

## How to Reach Us

To be automatically connected to the nearest North American Technical and Sales Office call:

**1-800-WATLOW2**

International Technical and Sales Offices:

**Australia** +61-3-9335-6449  
**China** +86-21-3950-9510  
**France** +33 (01) 3073-2425  
**Germany** +49 (0) 7253-9400-0  
**Italy** +39 (02) 458-8841  
**Japan** +81-3-3518-6630  
**Korea** +82-2-575-9804  
**Malaysia** +60-3-7980-7741  
**Mexico** +52 (442) 217-6235  
**Singapore** +65-6777-1266  
**Spain** +34 916 751 292  
**Sweden** +46 35-27-11-66  
**Taiwan** +886-7-288-5168  
**United Kingdom** +44 (0) 115-964-0777

Your Authorized Watlow Distributor:

For other product information:

Watlow FAX REPLY: +1 (732) 885-6344, outside the U.S.; or +1 (800) 367-0430, inside the U.S.

## About Watlow

Watlow Electric Mfg. Co., has been manufacturing industrial electric heating products since 1922 and is located in St. Louis, Missouri. Watlow products include electric heaters, sensors, controllers and switching devices. Watlow's facility in Winona, Minnesota has been designing solid-state electronic control devices since 1962, and has earned the reputation as an excellent supplier to original equipment manufacturers. These OEMs and end users depend upon Watlow to provide compatibly engineered controls that they can incorporate into their products with confidence. The controls operation resides in a 100,000-square-foot marketing, engineering and manufacturing facility in Winona, Minnesota.

## Warranty

The Watlow ESAFE® II Hybrid Power Switch 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.

## Returns

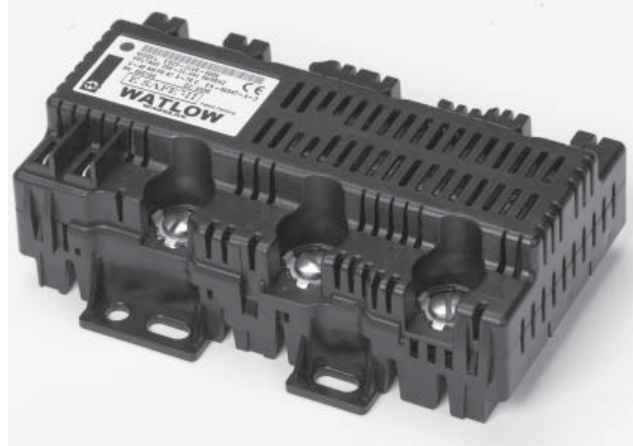
- Call or fax your distributor or the nearest Watlow sales office for best information about returns. (See outside back cover.)
- To return directly to Watlow in the U.S., first call or fax Customer Service for a Return Material Authorization (RMA) number (telephone: +1 (507) 454-5300; fax: +1 (507) 452-4507).
- Put the RMA number on the shipping label, along with on a written description of the problem.
- A restocking charge of 20% of the net price is charged for all standard units returned to stock.

## Quality and Mission Statement:

*Watlow will be the world's best supplier of superior thermal solutions by exceeding the expectations of our customers, shareholders, and employees.*

# E-SAFE® II Hybrid Power Switch

## User's Manual



1241 Bundy Boulevard, Winona, Minnesota USA 55987-5580

Phone: +1 (507) 454-5300 Fax: +1 (507) 452-4507

Internet: <http://www.watlow.com>

English

0600-0055-0001 Rev A (2007)

May 2007

Multiple U.S. and international patents pending.

## Safety Information

We use note, caution and warning symbols throughout this book to draw your attention to important operational and safety information.





**CAUTION or WARNING**

A "NOTE" marks a short message to alert you to an important detail.

A "CAUTION" safety alert appears with information that is important for protecting your equipment and performance. Be especially careful to read and follow all cautions that apply to your application.

A "WARNING" safety alert appears with information that is important for protecting you, others and equipment from damage. Pay very close attention to all warnings that apply to your application.

The safety alert symbol,  (an exclamation point in a triangle) precedes a general CAUTION or WARNING statement.

The electrical hazard symbol,  (a lightning bolt in a triangle) precedes an electric shock hazard CAUTION or WARNING safety statement.



**Electrical Shock Hazard CAUTION or WARNING**

## Technical Assistance

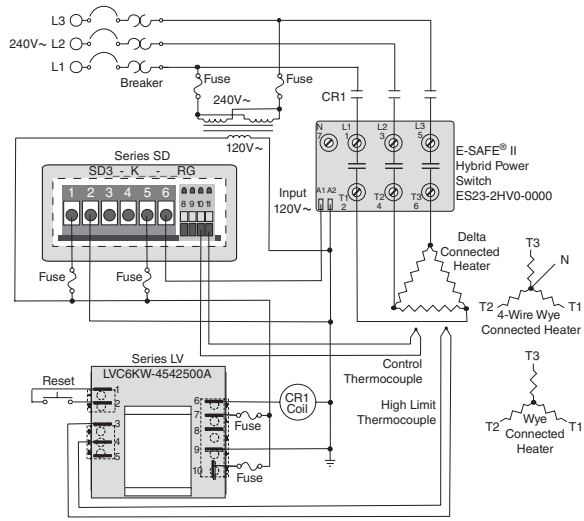
If you encounter a problem with your Watlow controller, review your configuration information to verify that your selections are consistent with your application: inputs; outputs; alarms; limits; etc. If the problem persists after checking the configuration of the controller, you can get technical assistance from your local Watlow representative (see back cover), or in the U.S., dial +1 (507) 494-5656.

Please have the following information available when calling:

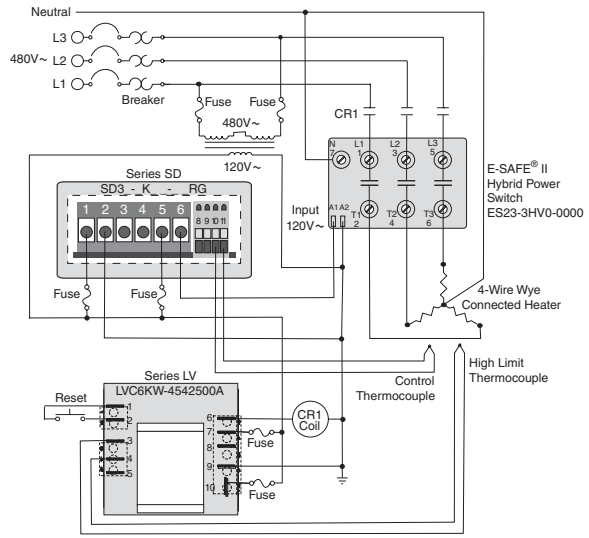
- Complete model number
- User's Manual

## Your Comments

We welcome your comments or suggestions on this user's manual. Please send them to: Technical Writer, Watlow, 1241 Bundy Blvd., P.O. Box 5580, Winona, Minnesota, USA 55987-5580; telephone: +1 (507) 454-5300; fax: +1 (507) 452-4507. © Copyright 2007 by Watlow, Inc. All rights reserved.



**System Wiring Example** 240 volt, 3-phase, 3 pole with ac input control



**System Wiring Example** 277/480 volt, 3-phase, 3 pole with ac input control, 4-wire Wye connected heater only



**WARNING:**

Wiring must conform to National Electric Code (NEC) safety standards, as well as locally applicable codes. Failure to do so could result in personal injury or loss of life.

See the product rating curve for wire gauge selection, ambient temperature and current restrictions.

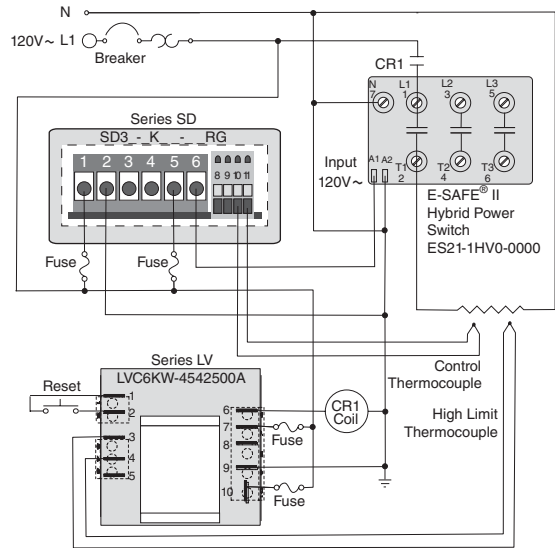


**WARNING:**

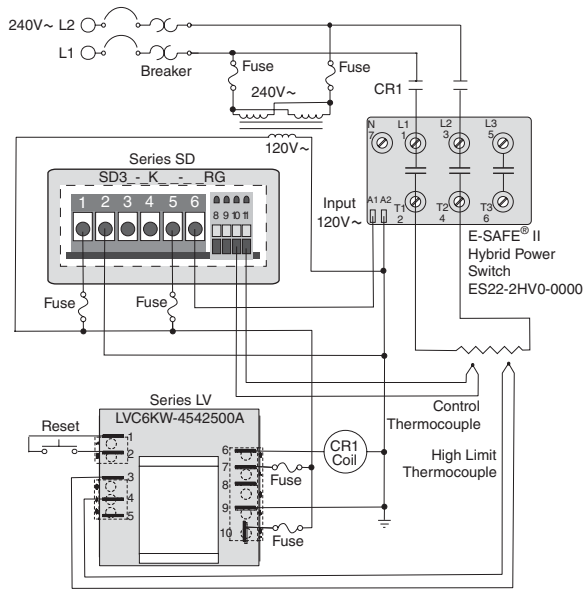
Only authorized and qualified personnel should install and service the E-SAFE II Hybrid Power Switch. Failure to comply with these recommendations may result in damage to equipment and property and injury to personnel.

**Torque Guidelines:**

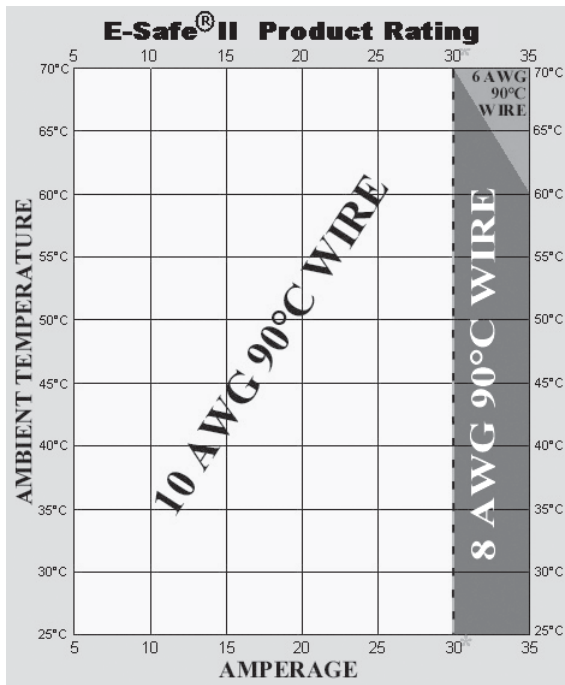
Properly torque line and load terminals to 2.25 nm (20 in-lbs).



**System Wiring Example** 120 volt, single-phase, 1 pole with ac input control



**System Wiring Example** 240 volt, single-phase, 2 pole with ac input control



These ratings apply to 3-phase units with cycle times of 30 seconds or more. Consult the factory for 1- and 2-phase unit ratings.

### U.L. Conditions of Acceptability

Applications must be tested as described below for specific wire insulation or specific wire gauge sizes. Tests shall be performed in the end application under worst-case operating conditions.

### Test Procedure

- Monitor the temperature of terminals, using thermocouples between the ring terminal and connectors L1, L2 or L3. The temperature must not exceed 95°C.
- Monitor the temperatures of wire insulation, using a thermocouple located 3 inches from the connector. The temperature must not exceed the insulation rating of the wire.



**WARNING:** Thermocouples attached to terminals will be at load voltage potential, measurements need to be taken with isolated equipment or isolate the sensor from the terminal with suitable insulation.



**WARNING:** Wiring must conform to National Electric Code (NEC) safety standards, as well as locally applicable codes. Failure to do so could result in personal injury or loss of life.

See the product rating curve for wire gauge selection, ambient temperature and current restrictions.



**WARNING:** Only authorized and qualified personnel should install and service the E-SAFE II Hybrid Power Switch. Failure to comply with these recommendations may result in damage to equipment and property and injury to personnel.



**WARNING:** Do not use an ungrounded wye- or delta-wired heater configuration at 400 or 480V~ (ac).

Failure to follow all specifications and wiring instructions may result in property damage, personal injury and/or loss of life.

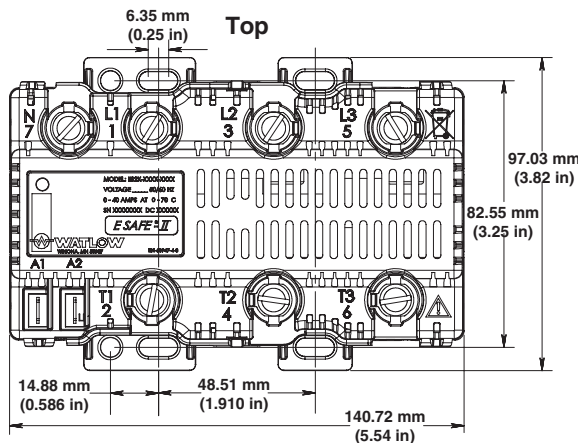


**CAUTION:** Provide proper enclosure ventilation to maintain an operating environment less than 70°C (158°F) maximum ambient rating. Failure to do so could cause damage to equipment and property.

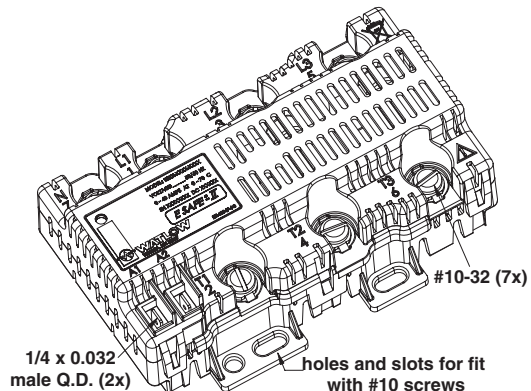
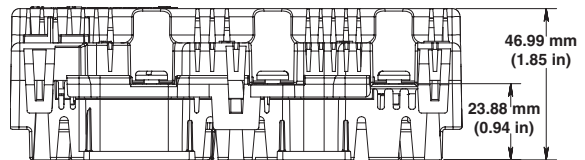
### Torque Guidelines:

Properly torque line and load terminals to 2.25 nm (20 in-lbs).

### Unit Dimensions



### Side



## Specifications

### Output voltage

- 100/120V~ (ac) +10/-15 percent, 50/60Hz
- 200/240V~ (ac) +10/-15 percent, 50/60Hz
- 230/277V~ (ac) +10/-15 percent, 50/60Hz

### Output amperage

- Up to 35 amperes single, dual and three-phase
- 30 A @ 277V~ (ac)

### Operating environment

- 0 to 70°C (32 to 158°F) operating temperature
- 0 to 90 percent RH, non-condensing
- Operational life: Four million switching cycles
- Installation category III, Pollution degree 2

### Control mode

- "No-arc" hybrid contactor

### Input command signal

- 3 to 32V $\overline{\text{=}}$  (dc), 24V~ (ac) +20/-20 percent
- 100 to 240V~ (ac) +10/-15 percent, [85 to 264V~ (ac)]

### Input command signal terminals

- 1/4 inch fast on appliance

### Line and load terminals

- No. 10 screw will accept ring terminals, locking fork terminals or block fork terminals, 1/4 in. (6.35 mm) by 10-32
- Wire insulation temperature can be determined through testing described in the U.L. Conditions of Acceptability.

## Ordering Information

<p><b>Number of Poles</b></p> <p>1 1 pole</p> <p>2 2 poles controlled</p> <p>3 3 poles controlled</p> <p><b>Load Voltage</b></p> <p>1 100 to 120V~ (ac)</p> <p>2 200 to 240V~ (ac)</p> <p>3 230/277V~ (ac) (400/480V~ (ac) with wye/star, neutral connected to center required)</p> <p><b>Command Signal Voltage</b></p> <p>LV Low voltage 3 to 24V<math>\overline{\text{=}}</math> (dc) or 24V~ (ac)</p> <p>HV High voltage 100 to 240V~ (ac) +10/-15 percent, [85 to 264V~ (ac)]</p> <p><b>Future Option</b></p> <p><b>Future Option</b></p> <p><b>Custom Parameters</b></p> <p>000 Standard product</p>	
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### Mounting

- Back panel mount
- Horizontal or vertical mounting options with equal product performance

NOTE: Do not use an RC snubber on the temperature control command signal output. The leakage current through a snubber circuit can turn the E-SAFE® II relay on, even when the command signal is off.

## E-SAFE® II Hybrid Power Switch

Watlow Winona, Inc.  
1241 Bundy Blvd.  
Winona, MN 55987 USA



Declares that the following product:

<p>Designation:</p> <p>Model Numbers:</p> <p>Classification:</p> <p>Rated Voltage and Frequency:</p> <p>Rated Power Consumption:</p>	<p><b>E-SAFE® II Hybrid Power Switch</b></p> <p>ES2 (1, 2 or 3) – (1, 2 or 3)(LV or HV) (0) – (0) (any three letters or numbers)</p> <p>AC51 Semiconductor Direct-on-line contactor,</p> <p>Installation Category III, Pollution degree 2, IP00</p> <p>100-120 Vac, 200-240 Vac, 277 Vac, 400 Vac*, 480 Vac*</p> <p>*Star or Wye with Center connected Neutral required.</p> <p>35 A Resistive Load Maximum</p>
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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

<p>EN 60947-4-1</p> <p>EN 60947-4-3</p> <p>EN 61000-4-2</p> <p>EN 61000-4-3</p> <p>EN 61000-4-4</p> <p>EN 61000-4-5</p> <p>EN 61000-4-6</p> <p>EN 61000-4-8</p> <p>EN 61000-4-11</p> <p>IEC 61000-3-12</p> <p>IEC 61000-3-11<sup>2</sup></p>	<p>2004</p> <p>2000</p> <p>1996</p> <p>2002</p> <p>2004</p> <p>1995</p> <p>1996</p> <p>1994</p> <p>2004</p> <p>2004</p> <p>2004</p> <p>2000</p>	<p>CRGD, 2005</p> <p>A2, 2001</p> <p>A2, 2001</p> <p>A3, 2005</p> <p>A1, 2001</p>	<p><b>Low-Voltage switchgear and controlgear Part 4-3: Contactors and motor-starters AC semiconductor controllers and contactors for non-motor loads. Class B Emissions</b></p> <p>Electrostatic Discharge Immunity</p> <p>Radiated Field Immunity</p> <p>Electrical Fast-Transient / Burst Immunity</p> <p>Surge Immunity</p> <p>Conducted Immunity</p> <p>Magnetic Field Immunity</p> <p>Voltage Dips, Short Interruptions and Voltage Variations Immunity</p> <p>Harmonic Current Emissions &gt; 16A &lt; 75 A</p> <p>Voltage Fluctuations and Flicker &gt; 16A &lt; 75 A</p>
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<sup>2</sup>NOTE 1: To comply with flicker requirements cycle time may need to be greater than 12 seconds if Load Power is  $\leq$  16A to comply with standard, or the maximum source impedance needs to be determined. Source impedance shall meet EN 61000-3-11 requirements for load currents > 16A.

### 73/23/EEC Low-Voltage Directive

<p>EN 60947-4-1</p> <p>EN 60947-4-3</p>	<p>2004</p> <p>2000</p>	<p>CRGD, 2005</p>	<p><b>Low-Voltage switchgear and controlgear Part 4-3: Contactors and motor-starters AC semiconductor controllers and contactors for non-motor loads.</b></p>
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Compliant with 2002/95/EC RoHS Directive  
2002/96/EC WEEE Directive Equipment Requires Recycling

Raymond D. Feller III  
Name of Authorized Representative

Winona, Minnesota, USA  
Place of Issue

October 2006  
Date of Issue

Signature of Authorized Representative