



***TS<sub>n</sub> SERIES***  
***Surge Protective Device***  
***Installation & Operation Manual***

# TSn 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.) If the Utility Voltage **not** match the SPD voltage, **DO NOT INSTALL THE SPD – CONTACT YOUR LOCAL SALES REPRESENTATIVE OR THOR SYSTEMS.**
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 the 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:** The SPD is pre-wired with #10AWG wire, as listed below.
  - Industrial Models (**TSni**) are provided with #10 Corona High Voltage Wire.
  - Commercial Models (**TSnc**) are provided with #10 MTW Wire.

Each phase conductor extends twenty-four inches (24") outside the enclosure, while the Ground and Neutral conductors (if applicable) extend thirty-six inches (36") outside the enclosure.

If the wires provided are not long enough to reach the respective terminals and a splice is required, **DO NOT USE WIRE NUTS.** Use a mechanical or compression lug to make the splice connection. Be sure to wrap the lugs with a dielectric tape to prevent arcing.

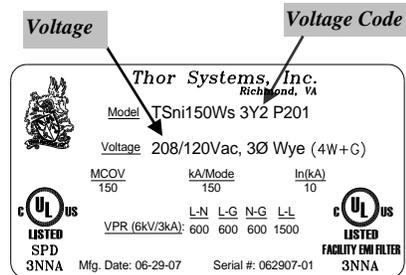
5. **Form C Contacts:** Models that include a Form C Contact need to have the wires enter the SPD through a knockout other than the power wire knockout. Keep a minimum of two inches (2") separation between the Form C wires and the power wires.

If the SPD is mounted outdoors or in an area that may expose the device to moisture, the SPD conduit opening must be sealed with silicone.

## **I. SYSTEM IDENTIFICATION LABELS**

- 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.
- AIC Label.** All THOR SYSTEMS Series **TSni** and **TSnc** models have a 100k AIC 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.

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## I. SYSTEM IDENTIFICATION LABELS, CONTINUED

- C. **Electrical Diagram Label.** An electrical diagram label (shown on the next page) is affixed to each SPD. If 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.**

## 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 on the next page.

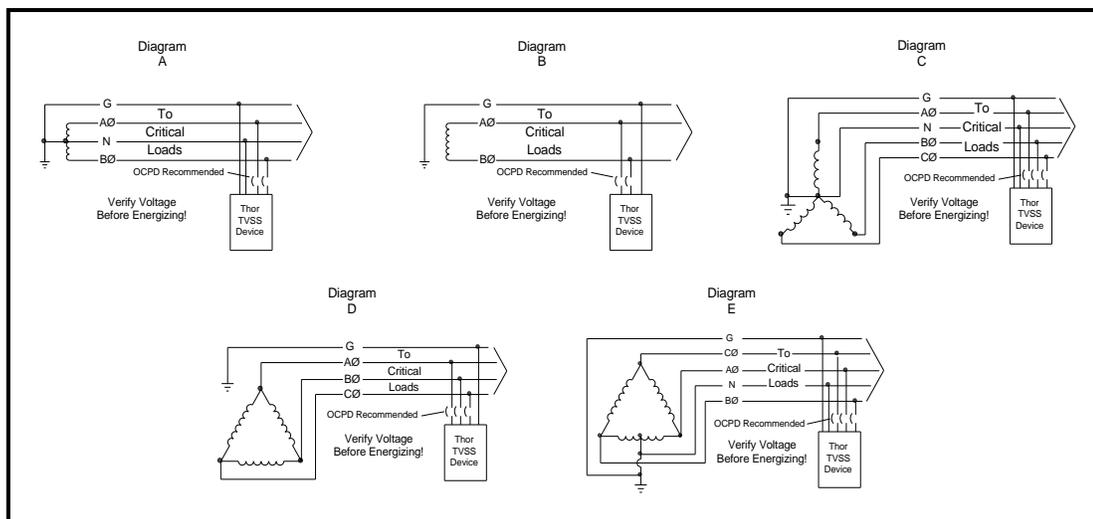
Sample Model number: *TSni150Ws* XXX *P100*. (XXX represents the voltage code; replace the XXX with the appropriate code to complete the model number): **TSni150Ws** 3Y2 *P100* (208/120Vac Three Phase WYE, 3L, N & G)

**THOR SYSTEMS, INC. - 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** represents a CØ High-Leg Application as **reference only**. Confirm the correct High-Leg **before** installation.

**THOR SYSTEMS, INC. - Electrical Diagram (Ref: Voltage Code Table)**



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### III. SYSTEM MOUNTING AND DIMENSIONS

- A. **Mounting Location.** Every TSn Surge Protective Device includes stainless steel mounting feet, enabling the installer to mount the unit without removing the SPD cover. Mount the *TSn* 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.

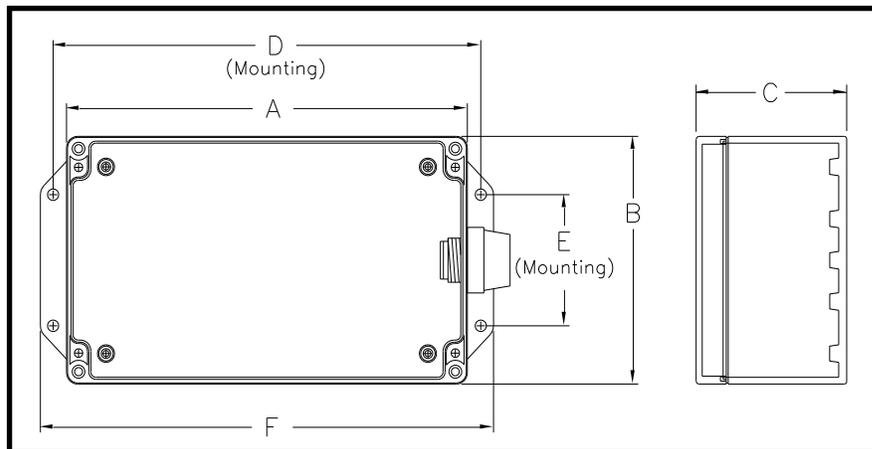
If the SPD is mounted outdoors or in an area that may expose the device to moisture, the SPD conduit opening must be sealed with silicone.

- B. **System Dimensions.** The table below provides dimensional information necessary for proper equipment installation. Each *TSn* product is shipped from the factory with plastic wall anchors and screws for mounting.

**TSn SERIES - DIMENSIONS TABLE**

TSn MODEL	DIM A	DIM B	DIM C	DIM D	DIM E	DIM F
TSn 150	10-1/2"	7-1/4"	3-3/4"	11"	5"	11-3/8"
TSn 100	9-1/2"	6-3/8"	3-1/2"	10"	3-1/2"	10-7/16"
TSn 050	7-7/8"	4-3/4"	3-1/2"	8-3/8"	2-1/2"	8-7/8"

**TSn SERIES – DIMENSIONS DIAGRAM**



### IV. SYSTEM POWER WIRING

- A. The SPD is pre-wired with #10AWG wire. Route the wires into the electrical panel on which the SPD is to be installed.

**WARNING!**

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

- B. Connect the Ground and Neutral (if applicable) to their respective buss bars.

If the wires provided are not long enough to reach the respective terminals and a splice is required, **DO NOT USE WIRE NUTS**. Use a mechanical or compression lug to make the splice connection. Be sure to wrap the lugs with a dielectric tape to prevent arcing.

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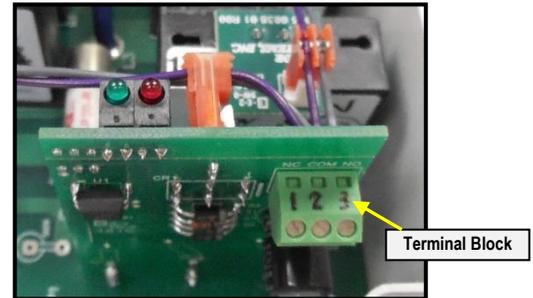


## V. OPTIONAL “FORM C” CONNECTION

- A. SPD systems provided with an optional Form C (Dry) contact will have a 3-Pole Terminal Block located on a vertical Printed Circuit Board near the system LEDs. [See Fig #1]

The terminals accept #16-#26AWG conductor and the contact ratings are 0.50A @ 30Vdc Resistive. The terminals are marked **1-2-3** for proper connection. The terminals have a torque rating of two (2) inch pounds.

**FIG #1**  
**Form C Terminal Block**



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

- B. If the Form C Contacts are pre-wired from the factory, the device is provided with a #22AWG, 3 Conductor cable wired as follows:
- White Wire = **Terminal #3**
  - Black Wire = **Terminal #2**
  - Red Wire = **Terminal #1**

## VI. POWER UP THE SYSTEM

- A. Reconfirm that proper phase connections have been made to the SPD.
- B. Close the breaker feeding the SPD.
- C. The SPD should now be on-line and protecting the load, as indicated by a Green LED. If the Green LED does not illuminate and/or if the Red LED does illuminate confirm voltages feeding the SPD. If the voltage appears correct, contact your local Sales Representative or THOR SYSTEMS.

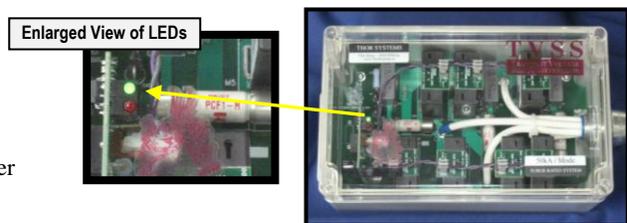
## VII. SYSTEM MONITORING TYPES

Your surge protection SPD system will include one (1) of two (2) monitoring types. For proper monitoring operation, confirm the monitor comes on-line per the descriptions on the following page.

### A. **Type 1 Monitor, Vertical PCB (Standard)**

1. **Features.** Green and Red LED visible through the “Clear” Lid. [See Fig 2]
2. **During normal operation.** The Green LED is illuminated confirming AC power to the SPD and indicating ALL of the protection modes are functional.
3. **After a Fault Condition.** The Red LED will illuminate upon any protection mode loss. Two (2) yellow tabs will protrude from the protection mode element (TpMOV) that has failed.

**FIG #2**  
**TYPE 1 MONITOR**



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### VII. SYSTEM MONITORING TYPES, CONTINUED

In the event of a protection mode loss, you should contact your local Sales Representative or THOR SYSTEMS.

#### B. Type 2 Monitor, TSm270s (Optional)

1. **Features.** Audible Alarm and Surge Counter; includes a four (4) Button Monitor Display providing a system Green and Red LED, Audible Alarm with Acknowledge Button, and a Surge Counter. The Surge Counter has eight (8) sensitivity settings. [See Fig 3]
2. **During normal operation.** During the SPD initial power up, the Surge Counter will display the Sensitivity Setting. The Sensitivity Setting is set to “3” by the factory. (See additional Surge Counter operations in the **Monitoring Overview** section below.)
  - The Green LED is illuminated confirming AC power to the SPD and indicating ALL of the protection modes are functional.
  - The Yellow **ENABLE** LED is illuminated indicating that the Audible Alarm will sound in the event of a fault condition.
  - The Surge Counter will display “0000” or other four (4) digit display representing the number of impulses the SPD has diverted. (See additional Surge Counter operations in the **Monitoring Overview** section below.)
3. **After a Fault Condition.** The Red LED will illuminate upon any protection mode loss. The Audible Alarm will sound (if the Alarm is enabled).
  - The Surge Counter will flash “ALRM” until the Acknowledge **ACK** button is pushed.
  - Two (2) yellow tabs will protrude from the protection mode element (TpMOV) that has failed.
4. **Monitoring Overview.** The TSm 270a Monitor uses a four (4) digit alpha-numeric LED display capable of indicating up to 27,000 impulse events. The 270a Monitor also contains four (4) indicating LEDs and four (4) membrane style switches capable of over one million operations.
  - a. **Indicating LEDs.** The Green **STATUS** LED is used to indicate that power is applied to the SPD. The Red **ALARM** LED is used to indicate the loss of a protection mode within the unit. The Yellow **ENABLE** LED indicates the status of the audible alarm and, finally, the Yellow **ACTIVE SURGE** LED illuminates during an actual counted surge event.
  - b. **LED Display.** The four (4) digit LED 5x7 dot matrix smart alpha-numeric display uses both alpha and numeric characters to count up to 27,000 impulse events. This is accomplished by converting the first character into a letter when the 10,000 impulse level is reached (example, A000). The letter is then incremented after each subsequent 1000 impulses for a total of 26,999 (example, Z999) counts
  - c. **Membrane Switches**
    - **ON.** Pressing the **ON** switch will power the monitor on and off, extinguishing all LEDs and the display. Pressing the **ON** switch a second time will illuminate the LEDs and Display in the same configuration as before the monitor was turned off. Any impulses recorded on the Display will be stored in an EE prom and will be displayed again when the monitor is turned back on.

FIG #3  
TYPE 2 MONITOR



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### VII. SYSTEM MONITORING TYPES, CONTINUED

- **ACK.** Pressing the **ACK** switch will silence the audible alarm in an alarm condition. If the alarm condition has cleared, pressing the **ACK** switch again will reset the display to the normal condition.
  - **ENABLE.** Pressing the **ENABLE** switch enables and disables the audible alarm function on the SPD. The current status is indicated by the Yellow **ENABLE** LED. If the Yellow LED is illuminated, the Audible Alarm is enabled. If the Yellow LED is not illuminated, the Audible Alarm is disabled.
  - **RESET.** The **RESET** switch will reset the impulse counter back to zero. Due to the advantages of knowing the total number of impulses the unit has experienced in a diagnostic situation, the **RESET** switch requires additional inputs for a reset to be performed. Please contact THOR SYSTEMS' Customer Service, for these additional inputs.
- d. **Sensitivity Settings.** The TSm 270a monitor has the capability of adjusting the sensitivity of the count circuitry. Often due to the electrical environment at the installation, the counter can experience excessive events that are continuously incremented or lower level events that do not trigger the counter. The Sensitivity Settings allow an adjustment of the circuit due to the electrical environment without requiring a hardware change.

To adjust the Sensitivity Setting, press and hold the **ENABLE** and **ACK** switches. After three seconds, the LED display will change to the sensitivity screen [SEN?]. The question mark [?] will actually display the current sensitivity setting--factory set to "3".

Using the **ON** and **RESET** switches will increase and decrease the sensitivity setting. The lower the setting, the more sensitive the circuit becomes, the higher the setting the less sensitive the circuit is. Settings are provided from "1" to "8." After the new level is selected, press the **ACK** switch. The monitor will return to normal operation and the sensitivity level will be displayed on any power-up function of the monitor.