

The TS series of devices provide the most unique lightning transient protection available for serial connected individual equipment applications. Models are available in many electrical configurations for single phase configurations. These products provide protection at locations feeding sensitive, mission critical equipment. These models are extremely effective in limiting transients generated at the facility and are strong enough for first line protection of connected equipment. All models are rated with a robust 120 kA total peak surge current rating.



- Description:** Series connected transient voltage surge suppressor with encapsulated Optimal Response Network™ circuitry (40 kA per mode / 120 kA total peak surge current) and Frequency Responsive Circuitry for virtual elimination of ring wave type transients.
- Application:** Designed for use at ANSI/IEEE Categories A, B, and C with susceptibility up to all exposure levels to protect sensitive/critical loads fed by a single electrical circuit.
- Warranty:** 5 Year
- Unit Listings:** Recognized Component under ANSI/UL 1449 by CSA (UL - VZCA2.E491157 and FOKY2.E491157); UL1283 Compliant
- Circuit Design:** Series connected hybrid design incorporating discrete all mode protection and utilizing our encapsulated Optimal Response Network™ and optional Frequency Responsive Circuitry design to provide lowest possible let-through-voltages. All suppression circuits are encapsulated in our high dielectric compound to promote long component life and protection from the environment and /or vibration. All circuits include Component Level / Thermal Fusing.
- Protection Modes:** Dedicated protection circuitry for every possible mode. Discrete L-N (Normal Mode), and Discrete L-G, N-G (Common Mode)
- Input Frequency:** 50-60 Hz
- Insertion Loss Data: &Freq. (L-N for 1P1)** **Frequency: 10 kHz 100 kHz 1 MHz Max Attenuation**  
**Attenuation:** 20 dB 40 dB 49 dB 63 dB @ 496 kHz
- Circuit Diagnostics:** Green LED, normally on.
- Connection/mounting:** External mounting feet. DIN rail mounting feet (DIN option) 3-position screw terminal strips on the line / equipment sides of the device. (wire connections are also available)
- Circuit Interrupt:** External (see installation instructions for details).
- Nominal Discharge Current (In) Rating:** 5 kA

### Key Features:

- ✓ Industry Leading Measured Limiting Voltage Performance
- ✓ Independent Verification of Performance and Safety
- ✓ Component-Level, Thermal Fusing
- ✓ Circuit Encapsulation
- ✓ 5 Year Warranty

Voltage Code (Single Phase)	System Voltage ( $V_{rms} - P, N, G$ )	Voltage Code (Single Phase Delta)	System Voltage ( $V_{rms} - P, P, G$ )
1P1	120 to 127	2N1	120
1P2	240 to 277	2N2	240
1P22	220	2N22	220
1P23	230	2N23	230
1P24	240	2N24	240
1P3	347	2N3	380
1P4*	Use 2N4 – 480 V	2N40	400
*Note: 2N4 voltage configuration is used for all 480 V applications (neutral can be used in place of one phase)		2N41	415
		2N4	480



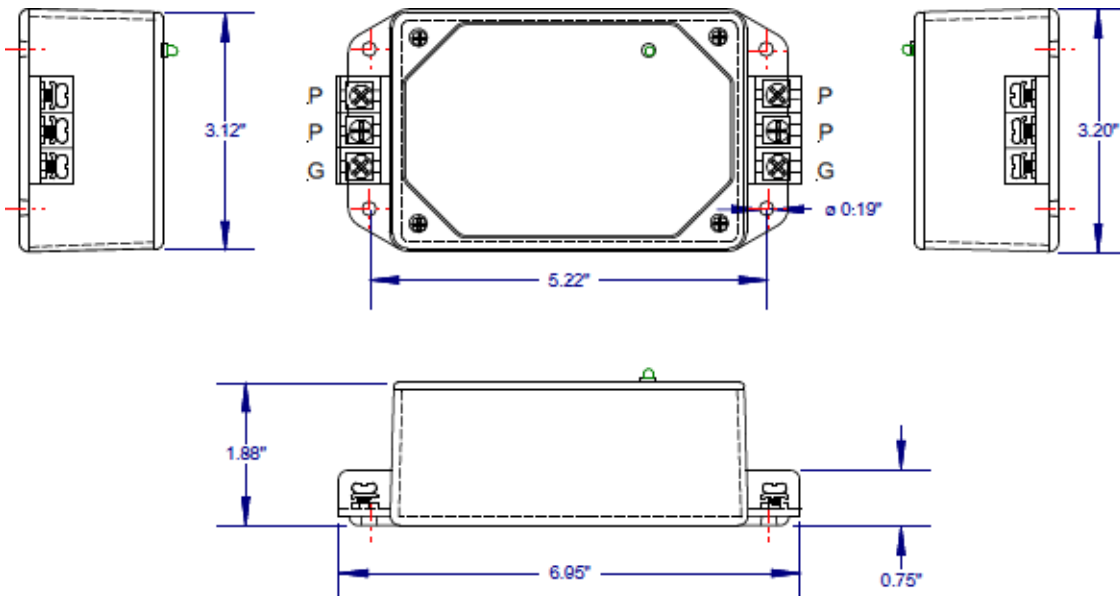
Model Number Selection Format			
Configuration	PSC	SPD Type	Voltage Code
<b>TS1 – Series Connected VRC*</b>	2 - 40 kA / mode (120-480 VAC)	3 - Type 2, 5 kA	12AC 12DC 24AC 24DC 1P1 1P2 1P22 1P23 1P3 1P24
<b>TS2 – Series Connected FRC*</b>	1 – Other (Low Voltage AC/DC Models)	0 = Low Voltage AC/DC Models	2N1 2N2 2N22 2N23 2N24 2N3 2N4
Typical Model Breakdown		Amperage	
<b>TS2231P1</b> (Sine Wave Tracking, Terminal Connected, 120 VAC, and 30Amps)		30	

\*VRC = Voltage Responsive Circuitry  
FRC = Frequency Responsive Circuitry

Options:
External Audible Alarm Module
Dry Relay Contacts
Remotely mounted NEMA-4X LED
No Neutral-to-Ground Sinewave Tracking Filter
DIN rail mounting
Modular ISDN Grade Telecom Circuit Protection (nn = 11, 14, 45, etc.)
Parallel connected
NEMA 4X housing

Surge Protective Device Measured Limiting Voltage Performance Testing Reference ANSI/IEEE Standards C62.41.1TM-2002, C62.41.2TM-2002, C62.45TM-2002, and C62.62TM-2010				
Model	Mode	MCOV (V <sub>rms</sub> )	UL 1449 VPR	Cat A, 30 Ω 100 kHz Ring Wave 2 kV / 67 A 270° Phase Angle
1P1	P-N	150	500	≤ 25
	P-G	150	600	≤ 100
	N-G	150	600	≤ 75
1P2 1P22 1P23 1P24	P-N	320	1000	≤ 25
	P-G	320	1000	≤ 100
	N-G	320	1000	≤ 75
1P3	P-N	420	1800	≤ 75
	P-G	420	1800	≤ 150
	N-G	420	1800	≤ 75
2N1	P-P	150	500	≤ 25
	P-G	150	600	--
2N2 2N22 2N23 2N24	P-P	320	900	≤ 25
	P-G	320	1000	--
	P-P	420	1200	≤ 75
2N3	P-G	420	1200	--
	P-P	552	1800	≤ 75
2N4	P-G	552	1800	--

**Measured Limiting Voltage (MLV) Test Parameters:** Positive polarity, Category A: Line power applied for 120 V only, Voltages are peak (±10%). Measured Limiting Voltages are measured from the insertion point on the sine wave to the peak of the surge for powered tests. In order to duplicate the results, the specified mode of protection must be tested 10 times in all modes and the individual results are averaged together. (Individual mode or shot results may vary by more than 10%. Scope Settings: Time Base = 10 microseconds per division, Sampling Rate = 2.5 GigaSamples/sec, Bandwidth = 400 MHz, Probes: Tektronix P5100/P6015A. These settings help to assure MLV results are accurate.)



**WARNING - HAZARDOUS VOLTAGES ARE PRESENT.** Improper installation may result in serious injury to the installer and/or damage to the electrical system or related equipment. Read and understand all instructions before beginning the installation. Safety equipment must be used as prescribed by OSHA, whenever working around hazardous voltages.

**Failure of unit and/or consequential equipment damage due to improper installation or misapplication is not covered by the product warranty!**

Voltage measurements and installation must be completed by a licensed/qualified electrician in accordance with the National and/or Canadian Electric Code, State, and Local codes. Those requirements supersede this instruction.

**POWER MUST BE REMOVED FROM THE ELECTRICAL SYSTEM BEFORE INSTALLING ANY SURGE PROTECTIVE DEVICE (SPD).**

## INSTALLATION MATERIALS REQUIRED

The following is a list of materials that may be needed for proper installation of this surge protective device. This list is intended to help the installer anticipate materials needed for a successful installation. The installer should become familiar with the scope of work to avoid lost time and improper installation.

- Y Power Connections Provided: terminal blocks are provided.
- Y Attachment Hardware: For plaster and sheet rock - Use (four ea.) appropriate screws and anchors/toggle bolts, flat washers, & lock washers. For Wood or Metal - Use appropriate screws, flat washers, & lock washers. Be careful not to damage the mounting feet of the SPD while mounting these devices. Alternate surface-mounting material: Double-sided, adhesive (sticky-backed) foam tape. Be sure adequate spacings are maintained within the installation cabinet.
- Y Connection notes: For models with wires provided, it is recommended that mechanical or compression lugs are used for connection to existing wiring. Inline insulated (buted) splices are recommended over wire nuts to help ensure an adequate mechanical and electric connection (visit the "Products" page on [www.ilsco.com](http://www.ilsco.com) for additional information on available connectors).
- Y Tools: Volt-Meter/Multimeter, Drill & bits, Torpedo Level, Screwdrivers, Appropriate Safety Equipment, etc.
- Y These SPDs are required to be installed inside a separate enclosure or cabinet. This will provide protection against incidental contact and protection of the wiring associated with the installation of these models.
- Y A fuse is required to meet the requirements of the UL listing of these devices. See the Ratings and Limits Table below for specific fuse information.

## RATINGS AND LIMITS

The phase/line connections of the TS Series models are required to be installed on the load side of a Class G (Cooper-Bussmann SC-xx) fuse as indicated below (see the product label for the particular model being installed):

Voltage Code / Designation	Nominal System Voltage* (V <sub>rms</sub> )	Maximum Continuous Operating Voltage (V <sub>rms</sub> )	Load Current Rating / Fuse Size (Amps)	Short-Circuit Current Rating (SCCR - Amps)
120, 1P1, 2N1	120	150	15 / 30	25,000
220, 1P22, 2N22	220	320	15 / 30	25,000
230, 1P23, 2N23	230	320	15 / 30	25,000
240, 1P24, 2N2, 2N24	208-240	320	15 / 30	25,000
277, 1P2	240-277	320	15/30	25,000
380, 1P3, 2N3	347-380	420	15 / 30	25,000
400, 2N40	400	552	15 / 30	25,000
415, 2N41	415	552	15 / 30	25,000
480, 1P4, 2N4	440-480	552	15 / 30	25,000

\* If the Neutral to Ground (N-G) voltage measures greater than 5 V<sub>rms</sub>, a problem may exist in the electrical system (with the neutral to ground bond). The SPD may be installed, however; a qualified electrician or Power Quality Engineer should be consulted to correct the problem.

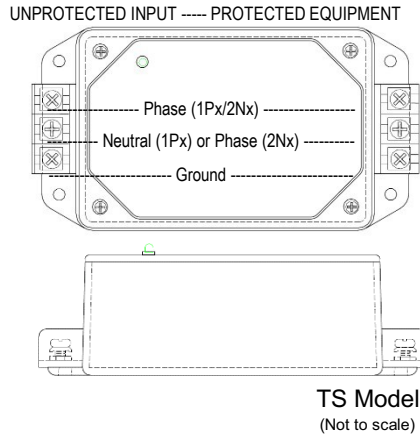
These SPDs are suitable for use on a circuit capable of delivering not more than 25,000 symmetrical Amperes (rms) at the nominal system voltage (for the corresponding model listed) in the table above when protected by the fuse indicated.

For the TS Series models, the terminals have a torque rating of 9 in-lbs and are rated for up to 10 AWG wire. The wire size must be coordinated with the fuse size (minimum 10 AWG for 30 Amps and minimum 14 AWG for 15 Amps).

Note: Models with a voltage code of 1Px have one phase, neutral and ground connection and are intended for single phase loads. Models with a voltage code of 2Nx have two phases and ground and are intended for single phase Delta loads (2 phases of a Delta transformer). All models require fusing for each phase connection/wire.

The design of the TS Series models provides an additional surge filter/mitigation circuit for sensitive/critical equipment and is designed specifically to mitigate the effects of ringing surges as defined the IEEE Std C62.41.1 Location Categories 'A' and 'B' (after the service equipment). These models are designed to be used in 50 to 60 Hz systems. The TS Series models should not be used in locations where the frequency exceeds 60 Hz or where the frequency is intentionally varied (i.e. output of a variable frequency drive).

## PRODUCT TERMINAL/WIRE LOCATIONS



## BEFORE INSTALLATION

Verify that system voltages in each mode (line to neutral, line to ground, neutral to ground and line to line, as applicable) and currents are not in excess of the limits in the table on Page 1. All voltage and current measurements should be made using a high quality RMS multimeter (i.e. UL or CSA listed CAT III or CAT IV meter).

**DO NOT INSTALL THE SPD IF THE MEASURED VOLTAGE EXCEEDS THE MAXIMUM CONTINUOUS OPERATING VOLTAGE OR LOAD CURRENT RATING OF THE DEVICE.**

There are no position-oriented components in the SPD; therefore, the device can be mounted upside down or sideways to allow for best installation. The installer should visualize the physical layout and wire routing prior to installation.

## INSTALLATION STEPS

### STEP 1: Remove

power from the electrical system.

### STEP 2: Mounting the

Unit

The SPD is provided with either 18-24 inches stranded wire or terminal strips on both the input and output of the device. This affords greatly improved flexibility when installing the device. The SPD should be located so that it is the last device in the circuit before the equipment to be protected and located as close to the protected equipment as possible. The SPD contains no position-oriented components; therefore, it can be mounted upside down or sideways. However, the SPD should be mounted in such a way as to allow maximum separation between the input and output wiring.

Y Mechanically mount the SPD. Secure the SPD using screws and mounting feet or adhesive backed foam as appropriate.

### STEP 3: Wire the SPD into the Electrical System

- Y Before cutting the wires for the installation, be sure to consider the routing of the wire to provide sufficient wire length for installation without providing excessive lead length.
- Y Connect the incoming system GROUND wire to the Green Ground wire or Ground terminal of the SPD on the input side.
- Y Connect the incoming system NEUTRAL wire to the White Neutral wire or Neutral terminal of the SPD on the input side. Note that there is no "neutral" wire or terminal for 2Nx voltage code. Instead there are two phase connections. See the next step.
- Y Connect the incoming system PHASE wire(s) to the Black Phase wire(s) or Phase terminal(s) of the SPD on the input side. Be sure the phase connection(s) is routed through the fuse specified in table on Page 1.

- Y Repeat the connections on the Protected Equipment side of the SPD. Note that additional fusing is not required on the load side connections.
- Y Before energizing the SPD and load, inspect the installation to be sure all connections are properly made and that the SPD is the appropriate SPD for the system voltage.

**STEP 4: Connecting Alarm Contact Leads (Models with option code “C”)**

- Y SPDs with the Dry Relay Contact (“C”) option are equipped with dry relay alarm contacts. They may be connected in either the normally open (NO) mode or the normally closed (NC) mode (or both) using the same common (COM). These contacts are rated for 0.5 Amps at 125 VAC or 1.0 Amps at 30 VDC. These connections are provided for remote status monitoring and are terminated in the removable, 3-position header under the cover lid of the SPD. Terminals numbered are as “1” for the “Common” terminal, “2” for the “Normally Open” terminal, and “3” for the “Normally Closed” terminal (with power applied). The wire size range for these terminals is 30 to 12 AWG and they have a torque rating of 4.0-5.5 in-lbs. When penetrating enclosure for the contact terminations, use a cable strain-relief fitting or conduit to maintain the enclosure rating and provide strain relief.

**STEP 5: Apply Power to the SPD**

- Y The LED indicator light should be illuminated and the dry relay contact should change state (if equipped). If not, remove power from the SPD.



## FIVE YEAR LIMITED WARRANTY

**LP Parts, LLC** warrants for a period of **five (5) years** from date of retail purchase that if its product ceases to properly function as a direct result of any electrical anomaly, including lightning, **LP Parts, LLC** will repair or replace the product without charge, subject to the terms and conditions set forth herein. If, in the sole subjective opinion of **LP Parts, LLC** the product has been modified, altered, tampered with, misused or misapplied or repaired by any entity other than **LP Parts, LLC**, or subjected to abuse, the warranty is void. The warranty shall not apply unless the product is installed by a qualified licensed and/or bonded electrician. The warranty period for repaired or replacement products shall be only the remaining portion of the original limited warranty. Any defect appearing more than five (5) years from the date of delivery to purchaser, shall be deemed to be due to ordinary wear and tear. **LP Parts, LLC**, however, assumes no risk or liability resulting from the use of its products, including but without limiting the generality of the foregoing: (1) The use of this product in combination with any electrical or electronic components, circuits, systems, assemblies or any other materials or substances; (2) The improper application or unsuitability of this product for use in any circuit or assembly. All warranty inspections and parts must be obtained at **LP Parts, LLC**. The giving of, or failure to give, any advice or recommendations by **LP Parts, LLC** shall not constitute any warranty by or impose any liability upon **LP Parts, LLC**. THIS WARRANTY DOES NOT GUARANTEE UNINTERRUPTED ELECTRIC SERVICE. REPAIR OR REPLACEMENT OF THIS PRODUCT IS THE EXCLUSIVE REMEDY OF THE RETAIL END USER PURCHASER. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR USE OR PURPOSE; ALL OF WHICH ARE HEREBY EXCLUDED AND EXPRESSLY DISCLAIMED. **LP PARTS, LLC** SHALL IN NO EVENT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES OF ANY KIND OR CHARACTER, INCLUDING, WITHOUT LIMITATION, THE EXPENSE OF INSTALLATION OR REMOVAL OF THIS PRODUCT, LOSS OF REVENUE OR PROFITS, FAILURE TO REALIZE SAVINGS OR OTHER BENEFITS, LOSS OF COMPUTERIZED OR OTHER DATA, DAMAGE TO ANY ELECTRIC OR ELECTRICAL EQUIPMENT, INCONVENIENCE AND/OR FOR THIRD PARTY CLAIMS MADE AGAINST THE WHOLESALE OR RETAIL PURCHASER OF THIS PRODUCT, EVEN IF BEFORE OR AFTER PURCHASE **LP PARTS, LLC** HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. **LP Parts, LLC** TOTAL LIABILITY FOR ANY CLAIM MADE AGAINST IT SHALL IN NO EVENT EXCEED THE PURCHASE PRICE PAID TO **LP PARTS, LLC** FOR THE DEFECTIVE PRODUCT. As a condition precedent to **LP Parts, LLC's** performance pursuant to this Warranty, Purchaser must return this product within the Warranty period FOB **LP Parts, LLC's** place of business in Lacombe, LA. *Please call 1-985-882-2985 for warranty return procedures. Return authorization is required.*



## **Contact Us**

**sales@petroguardian.com**

**985-882-2985**