

Series EHG SL10 Integrated Temperature Controller User's Guide

The Series EHG SL10 is a powerful instrument that integrates a temperature process controller, high-low temperature alert, and power switching with a safety high limit that meets UL® 1998 and CE 60730 requirements. The optional display and communications modules can be easily upgraded in the field to provide a digital display, adjustable control parameters, RS-485 MODBUS communications and other interface features. The compact design, inherent reliability and integrated safety limit functions make this control a tremendous value. The control is designed for easy integration with Watlow heaters providing additional value to simplify the engineering and component count on new equipment. CE compliance and UL recognition will reduce time and costs necessary for global agency testing and validation for OEMs.



Features

Standard Base Module

- Two, type K thermocouple inputs: process temperature controller and safety limit
- Process temperature output: 10 amp “NO ARC” relay
- Safety limit: 10 amp relay
- High-low temperature alert: 2 amp, 30V≈(ac/dc), Form A relay
- On-off and PID temperature control algorithm: Upgraded via communications to PID algorithm (minimum cycle time 5 seconds)



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Integrated Temperature Control

- Standard Molex Connectors
- Dimensions

Configuration	Width	Depth	Height
basic unit	88.8 mm (3.496 in)	40.2 mm (1.582 in)	55.8 mm (2.196 in)
with mounting bracket	88.8 mm (3.496 in)	48.4 mm (1.907 in)	55.8 mm (2.196 in)
with communications-display module & mounting bracket	88.8 mm (3.496 in)	63.6 mm (2.503)	55.8 mm (2.196 in)

Optional Communications Module

- Field adjustable set point
- Access to PID parameters
- Modbus RTU Communications
- RS-485
- 3-character, 7-segment LED display
- User Interface Software

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Patent Pending

Navigating the Series EHG SL10 with the Front Panel

The three-character display normally shows the process temperature. To view and change the existing Set Point value follow the steps below:

1. Press the Mode Key once. The right decimal point will illuminate when viewing the Set Point value.
2. Press the Up-Arrow or Down-Arrow Key to change the Set Point.
3. Press the Mode Key again to return to the process temperature display.

The display will automatically return to showing the process temperature after three seconds.

To view or change parameter values follow the steps below:

1. Hold down both the Up-Arrow and Down-Arrow Keys for five seconds.

This will display the Set Point High Limit prompt.

2. Press the Mode Key to view the other parameter prompts.
3. Press the Up-Arrow or Down-Arrow Key once to view a parameter's value.
4. Press the Up-Arrow or Down-Arrow Key to increase or decrease that value.
5. Press the Mode Key to again display the prompt and again to display the next prompt.
6. Press the Mode Key at the Display Build Number prompt to return to the process value display.

Display	Parameter Name & Description	Range	Default	Modbus Relative Address	Data Type & Read/ Write
Numeric	Process Value Controller View the present Process Value.	-18 to 400°C (0 to 752°F) EHG2-CNTL-0000 -18 to 537°C (0 to 999°F) EHG2-EXTR-0000	20°C (68°F)	20	unsigned integer R
Numeric	Closed Loop Set Point Set the set point that the controller will automatically control to.	0°C (32°F) to SLA setting	150°C (302°F)	34	unsigned integer RWE
No Display	Heat Output Power Read (via Modbus communications) the present heat output power level.	0 to 100%	0	22	unsigned integer R
No Display	Alert Status Read (via Modbus communications) the present alert status.	Alert Low (7) Alert High (8) Alert None (6)	Alert None	31	unsigned integer R
No Display	Process Comparison Value Set or read (via Modbus communications) the Process Comparison Value.	5 to 30°C (9 to 54°F) EHG2-CNTL-0000 5 to 50°C (9 to 90°F) EHG2-EXTR-0000	20°C (68°F)	68	unsigned integer RWE
No Display	Limit Status Read (via Modbus communications) the present condition of the limit.	Bit 5 (0x0020) 0 = Not tripped (process value below limit high set point) 1 = Tripped (process value exceeds limit high set point)	0	63	unsigned integer R
No Display	Controller Sensor Status Read (via Modbus communications) the present status of the controller sensor.	Bit 2 (0x0004) 0 = Good 1 = Failure	0	23	unsigned integer R
No Display	Limit Sensor Value View the present value of the limit sensor.	-18 to 400°C (0 to 752°F) EHG2-CNTL-0000 -18 to 537°C (0 to 999°F) EHG2-EXTR-0000	20°C (68°F)	60	unsigned integer R
[SLA] [SLA]	Limit High Set Point Set the high process value that will trigger the limit.	0 to 220°C (32 to 428°F) EHG2-CNTL-0000 0 to 438°C (32 to 820°F) EHG2-EXTR-0000	200°C (392°F)	33	unsigned integer RWE
Note: All values above 999 will be rounded off to fit in the three-character display. Full values can be read with other interfaces.					R: Read W: Write E: EEPROM
Note: The EHG SL10 does not support Modbus function code 16 (0x10) Write Multiple Registers. Parameter values must be written individually with function code 6 (0x06) Write Single Registers.					

Display	Parameter Name & Description	Range	Default	Modbus Relative Address	Data Type & Read/Write
[HtA] [HtA]	High Temperature Alert Value The High Temperature Alert occurs when the process variable exceeds the set point by more than the value set here.	1 to 99°C (2 to 178°F)	20°C (36°F)	35	unsigned integer RWE
[LtA] [LtA]	Low Temperature Alert Value The Low Temperature Alert occurs when the process variable is below the set point by more than the value set here.	5 to 99°C (9 to 178°F)	20°C (36°F)	36	unsigned integer RWE
[Cnt] [Cnt]	Control Mode Select Select a control method.	[onF] On-Off (2) [PID] PID (3)	on-off	42	unsigned integer RWE
[HyS] [HyS]	On-Off Hysteresis Set the how far below the set point the temperature can drop before the heater turns on.	3 to 28°C (5 to 50°F)	3°C (6°F)	41	unsigned integer RWE
[Pb] [Pb]	Proportional Band Set the proportional band in temperature units.	0 to 68°C (0 to 122°F)	0°C or 0°F	37	signed integer RWE
[Int] [Int]	Integral Set the integral value in minutes per repeat.	0 to 999	0	38	signed integer RWE
[dEv] [dEv]	Derivative Set the derivative value in minutes.	0 to 999	0	39	signed integer RWE
[Ct] [Ct]	Cycle Time Set the cycle time in seconds.	5 to 60	10	40	unsigned integer RWE
[Abt] [Abt]	Ambient Temperature View the ambient temperature.	0 to 106°C (0 to 190°F)	43°C (77°F)	24	unsigned integer R
[Adr] [Adr]	Modbus Device Address View and or change the present Modbus address.	1 to 247	1	15	unsigned integer RWE
[bAU] [bAU]	Modbus Baud Rate Select the communication speed.	[96] 9,600 (15) [192] 19,200 (16) [384] 38,400 (17)	9,600	16	unsigned integer RWE
[tU] [tU]	Temperature Units Select the temperature scale.	[F] °F (4) [C] °C (5)	°C	17	unsigned integer RWE
[rPP] [rPP]	Restore Programmed Parameters Restore factory default settings.	[YES] Yes [no] No	No	----	----
[brv] [brv]	Base Release Version View the controller's base release version.	0 to 9999	----	48	unsigned integer R
[bPv] [bPv]	Base Prototype Version View the controller's base prototype version.	0 to 9999	----	49	unsigned integer R
[bbu] [bbu]	Base Build Version View the controller's base build number.	0 to 9999	----	50	unsigned integer R
Note: All values above 999 will be rounded off to fit in the three-character display. Full values can be read with other interfaces. Note: The EHG SL10 does not support Modbus function code 16 (0x10) Write Multiple Registers. Parameter values must be written individually with function code 6 (0x06) Write Single Registers.					R: Read W: Write E: EEPROM

Display	Parameter Name & Description	Range	Default	Modbus Relative Address	Data Type & Read/Write
dru [drv]	Display Release Version View the interface's release version.	0 to 9999	----	11	unsigned integer R
dPu [dPv]	Display Prototype Version View the interface's prototype version.	0 to 9999	----	12	unsigned integer R
dbu [dbv]	Display Build Version View the interface's build number.	0 to 9999	----	13	unsigned integer R
Note: All values above 999 will be rounded off to fit in the three-character display. Full values can be read with other interfaces. Note: The EHG SL10 does not support Modbus function code 16 (0x10) Write Multiple Registers. Parameter values must be written individually with function code 6 (0x06) Write Single Registers.					R: Read W: Write E: EEPROM

Keys and Indicator Lights

Optional Communications Connectors

Alert (flashing red)
Indicates that the process temperature is higher than the Limit High Set Point.

Alert (solid red)
Indicates that the process temperature is higher than the Closed Loop Set Point plus the High Temperature Alert Value.

In Range (solid yellow)
Indicates that the process temperature is in the normal operating range (see figure at right).

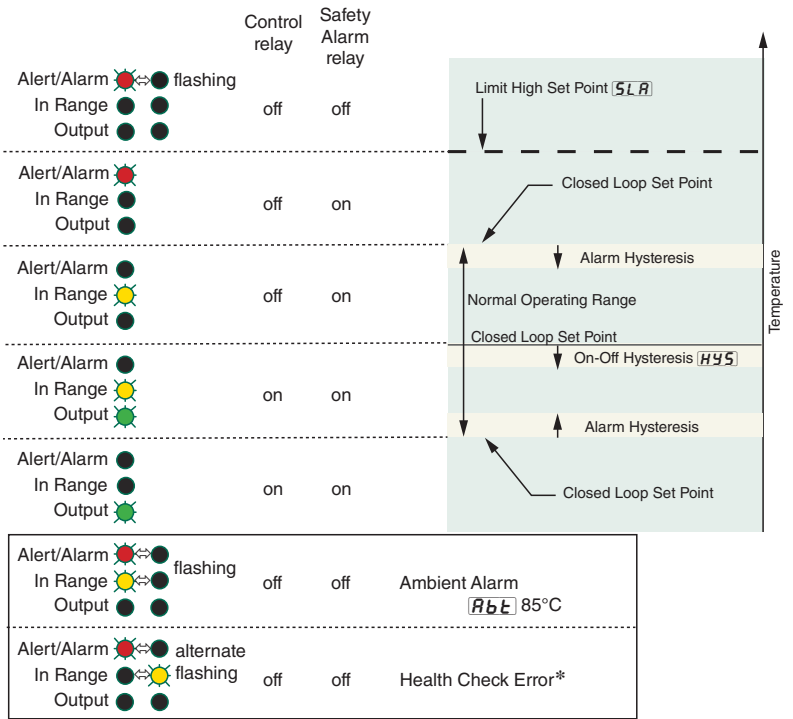
Output (green)
Indicates that the output is on.

Up-Arrow Key
Increases the displayed value.

Mode Key
Toggles the display between the set point and process temperature. Enters edited values and advances to the next prompt.

Down-Arrow Key
Decreases the displayed value.

Flashing Alert/Alarm (red) and In Range (yellow)
If they are flashing together, that indicates an Ambient Alarm (controller temperature higher than 85°C).
If they are flashing alternately, that indicates a Health Check Error.



*The two most likely causes of Health Check Error: Process Comparison and starting with version 5.00.1, the Health Check Error occurs when the thermocouple is broken or disconnected.

EHG SL10 Error Codes			
Display	Description	Possible Cause	Corrective Action
Flashing 888	Limit error	Sensor has exceeded SLA value or open thermocouple	<ul style="list-style-type: none"> Set SLA to correct Safety Limit Value Check wiring of sensor Check sensor configuration
Flashing 888	Control error	Sensor has exceeded SLA value or open thermocouple	<ul style="list-style-type: none"> Set SLA to correct Safety Limit Value Check wiring of sensor Check sensor configuration
Er3	Limit Sensor Error	Limit sensor reading out of range (< -13 or > 640)	<ul style="list-style-type: none"> Check wiring of sensor Check sensor configuration

EHG SL10 Error Codes (cont.)			
E-4	Control Sensor Error	Control sensor reading out of range (<-13 or > 640)	<ul style="list-style-type: none"> • Check wiring of sensor • Check sensor configuration
E-5	Limit Ambient Error	Temperature at limit sensor cold junction (> 185 degrees)	<ul style="list-style-type: none"> • Check to be certain the EHG SL10 is not in an ambient condition greater than 185 degrees C
E-6	Control Ambient Error	Temperature at control cold junction (> 185 degrees)	<ul style="list-style-type: none"> • Check to be certain the EHG SL10 is not in an ambient condition greater than 185 degrees C
E-9	HMI Communications Fault	Loss of communication between base and display communications module. Check if EHG2-MODU Display module is being used with EHG2-EXTR Base. These are not compatible and will generate this error. See Also E20.	<ul style="list-style-type: none"> • Check connection between EHG SL10 and display/communications module
Alh	Alarm High	Process temp exceeds set point by value greater than alarm high setting	<ul style="list-style-type: none"> • Set HTA value to correct high temperature alert value
ALo	Alarm Low	Process temp below set point by value greater than alarm low setting	<ul style="list-style-type: none"> • Set LTA value to correct Low temperature alert value
E91	Communications Queue Full	Communications buffer overflow	<ul style="list-style-type: none"> • Contact Technical Support at 1-507-494-5656
E10	EEPROM Error	EEPROM memory space fails CRC check (checksum for parameter space)	<ul style="list-style-type: none"> • Contact Technical Support at 1-507-494-5656
E11	CRC Error	Flash memory space fails CRC check (checksum for program space)	<ul style="list-style-type: none"> • Contact Technical Support at 1-507-494-5656
E12	CPU Clock Error	Clock frequency is < 5 MHz or > 13.1 MHz	<ul style="list-style-type: none"> • Contact Technical Support at 1-507-494-5656
E13	Stack Overflow	Stack has overflowed	<ul style="list-style-type: none"> • Contact Technical Support at 1-507-494-5656
E15	AI Function Error	Analog reference is < 1.82 or > 2.06 volts	<ul style="list-style-type: none"> • Contact Technical Support at 1-507-494-5656
E16	Process Comparison Error	Limit and control sensor readings differ by value greater than process comparison value	<ul style="list-style-type: none"> • Check setting of Proces Comparison Value • Set Process Comparison Value to correct value • Check wiring of sensors
E17	Data Store Error	Data store functions are not set up	<ul style="list-style-type: none"> • Check setting of Proces Comparison Value • Check wiring of sensors
E20	Base control firmware ID not supported	Base control firmware is not compatible with Display Module firmware	<ul style="list-style-type: none"> • Check firmware compatibility between Base Control and Display Module. Revision 1.0 through 19.0 for Base Control and Display Module are compatible for model EHG2-CNTL-0000. Revision 20.0 and greater for Base Control and Display Module are compatible for EHG2-EXTR-0000.

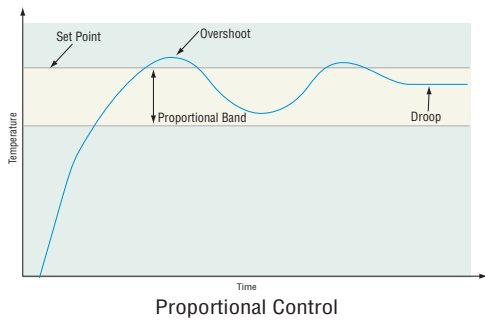
Proportional Control

Some processes need to maintain a temperature or process value closer to the set point than on-off control can provide. Proportional control provides closer control by adjusting the output when the temperature or process value is within a proportional band. When the value is in the band, the controller adjusts the output based on how close the process value is to the set point.

The closer the process value is to the set point, the lower the output power. This is similar to backing off on the gas pedal of a car as you approach a stop sign. It keeps the temperature or process value from swinging as widely as it would with simple on-off control. However, when the system settles down, the temperature or process value tends to “droop” short of the set point.

With proportional control the output power level equals (set point minus process value) divided by the proportional band value.

Adjust the proportional band with Proportional **Pb**.



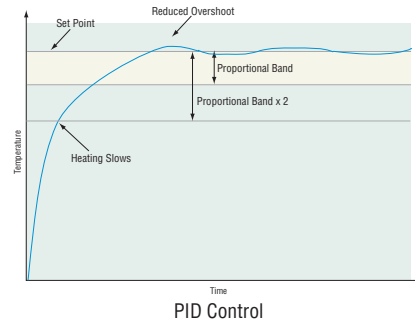
Proportional plus Integral (PI) Control

The droop caused by proportional control can be corrected by adding integral control. When the system settles down, the integral value is tuned to bring the temperature or process value closer to the set point. Integral determines the speed of the correction, but this may increase the overshoot at startup or when the set point is changed. Too much integral action will make the system unstable. Integral is cleared when the process value is outside of the proportional band.

Integral **Int** is measured in minutes per repeat. A low integral value causes a fast integrating action.

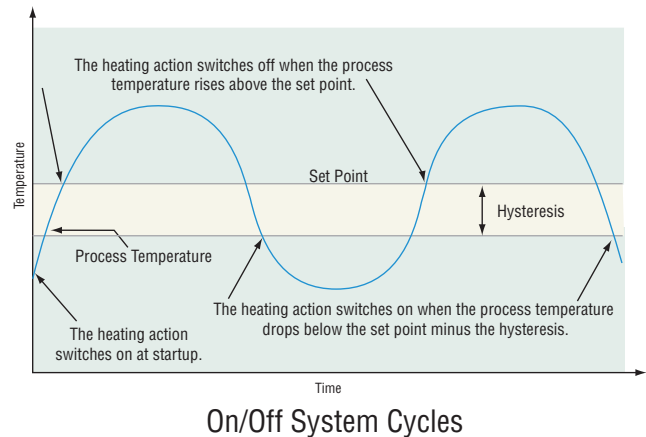
Proportional plus Integral plus Derivative (PID) Control

Use derivative control to minimize the overshoot in a PI-controlled system. Derivative **dEu** adjusts the output based on the rate of change in the temperature or process value. Too much derivative will make the system sluggish.

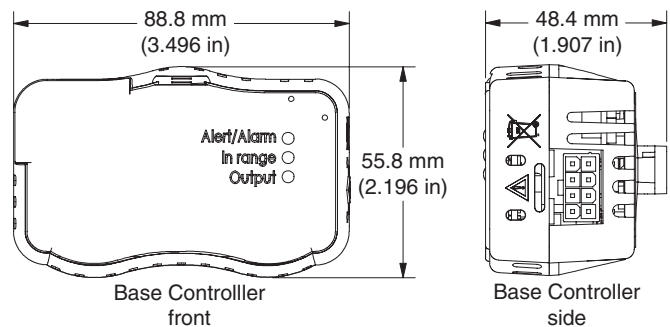


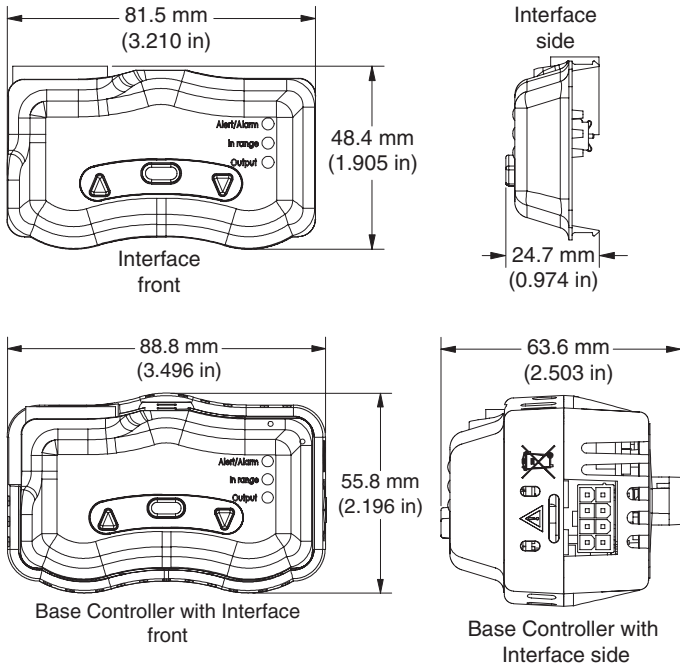
On-Off Control

On-off control switches the output either full on or full off, depending on the input, set point and hysteresis values. The hysteresis value indicates the amount the process value must deviate from the set point to turn on the output. Increasing the value decreases the number of times the output will cycle. Decreasing hysteresis improves controllability. With hysteresis set to the lowest value of 3°C or 5°F, the process value would stay closer to the set point, but the output would switch on and off more frequently, and may result in the output “chattering.” Both the control mode (**Cont** prompt) and hysteresis (**HYS** prompt) values can be changed either using the front panel or via Modbus communications.

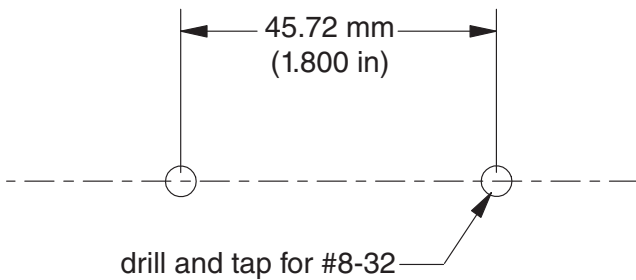


Mounting the Series EHG SL10

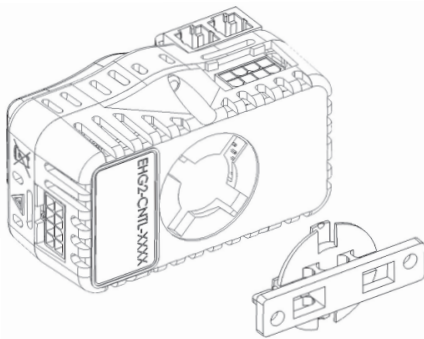




Panel Mount Dimensions



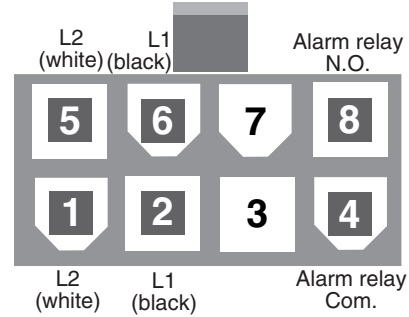
Mounting Bracket



The Series EHG SL10 mounting bracket lets you mount the controller in any of four angles. After disconnecting both wiring connectors, gently rotate the controller counterclockwise until it unlocks from the mounting bracket. Re-orient the controller on the mounting bracket and gently rotate it clockwise until it locks.

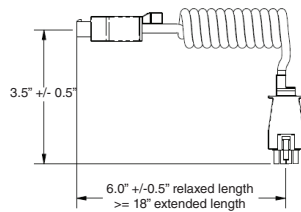
Wiring the Series EHG SL10 Power, Thermocouple and Heater Connections

View looking at the top of the controller.

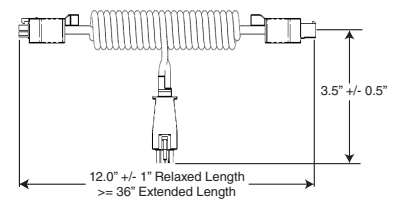


Power and relay connectors

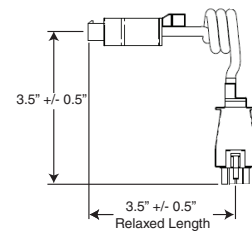
Control Power Cord Coiled, Terminated Long
Part Number: 4800-0022



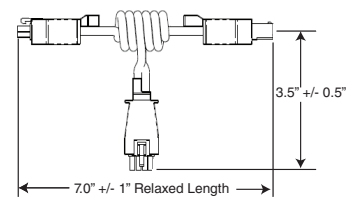
Control Power Cord Coiled, Jumpered Long
Part Number: 4800-0012



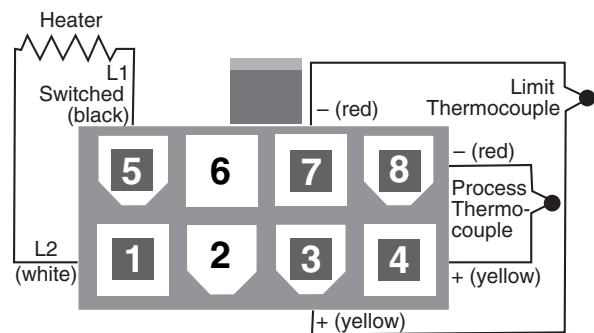
Control Power Cord Coiled, Terminated Short
Part Number: 4800-0021



Control Power Cord Coiled, Jumpered Short
Part Number: 4800-0011



With the control facing you this connector is on the right side.



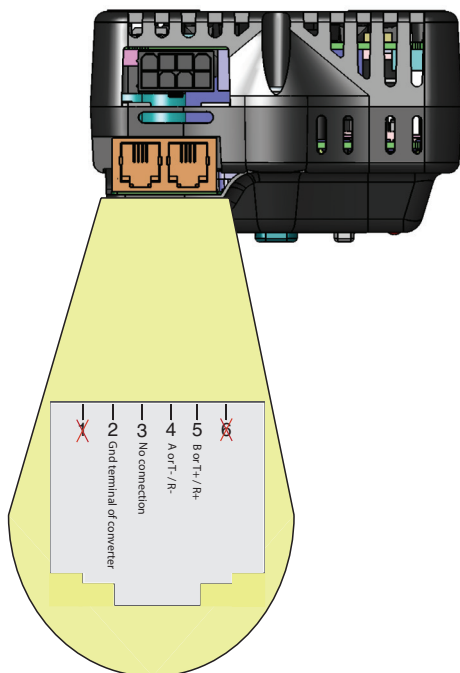
Thermocouple and heater connector

Wiring the Series EHG SL10 Communications Ports

The graphic below reflects the control being held upright with the display facing the holder. As shown, there are two jacks on the top of the communications module (RJ45 like, with 4 pins on each) which can accommodate either a four or six pin modular plug. Communications from a PC to any EHG SL10 controller on the network can be established by connecting it to either of the two available jacks. The other jack can then be connected to other EHG SL10 controllers on the network (32 maximum).

Looking at either of the jacks as shown in the graphic pin identification is from left to right.

- Left most pin, connects to ground terminal of converter
- Second pin from left, no connection
- Third pin from left, connects to converter A or T- / R-
- Right most pin connects to converter B or T+ / R+



Specifications

Power

- Isolated Universal Power Supply: 85 to 264V~ (ac) 50/60Hz
- Up to 2400 W with 10A switching capability

NO-ARC Relay

- 10A switching
- 4.5 million cycles

Environmental

- Ambient operating temperature range 0 to 70 °C (32 to 158 °F)

Agency Approvals

- UL® 1998/C-UL®
- CE 60730
- SEMI-S2

Agency Compliance

<https://www.watlow.com/Resources-and-Support/Additional-Support/Agency-Approvals> Search keyword: "SL10"

Ordering Information

Series EHG SL10 Integrated Temperature Controller

EHG2-EXTR-____ 0 to 438°C (32 to 820°F)

EHG2- CNTL-____ 0 to 200°C (32 to 428°F)

0000 basic control (purchased only as part of a heater assembly)

EHG2- MODU-____

DISP with display module

COMS with communications module

DSCM with display & communications module

Additional Power Cables

4800-0012: jumpered long cable

4800-0022: terminated long cable

4800-0011: jumpered short cable

4800-0021: terminated short cable

Warranty

The EHG SL10 controller is warranted by Watlow in accordance with the terms and conditions set forth on Watlow's website at www.watlow.com/terms.

WARNING: To avoid damage to property and equipment, and/or injury or loss of life, use National Electric Code (NEC) standard wiring practices to install and operate the Series EHG SL10. Failure to do so could result in such damage, and/or injury or death.

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