OPERATOR'S MANUAL

for the

TDA-5B
Aerosol Generator

Revision E

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OPERATING INSTRUCTIONS

TDA-5B Aerosol Generator

The TDA-5B Aerosol Generator operates on a thermal condensation principal. The oil being used as the aerosol reagent is vaporized upon entering the heater-block assembly. Vaporization occurs without the presence of an atmosphere capable of supporting combustion because the temperatures necessary exceed the flashpoint of the oils used. After vaporization has occurred the vapor is expelled form the heater block and allowed to rapidly cool to ambient temperatures. The vapor condensation (aka quenching) occurs immediately at the TDA-5B output collar before sufficient ambient atmosphere is present to enable combustion. This quenching requirement, inherent in thermal condensation generators, makes an air-gap necessary between the Aerosol Generator output and whatever hose or duct the aerosol is entering for testing. The air-gap requirement limits the use of thermal condensation generators to aerosol introduction ports having an in-flow of air. Systems having a positive duct pressure will require an auxiliary blower or alternative method for aerosol introduction.

CAUTION: Read the usage guidelines at the rear of this manual before operating this aerosol generator

1. Unscrew LIQUID FILL / GAUGE cap located on top of cabinet and fill reservoir until gauge registers 3/4 full with the desired liquid aerosol agent. See Appendix 2.

NOTE: It is important not to overfill the reservoir. The liquid should never be above the reservoir neck or the unit will not function properly.

2. Connect standard 1/4" O.D. plastic tubing from the INERT GAS fitting located on front of the cabinet to the pressure regulator for your source of compressed INERT GAS.

NOTE: To avoid a fire hazard, an inert gas must be used as a carrier gas with this unit. The most commonly used are nitrogen, carbon dioxide and argon.

WARNING: DO NOT USE COMPRESSED AIR

3. Plug power cord into appropriate voltage supply and turn Power Switch ON. (See Appendix 1 if you desire to switch the operating voltage.)

4. Adjust the Pressure Regulator for the supply of INERT GAS to 50 psig and maintain this pressure at all times.

NOTE: Increasing or decreasing the inert gas supply pressure above or below 50 psig will affect the aerosol output of the generator and its operation.

5. When the Temperature Controller reaches the desired operating point (approximately 20 minutes), the unit is ready to produce aerosol.

NOTE: Once the aerosol flow is started the displayed temperature will drop. This is normal.

6. Turn Aerosol Switch ON before adjusting Metering Valve, which is located on the front of the unit. The Metering Valve is used to adjust the aerosol concentration. Turning the valve counterclockwise will increase concentration and turning the valve clockwise will decrease concentration. When first starting the unit, the valve should be turned fully counterclockwise, after inert gas flow has been started, and then back to the desired output level.

NOTE: Once the heat has reached the level at which the green block illuminates (heater block temperature 765 ^{o} F +/- 10) the unit will continue to produce aerosol for 3 hours with the Metering Valve fully open. The aerosol will be emitted from the nozzle on the front panel in a steady stream of white smoke. When the Metering Valve is fully open and the entire aerosol output is diluted with 6,500 cfm of air, the aerosol concentration will be approximately 100 micrograms per liter.

7. When testing is complete, close the Metering Valve by turning clockwise until it stops. This will purge the inside of the heater block and keep it clean.

8. To be certain all the aerosol is expelled from the unit, wait approximately 30 seconds after the Metering Valve has been closed.

9. Then turn Aerosol and Power Switches OFF.

CAUTION: BEFORE SHIPPING OR TRANSPORTING UNIT

a. Be sure Metering Valve is fully closed (full clockwise).
b. Be sure Aerosol and Power Switches are in OFF positions.
c. Remove LIQUID FILL cap, then invert unit and drain all liquid from reservoir.
d. Replace LIQUID FILL cap and be certain it is closed tight.

NOTES:

1. The following liquids may be used in the TDA-5B to generate aerosols:

   DOP/DEHP (Di 2-ethylhexyl-phthalate)

   PAO (Poly Alpha Olefin) Emery 3004

2. The unit has been factory set for use with DOP unless otherwise noted. If an alternative liquid is considered, the unit must be adjusted for proper temperature and flow using that liquid. Optimum aerosol output is relative to the internal flow and temperature settings. These settings will vary depending on the unit and liquid. (See Appendix 2 for instructions on changing the temperature operating point). If you have any questions about this adjustment please contact ATI.

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TROUBLESHOOTING PROCEDURES

Symptom	Cause	Resolution
No Display on Controller	Not plugged to appropriate voltage source	Verify the unit is connected to an outlet with the correct voltage
	Fuse is blown	Check fuse & replace if necessary
	Power Switch in OFF position	Turn Power Switch to the ON position
	Controller is defective	Replace temperature controller or return for service
Green Ready Light Not Illuminated	Not enough time allowed for the unit to warm up	Wait a minimum of 25-30 minutes for temperature stabilization
	Cartridge Heater(s) is defective	Replace cartridge heater(s) or return unit for service
	Temperature Controller relay is defective	Return unit for service
	Temperature Controller is defective	Replace temperature controller or return unit for service
No Aerosol Output	Liquid reservoir is empty	Fill the liquid reservoir with the appropriate oil
	Aerosol Switch in OFF position	Move the Aerosol Switch to the ON position
	Improper inert gas pressure	Verify that 50 psi of inert gas is being supplied to the unit
	Heater Block is clogged	Return the unit for service
Inconsistent Aerosol Stream	Internal Regulator is defective	Replace the internal regulator or return the unit for service
	Improper inert gas pressure	Verify that 50 psi of inert gas is being supplied to the unit
	Improper internal flow setting	Verify (See Appendix 2)
	Improper temperature setting	Verify temperature setting is appropriate for the oil in use (See Appendix 2)
	Heater Block is partially clogged	Return the unit for service

TDA-5B AEROSOL GENERATOR

COMPONENT PARTS LIST

Item	Qty	Description
1	1	Toggle Switch, # T5A0-0061
2	2	Heater, 120 volt, 350 watt, # T5A0-0259
3	1	Fuse Holder, # T2E0-0322
4*	1	Fuse, 120 volt, 7 amp, #T5A0-0320
5	1	Digital temperature controller, #4600001
6	1	Nitrogen switch, # T5A0-0442
7	1	Air Regulator, # T5A0-0248
8	1	Metering Valve, # T5A0-0420

NOTE: Items shown above are for 120/240 volts unless marked * and listed below. Items listed below are required for 240-volt units.

4	2	Fuse, # 6400101

APPENDIX 1

The unit has been factory set for either 120 volt or 220-volt service. To confirm setting or change voltage, proceed as follows:

1. Turn off unit and disconnect from power source.

2. Remove four retaining screws on the side of the cabinet and lift off the top cover.

3. On models manufactured prior to July 2000 the 120v/220v switch is located above the heater block and is attached to the rear panel. To switch voltage use a flathead screwdriver to turn the switch to the desired voltage.

**Models manufactured after July 200 are voltage specific and do not have a voltage selector switch.*

4. After changing voltage, the power entry module fusing must be changed as per the manufacturer's instructions on the next page.

5. Reassemble unit and proceed with testing.

APPENDIX 2

The unit has been factory set for either DOP or PAO. The unit may also be set for any of the other liquids listed in the table below provided a ½ to 1 liter sample is supplied to ATI.

TDA-5B COMPARISON DOP SUBSTITUTES

MATERIAL	BLOCK TEMP.	FLOW	RESULTS/COMMENTS
DOP	760º - 770º F 404º - 410º C	10 - 11 lpm	Aerosol stream is very stable, uniform and dry. After varying the concentration from one end of the range to the other, aerosol is still very stable and dry.
DOS	780º - 790º F 415º - 420º C	6 lpm	Aerosol stream is dry and uniform. However, occasional clogging of the block occurs from higher block temperature.
Emery 3004	760º - 770º F 404º - 410º C	7 lpm	Aerosol stream is dry and uniform. Very stable through entire run cycle. An increase in flow resulted in aerosol wetting out. **Recommended Replacement For DOP**
Ondina Oil	760º - 780º F 404º - 415º C	7 lpm	Aerosol stream is dry and stable. Wetting out did not occur until temperature was reduced to 670^0 F. Pulsation did not occur until temperature reached 900^0 F. **Good Replacement For DOP**
Mineral Oil	750º - 760º F 400º - 404º C 770º - 790º F 410º - 420º C	10 lpm 6 lpm	Aerosol stream semi-wet. Increasing the temperature and reducing flow resulted in dryer stream of aerosol but clogged the block very quickly.

To change setup, proceed as follows:

1. Turn off unit and disconnect from power source.

2. After the unit has been allowed to cool down sufficiently, remove four retaining screws on the side of the cabinet side and lift off the top cover.

3. The regulator is located in front of heater block. To adjust flow, first turn Aerosol Switch on and fully close Metering Valve. Turn regulator valve and monitor flow with a flow meter attached to the aerosol outlet module.

4. After changing flow, the temperature controller module operating point must be changed as per the manufacturer's instructions on the next page.

5. Reassemble unit and proceed with testing.

TDA-5B Safety Guidelines

The following usage guidelines were developed in response to a fire incident involving one of ATI's competitor's thermal aerosol generators.

The following procedures and cautions should always be utilized to insure safe operation of ATI's TDA-5B generators.

1) Always use an inert gas such as Nitrogen, Argon, Carbon Dioxide or Helium, etc.
2) Ensure that the **Aerosol On/Off** switch and metering valve are in the closed position, the unit is full of liquid and the unit is in its final operating position before power is applied to the unit.
3) **Always use the proper liquid.** Generator operation is setup dependent. Use of an improper liquid may result in equipment damage or personal injury. The only liquids that are specified and accepted by the factory are DOP & PAO (Emery 3004).
4) **Always maintain a gas-input pressure of 50 PSIG +/- 5 psig**. Changes in input pressure can greatly affect the generator performance characteristics.
5) Always turn the **Aerosol On/Off** switch on prior to opening the liquid metering valve.
6) Always close the metering valve fully clockwise and allow the heater block to purge of liquid for 1 minute before shutting off the **Aerosol On/Off** switch.
7) **Caution should be used when refilling a hot unit.** Always use a funnel when filling the unit to prevent liquid spilling around the fill port. Spilling liquid or over filling will cause liquid to enter the cabinet and create a possible fire hazard.
8) **Never move a hot generator until it has been purged of liquid**. Movement of the generator while hot may cause liquid to flow into the heater block without an inert gas source. Ambient air combined with aerosol liquid may result in a flash fire situation.
9) **Never connect tubing or an unapproved adapter directly to the generator output collar**. For safe & proper operation of the generator, vapor emitted from the heater block must be immediately quenched (cooled) by ambient atmospheric conditions while in the presence of an Inert Gas. The only authorized adapter, available from ATI, allows for a flow of ambient air to contact the vapor immediately upon exiting the generator. **When using this adapter ensure that the quenching holes remain in the open position to allow sufficient airflow to quench the vapor stream.**
10) **The Inert Gas supply should always remain connected to a hot generator**. In the event that one or more of the steps outlined above is not followed and a fire results the Inert Gas supply should be used to help extinguish any resulting fire.

E5CSV temperature controller

Ready, set, go!

» Perfect control

» Easy setting up

» Enhanced functionality

Advanced Industrial Automation

OMRON

OMRON

Perfect temperature control in 4 simple steps

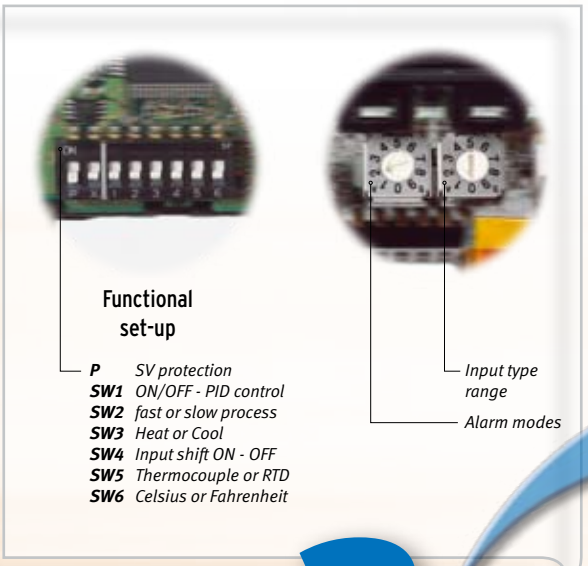
The E5CSV temperature-controller series is the enhanced successor to our E5CS series, the most widely sold temperature-controller that has established itself throughout the world as the ideal choice for simple, cost-effective temperature control.

Keeping the best...

The new series shares many of the outstanding features that made its predecessor such a success – including easy setting-up using DIP and rotary switches, a large 7-segment LED display and choice of ON/OFF or PID control with Self-Tuning. What's more, it still provides an indication of output and alarm status and direction of deviation from set point.

1 Select

100-240 VAC		24 VAC/VDC	
Relay output	Voltage (pulse) output	Relay output	Voltage (pulse) output



2 Set-up

Packing
Excellent control, especially in this disturbance-sensitive application.

Frying
The flat front makes the use of the E5CSV hygienic and it's easy and safe to clean thanks to its IP66 rating.

Sealing
Clear indication that the correct temperature has been reached thanks to the deviation indicator.

Enhancing the rest...

Building on the success of the previous E5CS, however, the new E5CSV series offers much more. Like an Auto-Tune function and the fact that as standard you can now select multiple input types (thermocouple/RTD). A new 3.5 digit display also means that E5CSV can show a larger range, now extending up to 1999 °C.The series also meets new RoHS requirements and complies with the stringent IP66 standard. What's more, depth has been reduced to a mere 78 mm.

Benefits of E5CSV temperature controllers:

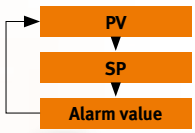
- Easy setting-up using DIP and rotary switches
- Meets broad range of basic temperature-control requirements with only 4 models
- No expert knowledge needed to optimise performance because of Self- and Auto-Tuning functions
- Reduced chance of malfunction thanks to set-value protection
- End-user friendly since the menu only has 3 parameters
- Excellent legibility with a large (13.5 mm) single-line, 3.5 digit, 7 segment LED display
- Clear status overview thanks to PV-SV deviation indicator, output and alarm indicator
- Easy connection to a broad range of temperature-sensor types

>> Ready...

>> Set...

>> Go!

3 Mount



4 Adjust

OMRON

Temperature Controllers
E5CSV

Easy Setting Using DIP Switch and Simple Functions in DIN 48 x 48 mm-size Temperature Controllers

- Easy setting using DIP and rotary switches.
- Multi-input (thermocouple/platinum resistance thermometer).
- Clearly visible digital display with character height of 13.5 mm.
- RoHS compliant.

CE c UL us LISTED

NEW

Model Number Structure

■ Model Number Legend

Models with Terminal Blocks

E5CSV-□1T□-500
1 2 3 4 5

1. **Output type**
   R: Relay
   Q: Voltage for driving SSR
2. **Number of alarms**
   1: 1 alarm
3. **Input type**
   T: Thermocouple/platinum resistance thermometer (multi-input)
4. **Power supply voltage**
   Blank: 100 to 240 VAC
   D: 24 VAC/VDC
5. **Terminal cover**
   500: Finger protection cover

Ordering Information

■ List of Models

Size	Power supply voltage	Number of alarm points	Control output	TC/Pt multi-input Incl. terminal cover
1/16 DIN 48 x 48 x 78 mm (W x H x D)	100 to 240 VAC	1	Relay	E5CSV-R1T-500
			Voltage (for driving SSR)	E5CSV-Q1T-500
	24 VAC/VDC	1	Relay	E5CSV-R1TD-500
			Voltage (for driving SSR)	E5CSV-Q1TD-500

■ Accessories (Order Separately)

Protective Front Cover

Type	Model
Hard Protective Cover	Y92A-48B

Specifications

■ Ratings

Supply voltage		100 to 240 VAC, 50/60 Hz	24 VAC/VDC, 50/60 Hz
Operating voltage range		85% to 110% of rated supply voltage	
Power consumption		5 VA	3 VA/2 W
Sensor input		Multi-input (thermocouple/platinum resistance thermometer) type: K, J, L, T, U, N, R, Pt100, JPt100	
Control output	**Relay output**	SPST-NO, 250 VAC, 3A (resistive load)	
	Voltage output (for driving the SSR)	12 VDC, 21 mA (with short-circuit protection circuit)	
Control method		ON/OFF or 2-PID (with auto-tuning)	
Alarm output		SPST-NO, 250 VAC, 1A (resistive load)	
Setting method		Digital setting using front panel keys (functionality set-up with DIP switch)	
Indication method		3.5 digit, 7-segment digital display (character height: 13.5 mm) and deviation indicators	
Other functions		• Setting change prohibit (key protection) • Input shift • Temperature unit change (°C/°F) • Direct/reverse operation • Control period switching • 8-mode alarm output • Sensor error detection	
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

Setting accuracy		Thermocouple (See note 1.): (±0.5% of indication value or ±1°C, whichever is greater) ±1 digit max. Platinum resistance thermometer (See note 2.): (±0.5% of indication value or ±1°C, whichever is greater) ±1 digit max.
Indication accuracy (ambient temperature of 23°C)		
Influence of temperature		R thermocouple inputs: (±1% of PV or ±10°C, whichever is greater) ±1 digit max. Other thermocouple inputs: (±1% of PV or ±4°C, whichever is greater) ±1 digit max. Platinum resistance thermometer inputs: (±1% of PV or ±2°C, whichever is greater) ±1 digit max.
Influence of voltage		
Hysteresis (for ON/OFF control)		0.1% FS
Proportional band (P)		1 to 999°C (automatic adjustment using auto-tuning/self-tuning)
Integral time (I)		1 to 1,999 s (automatic adjustment using auto-tuning/self-tuning
Derivative time (D)		1 to 1,999 s (automatic adjustment using auto-tuning/self-tuning)
Alarm output range		Absolute-value alarm: Same as the control range Other: 0% to 100% FS Alarm hysteresis: 0.2°C or °F (fixed)
Control period		2/20 s
Sampling period		500 ms
Insulation resistance		20 MΩ min. (at 500 VDC)
Dielectric strength		2,000 VAC, 50/60 Hz for 1 min between current-carrying terminals of different polarity
Vibration resistance	**Malfunction**	10 to 55 Hz, 20 m/s^2 for 10 min each in X, Y, and Z directions
	Destruction	10 to 55 Hz, 0.75-mm single amplitude for 2 hr each in X, Y, and Z directions
Shock resistance	**Malfunction**	100 m/s^2 min., 3 times each in 6 directions
	Destruction	300 m/s^2 min., 3 times each in 6 directions
Life expectancy	**Electrical**	100,000 operations min. (relay output models)
Weight		Approx. 120 g (Controller only)
Degree of protection		Front panel: Equivalent to IP66; Rear case: IP20; Terminals: IP00
Memory protection		EEPROM (non-volatile memory) (number of writes: 1,000,000)
EMC		EMI Radiated: EN 55011 Group 1 Class A EMI Conducted: EN 55011 Group 1 Class A ESD Immunity: EN 61000-4-2: 4 kV contact discharge (level 2) 8 kV air discharge (level 3) Radiated Electromagnetic Field Immunity: EN 61000-4-3: 10 V/m (80-1000 MHz, 1.4-2.0 GHz amplitude modulated) (level 3) 10 V/m (900 MHz pulse modulated) Conducted Disturbance Immunity: EN 61000-4-6: 3 V (0.15 to 80 MHz) (level 2) Noise Immunity (First Transient Burst Noise): EN 61000-4-4 Burst Immunity: 2 kV power-line (level 3), 1 kV I/O signal-line (level 3) Surge Immunity: EN 61000-4-5: Power line: Normal mode 1 kV; Common mode 2 kV Output line (relay output): Normal mode 1 kV; Common mode 2 kV Voltage Dip/Interrupting Immunity: EN 61000-4-11 0.5 cycle, 100% (rated voltage)
Approved standards		UL 61010C-1 (listing), CSA C22.2 No.1010-1
Conformed standards		EN 61326, EN 61010-1, IEC 61010-1, VDE 0106 Part 100 (finger protection), when the terminal cover is mounted.

Note: 1. The following exceptions apply to thermocouples.
- U, L: ±2°C ±1 digit max.
- R: ±3°C ±1 digit max. at 200°C or less

2. The following exceptions apply to platinum resistance thermometers.
Input set values 0, 1, 2, 3 for E5CSV: 0.5% FS ±1 digit max.
Input set value 1 for E5CSV: 0.5% FS ±1 digit max.

Installation

- All models in the E5CSV Series conform to DIN 43700 standards.
- The recommended panel thickness is 1 to 4 mm.
- Be sure to mount the E5CSV horizontally.

Mounting the E5CSV

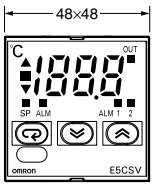
1. For waterproof mounting, waterproof packing must be installed on the Controller. Waterproofing is not possible when group mounting several Controllers.
2. Insert the E5CSV into the mounting hole in the panel.
3. Push the adapter from the terminals up to the panel, and temporarily fasten the E5CSV.
4. Tighten the two fastening screws on the adapter. Alternately tighten the two screws little by little to maintain a balance. Tighten the screws to a torque of 0.29 to 0.39 N·m.

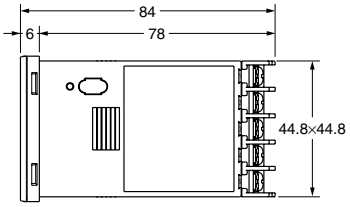
Dimensions

Note: All units are in millimeters unless otherwise indicated.

■ Controller

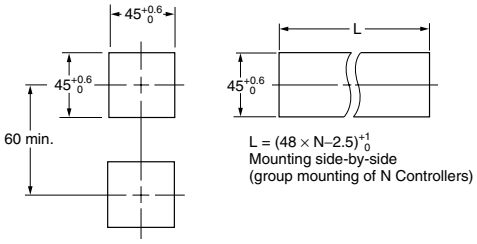
E5CSV





Note: Terminals cannot be removed.

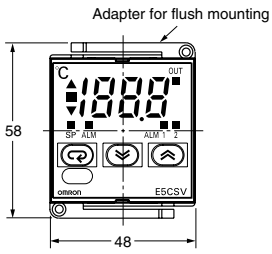
Panel Cutout Dimensions

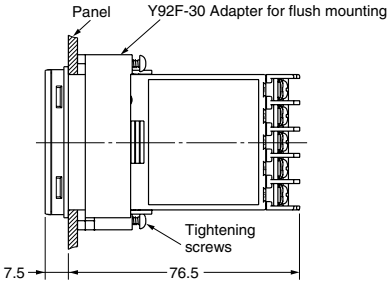


Hard Protective Cover

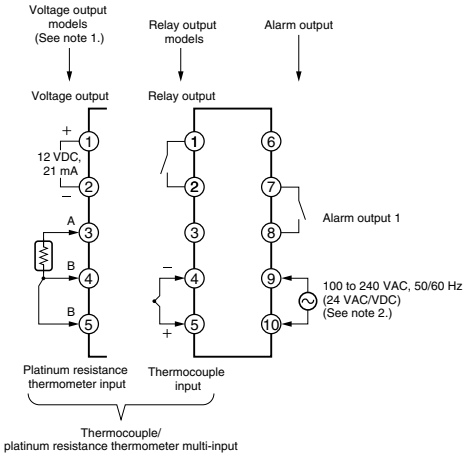
The Y92A-48B Protective Cover (hard type) is available for the following applications.

- To protect the set from dust and dirt.
- To prevent the panel from being accidentally touched causing displacement of set values.
- To provide effective protection against water droplets.



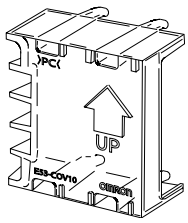


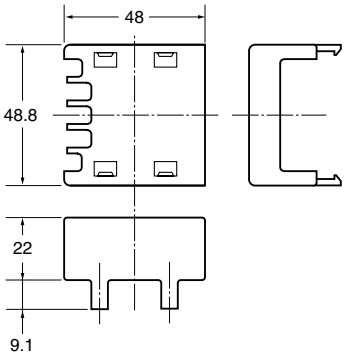
Note: 1. The recommended panel thickness is 1 to 4 mm.
2. Group mounting is possible in one direction only.



Terminal Cover

E53-COV10





Note: 1. The voltage output (12 VDC, 21 mA) is not electrically isolated from the internal circuits. When using a grounding thermocouple, do not connect output terminals 1 or 2 to ground. Otherwise, unwanted current paths will cause measurement errors.
2. Models with 100 to 240 VAC and 24 VAC/VDC are separate. Models using 24 VDC have no polarity.

Operation

E5CSV

Deviation indicators

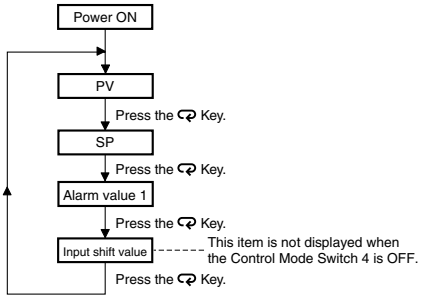
The △ indicator lights when the PV is greater than the SP and the ▽ indicator lights when the PV is less than the SP. The □ indicator (green) lights when the deviation is less than 1% FS (0.25% FS for multi-input models). These indicators flash during ST (self-tuning)/AT (auto-tuning).

Mode indicators

The SP indicator lights when the setting temperature is being displayed. The ALM indicator lights when the alarm value 1 is being displayed.

Mode Key

When the power is turned ON, normally the display will use the display items in the following order each time the Mode Key is pressed.



PV, SP, Alarm Value, Input Shift Display

The display switches each time the Key is pressed.

Output indicator

Lights when the control output is ON.

Alarm indicators

ALM1 (Alarm 1): Lights when the alarm 1 output is ON.
ALM2 (Alarm 2): For future use.

Up Key

Pressing the Up Key increases the SP/alarm value display. Keeping the Up Key pressed continues to increase the display value. When the internal protect switch is ON, press the Up Key while holding down the Lock Release Key.

Down Key

Pressing the Down Key decreases the SP/alarm value display. Keeping the Down Key pressed continues to decrease the display value. When the internal protect switch is ON, press the Down Key while holding down the Lock Release Key.

Lock Release Key

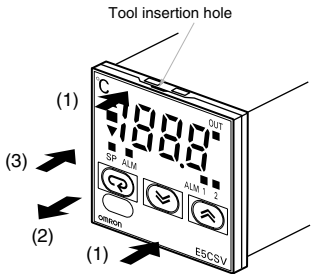
When the protect switch is ON, the set value can be changed by pressing the Up and Down Keys while holding down the Lock Release Key.

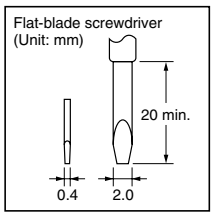
Settings before Turning ON the Power

E5CSV

Remove the E5CSV from the case to make the settings.

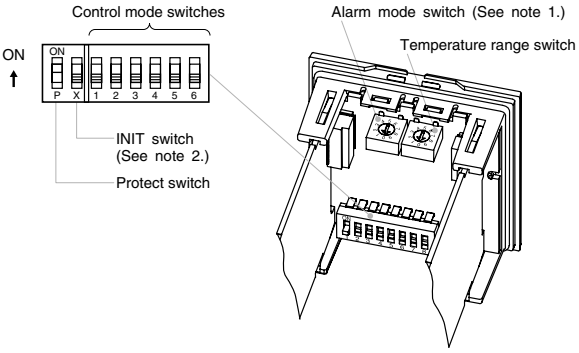
1. Insert the tool into the two tool insertion holes (one on the top and one on the bottom) and release the hooks.





2. Insert the tool in the gap between the front panel and rear case, and pull out the front panel slightly. Grip the front panel and pull out fully. Be sure not to impose excessive force on the panel.

3. When inserting the E5CSV, check to make sure that the sealing rubber is in place and push the E5CSV toward the rear case until it snaps into position. While pushing the E5CSV into place, push down on the hooks on the top and bottom surfaces of the rear case so that the hooks are securely locked in place. Make sure that electronic components do not come into contact with the case.

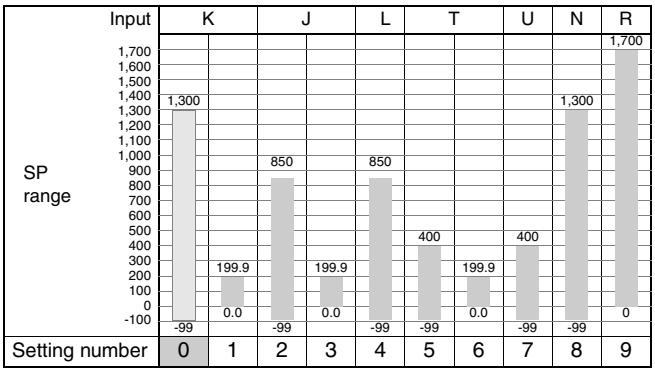


Note: 1. The INIT switch is always OFF during normal operation.

1. Sensor Type Specification

Multi-input (Thermocouple/Platinum Resistance Thermometer) Models

• Using Thermocouple Sensors, Control Mode Switch 5: OFF

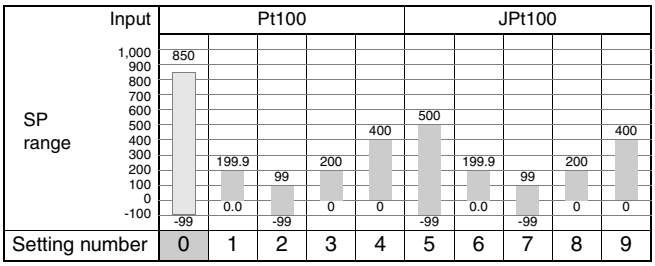


• The control range is -20° C to +20° C of the input temperature range.

Note: 1. The input indication range is the range that can be displayed for the control range (-99 to 1999). If the input is within the control range but exceeds the display range (-99 to 1999), values below -99 will be displayed as "ccc" and values above 1,999 will be displayed as "ccc."

2. If unit is changed to 1 degree when the SP and alarm value for the temperature range are displayed in 0.1-units from 0.0 to 199.9 or 0.0 to 99.9, the values will be multiplied by 10 (e.g., 0.5 becomes 5). If the unit is changed in the reverse direction, the values will be divided by 10. After changing the range, set the SP and alarm value again.

• Using Platinum Resistance Thermometers, Control Mode Switch 5: ON

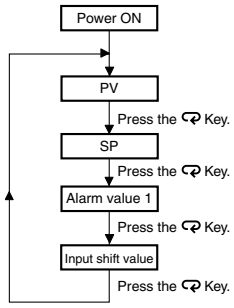


• The control range is -20° C to +20° C of the input temperature range.

Note: 1. The input indication range is the range that can be displayed for the control range (-99 to 1999). If the input is within the control range but exceeds the display range (-99 to 1999), values below -99 will be displayed as "ccc" and values above 1,999 will be displayed as "ccc."

2. If unit is changed to 1 degree when the SP and alarm value for the temperature range are displayed in 0.1-units from 0.0 to 199.9 or 0.0 to 99.9, the values will be multiplied by 10 (e.g., 0.5 becomes 5). If the unit is changed in the reverse direction, the values will be divided by 10. After changing the range, set the SP and alarm value again.

Mode Key Display Order



• If the SP falls outside the temperature range when the temperature range is changed, the SP will be displayed first. The SP will be changed automatically either to the minimum value or the maximum value, whichever is nearest.

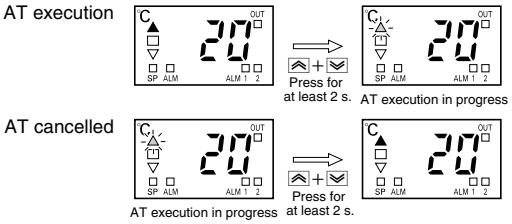
• If the alarm value falls outside the temperature range when the temperature range is changed, the alarm value will be displayed first. The alarm value will be changed automatically to the maximum value in the new temperature range.

ST (Self-tuning) Features

ST (self-tuning) is a function that finds PID constants by using step response tuning (SRT) when Controller operation begins or when the set point is changed. Once the PID constants have been calculated, ST is not executed when the next control operation is started as long as the set point remains unchanged. When the ST function is in operation, be sure to turn ON the power supply of the load connected to the control output simultaneously with or before starting Controller operation.

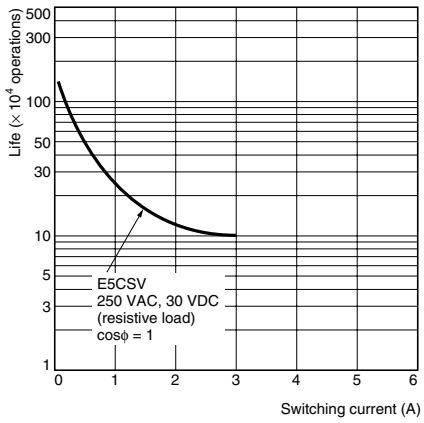
Executing AT (Auto-tuning)

AT (auto-tuning) is executed by pressing the ⊼ Up and ⊽ Down Keys for at least 2 s while the PV is displayed. The deviation indicators flash during auto-tuning (AT) execution. AT will be cancelled by performing the same operation that AT is executing during AT operation. Flashing stops when AT is completed.



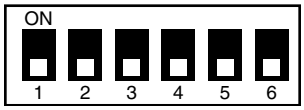
Note: One of the deviation indicators (▲■▼) will flash.

■ Electrical Life Expectancy Curve for Relays (Reference Values)



2. Operation Settings

Use the control mode switches ( ) to change the control mode. (All switches are OFF for the default settings.)

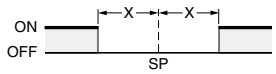
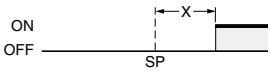
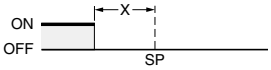
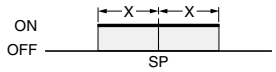
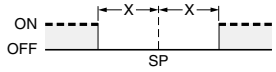
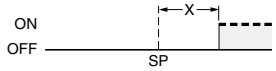
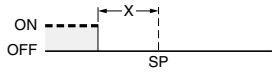
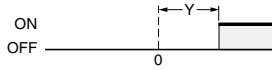


Function selection		1	2	3	4	5	6
ON/OFF PID	**PID control**	ON					
	ON/OFF control	OFF					
Control period	**2 s**		ON				
	20 s		OFF				
Direct/ reverse opera-tion	**Direct operation (cooling)**			ON			
	Reverse operation (heating)			OFF			
Input shift display	**Enabled**				ON		
	Disabled				OFF		
Tempera-ture Sensor selection	**Platinum resistance thermometer input**					ON	
	Thermocouple input					OFF	
Temper-ature unit	**°F**						ON
	°C						OFF

Note: The previous name Pt100 has been changed to JPt100 in accordance with revisions to JIS. The previous name J-DIN has been changed to L in accordance with revisions to DIN standards.

3. Alarm Modes

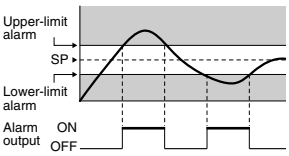
Select the number of the alarm mode switch when changing the alarm mode. (The default is 2).

Set value	Alarm type	Alarm output operation
0, 9	Alarm function OFF	OFF
1	Upper- and lower-limit	
2	Upper-limit	
3	Lower-limit	
4	Upper- and lower-limit range	
5	Upper- and lower-limit with standby sequence (See note 2.)	
6	Upper-limit with standby sequence (See note 2.)	
7	Lower-limit with standby sequence (See note 2.)	
8	Absolute-value upper-limit	

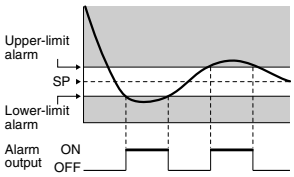
Note: 1. No alarm. The alarm value (alarm operation display) will not be displayed when the setting is 0 or 9 even if the selection key is pressed.
Alarm Setting Range
X: 0 to FS (full scale); Y: Within temperature range
The value of X is the deviation setting for the SP (set point).

2. Standby Sequence Function (The standby sequence operates when the power is turned ON.)

Rising Temperature



Dropping Temperature



Note: Turn OFF the power before changing the DIP switch settings on the E5CSV. Each of the switch settings will be enabled after the power is turned ON.

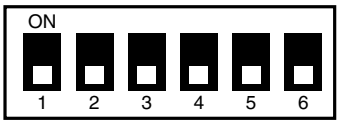
For details on the position of the temperature range switch, control mode switches, and alarm mode switch, refer to page 4.

4. Using the Control Mode Switches

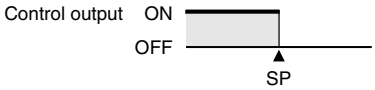
(1) Using ON/OFF Control and PID Control

(1.1) ON/OFF Control

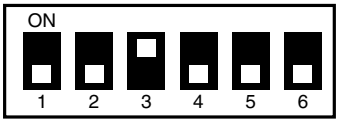
The control mode is set to ON/OFF control as the default setting.

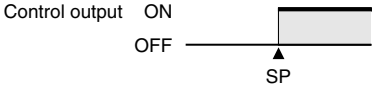


Switch 1 OFF: ON/OFF control



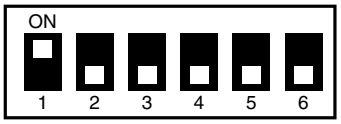
To perform cooling control of freezers, etc., turn ON switch 3.





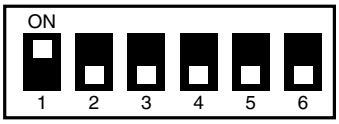
(1.2) PID Control

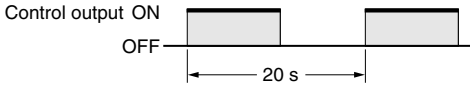
Turn ON switch 1 to use PID control.



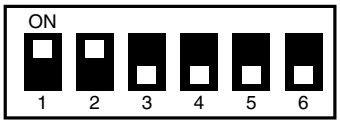
Switch 1 ON: PID control

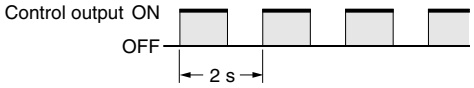
1. **Set the control period.**
   Performing Control via Relay Output, External Relay, or Conductor
   Switch 2: OFF (control period: 20 s)



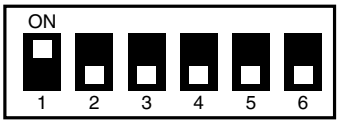


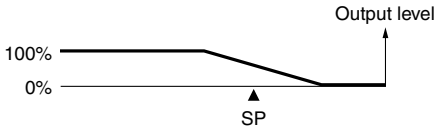
   Quick Control Response Using an SSR
   Switch 2: ON (control period: 2 s)



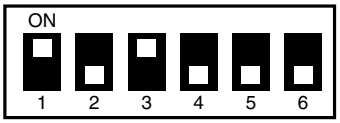


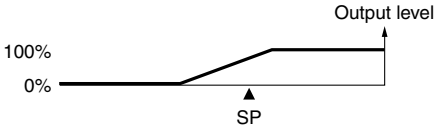
2. **Set direct/reverse operation for the output.**
   Performing Heating Control for Heaters
   Switch 3: OFF





   Performing Cooling Control for Freezers
   Switch 3: ON

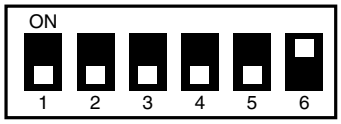




(2) Using the E5CSV in Devices for Fahrenheit-scale Users

(Displaying in °F)

Turn ON switch 6 to display temperatures in °F.



Temperature Range for °F

The temperature is set to °F using the same temperature range switch as °C.

Multi-input (Thermocouple/ Platinum Resistance Thermometer)
Control mode switch 5: OFF

Set-ting	°F	
0	K	-99 to 1999
1		0.0 to 199.9
2	J	-99 to 1500
3		0.0 to 199.9
4	L	-99 to 1500
5	T	-99 to 700
6		0.0 to 199.9
7	U	-99 to 700
8	N	-99 to 1999
9	R	0 to 1999

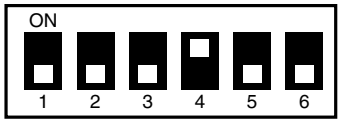
Multi-input (Thermocouple/ Platinum Resistance Thermometer)
Control mode switch 5: ON

Set-ting	°F	
0	Pt100	-99 to 1500
1		0.0 to 199.9
2		-99 to 99
3		0 to 200
4		0 to 400
5	JPt100	-99 to 900
6		0.0 to 199.9
7		-99 to 99
8		0 to 200
9		0 to 400

Note: The control range for multi-input (thermocouple/platinum resistance thermometer) models is -40 to +40°F of each temperature range. The previous name J-DIN has been changed to L in accordance with revisions to DIN standards.

(3) Setting Input Shift

Turn ON switch 4, and after turning ON the power, press the Mode Key until H0 (indicates input shift of 0) is displayed. Press the Up and Down Keys to set the shift value.



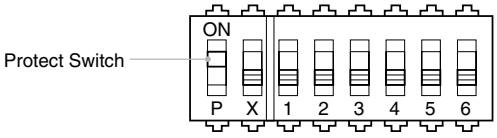
Shift Example

Input shift display	Measured temperature	Temperature display
H0 (no shift)	100°C	100°C
H9 (+9°C shift)	100°C	109°C
L9 (-9°C shift)	100°C	91°C

Note: When control mode switch 4 is turned OFF (no input shift display), the input shift is not displayed but the shift value is enabled. To disable input shift, set the input shift value to H0. The shift range depends on the setting unit.

Setting unit	1°C	0.1°C
Compensation range	-99 to +99°C	-9.9 to +9.9°C
Input shift display	L99 to H99	L9.9 to H9.9

5. Protect Switch



When the protect switch is ON, Up Key and Down Key operations are prohibited to prevent setting mistakes.

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• Safety units/relay units • Safety door/guard lock switches

KPP_E5CSV_01_EN_INT

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OMRON

OMRON®

Temperature Controller

E5CS-X

1/16 DIN Sized Controller Offers Selectable Control, Alarm Modes

- Accurate to ±0.5% of full scale
- Multiple temperature scale ranges allow flexibility to match application
- Field-selectable temperature ranges in °F and °C
- Selectable ON/OFF and PID control with auto-tuning of proportional band
- 8-function alarm, standard
- Tamper-proof setting, faulty sensor compensation and controller diagnostics
- Easy-to-read 11 mm high LED display
- Nonvolatile memory backup
- 3-year warranty

Ordering Information

■ TEMPERATURE CONTROLLERS

Item		Part number		
Sensor input type		Thermocouple (Types J and K)	Platinum RTD (Pt: 100 Ω, DIN and JIS standards)	Interchangeable thermistor (THE types)
Output	Contact	**E5CS-R1KJX-F**	**E5CS-R1PX-F**	**E5CS-R1GX-F**
	Voltage	**E5CS-Q1KJX-F**	**E5CS-Q1PX-F**	**E5CS-Q1GX-F**

Temperature Ranges

Thermocouple Input Type

Input type	Type K						Type J				
Temperature range	0 to 200	0 to 300	0 to 400	0 to 500	0 to 600	0 to 999	0 to 999	0 to 200	0 to 300	0 to 400	0 t0 500
Scale indication	°C	°C	°C/°F	°C/°F	°C/°F	°C/°F	°F	°C	°C	°C/°F	°C/°F
Unit of measure	1° C or F										

Platinum RTD Input Type

Temperature range	–50 to 50	0.0 to 50.0	–20 to 80	0.0 to 99.9	0 to 200	0 to 300	0 to 400	0 to 600	0 to 800
Scale indication	°C	°C	°C	°C/°F	°C/°F	°C	°C/°F	°F	°F
Unit of measure	1° C or F	0.1° C or F	1° C or F	0.1° C or F	1° C or F				

Thermistor Input Type

Temp. range	–50to 50	0 to 100	50 to 150	100 to 200	150 to 300	–50 to 100	0 to 200	100 to 300	200 to 400	300 to 600
Scale indication	°C					°F				
Unit of measure	1° C or F									

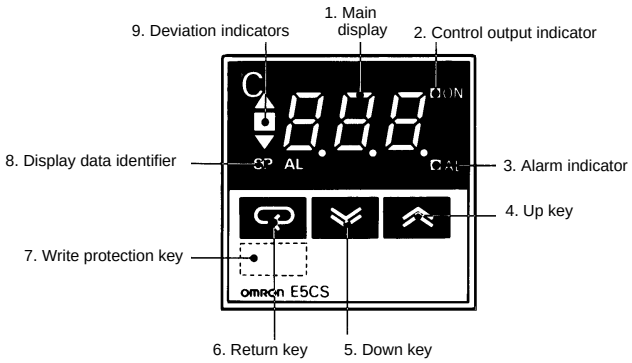
■ ACCESSORIES (ORDER SEPARATELY)

Description		Part number
Protective cover	Hard plastic; protects front panel against dust, dirt and water drops	**Y92A-48**
Panel mounting adapter	Replacement for one supplied with each unit	**Y92F-30**

Specifications

Part number			E5CS-□1KJX	E5CS-□1PX	E5CS-□1GX
Sensor input type			Thermocouple Type J (IC) and Type K (CA)	Platinum RTD (Pt: 100Ω) DIN or JIS standard	Thermistor (interchangeable type)
Supply voltage			100 to 240 VAC, 50/60 Hz; operates on 85 to 110% of rated voltage		
Power consumption			Approx. 7 VA		
Control output	Contact	Type	SPDT relay		
		Max. load	3 A, 250 VAC (resistive load)		
	Voltage	Logic load	12 VDC, 20 mA with short-circuit protection		
	Hysteresis		0.2% of full scale during ON/OFF control action		
	Response time	Output	2 seconds for output to change		
		Display	2 seconds for displayed indication to change		
	Service life	Mechanical	10 million operation minimum with contact output		
		Electrical	100,000 operations minimum with contact output		
Alarm output		Type	SPST-NO relay		
		Max. load	1 A, 250 VAC (resistive load)		
		Setting range	Absolute value alarm: Same as control output setting range Others: 0 to full scale		
Setting accuracy			Set value coincides with indicated value, so no relative error exists		
Indication accuracy			±0.5% of full scale, ±1 digit max.		
Display range			–999 to 999 (limited to input type)		
Control modes	Type		ON/OFF and PID with automatic tuning of proportional band, switch selectable		
	Proportional band		3% to 20% (in PID mode) automatically adjusted according to the rise time of the controlled system		
	Reset time		4 minutes (in PID mode)		
	Rate time		0.4 minutes (in PID mode)		
	Proportional period		2 or 20 seconds, switch selectable		
	Sampling period		500 ms		
Materials			Plastic case		
Mounting			Fits 1/16 DIN panel cutout; includes panel mounting adapter		
Connections			Screw terminals		
Weight			170 g (6 oz.) without mounting adapter		
Enclosure ratings		Front panel	IP50, NEMA 4 with optional Y92A-48N waterproof cover		
		Rear panel	IP30		
		Terminals	IP00		
Approvals		UL	Recognized, File Number E68481		
		CSA	Certified, File Number LR59623		
		CE	Conforms to EN61010-1		
Ambient temperature		Operating	–10°C to 55°C (14°F to 131°F)		
		Storage	–25°C to 65°C (–13°F 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 current-carrying terminals of different polarity		
Vibration	Mechanical durability		10 to 55 Hz, 0.75 mm (0.03 in) double amplitude 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		30 m/s^2, in 6 directions, 3 times each		
	Malfunction durability		100 m/s^2, in 6 directions, 3 times each		

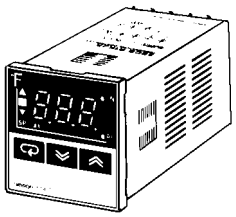
Nomenclature

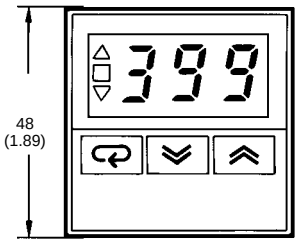


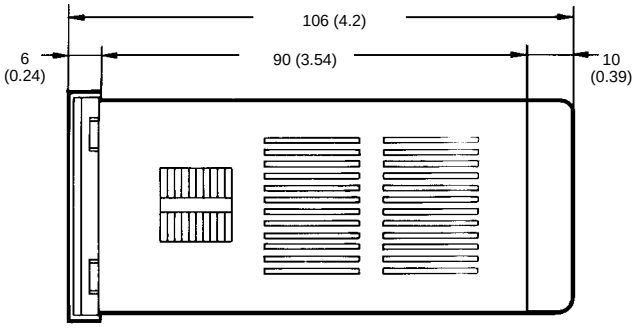
Key	Description	Key	Description
1	Main display sequentially displays the present temperature, set temperature, and an alarm value each time the return key is pressed.	7	The hidden write protection key provides protection against unauthorized setting of temperature and is used in conjunction with the internal “protection” switch. If the internal protection switch is set to ON, then to obtain Up and Down operation, the hidden key must be pressed simultaneously with the Up and Down keys. If the internal protection switch is set to OFF, changes can be made simply by pressing the Up and Down keys.
2	Control output indicator lights when the output is ON.		
3	Alarm indicator lights when the alarm output is ON.		
4	Up key increases the set temperature or alarm value when pressed. Increases the value quickly when held down.		
5	Down key decreases the set temperature or alarm value when pressed. Decreases the value quickly when held down.	8	Display data identifier lights SP when the set temperature is displayed on the main display and AL when an alarm value is displayed.
6	Return key changes the value displayed on the main display each time pressed.	9	Red deviation indicators light up an arrow when the present temperature is higher than the set temperature and light a down arrow when the present value is lower than the set temperature. The green block indicates the temperature deviation is within ±1% of the full scale.

Dimensions

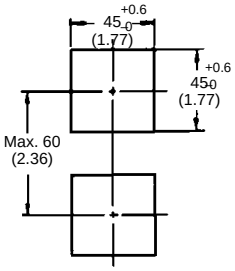
Unit: mm (inch)



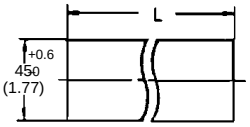




Panel Cutout



Side-by-side Mounting of Several Temperature Controllers

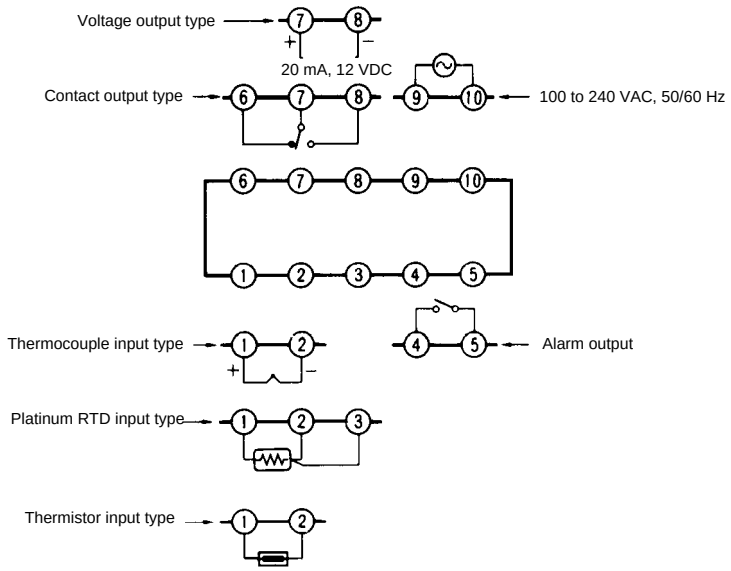


L = 48 x number of units – 2.5
(1.89 x number of units –0.1)

Controllers	2	3	4	5	6
L	93.5 +1 -0 (3.68)	141.5 +1 -0 (5.57)	189.5 +1 -0 (7.46)	237.5 +1 -0 (9.35)	285.5 +1 -0 (11.24)

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.

Connections



Operation

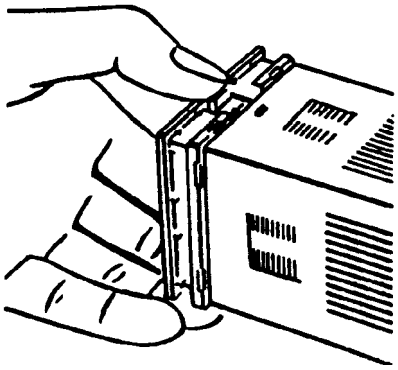
■ SETTINGS BEFORE APPLYING POWER

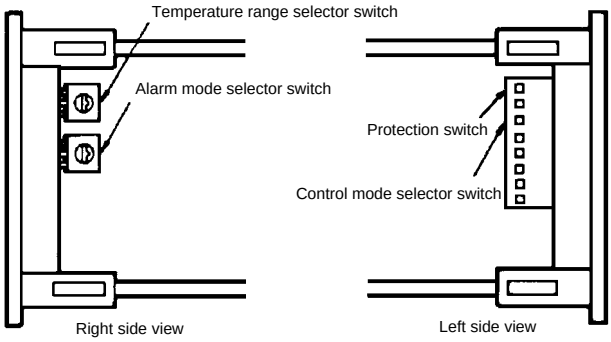
Note: Always turn off the power supply to the temperature controller before changing any switch settings.

Before applying power to the temperature controller, set the following selector switches to specify the temperature range, functions and alarm mode.

■ ACCESS TO INTERNAL SWITCHES AND SELECTORS

Push the tab on the underside of the front panel as you draw out the internal mechanism from the housing. The temperature range selector, and the alarm mode selector must all be set. A protection switch can also be set to protect settings. The following diagrams show the locations of these switches on the internal mechanism.





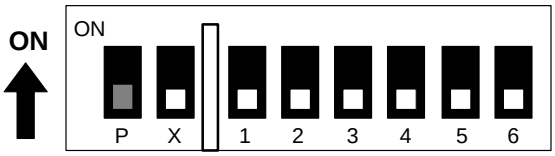
Select the desired temperature range by using the temperature range selector switch (rotary DIP type). The other rotary DIP switch is used to select one of eight alarm functions. Be sure the set temperature and alarm values are within the new range. Otherwise, the temperature controller automatically shifts these values to the maximum or minimum of the newly-set temperature range.

The protection switch may be used in conjunction with the front panel “hidden key” to prevent unauthorized changes to temperature settings. The switch is ON when it is pushed inwards in the direction of the white arrow.

The function selector switch is a 8-pin in-line DIP switch on the other side of the internal mechanism. Use it to select ON/OFF or PID control action, proportional period, control output, input shift function, temperature sensor input standard and scale indication for dual-scale temperature ranges.

■ FUNCTION SELECTOR SWITCH

The function selector switch is a 6-pin in-line DIP switch. The following table shows the selection made by each switch position.

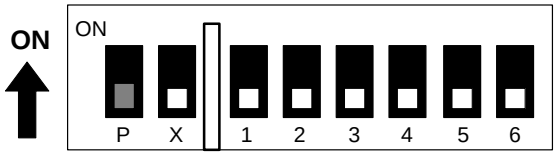


Function	Switch number	P	X	1	2	3	4	5	6
Key protection for Up/Down keys	Enables protection	ON							
	Disables protection	OFF							
Used for factory-authorized calibration only	Not used in normal operation		ON						
			OFF						
Control mode	PID action			ON					
	ON/OFF action			OFF					
Proportional period	2 seconds				ON				
	20 seconds				OFF				
Control output	Normal					ON			
	Reverse					OFF			
Input shift function	Enabled						ON		
	Disabled						OFF		
RTD sensor input standard	DIN							ON	
	JIS							OFF	
Scale indication for dual-scale range selection	°F								ON
	°C								OFF

■ CONTROL MODE SELECTION

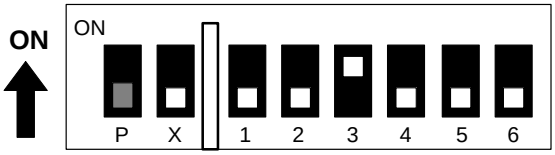
ON/OFF Action

Switch 1 of the function selector DIP switch is factory-set to OFF, so the temperature controller performs ON/OFF control action.Set switch 3 to ON when the temperature controller is used to control a cooling device such as a chiller or freezer.

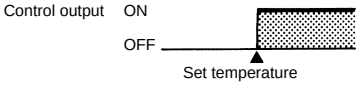


Switch 1 OFF:
Temperature controller performs ON/OFF action.

Set temperature



Switch 3 ON:
Used for cooling operations in ON/OFF action.



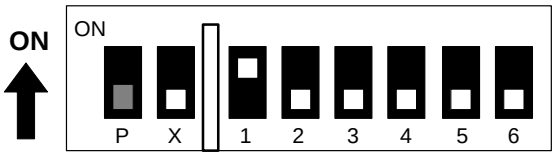
Set temperature

PID Action

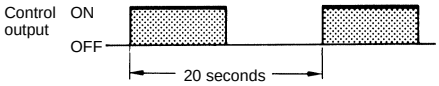
Set switch 1 of the function selector DIP switch to ON to perform PID control action. Follow the steps described below

Determining Proportional Period

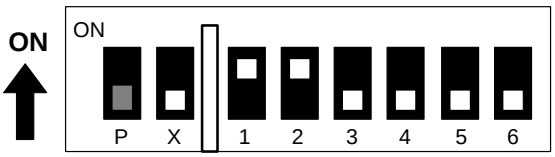
Set switch 2 of the function selector DIP switch to OFF to select a proportional period of 20 seconds. This is used when the PID control action is performed with the contact output of the temperature controller, or when using an external relay or contactor.



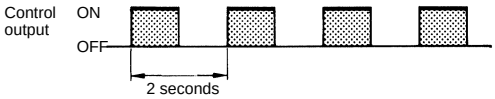
Switch 2 OFF:
Proportional period is 20 seconds.



When a quick response in required, set switch 2 to ON to select a proportional period of 2 seconds. Even when a solid state relay (SSR) is used, set the 2-second proportional period only when quick response is essential. Avoid using this setting with a contact output because it will shorten the relay's service life.

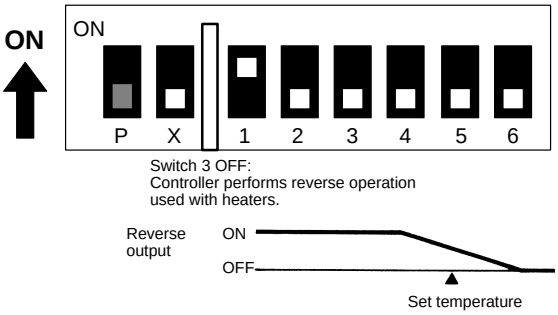


Switch 2 ON:
Proportional period is 2 seconds.

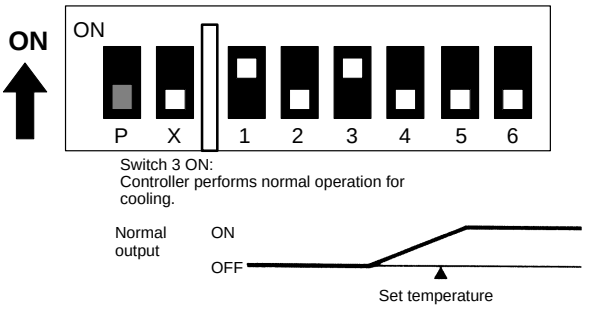


Determining Control Output Operation

If the temperature controller is used to control a heater, the control output can be set to perform a reverse (inverted) operation. Set switch 3 of the control output mode selector switch to OFF



By contrast, if the temperature controller is used to control a cooling device such as a chiller or freezer, set switch 3 to ON.



Auto-tuning of Proportional Band

Upon the initial power-up the proportional band is set to 3%. The optimum proportional band width, however, is automatically calculated and set within the range of 3 to 20%, according to the changes in the temperature of the controlled system. This automatic adjustment of the proportional band is performed regardless of whether the controlled system is a heating or cooling system.

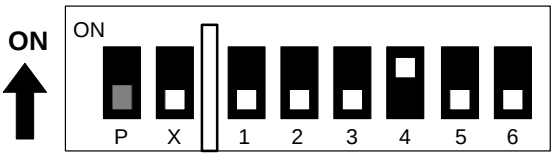
When the power is turned OFF once, and the ON again, the control action starts with the previous proportional band. However, the new proportional band is automatically calculated and set.

The calculation of the proportional band, however, is not carried out if the temperature of the controlled system changes at a faster rate than 7.5% of full scale per 2 seconds (e.g., faster then 3.75% per °C per second with eh full scale of 100°C). In this case, the previously calculated and set proportional band is used.

The temperature controller has an overshoot suppression function that reduced second and subsequent overshoots to a level less than the initial overshoot.

■ INPUT SHIFT FUNCTION

The temperature indication can be shifted by setting switch 4 of the function selector DIP switch to ON, and pressing the mode key repeatedly until the message “H0” (indicating) input shift) is displayed on the main display. Then set the shift value by using the Up or Down key.



Switch 4 ON: Input shift function enabled.

Fine adjustment of the temperature indication and the resulting controlled temperature is possible without changing or affecting the set point.

The input shift value can be set within the range from –99.9 to 99 (°F or °C).

For ranges that have resolution to 0.1, the input shift value can be set within the range from –9.9 to 9.9 (°F or °C. The input shift function may be useful to make small temperature corrections to the control system.

Note that the offset value remains effective even after switch 4 has been set to OFF. If the compensation action is not needed, be sure to set the offset value to 0.

For example:

- correction of known sensor calibration errors
- correction of known steady temperature offset between the heated work piece (load) and sensor. This is useful for applications where the sensor cannot be located exactly at the work piece.
- alignment of temperature indications in a multi-zone/multi-controller application, e.g., at ambient temperature

Note that the input shift changes the value of the controlled temperature when used in closed loop control. For example, with a set point and indication of 100°C and input shift set at +10°C, the controlled temperature will be 90°C.

Main display	Set input shift value	Temperature measured by sensor	Displayed temperature
H 0	0 offset	100°C	100°C
H 9	offset by +9°	100°C	109°C
L 9	offset by –9°	100°C	91°C

■ MATCHING THE CONTROLLER TO SENSOR STANDARD

Use switch 5 of the function selector DIP switch to match the controller to the thermocouple or RTD sensor to be used.

With switch 5 ON, the controller will accept DIN standard sensors. With switch 5 OFF, the controller accepts JIS standard sensors.

■ SELECTING SCALE INDICATION

Some dual-scale (°C/°F) temperature scale ranges may be selected by rotary DIP switch. To specify the scale indication to be displayed, used switch 6 on the in-line function selector DIP switch.

With switch 6 set to ON, the controller displays Fahrenheit scale. With switch 6 set to OFF, the controller displays Celsius scale.

■ SELECTING A SCALE RANGE

Use the rotary DIP switch to select the temperature scale range. The tables below show the switch setting number for each range. The temperature indication range is the set temperature range (full scale) ±10%, unless otherwise noted.

If the set temperature is shifted outside of changing the scale range, the set temperature is displayed. It is then automatically changed to the maximum or minimum value of the newly set temperature scale range.

If the alarm value is shifted outside the temperature scale range as a result of changing the scale range, it is automatically changed to the maximum value of the newly set scale range.

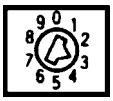
Thermocouple Input Type

Thermocouple input models are factory-set to switch position 2 for a temperature range of 0° to 400°, using a type K thermocouple.

Switch setting	0	1	2	3	4	5	6	6	7	8	9
Temperature range	0 to 200	0 to 300	0 to 400	0 to 500	0 to 600	0 to 999	0 to 999	0 to 200	0 to 300	0 to 400	0 t0 500
Scale indication	°C	°C	°C/°F	°C/°F	°C/°F	°C/°F	°F	°C	°C	°C/°F	°C/°F
Unit of measure	1° C or F										

Platinum RTD Type

Platinum RTD input models are factory-set to switch position 3 for a temperature range of 0.0° to 99.9°.



Switch setting	0	1	2	3	4	5	6	7	8
Temperature range	–50 to 50	0.0 to 50.0	–20 to 80	0.0 to 99.9	0 to 200	0 to 300	0 to 400	0 to 600	0 to 800
Scale indication	°C	°C	°C	°C/°F	°C/°F	°C	°C/°F	°F	°F
Unit of measure	1° C or F	0.1° C or F	1° C or F	0.1° C or F	1° C or F				

Note: 1. Do not set the selector switch to position 9. This will cause error message “FFF” or “——” to be displayed.
2. When changing scale ranges where the unit of measure changes 1° to 0.1° or vice versa, the set temperature also changes to reflect the unit of measure. For example, with a set temperature of 100°, a change from a scale range with 1° resolution to 0.1° makes the set temperature 10°; with a set temperature of 15°, a change in scale range resolution from 0.1° to 1° makes the set temperature 150°.

Thermistor Input Type

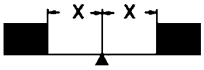
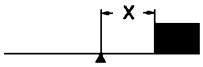
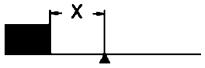
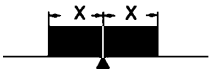
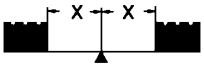
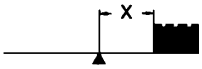
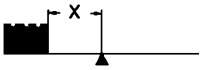
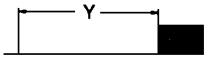
Thermistor input models are factory-set to switch position 0 for a temperature range of –50° to 50C°.

Switch setting	0	1	2	3	4	5	6	7	8	9
Temp. range	–50 to 50	0 to 100	50 to 150	100 to 200	150 to 300	–50 to 100	0 to 200	100 to 300	200 to 400	300 to 600
Scale indication	°C					°F				
Unit of measure	1° C or F									

Note: 1. The temperature indication range for a setting scale of –50° to 50°C is –50° to 60°C. It is the full scale ±10% with the other setting scale ranges.
2. With a temperature range, such as 50° to 150°C, exceeds the factory-set range, the indication unit is automatically adjusted to the minimum value. The set temperature is displayed upon power application.

■ SELECTING ALARM MODES

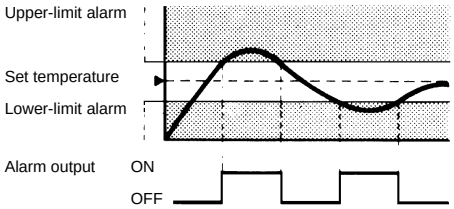
Select one of the eight alarm modes by using the rotary DIP switch located next to the rotary DIP switch for temperature scale range selection. The following table shows alarm functions. The selector switch is factory-set to position 2, upper-limit alarm.

Switch setting	Mode	Alarm output	Notes
0, 9	No alarm	OFF	When the alarm mode selector switch is 0 or 9, neither the alarm value is displayed nor the AL indicator lights even when the return key is pressed.
1	Upper- and lower-limit alarms		Alarm value setting range X may be 0 to full scale. If the alarm value is shifted outside the temperature scale range as a result of changing the scale range, it is automatically changed to the maximum value of the newly set scale range.
2	Upper-limit alarm		
3	Lower-limit alarm		
4	Upper- and lower-limit range alarm		
5	Upper- and lower-limit alarms with standby sequence		
6	Upper-limit alarm with standby sequence		
7	Lower-limit alarm with standby sequence		
8	Absolute-value alarm		Alarm value setting range Y must be within the temperature scale range.

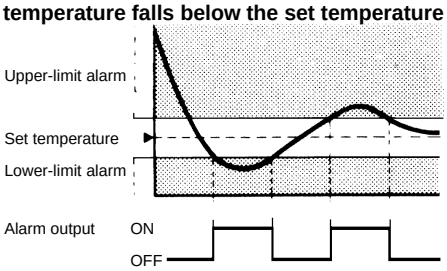
Standby Sequence

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.

When temperature rises from the set temperature

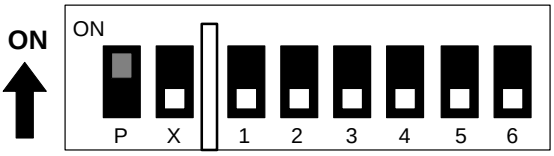


When temperature falls below the set temperature



■ SETTING KEY PROTECTION

Protect against unauthorized changes in temperature values by disabling the operation of Up and Down keys. Set function selector DIP switch “P” to ON. To enable changes from the front panel, simultaneously press the hidden write protection key (lower left corner) with the Up and Down keys. If the internal protection switch is set to OFF, changes can be made simply by pressing the Up and Down keys.



■ WHEN ALL FUNCTIONS HAVE BEEN SELECTED

To Set Temperature

Press the return key until the SP indicator lights. Then set the desired temperature value by using the Up and Down keys.

To Set Alarm Value

Press the return key until the AL indicator lights. Then set the desired alarm value in units of °F or °C. If the present temperature exceeds the set alarm value, the alarm output will be issued.

Neither the set alarm value is displayed nor the AL indicator lights with the integral alarm mode setting switch set to 0 or 9. Be sure to check the alarm mode setting switch, located inside the housing, for proper setting.

In Case of Sensor Failure

The error message “FFF” or “——” will appear on the main display if the temperature sensor short-circuits or breaks.

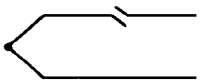
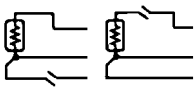
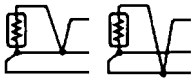
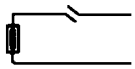
Precautions

The E5CS-X temperature controller has self-diagnostic functions that display the following error messages to simplify troubleshooting.

Message	Cause	Control output
FFF	(1) Temperature has risen beyond temperature scale range (2) Thermistor has been short-circuited	OFF during heating (reverse) operation ON during cooling (normal) operation
---	(1) Temperature has fallen below temperature scale range (2) Thermistor has broken	ON during heating (reverse) operation OFF during cooling (normal) operation
FFF (blinks)*	(1) Failure has occurred in thermocouple or platinum RTD (2) Temperature has risen much beyond scale range	OFF
--- (blinks)*	(1) Failure has occurred in platinum RTD (2) Polarities (positive and negative) of thermocouple are reversed (3) Temperature has fallen much below scale range	OFF
E11 or E33*	(1) Memory failure (E11) display (2) Analog-to-digital converter failure (E33) display Temperature controller must be repaired if recovery is not made by turning power off once and on again.	Both control outputs and the alarm output are OFF

Note: *Key operations are disabled.
When the alarm outputs are used, an alarm output occurs when the “FFF” and “——” messages appear in the display. These displays indicate when the temperature has risen beyond or fallen below the temperature scale range.

■ SENSOR FAILURE INDICATION

Condition		Display	Control output
Thermocouple sensor			
Break in sensor		FFF blinks	OFF
Short-circuit		Ambient temperature	OFF
Platinum RTD sensor			
Break in sensor		FFF blinks	OFF
		--- blinks	OFF
	Disconnection of two or three wires	FFF blinks	OFF
Short-circuit		--- blinks	OFF
Thermistor sensor			
Break in sensor		---	ON during heating (reverse) action OFF during cooling (normal) action
Short-circuit		FFF	ON during heating (reverse) action OFF during cooling (normal) action

Note: The resistance of the platinum RTD is 100 Ω at 0°C and increases to 140 Ω at 100°C.

Installation

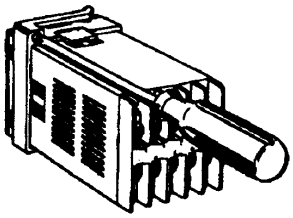
■ MOUNTING

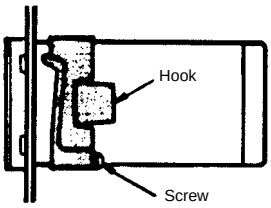
All E5CS-X models conform to DIN 43700 standard. Recommended panel thickness is 1 to 4 mm (0.04 to 0.16 in).

Insert the temperature controller, back end first, into the panel cutout. Mount the adapter (Y92F-30) supplied with each unit by pushing it forward from the back of the temperature controller. Push the adapter as close as possible to the front panel of the temperature controller to eliminate the gap between them. Then, secure the adapter with screws as shown.

Removal

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



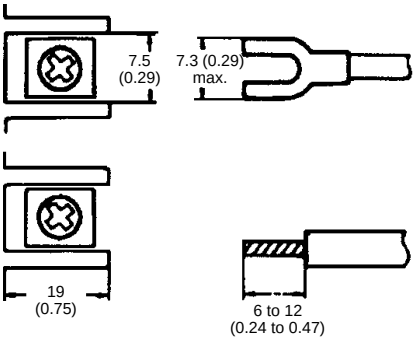


■ CONNECTIONS

Connection Examples

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

For solder-dipped leads, strip the lead wire 6 to 12 mm (0.24 to 0.47 in) and carefully insert the wire tip. Do not tighten the terminal screw with excessive force.



Precautions

■ ENVIRONMENT

Do not install the temperature controller in a location where there is a lot of dust or corrosive gases. Also avoid a location where the temperature controller is subjected to heavy vibration, shock, splashes of water or oil, and high temperatures.
Separate the temperature controller from equipment that generates strong, high-frequency electrical noise such as welding equipment.

Sensor Input Connections

The lead wires connecting the platinum RTD to the temperature controller must be separated from the power lines an the load lines, wherever possible, to prevent them from being inducted by electrical noise.

Use the specified compensating conductors for the thermocouple input type temperature controllers.

c:/H032E12A

Use lead wires having a small resistance for the platinum RTD type temperature controllers.

Sequence Circuit

Several seconds are required until the relay is turned ON after the power has been applied to the temperature controller. Be sure to take this time lag into consideration when designing a sequence circuit which incorporates this temperature controller.

■ RECALIBRATION

The E5CS-X temperature controller can be recalibrated by a factory-authorized repair service. Contact Omron for the location near you.

Unauthorized recalibration of the controller will void the warranty and may lead to erratic
operation.

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Cat. No. GCTC13 8/00 Specifications subject to change without notice. Printed in U.S.A.