. Because mounting brackets are attached to the top and bottom of a temperature controller, tight side-by-side mounting is possible.

■ CURRENT TRANSFORMER

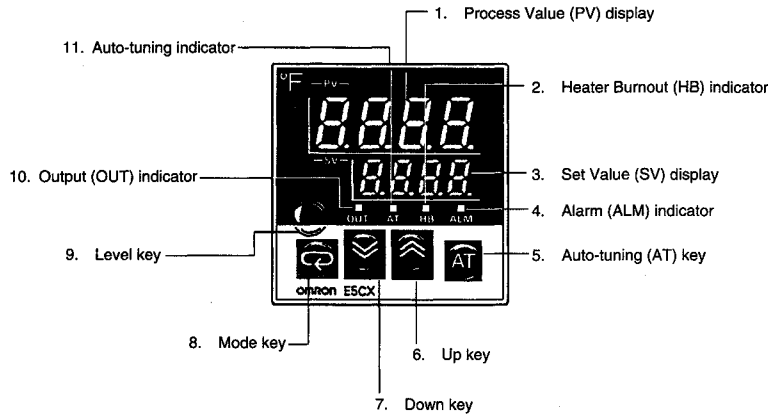
E54-CT1



E54-CT3



# Nomenclature

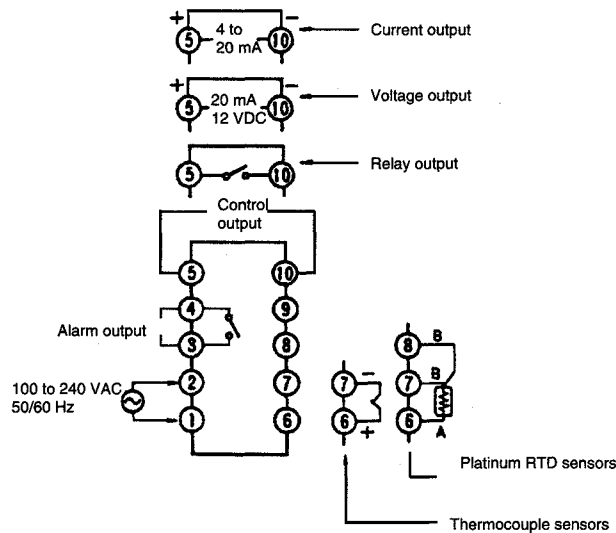


| Key | Description   | Key | Description   |
|-----|---|-----|---|
| 1   | Process Value indicator displays the process temperature and indicates the parameter being displayed on the SV (Set Value) display and error messages.  | 6   | When pressed, the up key increases the set temperature or other parameters. When held down, the key successively increases the value.   |
| 2   | Heater Burnout indicator lights when a heater burnout is detected and stays lit until rest. Provided on the Heater Burnout Alarm Types only.  | 7   | When pressed, the down key decreases the set temperature or other parameters. When held down, the key successively decreases the value. |
| 3   | Set Value (SV) displays set temperature and other parameters.   | 8   | The mode key shifts display to the next parameter.  |
| 4   | Alarm indicator lights when the alarm output is ON.   | 9   | Press the level key for at least 2 seconds to change levels to set different groups of parameters.                                      |
| 5   | Auto-tuning key. To start auto-tuning, press the key for at least 1 second when PID operation has been designated. To stop auto-tuning, press the key for at least 1 second during auto-tuning. | 10  | The output indicator lights when the control output is ON. There is no output indicator for Current Output Types.                       |
|     |   | 11  | The auto-tuning indicator flashes on and off about every second when auto-tuning is occurring.  |

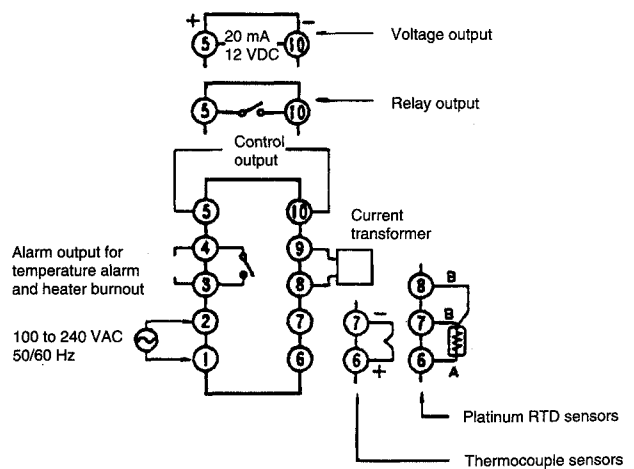
# Connections

## CONTROLLER WIRING

### Controllers without Heater Burnout Alarm

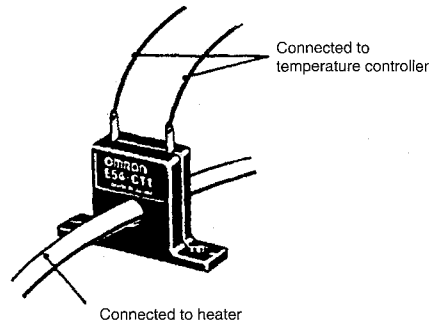
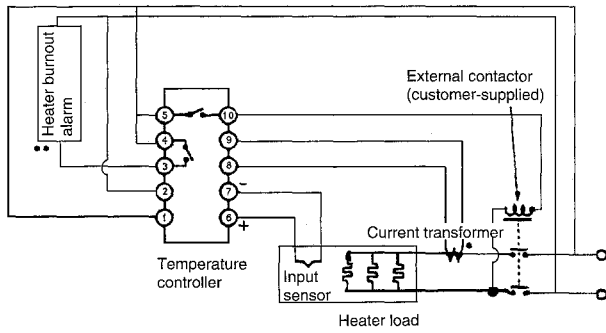


### Controllers with Heater Burnout Alarm



OVERALL SYSTEM

Connection Example



\*This wiring must be passed through the hole of the current transformer. The current transformer can be connected to the controller in any polarity.  
 \*\*For the heater burnout alarm types, the alarm output goes ON when either the normal alarm or the heater burnout alarm is activated.

**NOTE: DIMENSIONS SHOWN ARE IN MILLIMETERS. To convert millimeters to inches divide by 25.4.**

**OMRON**<sup>®</sup>  
 OMRON ELECTRONICS LLC  
 One East Commerce Drive  
 Schaumburg, IL 60173  
 1-800-55-OMRON

**OMRON ON-LINE**  
 Global - <http://www.omron.com>  
 USA - <http://www.omron.com/oei>  
 Canada - <http://www.omron.com/oci>

**OMRON CANADA, INC.**  
 885 Milner Avenue  
 Scarborough, Ontario M1B 5V8  
 416-286-6465