VIKING PUMP

# TECHNICAL SERVICE MANUAL

## SINGLE CHANNEL CONTROLLER



## CONTENTS




SINGLE CHANNEL CONTROLLER

## INTRODUCTION

This instruction manual describes the installation and operation of the controller. Its function is to set and monitor the heat cartridges for our electrically heated pumps. The controllers are programmed for a specific temperature range. Please see the table below for a listing of the available temperature ranges.

Your shipment should contain the following items:

- Controller (Watlow Model: PM6C2EH-AAAAAAA)
- Thermocouple
- Fitting adapter for thermocouple
- CD with Watlow Controller Manual
- 40 amp Relay with N size pump only (Watlow Model: DB10-60C0-0000

Check carefully that the contents have not been damaged during shipping.

**For additional information on the heat cartridges, please see the "Heat Cartridges" section of the TSM for your specific pump model (TSM 630.1 or TSM 630.2).**

| TEMPTERATURE RANGE OPTIONS | |
|---|---|
| **Fahrenheit** | **Celsius** |
| 0 - 150 | 0 - 65 |
| 0 - 250 | 0 - 120 |
| 0 - 350 | 0 - 175 |
| 0 - 450 | 0 - 230 |

## PANEL LAYOUT

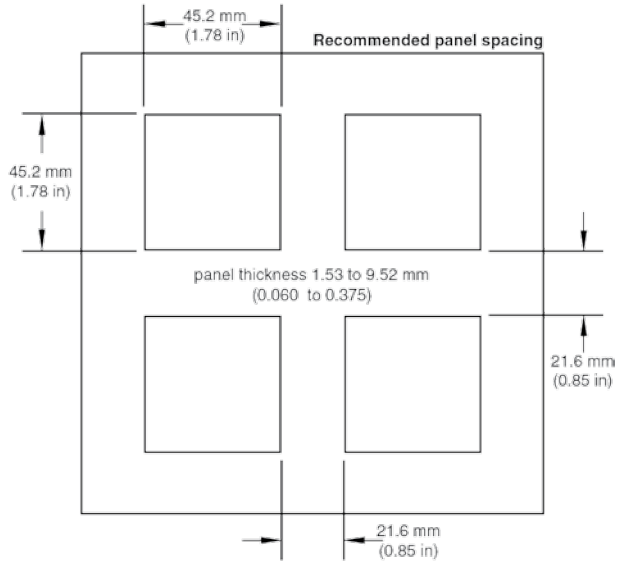



FIGURE 1 - CONTROLLER PANEL LAYOUT

# SAFETY INFORMATION AND INSTRUCTIONS

**INCORRECT INSTALLATION, OPERATION OR MAINTENANCE OF EQUIPMENT MAY CAUSE SEVERE PERSONAL INJURY OR DEATH AND/OR EQUIPMENT DAMAGE AND MAY INVALIDATE THE WARRANTY.**

**This information must be read fully before beginning installation, operation or maintenance and must be kept with the controller. All installation and maintenance must be undertaken by suitably trained and qualified persons only.**

**Symbol Legend :**

**Danger -** Failure to follow the listed precautionary measures identified by this symbol may result in serious injury or death.

**WARNING**

**Warning -** Safety instructions which shall be considered for reasons of safe operation of the controller and/or protection of the controller itself are marked with this symbol.

**WARNING**

This equipment is suitable for use in class 1, div. 2, Groups A, B, C, and D or Non-Hazardous locations only. Temperature Code T4A.

**EXPLOSION HAZARD.** Substitution of component may impair suitability for class 1, div. 2.

**EXPLOSION HAZARD.** Do not disconnect equipment unless power has been switched off or the area is known to be nonhazardous.

All electrical power to the controller and controlled circuits must be disconnected before removing the controller from the front panel or disconnecting other wiring.

Failure to follow these instructions may cause an electrical shock and/or sparks that could cause an explosion in class 1 div. 2 hazardous locations.

Use National Electric (NEC) or other country-specific standard wiring and safety practices when wiring and connecting this controller to a power source and to electrical sensors or peripheral devices. Failure to do so may result in damage to equipment and property, and/or injury or death.

- Always disconnect, lockout, and tag out supply circuits prior to installing.

- The installation must comply with standard and local regulations.

- All wiring should be done by a licensed electrician to meet local codes.

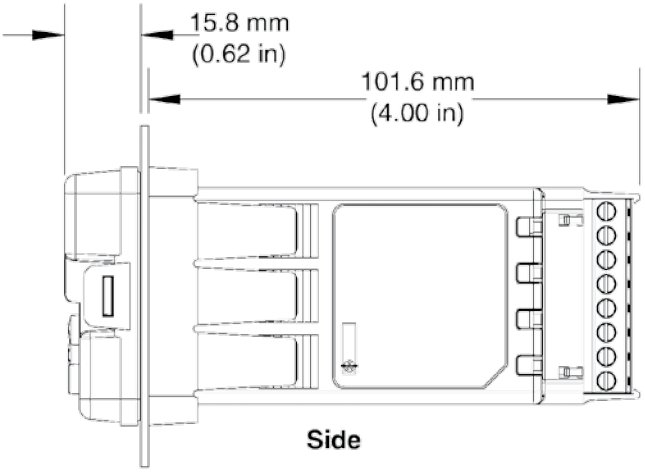
- Study this manual thoroughly before installing and using the controller.

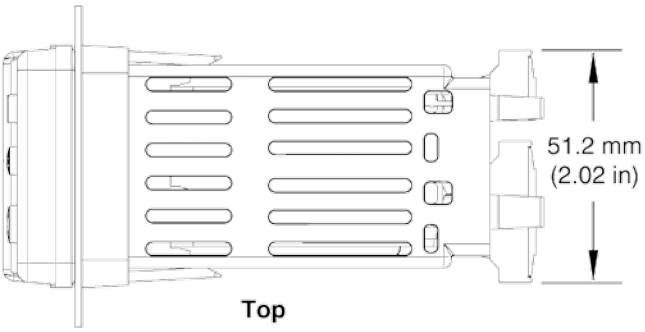
- Pay special attention to this section and the parts marked “WARNING!” or “DANGER”.

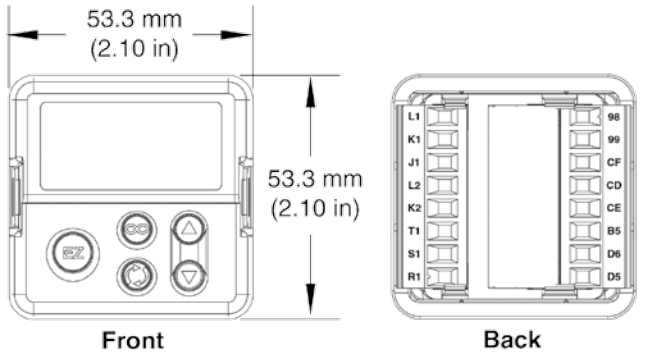
- Should questions or uncertainties arise, please contact your authorized Viking distributor.

# DIMENSIONS

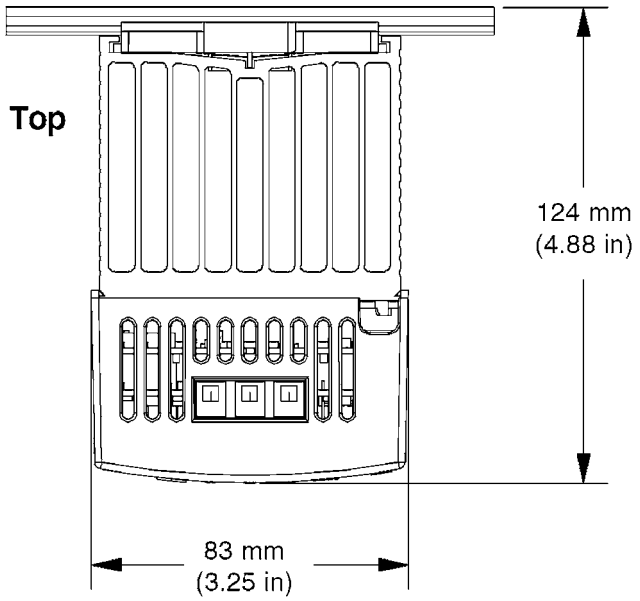
## Controller

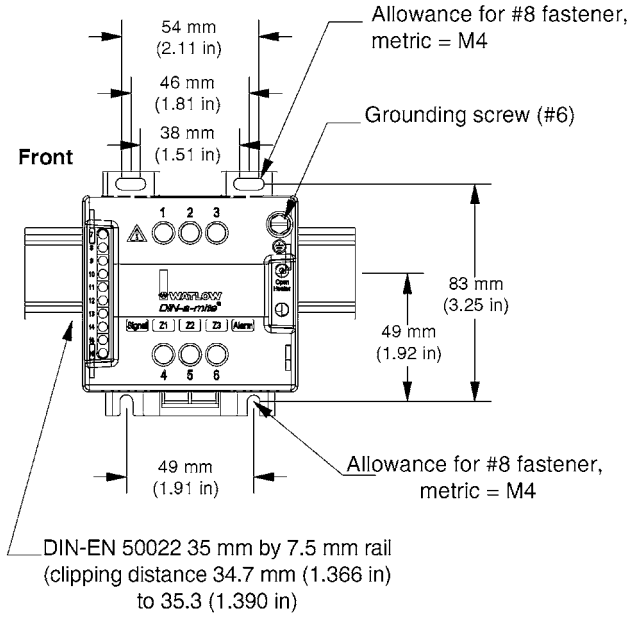


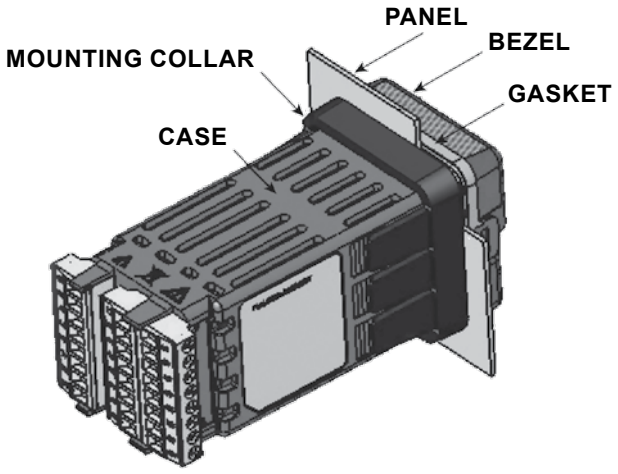



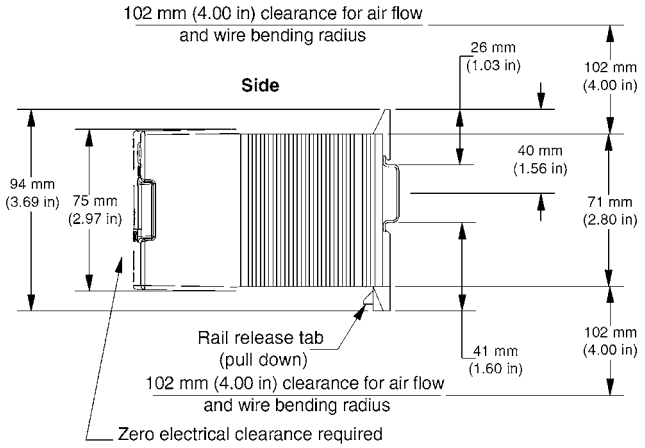




## Relay (for N size pumps only)



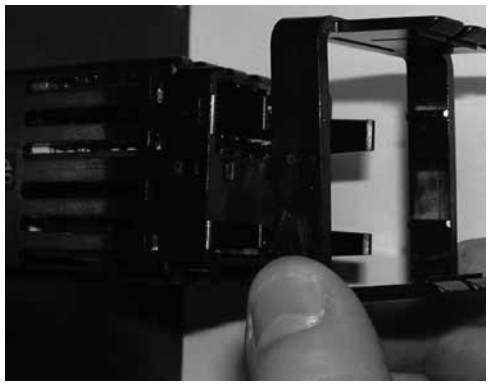



# INSTALLATION
## Controller

### Assembly

1. Make the panel cutout using the mounting template dimensions shown in **Figure 1.**
2. Insert the case assembly into the panel cutout.
3. While pressing the case assembly firmly against the panel, slide the mounting collar over the back of the controller.

   If the installation does not require a NEMA 4X (UL50, IP66) seal, simply slide together until the gasket is compressed.



**Slide the mounting collar over the back of the controller.**

4. For a NEMA 4X (UL50, IP66) seal, alternately place and push the blade of a screwdriver against each of the four corners of the mounting collar assembly. Apply pressure to the face of the controller while pushing with the screwdriver.

   Don't be afraid to apply enough pressure to properly install the controller. The seal system is compressed more by mating the mounting collar tighter to the front panel. If you can move the case assembly back and forth in the cutout, you do not have a proper seal.

   The tabs on each side of the mounting collar have teeth that latch into the ridges on the sides of the controller. Each tooth is staggered at a different depth from the front so that only one of the tabs on each side is locked onto the ridge at a time.

   **Note: There is a graduated measurement difference between the upper and lower half of the display to the panel. In order to meet the seal requirements mentioned above, ensure that the distance from the front of the top half of the display to the panel is 0.630 in. (16 mm) or less, and the distance from the front of the bottom half and the panel is 0.525 in. (13.3 mm) or less.**

# Removing The Mounted Controller From Its Case

**⚠ DANGER !**

**All electrical power to the controller and controlled circuits must be disconnected before removing the controller from the front panel or disconnecting other wiring.**

**Failure to follow these instructions may cause an electrical shock and/or sparks that could cause an explosion in class 1 div. 2 hazardous locations.**

1. From the face side of the controller, pull out the tabs on each side until you hear it click.


**Pull out the tab on each side until you hear it click.**

2. Once the sides are released grab the unit above and below the face with two hands and pull the unit out.

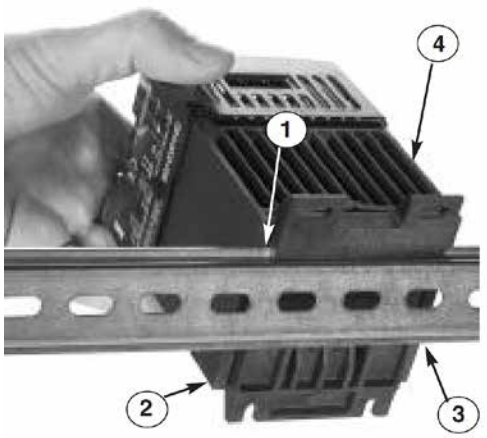
**Grab the unit above and below the face and pull forward.**

# Returning the Controller to its Case

1. Ensure that the orientation of the controller is correct and slide it back into the housing. The controller is keyed so it should slide easily back in to the case. **Do not force it.** Verify orientation again if it will not slide back into the case.
2. Using your thumbs push on either side of the controller until both latches click.

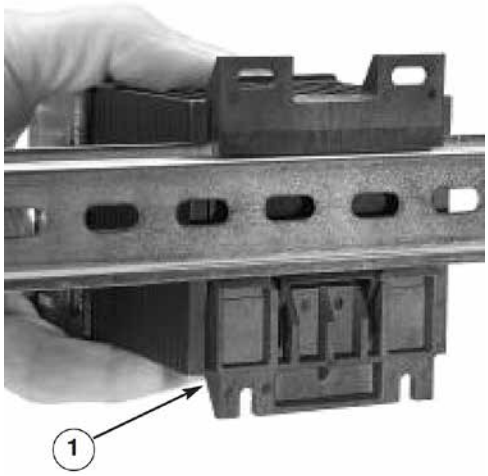
# Relay (for N size pumps only)

**Assembly:**




1. Push the unit in and down to catch the rail hook on top of the rail.
2. Rotate the bottom of the unit toward the rail.
3. The rail clasp will audibly “snap” into place. If the DIN-A-MITE does not snap into place, check to see if the rail is bent.
4. Mount the cooling fins vertically.

**Disassembly:**




1. Press down on the release tab while rotating the unit up and away from the rail.

# WIRING

For H-QS pumps, the wiring diagram in **Figure 2** shows how the controller is wired to the power source, cartridge heaters, ready light, and thermocouple. **Figure 4** shows the layout of the terminals on the controller. The terminal descriptions of the controller are given in **Table 1.**

For N size pumps, the wiring diagram in **Figure 3** shows how the controller is wired to the power source, cartridge heaters, relay, ready light, and thermocouple. **Figure 4** shows the layout of the terminals on the controller, and **Figure 5** shows the layout of the terminals on the relay. The terminal descriptions of the controller are given in **Table 1,** and the relay terminal descriptions are given in **Table 2.**

**⚠ DANGER !**

- **Always disconnect, lockout, and tag out supply circuits prior to installing.**
- **Use National Electric (NEC) or other country-specific standard wiring and safety practices when wiring and connecting this controller to a power source and to electrical sensors or peripheral devices. Failure to do so may result in damage to equipment and property, and/or injury or death.**
- **The installation must comply with standard and local regulations.**
- **All wiring should be done by a licensed electrician to meet local codes.**
- **Study this manual thoroughly before installing and using the controller.**
- **Pay special attention to this section and the parts marked "WARNING!" or "DANGER".**
- **Should questions or uncertainties arise, please contact your authorized Viking distributor.**
- **Proper selection and installation of the thermocouple wiring and cartridge heater wiring is the responsibility of the end user. Refer to the temperature controller manual for instructions.**

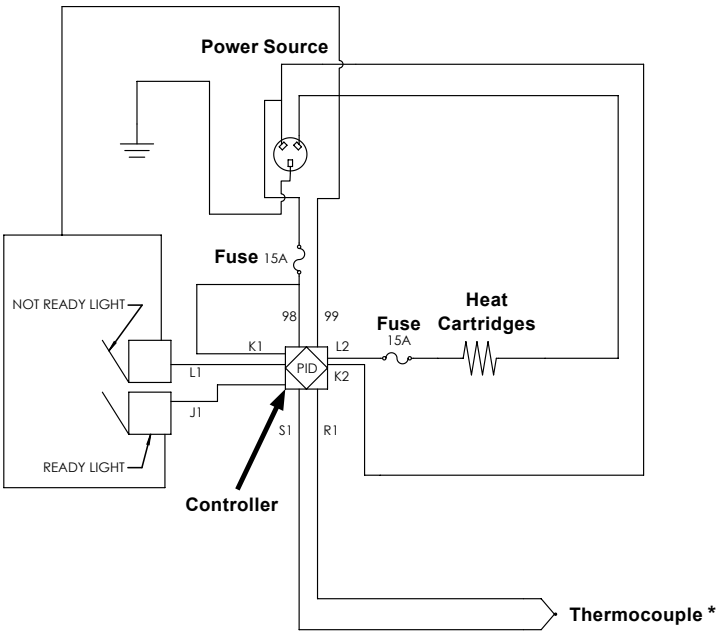



**FIGURE 2 - WIRING DIAGRAM FOR H-QS SIZE PUMPS**

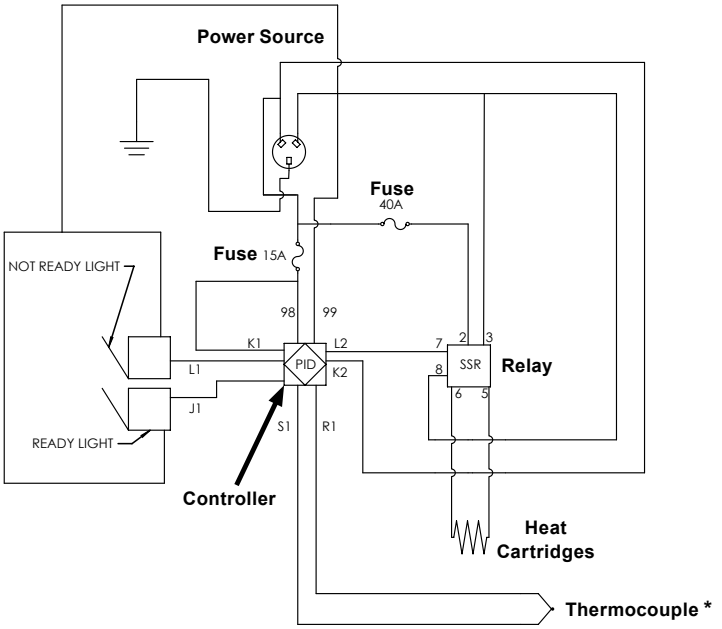



**FIGURE 3 - WIRING DIAGRAM FOR N SIZE PUMP ONLY**

**NOTES:**

*** Thermocouples are polarity sensitive. The negative lead (usually red) must be connected to S1.**

**The extension wire for thermocouples must be of the same alloy as the thermocouple.**

**⚠ DANGER !**

**Do not put a fuse or switch on the neutral line coming into terminal 3. Failure to follow this guideline could result in personal injury or death.**

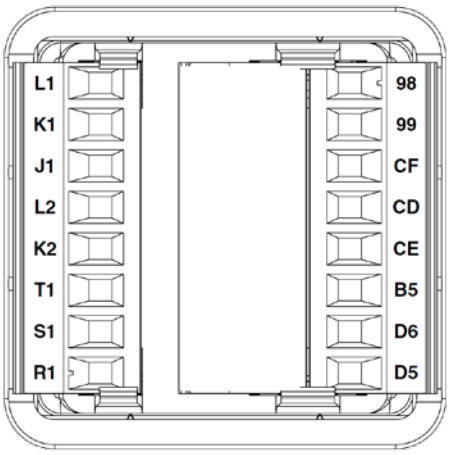



**FIGURE 4 - CONTROLLER TERMINAL LOCATIONS**

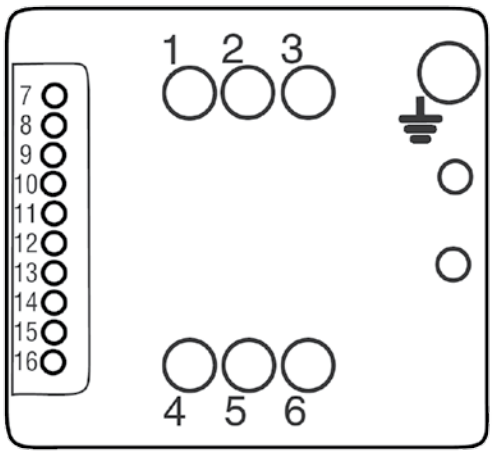



**FIGURE 5 - RELAY TERMINAL LOCATIONS (FOR N SIZE PUMP ONLY)**

| Slot A | | Slot C | |
|---|---|---|---|
| **L1** | Normally Open (Not Ready Light) | **98** | Power Input; AC; Fused (Controller) |
| **K1** | Common (Ready Light / Pump Interlock) | **99** | Common (Controller) |
| **J1** | Normally Closed (Ready Light) | **CF** | Not Used |
| **L2** | Power Output; Fused (Heat Cartridges) | **CD** | Not Used |
| **K2** | Common (Heat Cartridges) | **CE** | Not Used |
| **T1** | Not Used | **B5** | Not Used |
| **S1** | Negative Thermocouple Lead (Usually red wire used) | **D6** | Not Used |
| **R1** | Positive Thermocouple Lead | **D5** | Not Used |

**TABLE 1 - CONTROLLER TERMINAL DESCRIPTIONS**

| Relay Terminal Definitions | |
|---|---|
| **1** | Not Used |
| **2** | Power Input; AC; Fused (From Power Source) |
| **3** | Common |
| **4** | Not Used |
| **5** | Heater |
| **6** | Heater |
| **7** | Power Input (From Controller) |
| **8** | Common |
| **9 - 16** | Not Used |

**TABLE 2 - RELAY TERMINAL DESCRIPTIONS (FOR N SIZE PUMP ONLY)**

**NOTES:**

1. Input power for the controller must be 240VAC, single phase, 60 Hz or 220VAC, single phase, 50 Hz.
2. Controller terminals
   - **a.** 18 to 12 AWG wire size for heaters and controller. Use appropriate thermocouple wire for thermocouple and application.
   - **b.** Torque to 7.0 lb-in (0.8 Nm)
   - **c.** Wire strip length 0.30 in (7.6 mm).
3. Relay input terminals for use with N size pump only (terminals 7-16)
   - **a.** 24 to 16 AWG wire size
   - **b.** Torque to 4.4 lb-in (0.5 Nm)
   - **c.** Wire strip length of 0.22 in (5.5 mm)
4. Relay line and load terminals for use with N size pump only (terminals 1-6)
   - **a.** Will accept 18 to 8 AWG wire size
   - **b.** Torque to 12 lb-in (1.4 Nm)
   - **c.** Wire strip length 0.25 in (6.35 mm)
   - **d.** Retorque after 48 hours to minimize wire cold flow
   - **e.** Retorque terminals every 3 to 6 months
   - **f.** Ground terminal use spade terminal for No. 8 screw, with upturned lugs
   - **g.** Attach grounding wire to grounding screw (#6)
5. Maintain electrical isolation between thermocouple analog input 1 (terminals S1 and R1), any digital inputs-outputs, and process outputs 1 and 2 (terminals L1, K1 and L2, K2, respectively) to prevent ground loops.
6. To prevent injury and damage to the controller, do not connect wires to unused terminals.
7. The wires for the heat cartridges can be joined together in a junction box, and a single wire from the junction box can be connected to the controller.
8. The wiring diagram is only valid for standard type J thermocouples and controllers supplied from Viking Pump.
9. For information on the location and installation of the heat cartridges and thermocouple, please see the TSM for your specific pump. The thermocouple will require a fitting adapter which is included with the controller kit in order to mount to the pump.

## KEY LAYOUT AND FUNCTIONS

**Upper Display**

In the Home Page, displays the process value, otherwise displays the value of the parameter in the lower display.

**Zone Display**

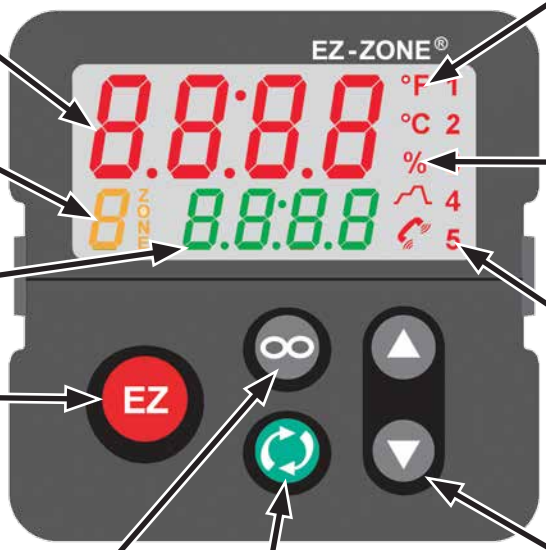
Indicates the controller zone.

**Lower Display**

Indicates the set point or output power value during operation, or the parameter whose value appears in the upper display.

**NOTE:**

**This controller has been pre-programmed by Viking Pump to lockout many functions to simplify installation and operation for customer specified electric heat applications. If advanced functionality is required, the user should source their own controller from a qualified heat control vendor.**




**Temperature Units**

Indicates whether the temperature is displayed in Fahrenheit or Celsius.

**Percentage Units**

Lights when the controller is displaying values as a percentage.

**Output Activity**

Number LEDs indicate activity of outputs. A flashing light indicates output activity.

#2 indicates when power applied to heaters.

**EZ Key**

Not Used

**Advance Key**

Advances through parameter prompts.

**Infinity Key**

Press to back up one level, or press and hold for two seconds to return to the Home Page. From the Home Page, you can clear alarms and errors if clearable.

**Up and Down Arrow Keys**

In the Home Page, adjusts the set point in the lower display. In other pages, changes the upper display to a higher or lower value, or changes the parameter selection.

## OPERATION

**⚠ WARNING !**

**Depending on the set point temperature at startup, the controller may deliver power to the heat cartridges and cause them to heat as soon as the controller is turned on.**

**⚠ WARNING !**

**Setting the set point temperature higher than necessary will not make the pump heat any faster and will shorten the life of the heat cartridges.**

1. Press and hold the Infinity Key for two seconds to bring up the Home Page.
2. Use the Up and Down Arrow Keys to adjust the set point temperature if necessary. The lower display of the Home Page shows the set point temperature. The set point temperature needs to be slightly higher than the melting point and significantly lower than the flash point or boiling point of the liquid being pumped.
3. To make sure that the liquid within the pump is melted and to avoid damage to the pump, do not start the pump until the set point temperature has been reached. Depending on your setup, there may be a ready light to indicate when the set point has been reached. On the Home Page, the upper display shows the process temperature, and the lower display shows the set point temperature.

# TROUBLESHOOTING

| Error Code | Description | Possible Causes | Corrective Action |
|---|---|---|---|
| Er.11<br>Error Input | Sensor does not provide a valid signal to controller | **1.** Thermocouple improperly wired or open | **1.** Correct wiring or replace thermocouple |
| No heat action | Output does not activate load | **1.** Output is incorrectly wired<br>**2.** Load, power, or fuse is open<br>**3.** Set point is incorrect<br>**4.** Heat cartridge is burnt out* | **1.** Correct output wiring<br>**2.** Correct fault in system<br>**3.** Adjust set point to correct temperature<br>**4.** Replace heat cartridge |
| No display | No display indication or LED illumination | **1.** Power to controller is off<br>**2.** Fuse open<br>**3.** Breaker tripped<br>**4.** Safety interlock switch open<br>**5.** Wiring error<br>**6.** Incorrect voltage to controller | **1.** Turn on power<br>**2.** Replace fuse between power source and controller<br>**3.** Reset breaker<br>**4.** Close interlock switch<br>**5.** Correct wiring issue<br>**6.** Check voltage requirements and apply correct voltage |
| Temperature runaway | Process value continues to increase past set point | **1.** Thermocouple reverse wired<br>**2.** Controller output wired incorrectly<br>**3.** Short in heater<br>**4.** Power controller connection to controller defective<br>**5.** Controller output defective | **1.** Correct thermocouple wiring (red wire negative)<br>**2.** Verify and correct wiring<br>**3.** Replace heater<br>**4.** Replace or repair power controller<br>**5.** Replace or repair controller |
| 100<br>rEtn<br>Device Error | Controller displays internal malfunction message at power up. | **1.** Controller is defective | **1.** Replace or repair controller |

*** Use an ohmmeter or multimeter to determine the resistance across the heat cartridge. A burnt out heater will have a reading of infinity (∞) ohms.**

**The customer supplied fuse between the heat cartridges and controller will typically blow when one of the heat cartridges fails**

# TECHNICAL DATA - Controller

| | |
|---|---|
| **Weight** | 6.6 oz. (186 g) |
| **Supply Voltage** | 1x220-240 (±10%) |
| **Frequency** | 50 or 60 Hz |
| **Power Consumption** | Max 10 VA |
| **Fuses** | Use Max 15 A |
| **Terminal Wire Size** | Use 18 to 12 AWG |
| **Terminal Tightening Torque** | 7 lb-in (0.8 Nm) |
| **Max Temperature Error @ Ambient** | ± 3.15°F (1.75 °C) |
| **Sampling Rates for Input & Output** | 10 Hz |
| **Heater Relay (L2,K2)** | NO-ARC 15A, Form A |
| **Ready Light Relay (L1,K1)** | Mechanical Relay 5A, Form C |
| **Operating Temperature** | 0-149°F (-18-65°C) |
| **Storage Temperature** | -40-185°F (-40-85°C) |
| **Allowable Humidity** | 0 to 90%; non-condensing |
| **Protection Class** | NEMA 4X/IP66 if installed correctly (see assembly step 4) (indoor use only) |
| **Pollution Degree** | Pollution Degree 2 |
| **Back-up Battery Information** | • Allows for data retention upon power failure<br>• Battery Type: lithium (recycle properly)<br>• Typical Battery Life: three cumulative years of unpowered life at 77°F (25°C) |
| **Agency Approvals** | • UL® Listed to UL® 61010-1 File E185611<br>• UL® Reviewed to CSA C22.2 No.61010-1-04<br>• UL® 50 Type 4X (indoor use only)<br>• FM Class 3545 File 3029084 temperature limit switches<br>• CE, RoHS, and W.E.E.E. compliant<br>• Suitable for use in Class 1, Div 2, Groups A, B, C and D or non-hazardous locations only. Temperature Code T4A<br>• UL® Listed to ANSI/ISA 12.12.01-2007 File E184390<br>• CSA approved; CSA C22. No. 24 File 158031 Class 4813-02<br>• UL® reviewed to Standard No. CSA C22.2 No. 213-M1987 |

# TECHNICAL DATA - Relay

| | |
|---|---|
| **Weight** | 1.6 lbs (0.7 kg) |
| **Supply Voltage** | 85V minimum - 660V maximum |
| **Frequency** | 50 or 60 Hz |
| **Power Consumption** | 1.2 watts per amp switched |
| **Storage Temperature** | -40 - +185°F (-40 - +85°C) |
| **Allowable Humidity** | 0 to 90%; non-condensing |
| **Protection Class** | IP20 |
| **Pollution Degree** | Pollution Degree 2 |
| **Classification** | Power Control; Installation III |
| **Agency Approvals** | • UL® 508 Listed and C-UL®, File E73741 |

## EU (EUROPEAN UNION) SPECIFICATIONS

The controller meets the essential requirements of the following European Union Directives by using the relevant standards shown below to indicate compliance

| | | |
|---|---|---|
| | **2004/108/EC Electromagnetic Compatibility Directive** | |
| **EN 61326-1** | **2006** | **Electrical equipment for measurement, control and laboratory use- EMC requirements (Industrial Immunity, Class B Emissions).** |
| EN 61000-4-2 | 1996 +A1,A2 | Electrostatic Discharge Immunity |
| EN 61000-4-3 | 2006 | Radiated Field Immunity 10V/M 80-1000 MHz, 3 V/M 1.4-2.7 GHz |
| 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 61000-4-11 | 2004 | Voltage Dips, Short Interruptions and Voltage Variations Immunity |
| EN 61000-3-2 | 2006 | Harmonic Current Emissions |
| EN 61000-3-3 | 2005 | Voltage Fluctuations and Flicker |
| SEMI F47 | 2000 | Specification for Semiconductor 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.** |
| | **Compliant with 2002/95/EC RoHS Directive** | |

## DISMANTLING AND DISPOSAL


The enclosure is made of Polycarbonate material. Use proper recycling techniques.

Do not throw in trash. When disposing, the parts must be handled and recycled in accordance with local regulations. Per 2002/96/EC W.E.E.E. Directive, please recycle properly.

The controller contains a lithium battery that must be recycled properly

## VIKING PUMP

### WARRANTY

Viking pumps, strainers and reducers are warranted to be free of defects in material and workmanship under normal conditions of use and service. The warranty period varies by type of product. A Viking product that fails during its warranty period under normal conditions of use and service due to a defect in material or workmanship will be repaired or replaced by Viking. At Viking's sole option, Viking may refund (in cash or by credit) the purchase price paid to it for a Viking product (less a reasonable allowance for the period of use) in lieu of repair or replacement of such Viking product. Viking's warranty is subject to certain restrictions, limitations, exclusions and exceptions. A complete copy of Viking's warranty, including warranty periods and applicable restrictions, limitations, exclusions and exceptions, is posted on Viking's website (www.vikingpump.com/warranty/warranty-info). A complete copy of the warranty may also be obtained by contacting Viking through regular mail at Viking Pump, Inc., 406 State Street, Cedar Falls, Iowa 50613, USA.

THIS WARRANTY IS AND SHALL BE VIKING'S SOLE AND EXCLUSIVE WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ALL WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGMENT, ALL OF WHICH OTHER WARRANTIES ARE EXPRESSLY EXCLUDED.

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