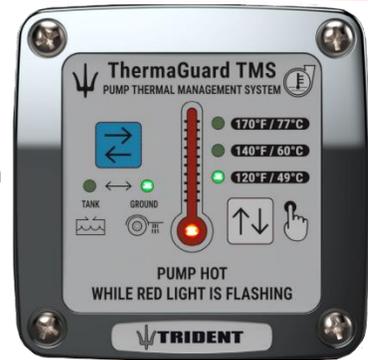


ThermaGuard™ TMS/TRV Installation & Operation Guide

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1. Specifications

a. Electrical

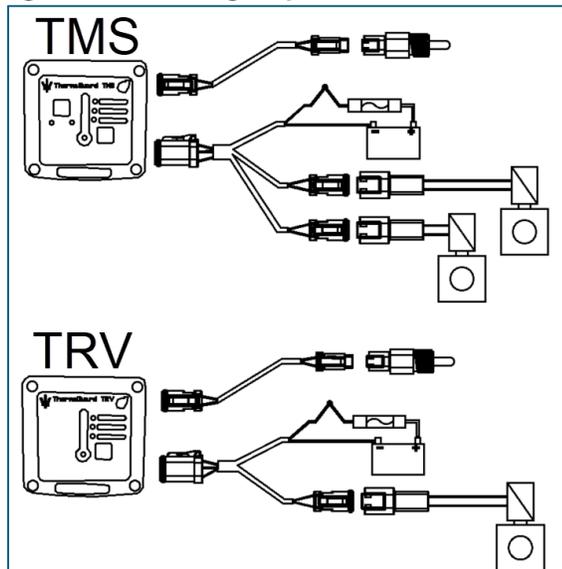
- Voltage: 9-28V DC, 0.25 to 3 Amps (Outputs On)
- Operating Temperature: -25C to 90C
- Outputs: Rated to 2.5A/1.25A switching (12/24V)
- Accuracy: +/- 2°F (1.1° C)
- Optional: 12-24V 120db audible alarm

b. Mechanical

- Control Head Dimensions: 3-5/8" x 3-5/8" x 3/8" (panel space required)
- Behind Panel Clearance: 3" for wire harness
- Durability: Encapsulated assembly, IP67, resistant to moisture, thermal effects, and vibration
- Materials: UV resistant external components

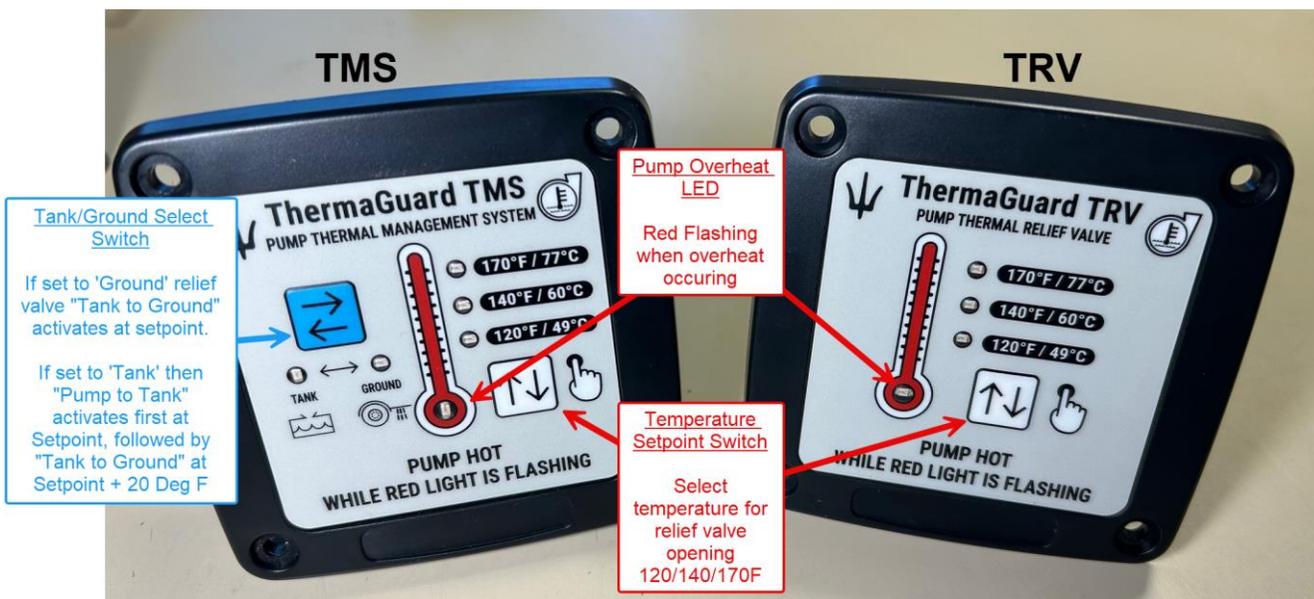
2. Use Summary

- a. The TMS and TRV pump thermal relief systems are designed to quickly protect pump seals and hose lines from overheating during dead-head water flow conditions.
 - The system consists of the Electronic Control Head in either a TMS or TRV model, 1/4" NPT threaded NTC thermistor sensor probe, wire harness, solenoid valve(s) and check valve(s).
 - Optional audible alarm and wire adaptor
- b. The TMS or TRV monitors the temperature of the pump real-time. When temperature reaches the setpoint the alarm visually activates, and the system takes action to protect the pump. The controller drives a solenoid valve(s) open allowing adequate relief flow to keep the pump cool.



c. Difference between TMS and TRV Systems

- The TMS has the capability of driving 2 relief valves in successive operation if configured that way.
 - By default, the “Pump to Tank” valve is active at the setpoint.
 - If the temperature continues to rise 20°F beyond the setpoint, the “Pump to Ground” valve will activate.
 - However, If the Blue button on the TMS front panel is used to switch to ‘Ground’ Mode, then the “Pump to Ground” valve is used exclusively at the setpoint vs. sending the water back to tank.
- In contrast the TRV is configured to drive a single valve labeled “Pump to Tank” on the simplified harness. The Blue ‘Tank/Ground’ select switch is absent from the control panel.
 - The High Flow TRV utilizes two solenoid valves dumping to ground to operate on pumps larger than 2000GPM
- On either unit as pump temperature reduces, the outputs switch off in sequence as the temperature drops. The switching value is 2° F (1.1° C) below the rising switch points.
- The single output on the TRV switches off at 2° F (1.1° C) below the setpoint.



3. Safety Notes, Cautions, Support



- a. Read the operation and installation documentation to become familiar with all aspects.
- b. A “Quick Start” guide is also available for those familiar with the ThermaGuard™ product (doc 02.066.1) Available at www.Tridentdirect.com
- c. The equipment and components described in this document are intended for use as part of a properly designed pump system.
- d. The installer of these components takes responsibility for the installation.
- e. In no way is this equipment intended to replace safe pump operation procedures and should not change any aspect of training as it pertains to safely operating a fire apparatus.
- f. This product should be installed and used within the stated electrical and environmental conditions.
- g. This engineered product consists of Trident part numbered TMS/TRV electronic controls and accessories have been tested as a complete system and any deviation on installation recommendations, modifications or substitution of accessories/equipment is the responsibility of the installer.
- h. If any components are damaged or degraded, they should immediately be repaired or replaced.
- i. Install all cabling and components in a protected manner away from extreme environmental variables such as nearby exhaust, hot engine, hot hydraulics or moving components.
- j. All harnessing should be tied up securely and protected from being pinched, crushed, extreme bends or subjected to extreme vibration.



Disclaimer: Trident Emergency Products has no control over the number and variety of applications for which its products may be purchased or the conditions under which they may be used, Trident Emergency Products liability on any claim, whether in contract, tort (including negligence), or otherwise, for any loss or damage shall in no case exceed the price paid for the product or any part thereof which give rise to claim. As always, Trident Emergency Products technical assistance and support is available for your convenience on all matters.



Customer Service Phone is (215) 293-0700. We pride ourselves with exceptional customer service and are available to answer questions pertaining to new or existing orders and any of your after the sale support concerns. If a product needs to be returned, please call and request a Returned Goods Authorization (RGA) number. Warranty claims must be made by an authorized Trident Emergency Products employee. Be prepared to provide the product model number and purchase invoice number. Replacement parts ordered will be invoiced to your account. Once an RGA number is received, you must write it on all boxes and paperwork. Trident Emergency products will not accept your returned goods without an RGA number. Upon receiving the return, if it is determined to be covered under warranty, a credit memo will be issued and mailed to you for your records.



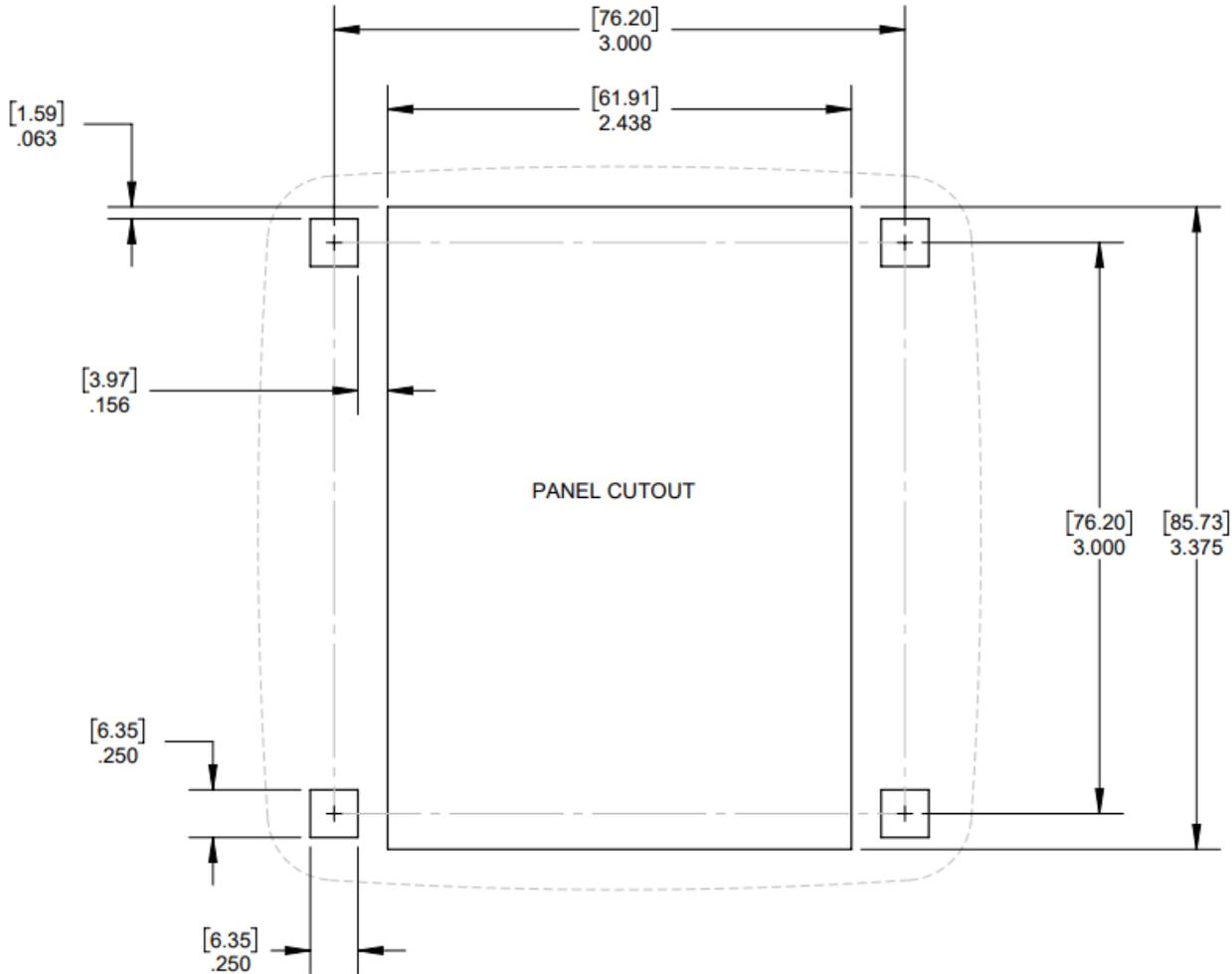
Note: All designs, specifications, and dimensional data contained in our catalog are subject to change without notice. No additional warranties, express or implied, including warranties of merchantability for fitness for a particular purpose, are created by the descriptions and depictions of the products on or in our catalog. Additionally, Trident Emergency Products is not responsible for typographical errors.

4. Minimum Required Components and Tools for Installation

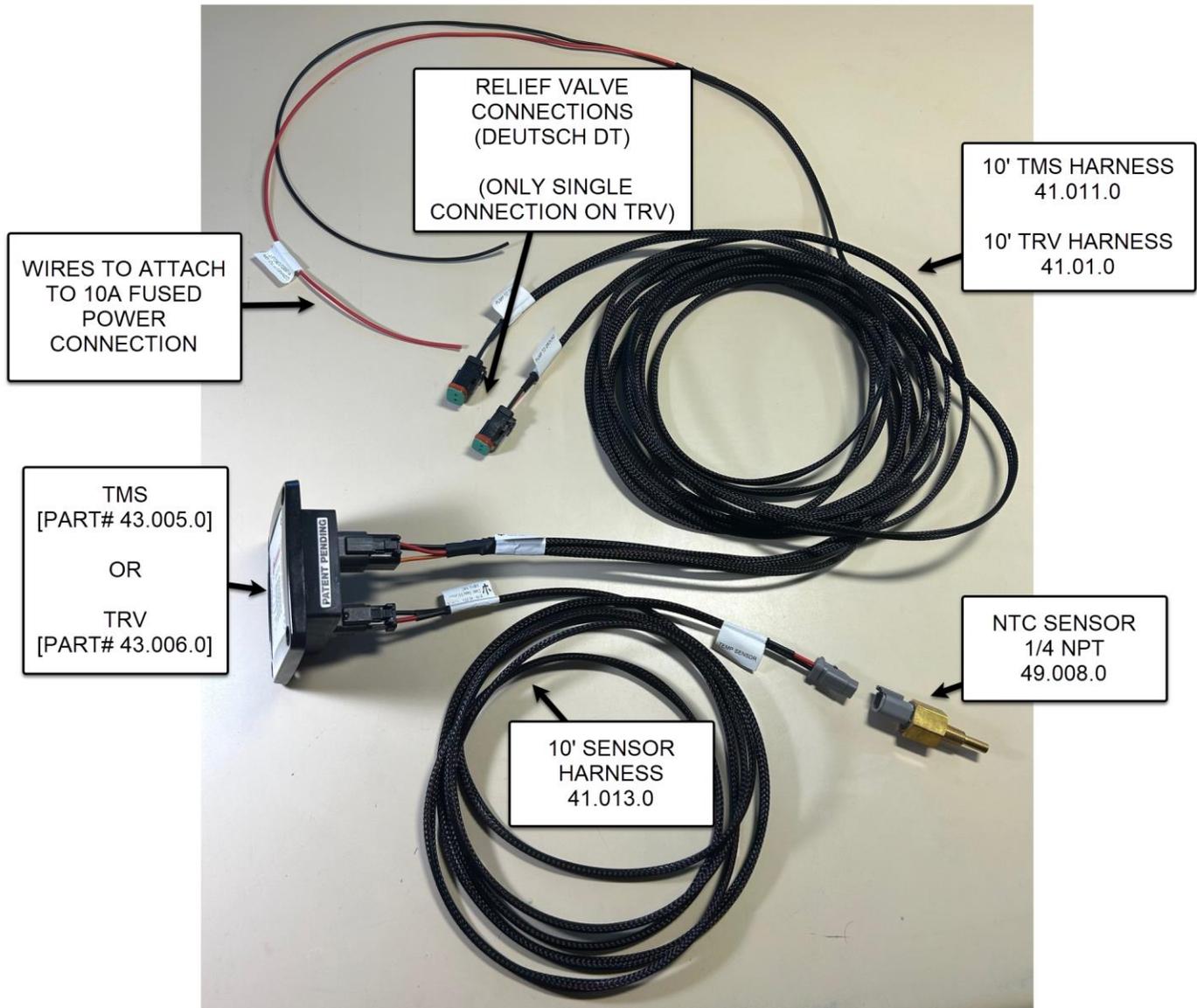
- a. Fabricated Panel cut-out using template provided, or dimensions shown in beginning of Section 5 (Quick Summary Install/Operation Guide).
- b. ¼” NPT port to install Thermistor into the direct water stream. This needs to be located as close to the pump impeller as possible.
- c. #2 Philips screwdriver.
- d. 23mm or 7/8” open end wrench (To install sensor).
- e. Pipe sealant for sensor threads.
- f. Zip ties for securing harnessing.
- g. 7.5A to 10A Fused circuit.
- h. TMS Kit consisting of:
 - Control Head TMS [P# 43.005.0]
 - Main Harness TMS [P# 41.011.0]
 - Sensor Harness [P# 41.013.0]
 - Temperature Sensor [P#49.008.0]
 - 2 Solenoid Relief Valve Assemblies [30.126.0]
 - 2 Check Valves [30.012.0]
 - 2 Brass ¼” MNPT X 3/8” MNPT fitting [09.165.0]
 - Hardware kit mounting screws/inserts [27.025.0]
- i. TRV Kit consisting of:
 - Control Head TRV [P# 43.006.0]
 - Main Harness TRV [P#41.012.0]
 - Sensor Harness [P# 41.013.0]
 - Temperature Sensor [P#49.008.0]
 - 1 Solenoid Relief Valve Assemblies [30.126.0]
 - 1 Check Valves [30.012.0]
 - 1 Brass ¼” MNPT X 3/8” MNPT fitting [09.165.0]
 - Hardware kit mounting screws/inserts [27.025.0]
- j. TRV High-Flow Kit consisting of:
 - Control Head TRV [P# 43.006.0]
 - Main Harness TMS [P# 41.011.0]
 - Sensor Harness [P# 41.013.0]
 - Temperature Sensor [P#49.008.0]
 - 2 Solenoid Relief Valve Assemblies [30.126.0]
 - 2 Check Valves [30.012.0]
 - 2 Brass ¼” MNPT X 3/8” MNPT fitting [09.165.0]
 - Hardware kit mounting screws/inserts [27.025.0]
- k. Optional components (Use for TMS or TRV) (See section 6).
 - Audible Alarm Wire Harness [P#41.014.0]
 - Audible Device CAI 120db [P#40.013.0]

5. Quick Install Summary

- Panel Cut-out dimensions below (1:1 Scale). Print with no scaling and check measurements before using as a template.
- Overall dimension of control head above panel is 3.875" x 3.875" x .350".
- If screw inserts are used in the panel they should be for #8 self-threading screws.

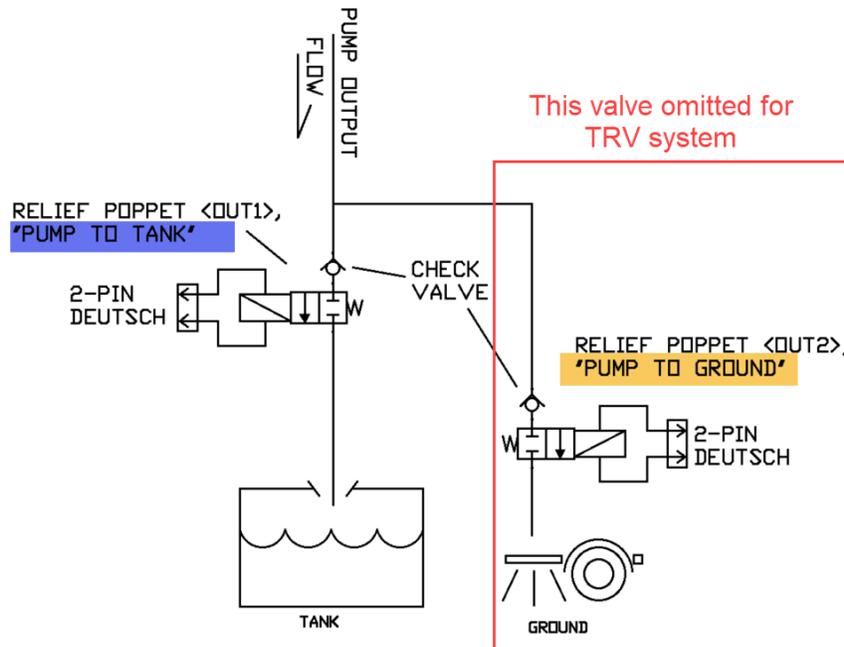


- a. The Temperature Sensor (Thermistor) has a 1/4" NPT thread and should be installed as close to the pump impeller as possible. The sensor tip should be in the direct water stream. Avoid using adaptors that would place the sensor in a void or recess.
- b. Use pipe sealant on 1/4" NPT threads.
- c. The solenoid relief valve and check valve must be installed as shown in the following illustration.

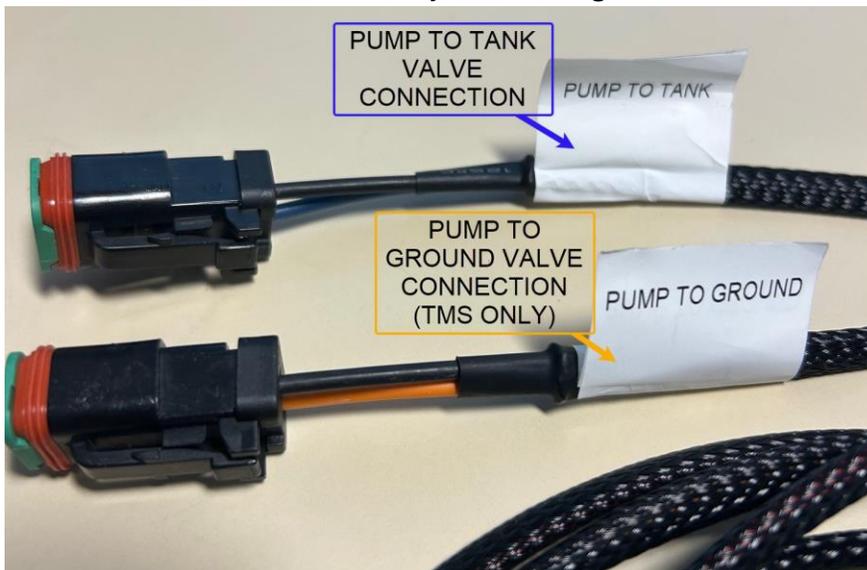


a. The solenoid relief valves, and check valve must be installed as shown below. This installation diagram is for the TMS system.

- Omit secondary solenoid valve (In RED BOX) and relief valve from standard TRV installation.
- Highlighted color matches harness wire color at solenoid connector.
- 2-pin DT06-2S connector with BLUE wire is the main “Pump to Tank” relief valve, The 2-pin connector with ORANGE wire (TMS only) is secondary “Pump to Ground” relief valve. See illustrations below.
- Discharge tubing on solenoid valves **MUST** be minimum 3/8”ID tubing or 1/2” OD hose.
- Note the flow direction arrow on the solenoid valves.
- **NOTE:** For High Flow TRV system both solenoid valves are plumbed to ground.

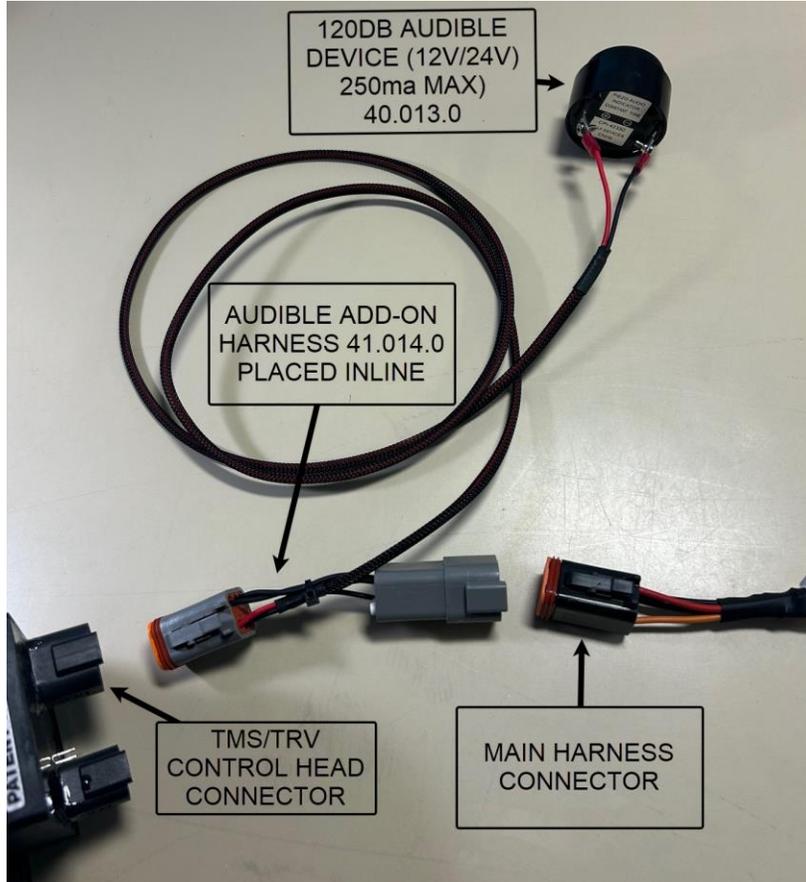


b. Relief valve connections for TMS system. Mating connections on the valves are Deutsch DT04-2P.



Optional Components for Installation

- d. Audible alarm. Plugs inline between control head TMS or TRV unit and drives 120 DB audible alarm.
 - Output of TMS is switched ground and is only rated at 250mA DC current.
- e. Audible voltage is rated for 12/24V operation and is connected via screw terminals.

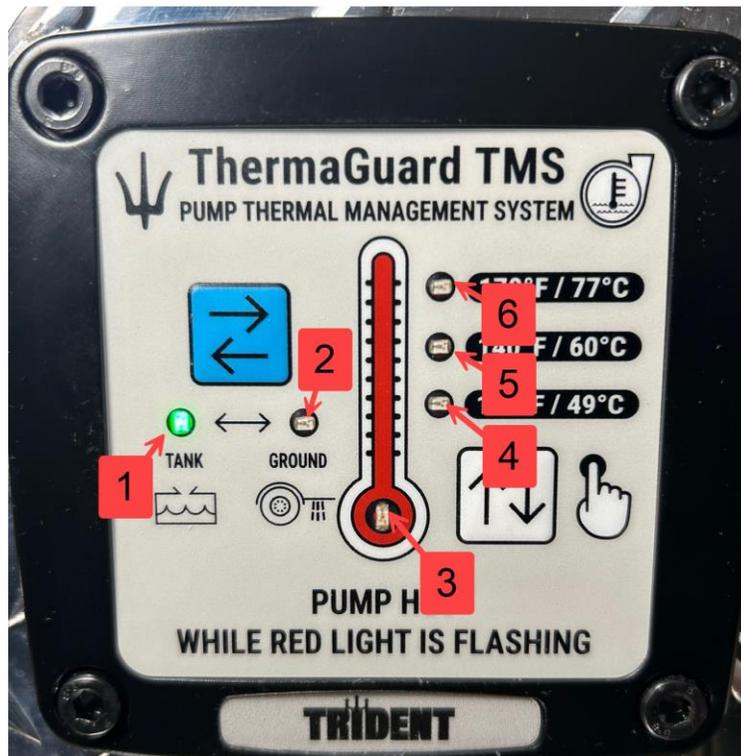


6. Operation/Diagnostics

a. Power-Up Lamp Test

- A self-test sequence is performed each time the TMS or TRV system is powered on.
- TMS: EVERY LED on the front panel is illuminated for ½ a second in sequence starting at the “TANK” followed by “GROUND”, then the “PUMP HOT”, “120°F”, “140°F”, “170°F”.
- TRV: EVERY LED on the front panel is illuminated for ½ a second in sequence starting “PUMP HOT”, “120°F”, “140°F”, “170°F”.

LED TEST SEQUENCE AT START-UP



b. Power-Up Relief Valve Output Cycle

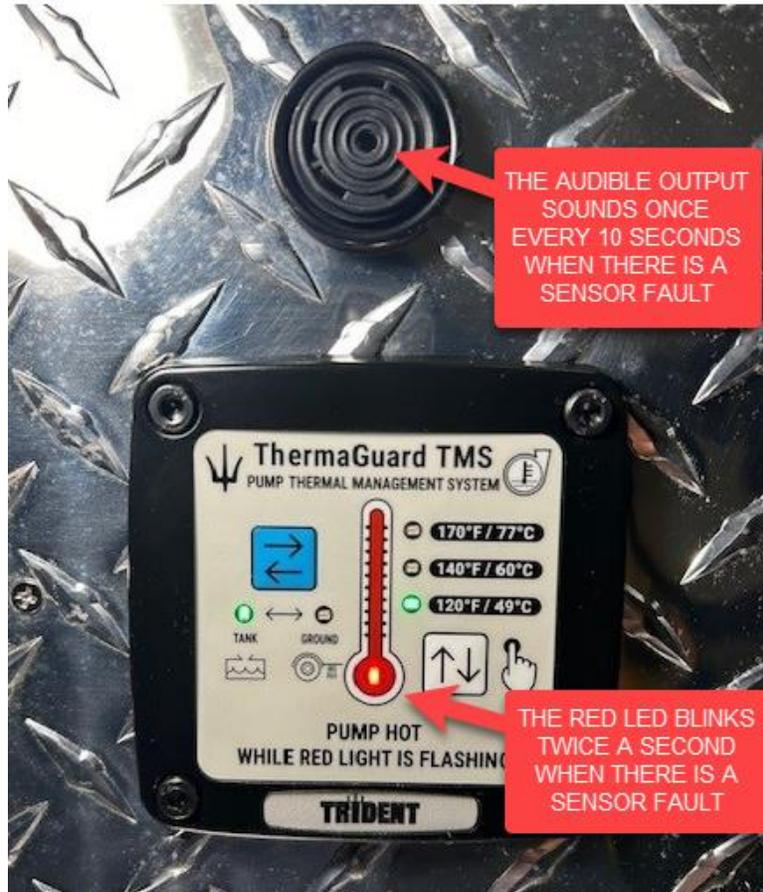
- Immediately after the LED test completes the outputs that drive the relief solenoid valves are pulsed for ½ second to cycle the valve. An audible relay click can be heard as the outputs are cycled. This cycling provides movement to the valve poppet which helps clear any possible debris and increases the life of the valve insuring reliable operation. Additionally, any trapped water can drain away between the check valve and the solenoid valve.
- If the “Temp Setpoint” button is momentarily pushed down while performing the self-test sequence the audible output will sound while the relief valve outputs are cycled ‘ON’. This can be used to test the audible alarm operation.

c. Normal Operation (Not Indicating Pump Hot)

- Once the self-test is complete, the system transitions to normal operation.
- Normal operation is a green LED indicating of ‘Tank’ or ‘Ground’ selection (NOTE: Tank/Ground selectable feature only on TMS units)

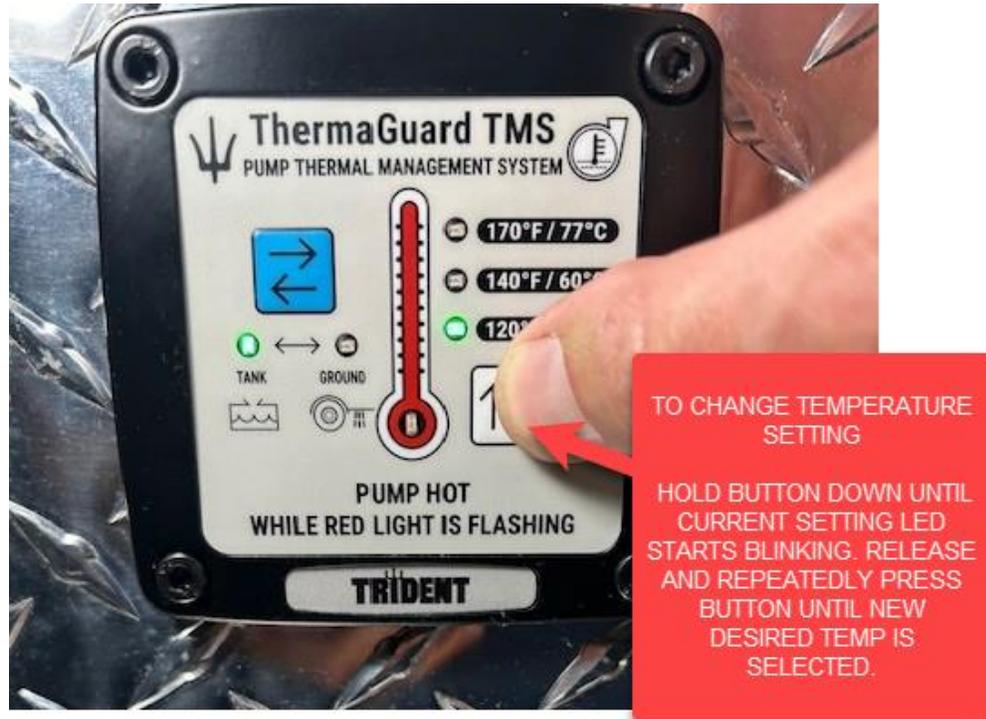
- Normal operation is a green LED indicating the temperature selection. Default factory selection is 120°F / 49°C
 - There should be no other LED lamp illuminated during normal operation.
- d. Normal operation (Pump Hot)
- When the pump water temperature reaches the setpoint temperature, output 1 “Pump to Tank” relief opens/energizes.
 - Additionally, the visual ‘**PUMP HOT**’ red LED lamp will flash on and off at a 1 second rate.
 - Additionally, If the audible option is installed the audio output is pulsed on and off at a 1 second rate. The red LED and audible output will be in sync with each other.
 - With TMS, the following additional features are available:
 - When in “Tank” mode, if the temperature continues to rise 20°F (~11 deg °C) above the setpoint the “Pump to Ground” valve will activate progressively.
 - If the blue button is used to change the Tank/Ground selection set to “Ground”, the “Pump to Ground” output is switched ‘ON’ at the setpoint in lieu of the “Pump to Tank” relief which will close/remain closed (disabled).
 - The system will keep outputs activated until the temperature begins to drop. The outputs will sequence ‘off’ as the temperature drops 2°F (~1.1°C) below the initial setpoint(s).
 - The audible alarm, if installed, can be silenced for 15 seconds if the **Up/Down arrow temperature select button** is momentarily pressed while the system is indicating “Pump Hot”.
 - The red flashing LED and audible alarm will shut-off once the temperature drops below the setpoint temperature.
 - The temperature setpoint can be changed freely at anytime and the system will respond accordingly.
- e. Continuous sensor Input monitoring
- During normal operation the NTC sensor signal is constantly monitored. If the sensor voltage ever drops below 0.4VDC or increases above 4.9VDC on the sensor input pin, the control head indicates ‘**Sensor input out of range**’ as detailed below.
 - The red “Pump Hot” LED will blink at a 2 pulses per second rate continuously.
 - If an audible alarm device is attached to the system, the alarm will sound for 1 second every 10 seconds.
 - The relief valve outputs will not activate in ‘**Sensor input out of range**’.

THE SENSOR INPUT IS CONTINUOUSLY MONITORED



f. Changing the Temperature Setpoint

- The temperature setting can be changed at any time during normal operation. This allows for flexibility in varying pumping conditions.
- To change the temp setting, hold down the '**White Up/Down arrow temp select button**'. When the LED next to the current setting begins to blink, release the button and repeatedly press until the desired setting is achieved. The selection rotates across each of the 3 settings each time the button is momentarily pressed. Once the selection is made the LED will stop flashing and the new setting is now maintained.

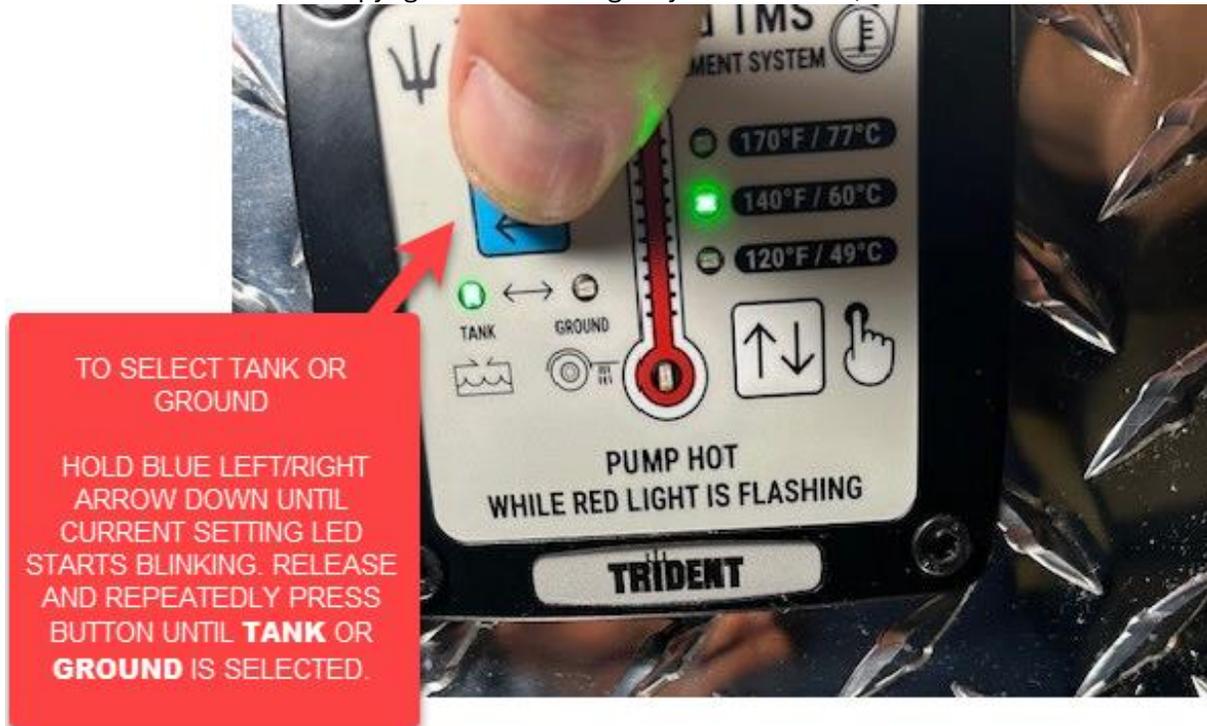


g. Audible Alarm Silence

- Pressing the **Up/Down arrow temperature select button** while the system is indicating "Pump Hot" will silence the audible output for 15 seconds.

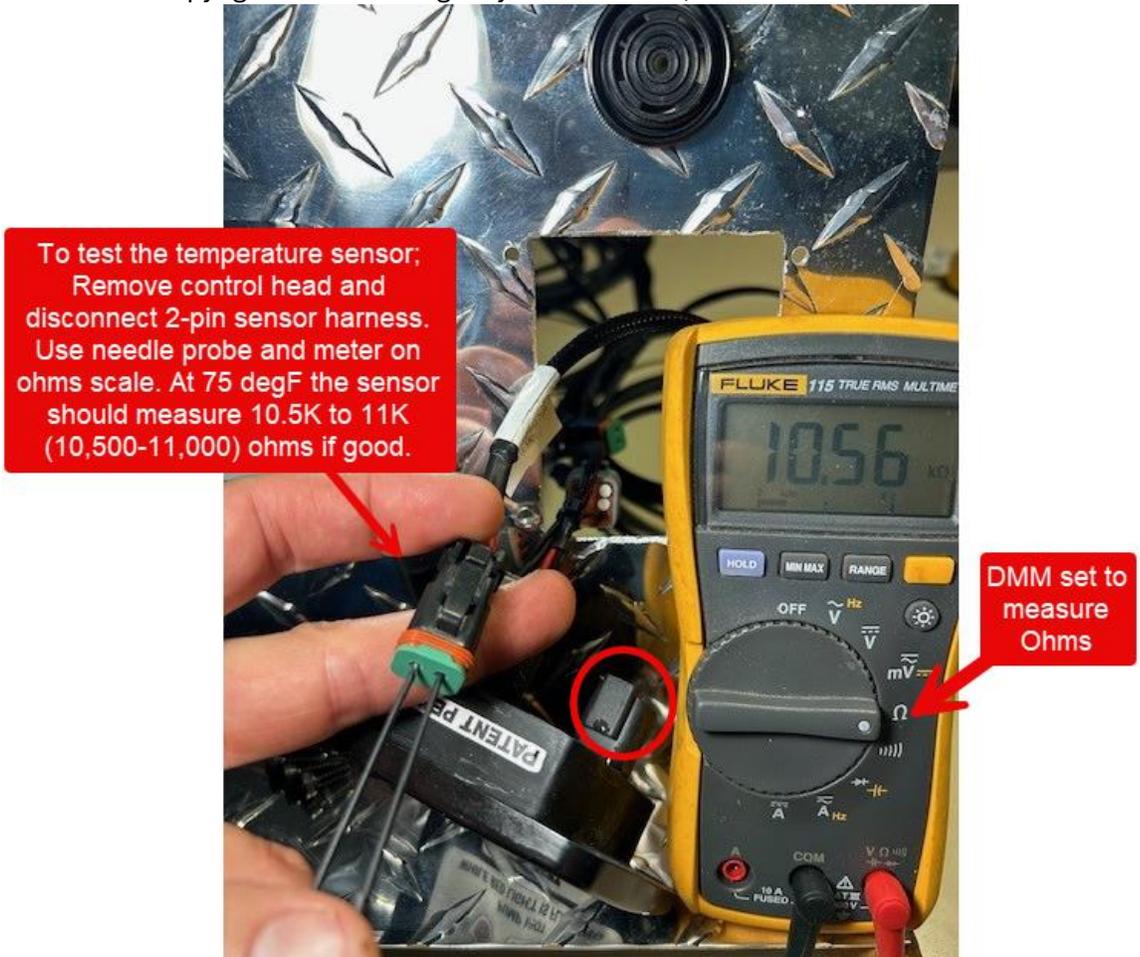
h. Tank/Ground Select

- The Tank/Ground setting can be changed at any time during normal operation. This allows '**GROUND**' (atmosphere discharge) to be selected when it is desired to not circulate all heated water back to the onboard water tank. '**TANK**' can be selected when it is desired to not discharge water to ground/pavement during cold weather or when the onboard water supply is limited and must be conserved. Note: In 'Tank' mode when the temperature is +20 Deg°F (~11 deg °C) hotter than the setpoint, the Pump to Ground Output will activate while the Pump to Tank is still active. This is to prevent overheating the onboard water supply.
- To change the '**TANK/GROUND**' setting hold down the '**Blue left/right arrow select button**'. When the LED begins to blink, release the button and repeatedly press until the desired setting is achieved. The selection rotates across each of the 2 settings.



7. Maintenance/Repair/Troubleshooting

- a. The ThermaGuard™ system does not require any specific periodic maintenance.
- b. The Control Head interface can be cleaned with water and mild detergents without degradation.
- c. Troubleshooting (Sensor)
 - If the system is in fault at start-up, faults intermittently or faults after being in normal operations, follow suggestions below for trouble shooting. (see section 6e in this manual for description of diagnostic function).
 - The NTC temperature sensor resistance can be tested with any DMM (Digital Multi-Meter). A few temperatures and resistances are listed below for reference.
 - 40°F = 26K ohms, 50°F = 20K ohms, 60°F = 15.5K ohms, 70°F = 11.8K, 77°F = 10K ohms. See following illustration explaining how to test the sensor.



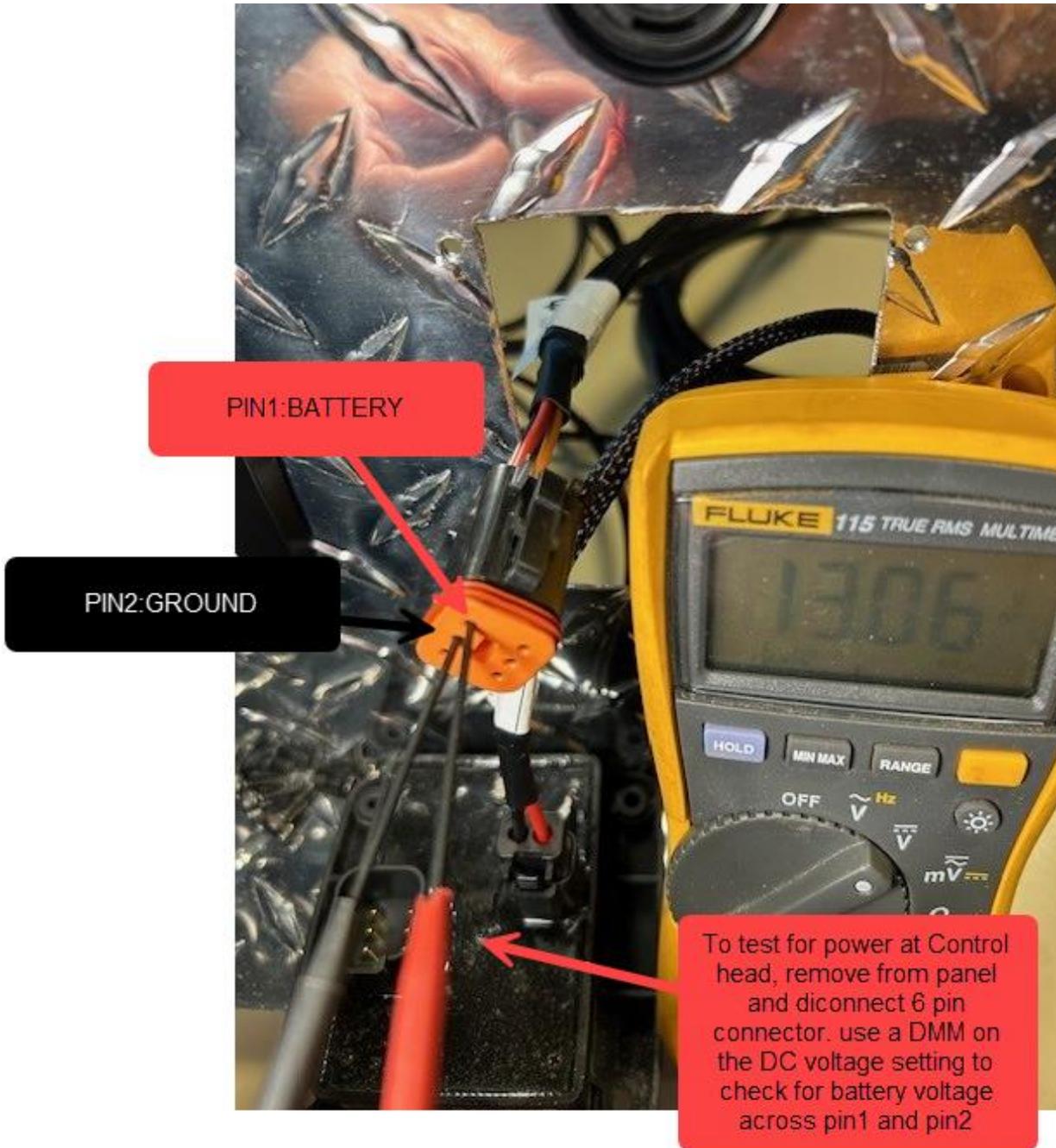
- Additional notes regarding electrical circuit issues.
 - Do not use dielectric grease on any of the connectors as this can pull dirt into the connector internals. Additionally, oil and grease can create hydraulic pressure that prevents connectors from seating or dislodging the gaskets.
 - Check that all connectors are firmly seated with locks engaged. A click/detent is apparent when the locks slip/detent into place.

d. Troubleshooting (Relief Valve/Check Valve)

- If the valve is leaking it is possible there is debris stuck in the valve. The manual override feature can be used (below) or the valve can be removed and inspected for debris.
- There is a manual override feature that can be used to flush the valve while under pumping conditions.
 - If the 'Temperature' select button is pushed 3 times in succession within 1 second, the valve output(s) will cycle open for 1 second and then close again.
 - The valves open with assistance of inlet pressure, so it is important that the valves have some pressure on the inlet to open the valve for flushing.
 - Note: The valves cannot be back flushed as the valve will be forced against the seat if pressurized from the outlet side. Additionally, the inline check valve would be forced closed.
 - The valves have screens on the inlet side. If the valves are not discharging enough water when discharging it may be possible the screens are clogged. Disassemble the valve and clean the screen. Reassemble and test.

e. Troubleshooting (No Power to Control head)

- Check fuse and circuit breaker connections.
- Check ground connections
- Use DMM (Digital Multi-Meter) to verify power on main connector. **Pin 1=Battery**, **Pin2=System Ground** pin. -See Illustration below.



8. Replacement parts

Ref	PART#	DESC
1	43.005.0	TMS Contol head
2	41.011.0	TMS Main harness
3		
4	43.006.0	TRV Control head
5	41.012.0	TRV Main harness 10ft.
6		
7	27.025.0	Mounting hardware kit (4 inserts/4 screws
8	41.013.0	Sensor harness 10ft.
9	49.008.0	NTC Sensor 10K 3892 coefficient
10	41.014.0	Audible add-on harness 4ft.
11	40.013.0	120db audible CUI devices 12/24v
12	30.126.0	Sol Valve with Deutsch 3/8 FNPT 12V
13	30.012.0	Check Valve 1/4 NPT
14	09.165.0	Brass 1/4" MNPT x 3/8" MNPT

9. Warranty/Returns

For five years after the date of purchase, Trident Emergency Products, LLC warrants its products to be free from defects in materials and workmanship when properly installed, operated, and maintained.

If during the warranty period, a product is discovered to be defective, Trident will, at its option, replace or repair the warranted product or grant the purchaser a credit for the product claimed to be defective. Trident will have the sole discretion to determine whether the product was defective.

No warranty of merchantability or fitness for a particular purpose, nor any warranty, express or implied, is made by Trident. The aforesaid states Trident Emergency Products, LLC's entire and exclusive liability and buyer's exclusive remedy for any claim for damages in connection with the sale of its products. In no event shall Trident be liable for any special incidental, or consequential damages whatsoever.

This warranty is null and void if the product is damaged due to abuse, misuse, negligence or accidental causes.

Return Policy: No material will be accepted for return without authorization by the factory, and a return goods authorization number assigned. Materials must be returned prepaid. A 20% restocking fee normally applies. No material will be accepted for a credit after one year from the date of purchase. Custom products and special orders are not returnable.



10. Ordering

Please use Trident part numbers and descriptions when placing orders. All orders must be written, **E-Mail (sales@tridentdirect.com)** or Fax to (215) 293-0701 or placed online at www.tridentdirect.com. All orders will be acknowledged by Trident within 2-days and shall become final after acknowledgment if not challenged. **No verbal orders will be accepted.**



Terms: 1%10-NET30 days on approved credit, or with MC/Visa credit card. Service charge 1.5% on past due accounts.

Freight: F.O.B. Hatboro, PA, USA. Our responsibility ceases upon delivery to common carrier. Consignee must file claim for storage and damaged freight with the carrier.

Delivery: Most standard items are shipped in five business days or less. Consult with customer service for availability, special threads, or special-order products.

Return Policy: No material will be accepted for return without authorization by the factory, and a return goods authorization number assigned. Materials must be returned prepaid. A 20% restocking fee normally applies. No material will be accepted for a credit after one year from the date of purchase. **Custom products and special orders are not returnable.**



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