



***TSr SERIES***

***Surge Protective Device***

***Installation & Operation Manual***

# TSrc/TSri SERIES INSTALLATION & OPERATION



## Quick Reference - Electrician Installation Information

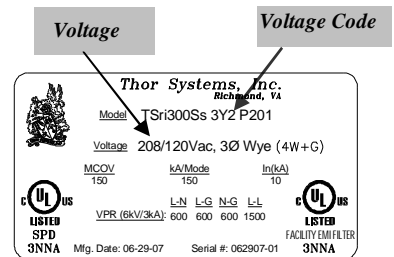
### **WARNING!**

**Failure to confirm voltage can result in serious damage, injury, or even death.**

1. **Confirm Voltage.** Confirm the voltage of the Surge Protective Device (SPD) device matches the utility voltage. (Reference Section I, System Identification Labels.) Should the Utility Voltage not match the SPD voltage, **DO NOT INSTALL THE SPD – CONTACT YOUR LOCAL SALES REPRESENTATIVE OR THOR SYSTEMS, INC.**
2. **Neutral-Ground Bond Confirmation.** If the SPD is connected to a Split Phase, 3 Phase WYE, or 3 Phase High-Leg Delta Transformer supplied source, confirm the Neutral and Ground have a bonding jumper in place. **Note: If the X-0 bond is not in place, do NOT install SPD.**
3. **Mounting Location Recommendations.** Mount the SPD in a location that ensures the conductors are as short and straight as possible.
4. **Wire Size:** #6AWG is recommended.
5. **Safety Ground.** Per NEC Article 250, ground the TVSS device to the nearest NEC-approved grounding electrode. A mechanical lug is provided and labeled as “**Ground.**”
6. **Form C Contacts:** Models that include a Form C Contact need to have the wires enter the SPD through a knockout other than the power wire knockout. Keep a minimum of two inches (2”) separation between the Form C wires and the power wires.

### I. **SYSTEM IDENTIFICATION LABELS**

A. **UL Label.** All SPDs have a UL label affixed. This label includes the proper UL marks as well as the UL assigned Voltage Performance Ratings (VPR). It also provides the Model Number and Voltage Rating of the SPD. Prior to installation, verification of the voltage **MUST** be confirmed. You must confirm that the voltage and service configuration of the SPD match the voltage and service configuration of the distribution equipment the SPD will be connected to.



B. **AIC Label.** All THOR SYSTEMS’ Series *TSri* and *TSrc* models have a 100kAIC rating up to 480Vac. Every SPD is labeled with an AIC label as shown here.

Per NEC Article 285 Section 6, prior to installation the fault current coordination between the utility service and the SPD to be installed must be confirmed. The AIC rating of the SPD must be equal to (or greater than) the AIC rating of the distribution equipment supplying the installation.

Suitable For Use on a Circuit Capable of Delivering Not More Than 100k rms symmetrical Amps, at 480 Volts Maximum.

C. **Electrical Diagram Label.** An electrical diagram label is affixed to each SPD. Should the utility electrical configuration not match the SPD electrical diagram label, **DO NOT INSTALL THE SPD – CONTACT YOUR LOCAL SALES REPRESENTATIVE OR THOR SYSTEMS, INC.**

### **WARNING!**

**Failure to confirm electrical diagram can result in serious damage, injury, or even death.**

## Tsrc/TSri SERIES INSTALLATION & OPERATION



### II. SYSTEM VOLTAGE CONFIGURATIONS

THOR SYSTEMS, INC. offers SPDs in various voltage configurations. As illustrated on the UL Label on the previous page, each model number contains a three (3) digit code representing the voltage specific to that model. The table below lists the various three (3) digit codes and respective voltage configurations. An electrical diagram for each code is pictured at the bottom of this page.

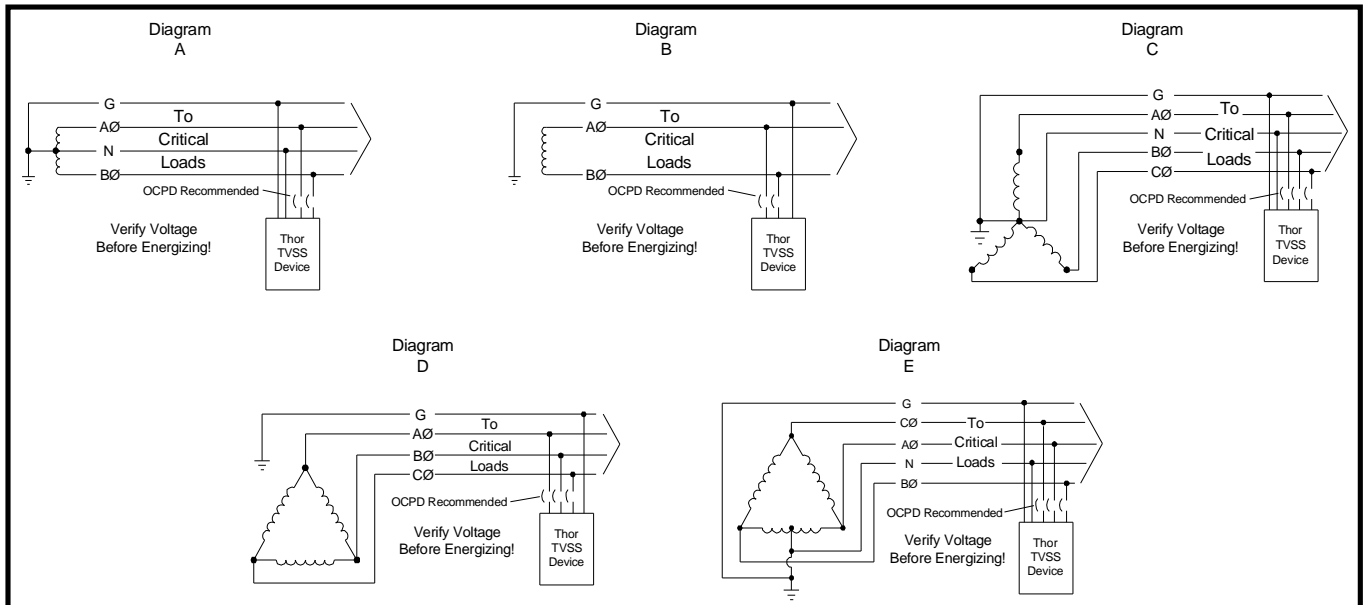
Sample Model number: *TSri150Ts* XXX *M101*. (XXX represents the voltage code; replace the XXX with the appropriate code to complete the model number):

**TSri150Ts 3Y2 M101 = 208/120Vac Three Phase WYE, 3L, N & G**

**Voltage Code Table**

Voltage Code	Voltage Configuration	Ref. Diagram	Wire Color Code				
			L1 (AØ)	L2 (BØ)	L3 (CØ)	Neutral	Ground
2S1	240/120Vac Single (Split) Phase	A	Black	Red	N/A	White	Green
2S2	240Vac Single Phase	B	Black	Red	N/A	N/A	Green
2S4	480Vac Single Phase	B	Brown	Orange	N/A	N/A	Green
3Y2	208/120Vac Three Phase WYE	C	Black	Red	Blue	White	Green
3Y4	480/277Vac Three Phase WYE	C	Brown	Orange	Yellow	White	Green
3D2	240Vac Three Phase Delta	D	Black	Red	Blue	N/A	Green
3D4	480Vac Three Phase Delta	D	Brown	Orange	Yellow	N/A	Green
3H <sup>(1)</sup>	240Vac High-Leg Delta	E <sup>(2)</sup>	Black	Red	Blue	White	Green

(<sup>1</sup>) Insert **a** for AØ High-Leg; **b** for BØ High-Leg; **c** for CØ High-Leg  
 (<sup>2</sup>) **Diagram E** below represents a CØ High-Leg Application as **reference only**. Confirm the correct High-Leg **before** installation.



**WARNING!**  
**Failure to verify voltage can result in serious damage, injury, or even death.**

## TSrc/TSri SERIES INSTALLATION & OPERATION



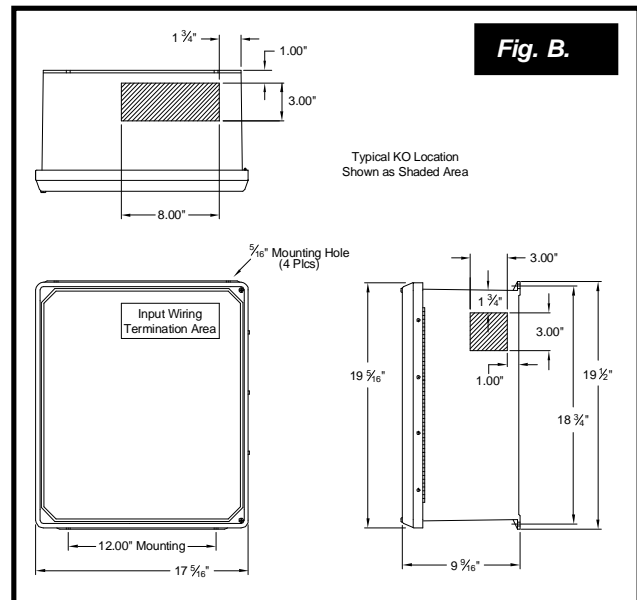
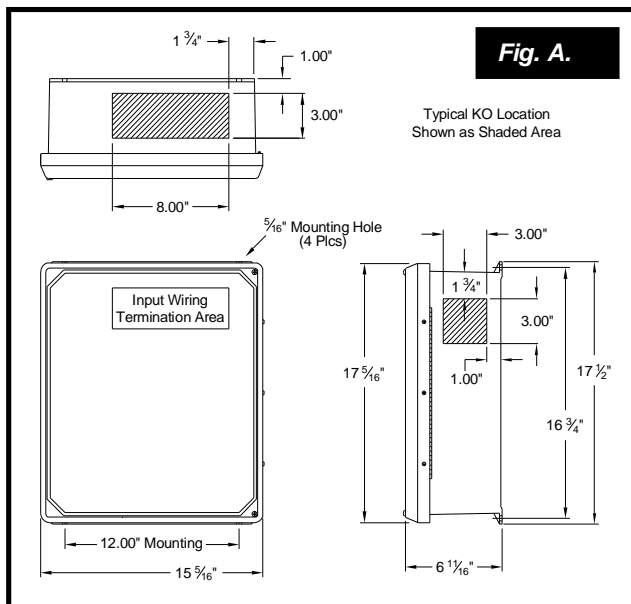
### III. SYSTEM MOUNTING AND DIMENSIONS

- A. Mounting Location.** Mount the *TSr* as close as possible to the load to be protected. To achieve maximum SPD system performance, position the SPD in a location which permits the conductors to be as short and as straight as possible. Wall mount the Surge Protective Device using 3/8-16" mounting hardware.
- B. System Dimensions/Knockout Location.** The illustrations below show the physical dimensions and knockout entry locations for both the *TSrc* and *TSri* models. Punch the proper size hole in the SPD located closest to the knockout to be utilized in the electrical panel.

**Knock-Out Locations – Figures A & B**

Model Series	Voltage Code*	Extended Filter Option	Fig Ref (see below)
TSrc (Commercial Grade)	2S1 3Y2, 3Y4, 3Y6 3Ha, 3Hb, 3Hc	Not Available	Fig. A
TSrc (Commercial Grade)	2S2, 2S4 3D2, 3D4	Not Available	Fig. B
TSri (Industrial Grade)	2S1 3Y2, 3Y4, 3Y6 3Ha, 3Hb, 3Hc	w/o Optional Extended Filter	Fig. A
TSri (Industrial Grade)	2S1 3Y2, 3Y4, 3Y6 3Ha, 3Hb, 3Hc	w/Optional Extended Filter	Fig. B
TSri (Industrial Grade)	2S2, 2S4 3D2, 3D4	Not Available	Fig. B

\*See Page 3 for Voltage Code Descriptions



## *TSrc/TSri SERIES* **INSTALLATION & OPERATION**



**WARNING!**  
***Improper wiring can result in serious damage, injury, or even death.***

#### **IV. SYSTEM POWER WIRING**

- A. Insure that all power is removed before beginning installation. A qualified licensed electrician shall install all electrical connections.
- B. Based upon the input option ordered, input terminals are provided inside the SPD for the lines (phases), Neutral (if used), Ground and Safety Ground connections.

#### **Input Termination Wire Range & Torque Tightening Specifications**

Input Type	Wire Range	Tightening Torque
DIN RAIL Terminal Block	#4 - #6AWG	18 - 22 In. Lbs.
Fused Disconnect Switch	#4 - #6AWG	22 – 31 In. Lbs.
Surge Disconnect Switch	#2 - #6AWG	50 In. Lbs.
Distribution Block	#2 - #6AWG	80 In. Lbs. (For #2-#6AWG)

- C. Connect the phase wires to the input Terminal Block, Surge Disconnect Switch or Fused Disconnect Switch. The terminals are marked Line1 (AØ), Line2 (BØ), and Line3 (CØ).
- D. Connect the Ground to the terminal marked “**Surge Ground.**”
- E. Connect the Neutral (if used) to the terminal marked “**Neutral.**”
- F. Connect the Safety Ground to the terminal marked “**Ground.**”

#### **V. POWER UP THE SYSTEM**

- A. Apply power to the SPD.
- B. The surge protector is fully operational when the Green LEDs on the SPD are illuminated.
- C. The *TSr* should have seven (7) illuminated Green LEDs visible through the enclosures *CLEAR* cover. If the Green LEDs are not illuminated or if any of the Red LEDs *are* illuminated, check to ensure power is applied to the SPD.
- D. If the SPD is not operating properly, remove power to the SPD and contact your local Sales Representative or THOR SYSTEMS, INC.

## TSrc/TSri SERIES INSTALLATION & OPERATION



### VI. SYSTEM MONITORING

Monitoring Model No. Suffix	Suffix Description
<b>P100</b>	Monitoring Type 1 <ul style="list-style-type: none"> <li>• Green and Red LED per each Replaceable Module (Standard)</li> </ul>
<b>P101</b>	Monitoring Type 1 <ul style="list-style-type: none"> <li>• Green and Red LED per each Replaceable Module</li> <li>• Dry (Form C) Contact</li> </ul>
<b>P200</b>	Monitoring Type 2 <ul style="list-style-type: none"> <li>• Green and Red LED per each Replaceable Module</li> <li>• Green STATUS LED on Monitoring Display Panel</li> <li>• Audible Alarm with Silence and Enable Button on Monitoring Display Panel</li> <li>• Surge Counter with (8) Sensitivity Settings on Monitoring Display Panel</li> <li>• Yellow Active Surge LED on Monitoring Display Panel</li> </ul>
<b>P201</b>	Monitoring Type 2 <ul style="list-style-type: none"> <li>• Green and Red LED per each Replaceable Module</li> <li>• Monitoring Green STATUS LED on Monitoring Display Panel</li> <li>• Audible Alarm with Silence and Enable Button on Monitoring Display Panel</li> <li>• Surge Counter with eight (8) Sensitivity Settings on Monitoring Display Panel</li> <li>• Yellow Active Surge LED on Monitoring Display Panel</li> <li>• Dry (Form C) Contact</li> </ul>
<b>P203</b>	Monitoring Type 2 <ul style="list-style-type: none"> <li>• Green and Red LED per each Replaceable Module</li> <li>• Monitoring Green STATUS LED on Monitoring Display Panel</li> <li>• Audible Alarm with Silence and Enable Button on Monitoring Display Panel</li> <li>• Surge Counter with eight (8) Sensitivity Settings on Monitoring Display Panel</li> <li>• Yellow Active Surge LED on Monitoring Display Panel</li> <li>• Dry (Form C) Contact two (2) each</li> <li>• Phase Loss Relay</li> </ul>

**A. Green and Red LED per Each Replaceable Module – Standard.**  
 All standard TSr models are equipped with a Green and Red LED per each module, visible through the clear window of the enclosure. Each Module will include an illuminated Green LED indicating the respective module is good. Upon a module failure, a Red LED will illuminate on the respective module.

**B. Green Status LED on Monitoring Display Panel – Optional.**  
 Models with the Type 2 Monitoring Display Panel (**P2**) include a Green **STATUS** LED which is illuminated when the Monitoring Display is on. Pressing the Display Panel **ON** button will turn the monitor off. Pressing the **ON** button a second time will turn the Display Panel on again.

**C. Audible Alarm – Optional.** Models with the Type 2 Monitoring Display Panel (**P2**) include an Audible Alarm that will sound a fault alarm when a module has failed. Pressing the **ACK** button on the Display Panel will silence the alarm. A **RED ALARM** LED will illuminate on the Display Panel and will not go off until the failed module has been replaced. A **YELLOW ENABLE** LED is also on the Display Panel. When illuminated, the Audible Alarm will sound after a module fault. To prevent the Audible Alarm from sounding, press the **ENABLE** button on the Display Panel turning off the **YELLOW ENABLE** LED. To enable the Audible Alarm, press the **ENABLE** button again.



## TSSrc/TSri SERIES INSTALLATION & OPERATION



### VI. SYSTEM MONITORING, CONTINUED

**D. Surge Counter – Optional.** Models with the Type 2 Monitoring Display Panel (**P2**) include a Surge Event Counter that increments after a surge event. The Surge Counter has eight (8) user-programmable sensitivity settings. The factory pre-set is SEN3 (Sensitivity 3) which will increment the counter with an  $8\mu\text{s} \times 20\mu\text{s}$  surge event that exceeds approximately 500A. Due to various factors (load, wire size, distance from electrical panel), the values shown below are approximate:

- SEN1 increments on an  $8\mu\text{s} \times 20\mu\text{s}$  surge event exceeding 200A
- SEN2 increments on an  $8\mu\text{s} \times 20\mu\text{s}$  surge event exceeding 350A
- SEN3 increments on an  $8\mu\text{s} \times 20\mu\text{s}$  surge event exceeding 500A
- SEN4 increments on an  $8\mu\text{s} \times 20\mu\text{s}$  surge event exceeding 650A
- SEN5 increments on an  $8\mu\text{s} \times 20\mu\text{s}$  surge event exceeding 800A
- SEN6 increments on an  $8\mu\text{s} \times 20\mu\text{s}$  surge event exceeding 950A
- SEN7 increments on an  $8\mu\text{s} \times 20\mu\text{s}$  surge event exceeding 1100A
- SEN8 increments on an  $8\mu\text{s} \times 20\mu\text{s}$  surge event exceeding 1250A

To change the Sensitivity Setting, press the **ACK** and **ENABLE** buttons on the Monitoring Display Panel at the same time. The window displaying the number of surge events will change to show the current sensitivity setting. To raise the Sensitivity Setting, press the **ON** button. To lower the sensitivity setting, press to **RESET** button. Once you have reached the desired Sensitivity Setting, press the **ACK** button. After pressing the **ACK** button, the display will switch back to the numeric surge event number.

**E. Active Surge Event LED – Optional.** Models with the Type 2 Monitoring Display Panel (**P2**) include a Yellow Active Surge Event LED that flashes during a Surge Event. Every time the Surge Event LED flashes, the Surge Counter will increment by one (1).

**F. Dry (Form C) Contact.** Models with the optional Dry (Form C) Contacts, standard on TSri Models, have a set of terminals that change state based upon the module status. The terminals are marked 1-2-3. TSSrc Models have (1) Set of Contacts, while TSri models have (2) sets of contacts.

Dry (Form C Contact) Operation	
Power <b>Off</b> to the SPD	Terminals 2-3 are Normally Closed
Power <b>On</b> to SPD and All Modules are Good	Terminals 2-3 are Normally Closed
Power <b>On</b> to SPD and Any Module Failed	Terminals 1-2 are Normally Closed

**G. Phase Loss Relay.** Models with the optional Phase Loss Relay have a set of terminals that change state based upon the phase status. The terminals are marked 1-2-3.

Phase Loss Relay Operation	
Power <b>Off</b> to the SPD	Terminals 2-3 are Normally Closed
Power <b>On</b> to SPD and All Modules are Good	Terminals 1-2 are Normally Closed
Power <b>On</b> to SPD and Any Module Failed	Terminals 2-3 are Normally Closed

## *TSrc/TSri SERIES* **INSTALLATION & OPERATION**



### **VII. SURGE TILE REPLACEMENT**

- A. Surge Tile Identification:** The *TSr* Series allows for failed Surge Tiles to be replaced in the field by a qualified electrician. The Surge Tile voltage rating varies based on the system voltage. The Surge Tile is keyed and numerically color-coded to prevent the installation of an incorrect voltage Surge Tile. The table below identifies the numeric, color and key value of the Surge Tile per Voltage.

**THOR SYSTEMS, INC.**  
**Surge Tile Numeric, Color, & Key Values**

System Voltage (AC)	Numeric Value	Color	Pin ID (Key Value)
240/120 Vac or 208/120 Vac	150	Purple	I
480/277 Vac	320	Red	II
480 Vac	550	Yellow	X

#### **B. Surge Tile Removal**

1. Unplug the 24AWG wire harness from the failed Surge Tile.
2. Using a 7/16" socket, remove the two (2) ¼-20 serrated washer head hex nuts that hold the Surge Tile to the bus structure.
3. If your Surge Protective Device has a dielectric paper between the Surge Tiles, be sure to keep the paper in place during the removal of the Surge Tile.
4. Remove the Surge Tile.

#### **C. Surge Tile Replacement**

1. Verify the numeric value, color-coded label, and pin ID match the Surge Tile being replaced.
2. If your SPD has a dielectric paper between the Surge Tiles, be sure to keep the paper in place during installation of the Surge Tile.
3. Secure the Surge Tile with the two (2) ¼-20 serrated washer head hex nuts removed in Step B-2 above.
4. Replace the 24AWG wire harness that was unplugged in Step B-1 above.