Series EHG CL
Integrated Temperature Controller
User's Guide

The Series EHG CL 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
- 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)
Control with mounting bracket	88.8 mm (3.496 in)	48.4 mm (1.907 in)	55.8 mm (2.196 in)
Control with communi-catons-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

Patent Pending

0600-0091-0000 Rev. A
September 2012

Watlow Winona
1241 Bundy Boulevard
Winona, MN 55987
Phone: (507) 454-5300; Fax: (507) 452-4507
http://www.watlow.com

Navigating the Series EHG CL 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 537°C (0 to 999°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 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 50°C (9 to 90°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 537°C (0 to 999°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 438°C (32 to 820°F)	200°C (392°F)	33	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
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 CL 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**

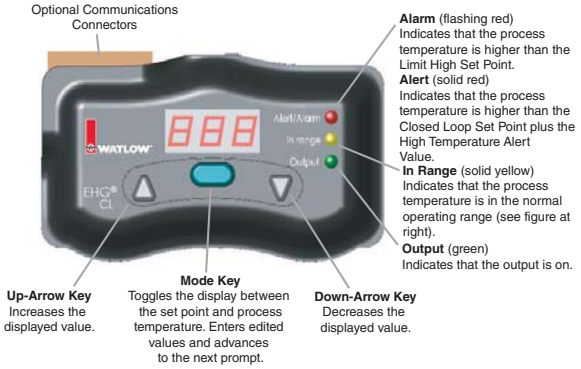
Display	Parameter Name & Description	Range	Default	Modbus Relative Address	Data Type & Read/ Write
HYS [HyS]	**On-Off Hysteresis** Set the how far below the set point the temperature can drop before the heater turns on.	3 to 28°C (5 to 50°F)	3°C (6°F)	41	unsigned integer RWE
Pb [Pb]	**Proportional Band** 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
dPv [dPv]	**Display Prototype Version** View the interface's prototype version.	0 to 9999	- - - -	12	unsigned integer R
dbv [dbv]	**Display Build Version** View the interface's build number.	0 to 9999	- - - -	13	unsigned integer R

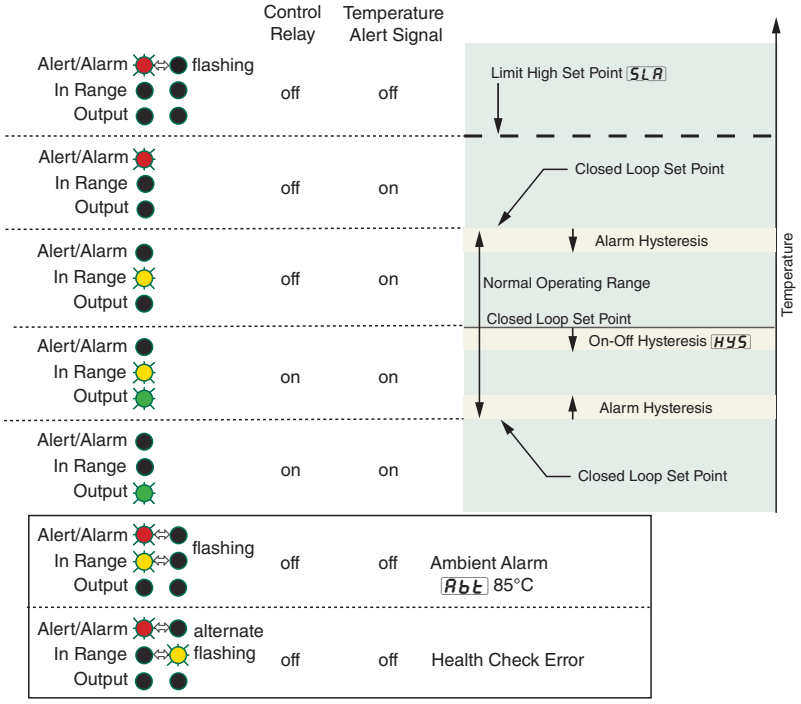
Note:
All values above 999 will be rounded off to fit in the three-character display. Full values can be read with other interfaces.

Note:
The EHG CL 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 CL Error Codes			
Display	**Description**	**Possible Cause**	**Corrective Action**
Flashing 888	Limit error	Sensor has exceeded SLA value or open thermocouple	• 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	• 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 CL 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 CL is not in an ambient condition greater than 185 degrees C
Er9	HMI Communications Fault	Loss of communication between base and display communications module. See Also E20.	• Check connection between EHG CL and display/communications module

EHG CL Error Codes (cont.)			
Display	**Description**	**Possible Cause**	**Corrective Action**
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	• Contact Technical Support at 1-507-494-5656
E10	EEPROM Error	EEPROM memory space fails CRC check (checksum for parameter space)	• Contact Technical Support at 1-507-494-5656
E11	CRC Error	Flash memory space fails CRC check (checksum for program space)	• Contact Technical Support at 1-507-494-5656
E12	CPU Clock Error	Clock frequency is < 5 MHz or > 13.1 MHz	• Contact Technical Support at 1-507-494-5656
E13	Stack Overflow	Stack has overflowed	• Contact Technical Support at 1-507-494-5656
E15	AI Function Error	Analog reference is < 1.82 or > 2.06 volts	• 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	• 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	• Check setting of Process Comparison Value • Check wiring of sensors
E20	Base control firmware ID not supported	Base control firmware is not compatible with Display Module firmware	• Check firmware compatibility between Base Control and Display Module. Revision 20.0 and greater for Base Control and Display Module are compatible for EHG2-AAAA-0000.

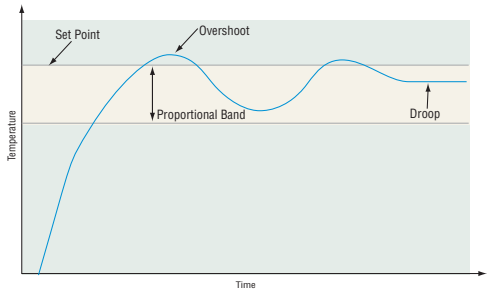
Proportional Control

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 Control

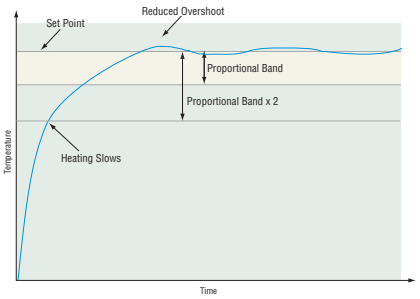
Proportional plus Integral (PI) Control

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

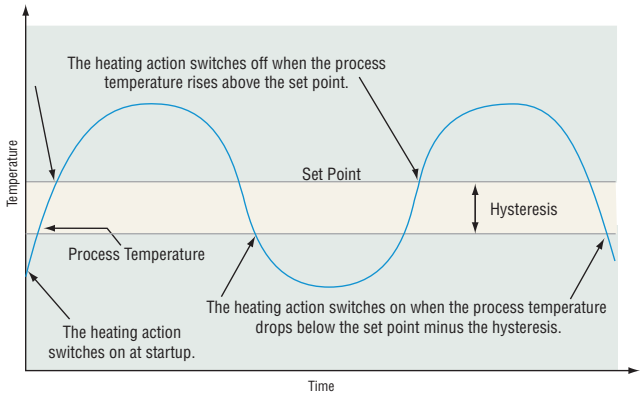
Use derivative control to minimize the overshoot in a PI-controlled system. Derivative [dEu] adjusts the output based on the rate of change in the temperature or process value. Too much derivative will make the system sluggish.



PID Control

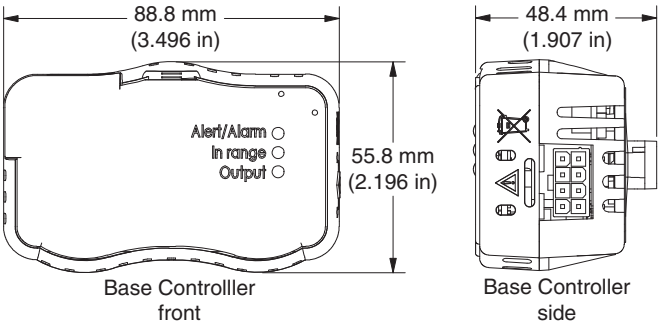
On-Off Control

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.



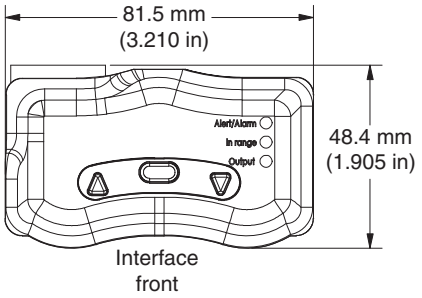
On/Off System Cycles

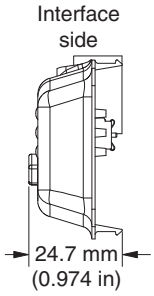
Mounting the Series EHG CL

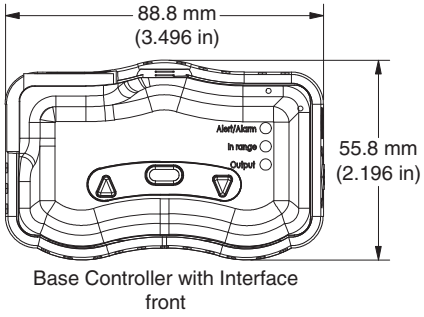


Base Controlller front

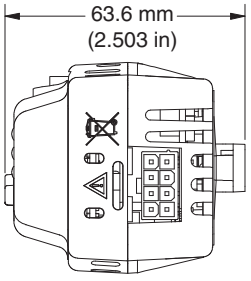
Base Controller side





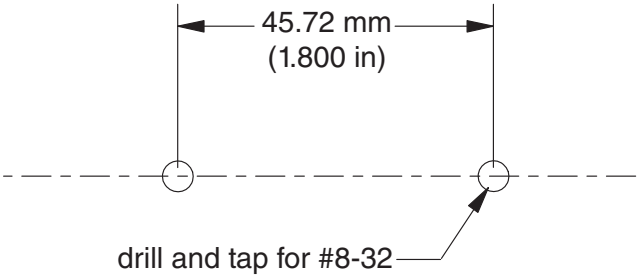


Base Controller with Interface front

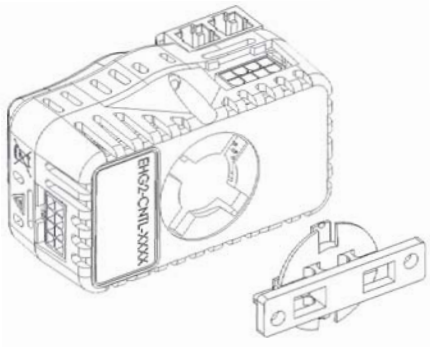


Base Controller with Interface side

Panel Mount Dimensions



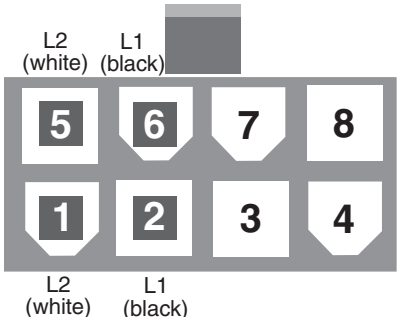
Mounting Bracket



The Series EHG CL 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.

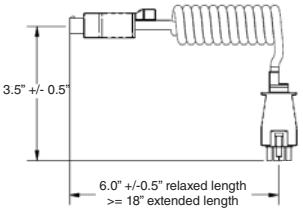
Wiring the Series EHG CL Power, Thermocouple and Heater Connections

View looking at the top of the controller.

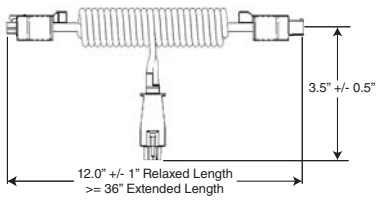


Power and relay connectors

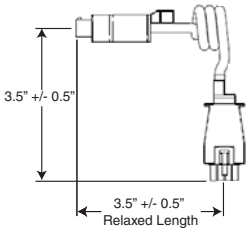
Control Power Cord Coiled, Terminated Long
Part Number: 4800-0022



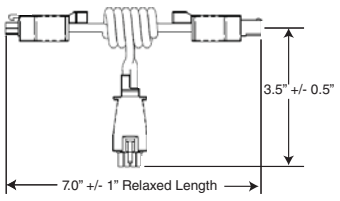
Control Power Cord Coiled, Jumpered Long
Part Number: 4800-0012



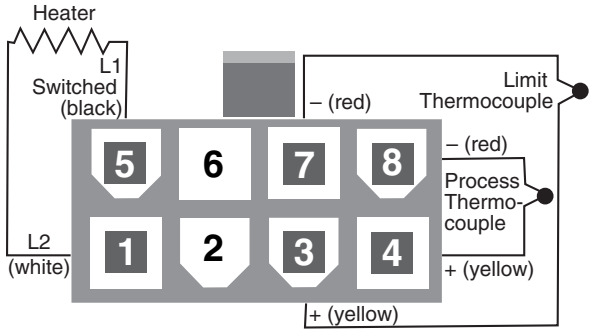
Control Power Cord Coiled, Terminated Short
Part Number: 4800-0021



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



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



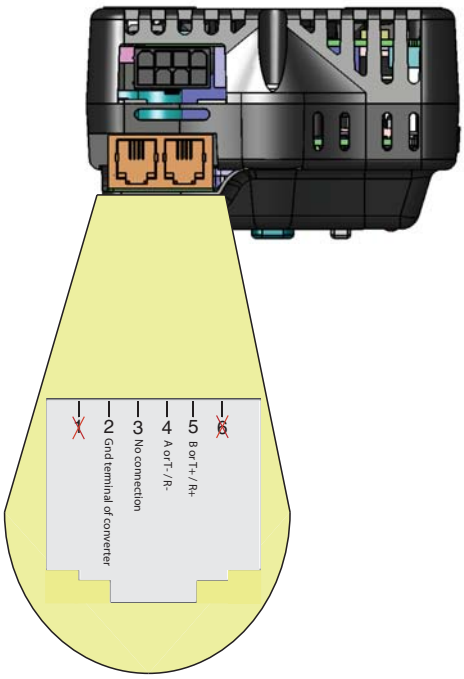
Thermocouple and heater connector

Wiring the Series EHG CL 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 CL 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 CL 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 CL Integrated Temperature Controller

- EHG2-AAAA-_ _ _ _ 0 to 537°C (0 to 999°F)
- Display Module - EHG2-CLOO-COMS
- Communications Module - EHG2-CLOO-COMS
- Display with Communications Module - EHG2-CLOO-DSCM

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 Series EHG CL 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 CL. Failure to do so could result in such damage, and/or injury or death.

Declaration of Conformity

Series EHG® CL

CE

WATLOW

an ISO 9001 approved facility since 1996.

1241 Bundy Blvd.
Winona, MN 55987 USA

Declares that the following product:

Designation:	**Series EHG® CL**
Model Numbers:	EHG2-AAAA- additional number or letters.
Classification:	Electronic Thermostat with Integrated Temperature Limiter Protective Control, Control Relay = 2CK, Limit Relay = 2BJ 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.

2004/108/EC Electromagnetic Compatibility Directive

EN 60730-1	**2010**	**Edition 4**	**Automatic electrical controls for household and similar use**
EN 60730-2-9	**2010**		**– Temperature Sensing Controls, Class B Emissions**
EN 61000-4-2	2008		Electrostatic Discharge Immunity
EN 61000-4-3	2010		Radiated Field Immunity
EN 61000-4-4	2011		Electrical Fast-Transient / Burst Immunity
EN 61000-4-5	2006		Surge Immunity
EN 61000-4-6	2008		Conducted Immunity
EN 61000-4-8	2009		Power frequency magnetic field immunity
EN 61000-4-11	2004		Voltage Dips, Short Interruptions and Voltage Variations Immunity
EN 61000-4-28	2009		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	**2010**	**Edition 3**	**Safety Requirements of electrical equipment for measurement, control and laboratory use. Part 1: General requirements**
EN 60730-1	**2010**	**Edition 4**	**Automatic electrical controls for household and similar use**
EN 60730-2-9	**2011**	**Edition 3.1**	**– Temperature Sensing Controls**
UL 1998	**2008**	**ED.2**	**Software in programmable components.**

Compliant with 2002/95/EC RoHS Directive

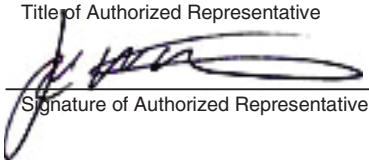
Per 2002/96/EC WEEE Directive  ***Please Recycle Properly***

Joe M. Millanes
Name of Authorized Representative

Winona, Minnesota, USA
Place of Issue

Directory of Operations
Title of Authorized Representative

Sept. 2012
Date of Issue



Signature of Authorized Representative

How to Reach Us

Corporate Headquarters

Watlow Electric Manufacturing Company
12001 Lackland Road
St. Louis, MO 63146
Sales: 1-800-WATLOW2
Manufacturing Support:
1-800-4WATLOW
Email: info@watlow.com
Website: www.watlow.com
From outside the USA and Canada:
Tel: +1 (314) 878-4600
Fax: +1 (314) 878-6814

Latin America

Watlow de México S.A. de C.V.
Av. Fundición No. 5
Col. Parques Industriales
Querétaro, Qro. CP-76130
Mexico
Tel: +52 442 217-6235
Fax: +52 442 217-6403

Europe

Watlow France
Tour d'Asnières.
4 Avenue Laurent Cély
92600 Asnières sur Seine
France
Tél: + 33 (0)1 41 32 79 70
Télécopie: + 33(0)1 47 33 36 57
Email: info@watlow.fr
Website: www.watlow.fr

Watlow GmbH
Postfach 11 65, Lauchwasenstr. 1
D-76709 Kronau
Germany
Tel: +49 (0) 7253 9400-0
Fax: +49 (0) 7253 9400-900
Email: info@watlow.de
Website: www.watlow.de

Watlow Italy S.r.l.
Viale Italia 52/54
20094 Corsico MI
Italy
Tel: +39 024588841
Fax: +39 0245869954
Email: italyinfo@watlow.com
Website: www.watlow.it

Watlow Ibérica, S.L.U.
C/Marte 12, Posterior, Local 9
E-28850 Torrejón de Ardoz
Madrid - Spain
T. +34 91 675 12 92
F. +34 91 648 73 80
Email: info@watlow.es
Website: www.watlow.es

Watlow UK Ltd.
Linby Industrial Estate
Linby, Nottingham, NG15 8AA
United Kingdom
Telephone: (0) 115 964 0777
Fax: (0) 115 964 0071
Email: info@watlow.co.uk
Website: www.watlow.co.uk
From outside The United Kingdom:
Tel: +44 115 964 0777
Fax: +44 115 964 0071

Asia and Pacific

Watlow Singapore Pte Ltd.
16 Ayer Rajah Crescent,
#06-03/04,
Singapore 139965
Tel: +65 6773 9488 Fax: +65 6778 0323
Email: info@watlow.com.sg Website: www.watlow.com.sg

Watlow Australia Pty., Ltd.
4/57 Sharps Road
Tullamarine, VIC 3043
Australia
Tel: +61 3 9335 6449
Fax: +61 3 9330 3566
Website: www.watlow.com

Watlow Electric Manufacturing (Shanghai) Company
1118 Fangyuan Road, Anting Industrial Park, Jiading, Shanghai,
PRC 201203
People's Republic of China
Tel: +86 21 39509510
Fax: +86 21 5080-0906
Email: info@watlow.cn
Website: www.watlow.cn

ワトロー・ジャパン株式会社
〒101-0047 東京都千代田区内神田1-14-4
四国ビル別館9階
Tel: 03-3518-6630 Fax: 03-3518-6632
Email: infoj@watlow.com Website: www.watlow.co.jp

Watlow Japan Ltd.
1-14-4 Uchikanda, Chiyoda-Ku
Tokyo 101-0047
Japan
Tel: +81-3-3518-6630 Fax: +81-3-3518-6632
Email: infoj@watlow.com Website: www.watlow.co.jp

Watlow Korea Co., Ltd.
#1406, E&C Dream Tower, 46, Yangpyeongdong-3ga
Yeongdeungpo-gu, Seoul 150-103
Republic of Korea
Tel: +82 (2) 2628-5770 Fax: +82 (2) 2628-5771
Website: www.watlow.co.kr

Watlow Malaysia Sdn Bhd
No. 14-3 Jalan 2/114
Kuchai Business Centre
Jalan Kuchai Lama
58200 Kuala Lumpur
Malaysia
Tel: +60 3 7980 7741 Fax: +60 3 7980 7739

瓦特龍電機股份有限公司
80143 高雄市前金區七賢二路189號 10樓之一
電話: 07-2885168 傳真: 07-2885568

Watlow Electric Taiwan Corporation
10F-1 No.189 Chi-Shen 2nd Road Kaohsiung 80143
Taiwan
Tel: +886-7-2885168 Fax: +886-7-2885568

Your Authorized Watlow Distributor

TOTAL CUSTOMER SATISFACTION
3 Year Warranty