8228-0010A
12/03

Operation Manual

Titan MP

Transient Voltage Surge Suppressor (TVSS)

Titan MP500
Titan MP400
Titan MP320
Titan MP250

efi ELECTRONICS

⚠ DANGER

HAZARDOUS VOLTAGE

- This equipment must be installed and serviced only by qualified electrical personnel.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.
- Disconnect all power supplying this equipment before working on or inside it.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace the door/cover before energizing.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

LOSS OF BRANCH CIRCUIT POWER/LOSS OF SURGE PROTECTION

In the event that the surge protective elements of this unit have been damaged (i.e. excessive surge energy, power system anomaly, etc.), the surge protective elements can lose their ability to block power system voltage and attempt to draw excessive current from the line. This TVSS is equipped with overcurrent protection that will automatically disconnect the surge protective elements from the mains should the surge protective elements be damaged.

The effects of damaged surge protective elements and the subsequent operation of the automatic overcurrent protection must be considered when applying a TVSS, particularly when critical loads requiring continuity of power or continuity of surge protection are present on the power system. The following items should be considered when applying a TVSS:

- Tripping of the branch circuit breaker feeding the TVSS can occur when the surge protective elements are damaged.
- Periodic inspection of the state of the status indicator lights on the TVSS should be made as part of the preventive maintenance schedule. The TVSS should be promptly serviced when an alarm state exists.
- For unmanned, inaccessible, or critical installations, the dry contacts should be used to signal an alarm state to the central supervisory system.
- In addition to the preceding items, the use of multiple TVSS devices to achieve redundancy should be considered for critical applications.

Failure to follow these instructions can result in loss of power or loss of surge protection that can cause injury or equipment damage.

CAUTION

LOSS OF SURGE PROTECTION

- During installation into an electrical system, TVSS devices must not be energized until the electrical system is completely installed, inspected, and tested. All conductors must be connected and functional, including the neutral. The voltage rating of the device and system must always be verified before energizing the surge protective device.
- Any factory or on-site testing of power distribution equipment that exceeds the normal operating voltage, such as high-potential insulation testing, or any other tests where the suppression components will be subjected to voltages higher than their rated turn-on voltage must be performed with the suppressor disconnected from the power source. The neutral connection at the TVSS device must also be disconnected prior to performing high-potential testing and then reconnected upon completion of the test.

Failure to follow these instructions can result in equipment damage.

INTRODUCTION

⚠ DANGER

HAZARDOUS VOLTAGE

- This equipment must be installed and serviced only by qualified electrical personnel.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.
- Disconnect all power supplying this equipment before working on or inside it.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace the door/cover before energizing.

Failure to follow these instructions will result in death or serious injury.

Proper installation is imperative to maximize the transient voltage surge suppressor (TVSS) device's effectiveness and performance. The installer should follow the steps outlined in this instruction bulletin to ensure proper installation. Read the entire instruction bulletin before beginning the installation. These instructions are not intended to replace national or local electrical codes. Check all applicable electrical codes to verify compliance. Installation of surge suppressors should only be performed by qualified electrical personnel.

NOTE: TVSS devices are designed for use on the load side of the service entrance disconnect only.

UNPACKING AND PRELIMINARY INSPECTION

Inspect the entire shipping container for damage or signs of mishandling before unpacking the device. Remove the packing material and further inspect the device for any obvious shipping damage. If any damage is found, do not install. If damage is a result of shipping or handling, immediately file a claim with the shipping company.

STORAGE

The device should be stored in a clean, dry environment. Storage temperature is -40 to +65 °C (-40 to +149 °F). All of the packaging materials should be left intact until the device is ready for installation.

IDENTIFICATION NAMEPLATE

The identification nameplate is located on the inside of the door/cover.

SAFETY LABELS

English versions of all safety labels (danger, warning, caution) are provided.

TVSS LOCATION CONSIDERATIONS

Environment

The device is designed to operate in an ambient temperature range of 0 to +50 °C (+32 to +122 °F) with a relative humidity of 0 to 95% non-condensing. Refer to the product data sheet for further details on enclosures.

Audible Noise

The device background noise is negligible and does not restrict the location of the installation.

Mounting

The device is designed to be surface mounted. Refer to the device submittal drawings or the product data sheet for typical mounting dimensions and weight. Install the Titan MP TVSS device in a restricted access area.

Service Clearance

The service clearance should meet all applicable code requirements.

Equipment Performance

To obtain the maximum system performance, locate the device as close to the circuit being protected as possible to minimize the interconnecting wiring length. For every foot of wire length, approximately 175 volts (6 kV / 3 kA, 8/20 microsecond) is added to the suppressed voltage. The suppressed voltage rating is located on the device nameplate and is measured 6 inches outside the panel, according to UL® 1449 Second Edition.

ELECTRICAL

Voltage Rating

Prior to mounting the TVSS device, verify that the device has the same voltage rating as the power distribution system in which it is installed by comparing the nameplate voltage or model number on the TVSS with the nameplate of the electrical distribution equipment.

CAUTION

- This devise may be damaged if connected to an ungrounded or corner grounded delta configuration. If the premise wiring is 3 phase 3-wire + ground, check with the facility manager or the power company to make sure the power system configuration is a Wye or High-Leg Delta system.

Failure to follow these instructions can result in equipment damage.

The specifier or user of the device should be familiar with the configuration and arrangement of the power distribution system in which any TVSS is to be installed. The system configuration of any power distribution system is based strictly on how the secondary windings of the transformer supplying the service entrance main or load are configured. This includes whether or not the transformer windings are referenced to earth via a grounding conductor. The system configuration is not based on how any specific load or equipment is connected to a particular power distribution system. See Table 2 for the service voltage of each TVSS.

Suitable for use on a circuit capable of delivering not more than 200,000 rms symmetrical Amperes, _z_ volts maximum.

Table 1:

Model	Z Volts
T_MP120/208Y	208
T_MP120/240Y	240
T_MP240/120D	240
T_MP220/380Y	380
T_MP277/480Y	480
T_MP480	480
T_MP347/600Y	600

Table 2: Voltage Ratings

Service Voltage	Max surge current rating per phase	Catalog Number
120/240 Vac 1-phase Wye, 3-wire (+G)	500 kA	T500MP120/240Y
	400 kA	T400MP120/240Y
	320 kA	T320MP120/240Y
	250 kA	T250MP120/240Y
120/208 Vac 3-Phase Wye, 4-wire (+G)	500 kA	T500MP120/208Y
	400 kA	T400MP120/208Y
	320 kA	T320MP120/208Y
	250 kA	T250MP120/208Y
240/120 Vac Split Phase Delta	500 kA	T500MP240/120D
	400 kA	T400MP240/120D
	320 kA	T320MP240/120D
	250 kA	T250MP240/120D
220/380 Vac 3-Phase Wye, 4-wire (+G)	500 kA	T500MP220/380Y
	400 kA	T400MP220/380Y
	320 kA	T320MP220/380Y
	250 kA	T250MP220/380Y
277/480 Vac 3-Phase Wye, 4-wire (+G)	500 kA	T500MP277/480Y
	400 kA	T400MP277/480Y
	320 kA	T320MP277/480Y
	250 kA	T250MP277/480Y
480 Vac 3-Phase Wye, 3-wire (+G)	500 kA	T500MP480
	400 kA	T400MP480
	320 kA	T320MP480
	250 kA	T250MP480
347/600 Vac 3-Phase Wye, 4-wire (+G)	500 kA	T500MP347/600Y
	400 kA	T400MP347/600Y
	320 kA	T320MP347/600Y
	250 kA	T250MP347/600Y

Terminals, Wire Size, and Installation Torque

Terminals are provided for phase (line), neutral, and equipment ground connections. The Titan MP terminals accept #12 to #2 AWG (34 mm^2) copper wire for phase, neutral, and ground connectors. Optional fused disconnect terminals accept #10 to #4 AWG connectors. Torque all connections to 48 lb-in.

⚠ WARNING

UNDERSIZED WIRING
(USE ONLY CONDUCTORS RATED 30 A OR GREATER)

- The TVSS is designed for connection to a 30 A (or greater) circuit breaker.
- The circuit breaker is the intended disconnect means for the TVSS without integral disconnect option and provides short circuit protection to the connecting conductors.
- The circuit breaker maximum rating should not exceed the rating required to protect the connecting conductors.
- Use conductors rated 30 A (or greater) for the application.

Failure to follow these instructions can result in death or serious injury.

Integral Disconnect

The integral disconnect is a mechanical means for qualified maintenance personnel to isolate the entire surge suppressor to service the device's components. The disconnect opens the phase connections to the TVSS device.

Turn disconnect handle to the OFF position prior to opening the door of the unit. With the handle in the OFF position, the TVSS device will be disconnected from the circuit and the circuit will not be protected from surges. Maintenance may now be performed on the module and associated parts. Upon completion of repairs, close the door of the unit and turn the handle to the ON position.

Location of TVSS

Install TVSS devices on the load side of the main overcurrent protection to comply with UL 1449 and the NEC. The TVSS may be installed on a separate breaker circuit or paralleled with an existing branch circuit provided that the requirements of the disconnecting means are met (see the "Disconnecting Means" section on page 6 and the caution statement "LOSS OF BRANCH CIRCUIT POWER/LOSS OF SURGE PROTECTION" on page 2).

Locate the TVSS device as close as possible to the circuit being protected to minimize the wire length and optimize TVSS performance. Avoid long wire runs so that the device will perform as intended. To reduce the impedance that the wire displays to surge currents, the phase, neutral, and ground conductors must be routed within the same conduit and tightly bundled or twisted together to optimize device performance. Avoid sharp bends in the conductors. See Figure 1.

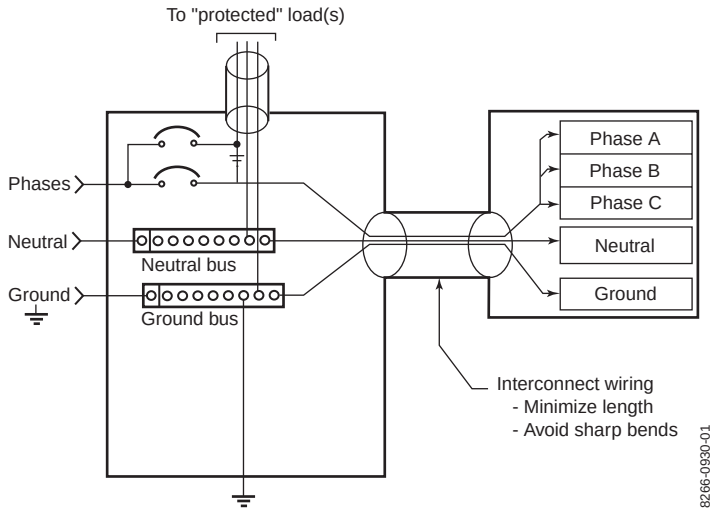

Figure 1: TVSS Wiring Practice

SYSTEM GROUNDING

CAUTION

SYSTEM GROUNDING

- TVSS must be installed on solidly grounded power systems.
- Verify that the service entrance equipment is bonded to ground in accordance with all applicable codes.
- Verify that the neutral terminals are grounded to system ground in accordance with all applicable codes.

Failure to follow these instructions can result in equipment damage.

An equipment ground conductor must be used on all electrical circuits connected to the TVSS device. For the best performance, use a single-point ground system where the service entrance grounding electrode system is connected to and bonded to all other available electrodes, building steel, metal water pipes, driven rods, etc. (for reference, see IEEE STD 142-1991). The ground impedance measurement of the electrical system should be as low as possible, and in compliance with all applicable codes, for sensitive electronics and computer systems.

When metallic raceway is used as an additional grounding conductor, an insulated grounding conductor should be run inside the raceway and sized in accordance with all applicable codes.

⚠ WARNING

INADEQUATE RACEWAY ELECTRICAL CONTINUITY

- Ground impedance must be as low as possible and in compliance with all applicable codes for sensitive electronic and computer systems.
- Install an insulated grounding conductor inside a metallic raceway when the raceway is used as an additional grounding conductor. Size the conductor in accordance with all applicable codes.
- Maintain adequate electrical continuity at all raceway connections.
- Do not use isolating bushings to interrupt a metallic raceway run.
- Do not use a separate isolated ground for the TVSS.
- Verify proper equipment connections to the grounding system.
- Verify ground grid continuity by inspections and testing as part of a comprehensive electrical maintenance program.

Failure to follow these instructions can result in death or serious injury.

INSTALLATION

⚠ DANGER

HAZARDOUS VOLTAGE

- This equipment must be installed and serviced only by qualified electrical personnel.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.
- Disconnect all power supplying this equipment before working on or inside it.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace the door/cover before energizing.

Failure to follow these instructions will result in death or serious injury.

Conduit Location and Recommendations

The recommended conduit entry is at the bottom of the device enclosure. Use a conduit seal that is appropriate for the enclosure rating.

Special Enclosure Considerations

Removing and Reconnecting the RJ45 Patch Cables

The RJ45 patch cables are marked with matching phase connections. If any of the cables are removed, reconnect the cables as marked.

WIRING

⚠ DANGER

HAZARDOUS VOLTAGE

- This equipment must be installed and serviced only by qualified electrical personnel.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.
- Disconnect all power supplying this equipment before working on or inside it.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace the barrier and the door/cover before energizing.

Failure to follow these instructions will result in death or serious injury.

Follow steps 1–5 to make wiring connections.

1. Use an AC voltmeter to check all voltages and ensure that normal operating voltages of the power system match the voltage rating on the TVSS device nameplate.
2. Mount the device as close as possible to the equipment being protected.
3. Disconnect all power supplying the equipment before working on or inside it.
4. Connect the device to the equipment using an approved wiring method. The connecting wires should be twisted together and kept as short as possible to enhance the performance of the device. See pages 7 and 8 for the recommended wire size. For wiring diagrams, see figures 2 thru 4.

a. Connect the wire to the ground bus of the distribution panel and to the ground connection of the TVSS device.

b. Connect the wire to the NEUTRAL bus of the distribution panel and to the NEUTRAL connection of the TVSS device.

c. Be sure the circuit breaker is open (OFF) prior to making any connections of any kind. If a circuit breaker or circuit breaker space is not available, connect to an existing circuit breaker by using an integral disconnect. Integral disconnects are available from EFI as an option. Be sure the disconnect is open (OFF) and the circuit is de-energized before making any connections. Connect a wire (in conduit) to each phase (HOT) terminal on the LOAD side of a circuit breaker. Refer to the markings on the device when connecting the phase, neutral, and ground conductors.

   NOTE: If a fused disconnect is present, check and replace any bad fuses when replacing a TVSS module.

   NOTE: On a high-leg delta installation, the high-leg of the power system must be connected to phase B of the TVSS.

5. After all connections have been made, close the door and restore power to the equipment as required. If the TVSS device is properly installed and functioning, the green LED indicators on the display will be lit.

If you have any questions pertaining to the installation, contact your EFI representative.

NOTE: Always install the TVSS on the LOAD side of the main disconnect.

Wiring Diagrams

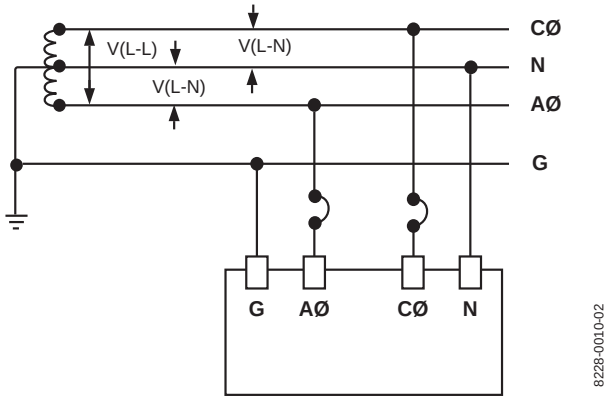

Figure 2: Single-Phase,, Grounded Installation 120/240 V

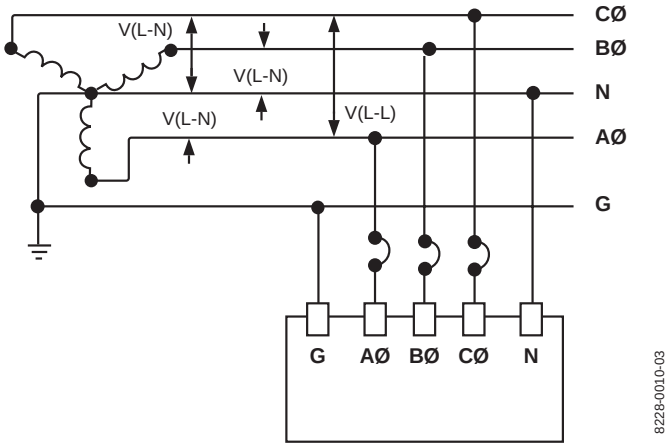

Figure 3: Three-Phase, 3- or 4-Wire, Grounded Wye Installation 120/208 V, 277/480 V, 220/380 V, 347/600 V

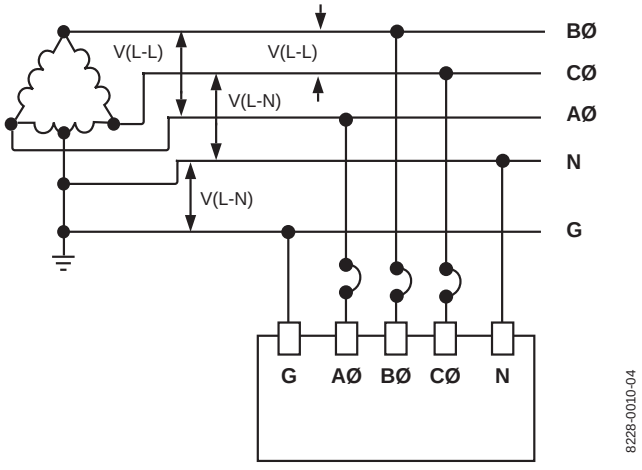

Figure 4: Three-Phase, 4-Wire, High-Leg Delta Installation 240/120 High-leg

NOTE: High-leg on phase B.

OPERATION

⚠ DANGER

HAZARDOUS VOLTAGE

- This equipment must be installed and serviced only by qualified electrical personnel.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.
- Disconnect all power supplying this equipment before working on or inside it.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace the door/cover before energizing.

Failure to follow these instructions will result in death or serious injury.

LED Status Indicators

The TVSS display panel shows the status of the module with diagnostically controlled green/red LEDs. If a unit is operating correctly, all the phase LEDs will be illuminated green. To test the integrity of the diagnostics for each phase, push the button below the phase LEDs on the diagnostic display. The green LED will turn red and the alarm will sound, if the alarm is enabled. Releasing the test button will complete the test; the red LED will turn green and the alarm will shut off.

If an inoperable condition occurs on any phase, the audible alarm sounds and the corresponding phase LED on the diagnostic display panel is illuminated red. This indicates that the device needs service by qualified electrical personnel. The audible alarm can be silenced, until a qualified person is able to evaluate and service the TVSS device, by pressing the alarm enable/disable button. The alarm will silence and the green alarm LED will not be lit. The red phase LED will continue to be illuminated until the inoperative condition had been cleared.

On a module (see Figure 5), if the left green LED is not lit, it indicates a loss of suppression from line-to-ground for that phase. If the right green LED is not lit, it indicates a loss of suppression from line-to-neutral for that phase. If both green LEDs are not lit and the diagnostic display panel has power, then power has been lost to that phase or module is bad and should be replaced.

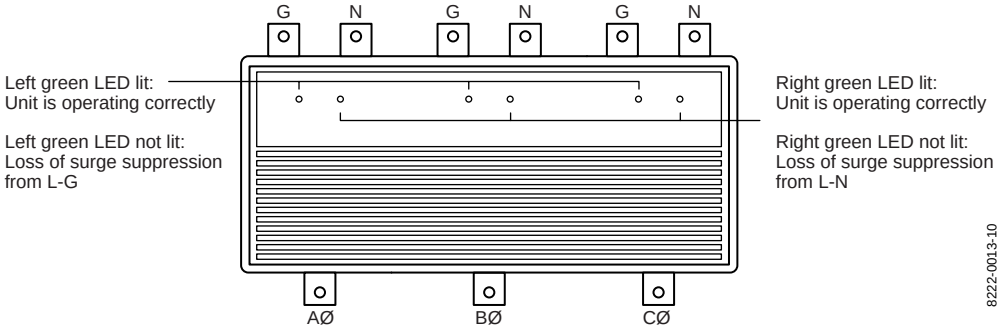

Figure 5: Three-Phase Display Panel without Surge Counter Option

Audible Alarm

Push the alarm enable/disable button to enable or disable the alarm. If the green alarm LED is lit the alarm is enabled. If the green alarm LED is not lit the alarm is disabled.

Surge Counter Option

The optional surge counter displays the number of transient voltage surges since the counter was last reset. The counter is battery powered to retain memory in the event of a power loss to the diagnostic display panel.

To reset the surge counter remove all power and press the small switch located inside the unit on the underside of the diagnostic circuit board (near the RJ45 connectors) (See Figure 6). This will reset the counter to zero.

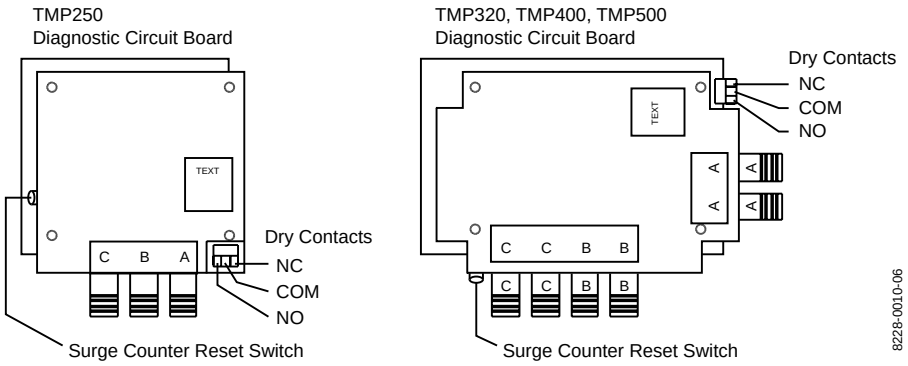

Figure 6: Diagnostic Circuit Board (inside the unit door)

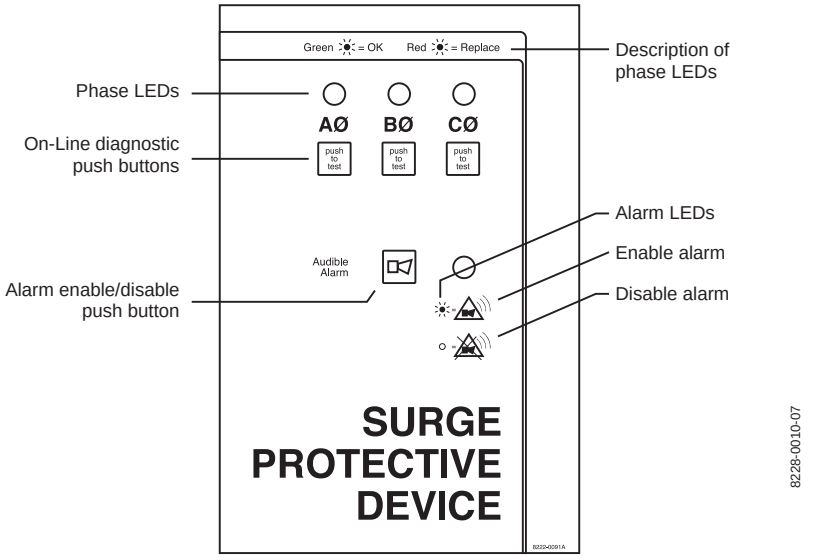

Figure 7: Three-Phase Display Panel without Surge Counter Option

NOTE: Phase B is not present on single-phase applications.

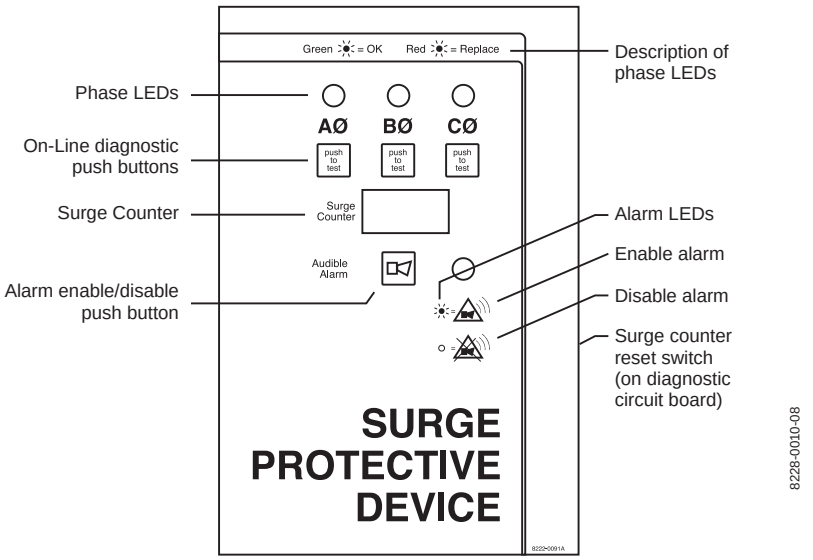

Figure 8: Three-Phase Display Panel with Surge Counter Option

NOTE: Phase B is not present on single-phase applications.

Dry Contacts

The Titan MP TVSS device is provided with dry contacts. The connection for the dry contacts is located inside the unit on the back of the diagnostic display panel.The dry contacts are 3-position, Form “C” type with Normally Open, Normally Closed and Common connections (See Figure 6). The unpowered state shall be closed between terminals NC and COM. This is also the alarm condition. The opposite state, closed between terminals NO and COM, indicates that power is on to the unit and that no alarm condition exists (See Table 2). These contacts can be used for remote indication of the TVSS device’s operating status to a computer interface board or emergency management system. Also, these contacts are designed to work with the TVSS remote monitor option described on page 16.

The contacts are designed for a Maximum voltage of 24 VDC / 24 Vac and a maximum current of 2 A. Higher energy applications may require additional relay implementation outside the TVSS. Damage to the TVSS device’s relay caused by use with energy levels in excess of those discussed in this instruction bulletin are not covered by warranty. For application questions, contact your EFI representative.

Care must be taken in installing the dry contact wiring because the terminals are on a moving door. Avoid the door hinge, any disconnect switches, and the high voltage areas of the enclosure when routing the wiring. To avoid the door hinge, tie wrap any dry contact wiring to the existing cable harness which crosses the hinge. Once the dry contact wiring is secured on a non-moving point of the enclosure, it is the user’s responsibility to maintain separation between dry contact wiring and the power wiring in the enclosure.

Table 3: Dry Contact Configuration

Alarm Contact Terminals	Contact State with Power Removed
NC	Normally closed
COM	Common
NO	Normally open

Remote Monitor Option

The remote monitor has two LEDs, one red and one green, and an audible alarm with an enable/disable switch. Normal status is a lit green LED, and no audible alarm. To test the integrity of the remote monitor, press the push-to-test switch. The green LED will turn off, the red LED will turn on, and the alarm will sound, if the alarm is enabled. Releasing the switch will complete the test; the red LED will turn off, the green LED will turn on and the alarm will shut off.

If protection on any phase is lost, the green LED will turn off, the red LED will turn on and an alarm sounds if it is enabled. The audible alarm can be silenced by depressing the alarm enable/disable switch. The red LED will continue to be illuminated until the inoperative condition had been cleared.

The remote monitor includes a 120 Vac to 12 Vdc adapter with a six-foot power cord. Connections are made to the remote monitor dry contact terminals via the appropriate lengths of solid or stranded #30 to #14 AWG 600 V wire (not provided) from the TVSS dry contact terminals.

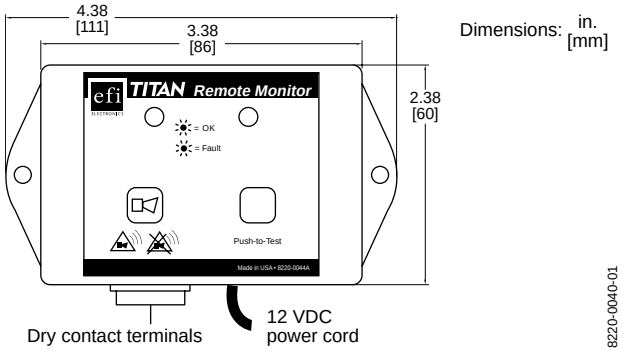

Figure 9: Remote Monitor Option

MAINTENANCE

⚠ DANGER

HAZARDOUS VOLTAGE

- This equipment must be installed and serviced only by qualified electrical personnel.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.
- Disconnect all power supplying this equipment before working on or inside it.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace the door/cover before energizing.

Failure to follow these instructions will result in death or serious injury.

Inspect the TVSS device periodically to maintain reliable system performance and continued transient voltage surge protection. Periodically check the state of the display LED status indicators.

Troubleshooting

Refer to Figure below for troubleshooting procedures.

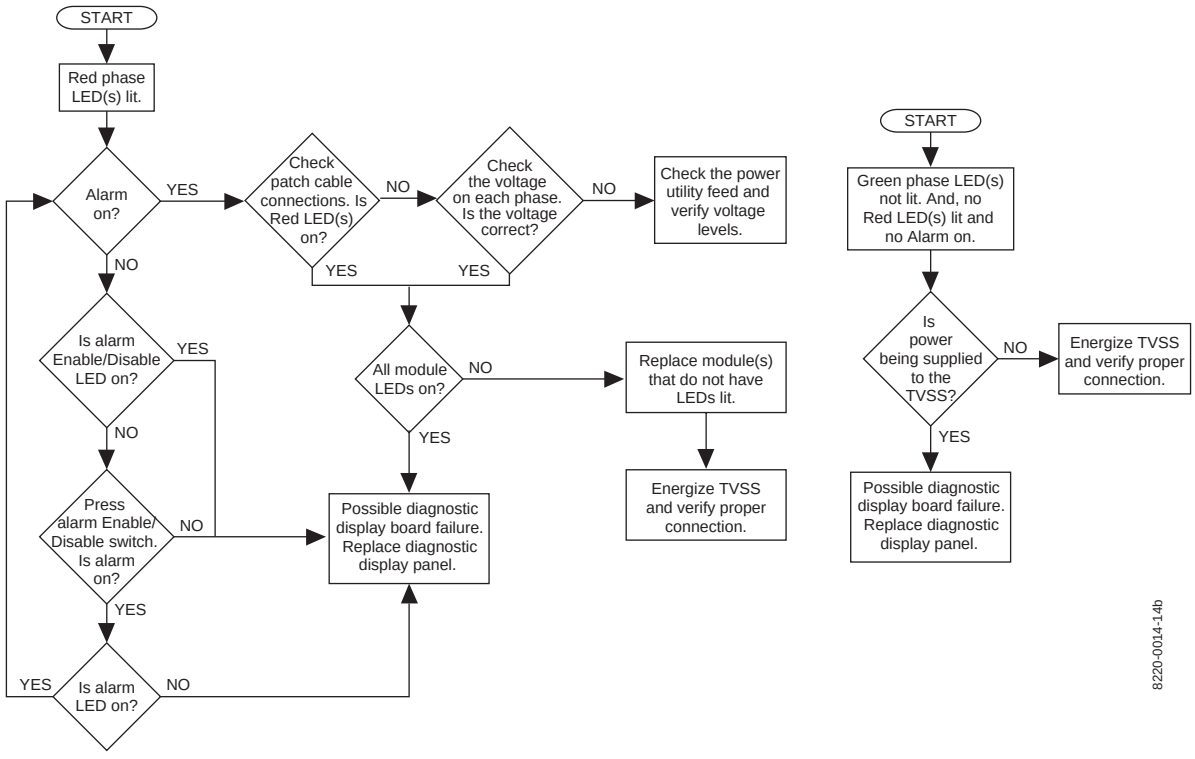

Figure 10: Troubleshooting Flowcharts

Replacement Parts

Table 4:

Service Voltage	Max surge current rating per phase	Module Part Number
120/240 Vac 1-phase Wye, 3-wire (+G)	500 kA	M500MP120/240Y
	400 kA	M400MP120/240Y
	320 kA	M320MP120/240Y
	250 kA	M250MP120/240Y
120/208 Vac 3-Phase Wye, 4-wire (+G)	500 kA	M500MP120/208Y
	400 kA	M400MP120/208Y
	320 kA	M320MP120/208Y
	250 kA	M250MP120/208Y
240/120 Vac Split Phase Delta	500 kA	M500MP240/120D
	400 kA	M400MP240/120D
	320 kA	M320MP240/120D
	250 kA	M250MP240/120D
220/380 Vac 3-Phase Wye, 4-wire (+G)	500 kA	M500MP220/380Y
	400 kA	M400MP220/380Y
	320 kA	M320MP220/380Y
	250 kA	M250MP220/380Y
277/480 Vac 3-Phase Wye, 4-wire (+G)	500 kA	M500MP277/480Y
	400 kA	M400MP277/480Y
	320 kA	M320MP277/480Y
	250 kA	M250MP277/480Y
480 Vac 3-Phase Wye, 3-wire (+G)	500 kA	M500MP277/480
	400 kA	M400MP277/480
	320 kA	M320MP277/480
	250 kA	M250MP277/480
347/600 Vac 3-Phase Wye, 4-wire (+G)	500 kA	M500MP347/600Y
	400 kA	M400MP347/600Y
	320 kA	M320MP347/600Y
	250 kA	M250MP347/600Y

EFI Electronics
1751 South 4800 West
Salt Lake City, UT 84104
1-800-877-1174
www.efinet.com