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, 30V1 (ac/dc), Form A relay
- On-off and PID temperature control algorithm: Upgraded via communications to PID algorithm (minimum cycle time 5 seconds)

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 communicatons-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

0600-0050-0000 Rev. D
February 2011

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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.

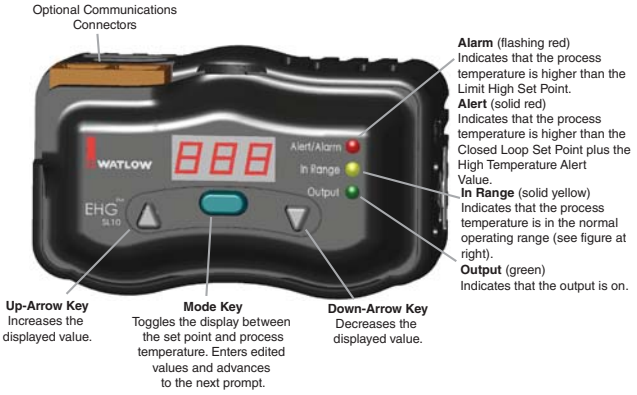
2. Press the Mode Key to view the other parameter prompts.
3. Press the Up-Arrow or Down-Arrow Key once to view a parameter's value.
4. Press the Up-Arrow or Down-Arrow Key to increase or decrease that value.
5. Press the Mode Key to again display the prompt and again to display the next prompt.
6. Press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

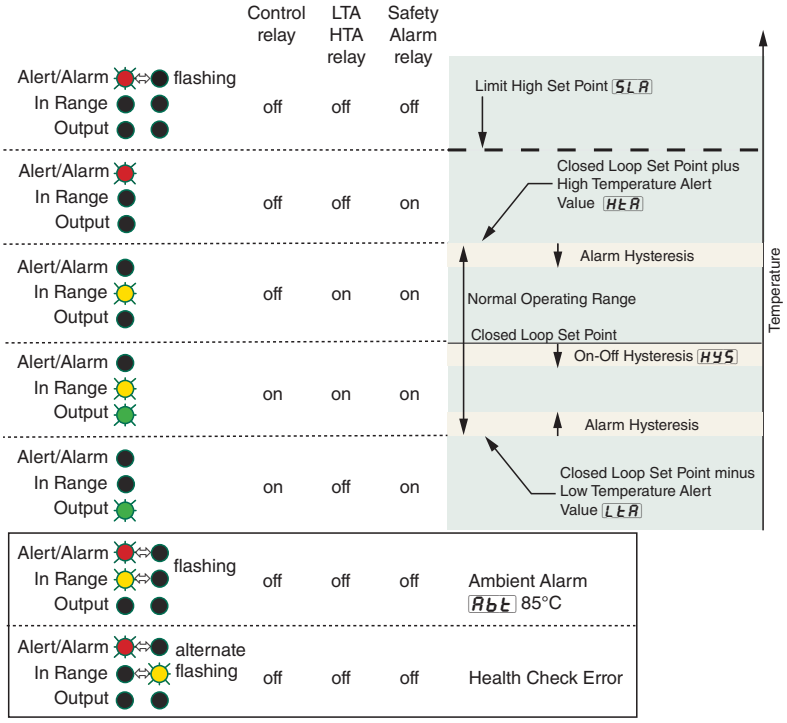
Display	Parameter Name & Description	Range	Default	Modbus Relative Address	Data Type & Read/ Write
Numeric	**Process Value Controller** View the present Process Value.	-18 to 400°C (0 to 752°F)	20°C (68°F)	20	unsigned integer R
Numeric	**Closed Loop Set Point** Set the set point that the controller will automatically control to.	0°C (32°F) to Set Point High Limit	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)	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)	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)	200°C (392°F)	43	unsigned integer RWE
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
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
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
drv [drv]	**Display Release Version** View the interface's release version.	0 to 9999	- - - -	11	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
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





EHG SL10 Error Codes			
Display	**Description**	**Possible Cause**	**Corrective Action**
SL 1	Limit error	Sensor has exceeded SLA value or open thermocouple	• Set SLA to correct Safety Limit Value • Check wiring of sensor • Check sensor configuration
SL2	Control error	Sensor has exceeded SLA value or open thermocouple	• 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)	• Check wiring of sensor • Check sensor configuration
Er4	Control Sensor Error	Control sensor reading out of range (<-13 or > 640)	• Check wiring of sensor • Check sensor configuration
Er5	Limit Ambient Error	Temperature at limit sensor cold junction (> 185 degrees)	• Check to be certain the EHG SL10 is not in an ambient condition greater than 185 degrees C
Er6	Control Ambient Error	Temperature at control cold junction (> 185 degrees)	• Check to be certain the EHG SL10 is not in an ambient condition greater than 185 degrees C
Er9	HMI Communications Fault	Loss of communication between base and display communications module	• Check connection between EHG SL10 and display/communications module
Ah 1	Alarm High	Process temp exceeds set point by value greater than alarm high setting	• Set HTA value to correct high temperature alert value
ALo	Alarm Low	Process temp below set point by value greater than alarm low setting	• Set LTA value to correct Low temperature alert value
E91	Communications Queue Full	Communications buffer overflow, return to factory	• Contact Technical Support at 1-507-494-5656
E 10	EEPROM Error	EEPROM memory space fails CRC check (checksum for parameter space), return to factory	• Contact Technical Support at 1-507-494-5656
E 11	CRC Error	Flash memory space fails CRC check (checksum for program space), return to factory	• Contact Technical Support at 1-507-494-5656
E 12	CPU Clock Error	Clock frequency is < 5 MHz or > 13.1 MHz, return to factory	• Contact Technical Support at 1-507-494-5656
E 13	Stack Overflow	Stack has overflowed, return to factory	• Contact Technical Support at 1-507-494-5656
E 15	AI Function Error	Analog reference is < 1.82 or > 2.06 volts, return to factory	• Contact Technical Support at 1-507-494-5656
E 16	Process Comparison Error	Limit and control sensor readings differ by value greater than process comparison value	• Check setting of Proces Comparison Value • Set Process Comparison Value to correct value • Check wiring of sensors
E 17	Data Store Error	Data store functions are not set up, return to factory	• Check setting of Proces Comparison Value • Check wiring of sensors

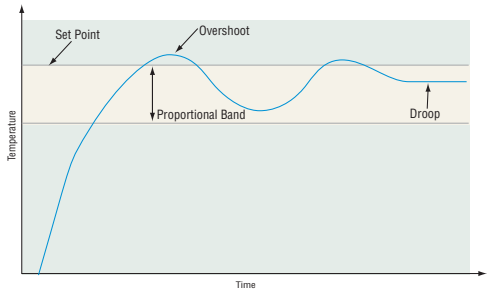
Proportional Control

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 Control

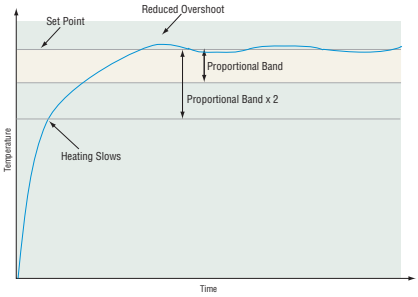
Proportional plus Integral (PI) Control

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

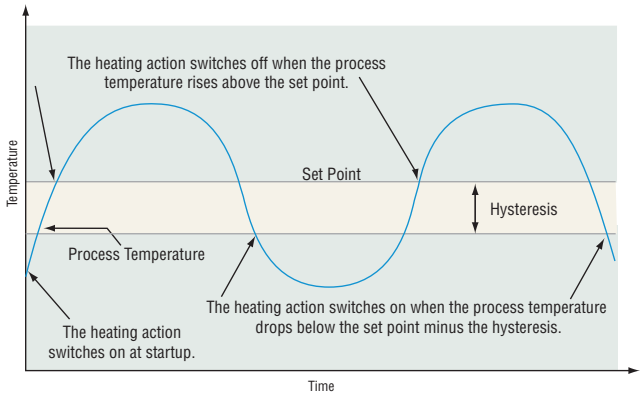
Use derivative control to minimize the overshoot in a PI-controlled system. Derivative [dEu] adjusts the output based on the rate of change in the temperature or process value. Too much derivative will make the system sluggish.



PID Control

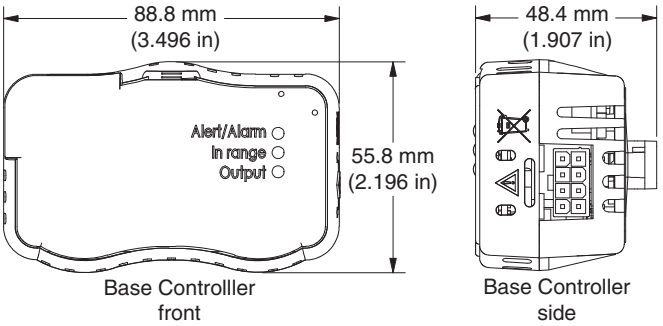
On-Off Control

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 ([Cnt] prompt) and hysteresis ([HYS] prompt) values can be changed either using the front panel or via Modbus communications.



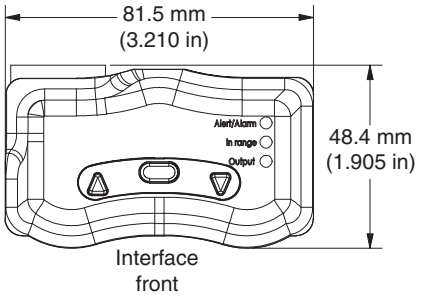
On/Off System Cycles

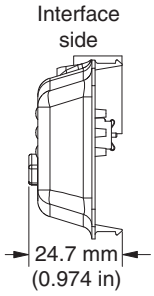
Mounting the Series EHG SL10

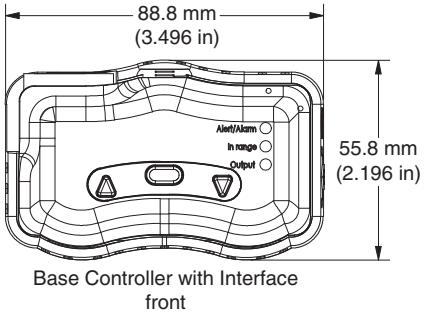


Base Controlller front

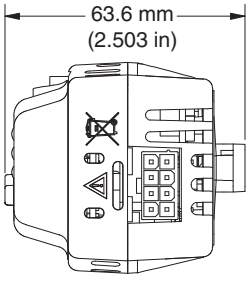
Base Controller side





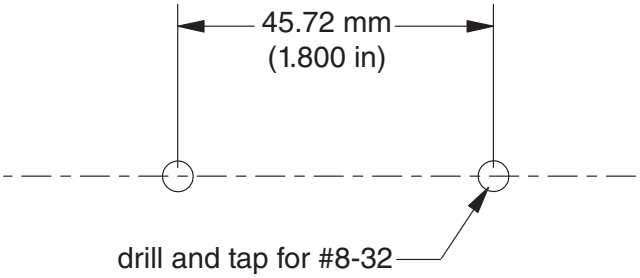


Base Controller with Interface front

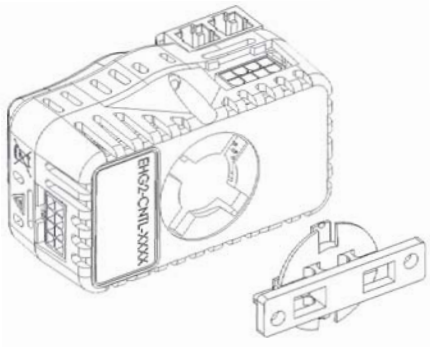


Base Controller with Interface side

Panel Mount Dimensions



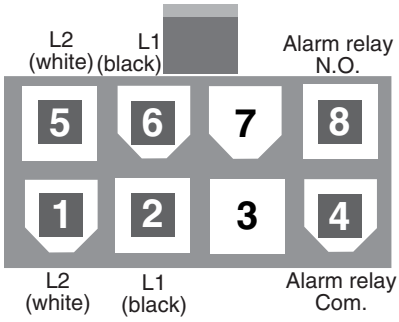
Mounting Bracket



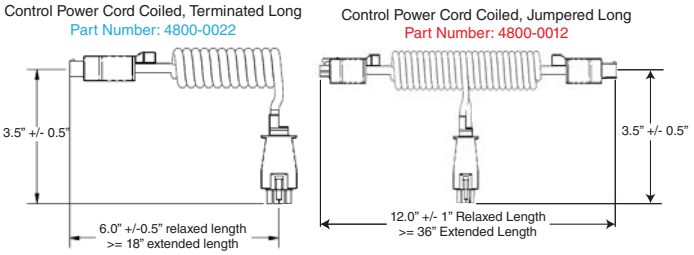
The Series EHG SL10 mounting bracket lets you mount the controller in any of four angles. After disconnecting both wiring connectors, gently rotate the controller counterclockwise until it unlocks from the mounting bracket. Re-orient the controller on the mounting bracket and gently rotate it clockwise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

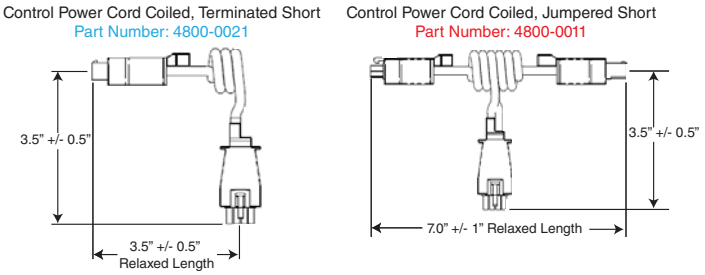
Wiring the Series EHG SL10 Power, Thermocouple and Heater Connections

View looking at the top of the controller.

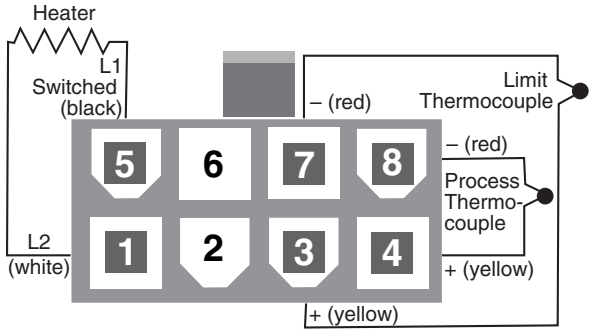


Power and relay connectors





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



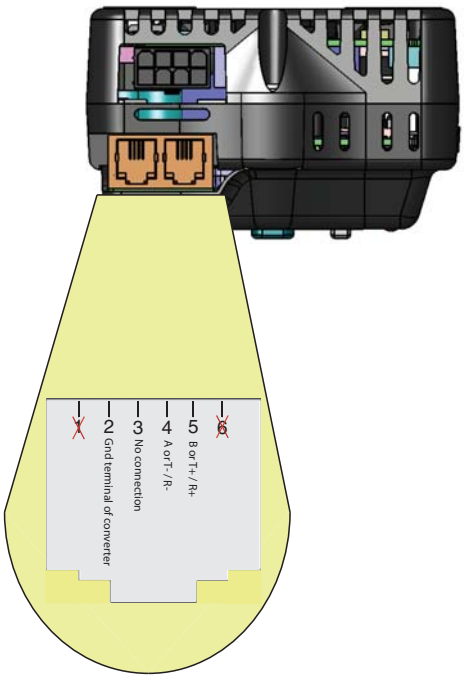
Thermocouple and heater connector

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 6 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

Ordering Information

Series EHG SL10 Integrated Temperature Controller

EHG2- CNTL-_ _ _ _

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

Declaration of Conformity

Series EHG SL10
Watlow Winona, Inc.
1241 Bundy Blvd.
Winona, MN 55987 USA

CE

Declares that the following product:

Designation:	**Series EHG SL10**
Model Numbers:	EHG2-CNTL-(0000, DISP, COMS, DSCM)
Classification:	Electronic Thermostat with Integrated Temperature Limiter Protective Control, Control Relay = 2CK, Limit Relay = 2JK, TA Relay = 2B Installation Category II, Pollution degree 2, Software Class B
Rated Supply Source:	100 to 240 V~ (ac), 50 or 60 Hz
IP Code	IP20
Rated Power:	5 VA Unit power, 10 A Resistive Heater Load

Meets the essential requirements of the following European Union Directives by using the relevant standards show below to indicate compliance.

89/336/EEC Electromagnetic Compatibility Directive

EN 60730-1	2001	+ A1-A4	Automatic electrical controls for household and similar use
EN 60730-2-9	2002	+ A1	- Temperature Sensing Controls, Class B Emissions
EN 61000-4-2	1996	+ A1, A2	Electrostatic Discharge Immunity
EN 61000-4-3	2006		Radiated Field Immunity
EN 61000-4-4	2004		Electrical Fast-Transient / Burst Immunity
EN 61000-4-5	2006		Surge Immunity
EN 61000-4-6	1996	+ A1, A2, A3	Conducted Immunity
EN 61000-4-8	1994	+ A1	Power frequency magnetic field immunity
EN 61000-4-11	2004		Voltage Dips, Short Interruptions and Voltage Variations Immunity
EN 61000-4-28	2000		Variation of power frequency immunity – Level 2
EN 61000-3-2	2006		Harmonic Current Emissions
EN 61000-3-3	2005		Voltage Fluctuations and Flicker
SEMI F47	2000		Specification for Semiconductor Processing Equipment Voltage Sag Immunity – Figure R1-1

2006/95/EC Low-Voltage Directive

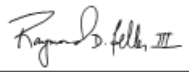
EN 61010-1	2001		Safety Requirements of electrical equipment for measurement, control and laboratory use. Part 1: General requirements
EN 60730-1	2001	+ A1-A4	Automatic electrical controls for household and similar use
EN 60730-2-9	2002	+ A1	- Temperature Sensing Controls
UL 1998		ED.2	Software in programmable components.

Raymond D. Feller III
Name of Authorized Representative

Winona, Minnesota, USA
Place of Issue

General Manager
Title of Authorized Representative

February 2009
Date of Issue



Signature of Authorized Representative

Warranty

The Series EHG SL10 is warranted to be free of defects in material and workmanship for 24 months after delivery to the first purchaser for use, providing that the units have not been misapplied. Since Watlow has no control over their use, and sometimes misuse, we cannot guarantee against failure. Watlow's obligations hereunder, at Watlow's option, are limited to replacement, repair or refund of purchase price, and parts which upon examination prove to be defective within the warranty period specified. This warranty does not apply to damage resulting from transportation, alteration, misuse or abuse.

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.

How to Reach Us

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