SOLA HD

Surge Protective Device

STV 200/400K Series

Instruction Manual

While every precaution has been taken to ensure accuracy and completeness in this manual, SolaHD assumes no responsibility, and disclaims all liability for damages resulting from use of this information or for any errors or omissions.

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Introduction

The STV 200/400K Series are surge protective devices (SPD) that offer continuous protection from damaging transients and electrical noise. They are capable of handling the high-impulse, potentially damaging transients commonly found at the service entrance or distribution panels. The modular design of the STV 200/400K Series provides installation flexibility, while its robust design allows placement in the most severe exposure locations.

Proper installation is required for maximum system performance. To ensure a quality installation, the installer should read the entire manual and follow all instructions before and during the installation.

These instructions do not replace national or local electrical codes. Check applicable electrical codes to ensure compliance. Installation of the STV 200/400K Series should only be performed by qualified personnel.

Warnings Defined

⚠ DANGER **Danger:** Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.

⚠ WARNING **Warning:** Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

⚠ CAUTION **Caution:** Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Pre-Installation

Unpacking and Preliminary Inspection

1. Inspect the shipping crate(s) for damage or signs of mishandling before unpacking the unit.
2. Remove any securing bands and cardboard packing and inspect the unit for any obvious shipping damage.
3. If any damage as a result of shipping is observed, immediately file a claim with the shipping agency and forward a copy to your local SolaHD Sales Representative.

Storage

The unit should be stored in a clean, dry environment. The storage temperature range is -55ºC (-67ºF) to +85ºC (+185ºF). Care should be taken to avoid condensation. All packing and shipping materials should be left intact until the unit is ready for final installation. If the unit has been stored for an extended period of time, the unit should be cleaned and carefully inspected before placing into service.

Location Considerations

Environment: The unit is designed for indoor operation in ambient temperatures of -40ºC (-40ºF) to +60ºC (+140ºF) with a relative humidity of 0% to 95% (non-condensing).

The unit is provided in an industrial-use enclosure, which is dust-tight and drip-tight and should not be installed in areas with excessive dust, corrosive vapors, flammable materials, or explosive atmospheres.

Audible Noise: The audible noise of the unit is less than 40 dB at 5 feet, which allows placement within most rooms (if desired).

Tip: To maximize system performance, locate the unit as close as possible to the protected circuit and keep interconnecting wiring less than 5 feet.

Service Clearance: Service clearance is needed for units with hinged doors on the front that are capable of being opened. Thirty-six inches (36 in./914 mm) minimum is recommended.

For optimum transient surge protection, coordinated surge suppression should be applied at the service entrance and all other electrical connections to the building (telephone, CATV, etc.); at known surge generating loads within the building (large motors, arc welders, switched capacitors, etc.); as well as at sensitive electronic loads (such as computers, electronic appliances, solid state motor drives, etc.). For interconnected electronic loads (such as by way of data cabling), transient surge suppression should also be applied to the interconnecting wiring (data cables).

Mounting: The unit is intended to be wall mounted. Refer to the “Individual Instruction Sheet” or “Unit Submittal Drawings” for typical mounting dimensions and weight.

Electrical Connections

⚠ DANGER **Verify that all power circuits are de-energized and locked out before making electrical connections.**

All electrical connections must be installed by a qualified (licensed) electrician. All wiring must comply with the National Electrical Code (NEC) and applicable local codes.

Voltage Ratings and Power Source Configurations

⚠ CAUTION **Before making connections to the unit, verify that the unit model number and nameplate voltage rating are appropriate for connection to the intended power source. See the table below for voltage ratings and power source configurations.**

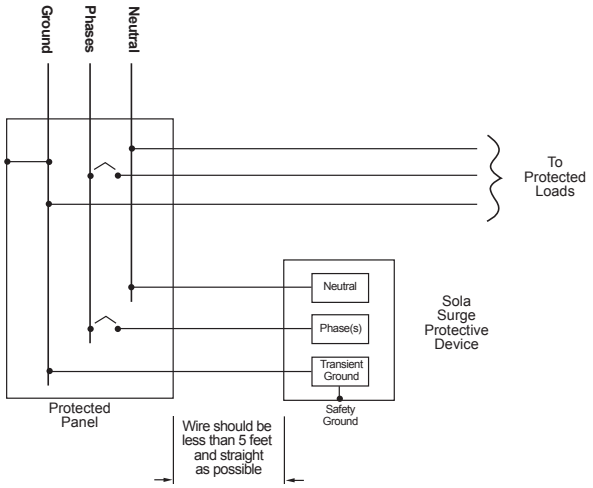
Voltage Ratings and Power Source Configurations			
Source Configurations	**Nominal Operating Voltage L-N/L-G/L-L**	**Maximum Continuous**	**Model Voltage Code (found in part number)**
Three Phase Delta, 3 W + G 	N/A/480/480	580 L-L	48D
Three Phase WYE, 4 W + G 	120/120/208	150 L-N	10Y
	277/277/480	320 L-N	27Y

Parallel Connection

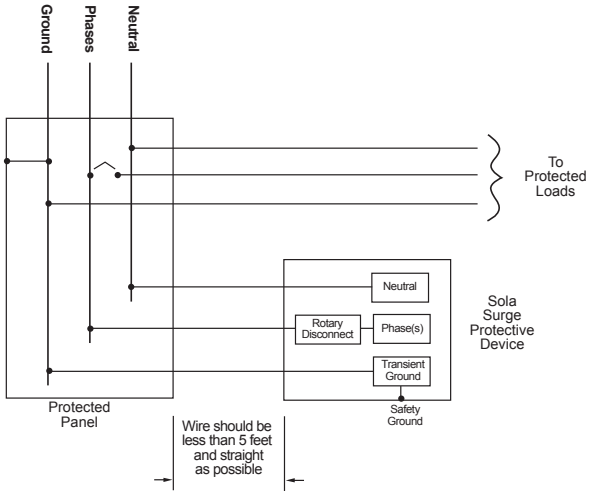
To reduce the wiring impedance to surge currents, it is recommended that the phase, neutral (if required), and ground conductors are twisted together and routed in the same raceway (conduit). Avoid any sharp bends in the conductors.

Tip: To maximize system performance, the unit must be located as close to the protected circuit as practical (to minimize interconnecting wiring length).

Typical Parallel Connection Without Internal Rotary Disconnect



Typical Parallel Connection With Internal Rotary Disconnect



Wire Sizing: With parallel connection, the size of the wiring to the SPD unit is independent of the protected circuit's ampacity. For suggested wire size, refer to the "Individual Product Sheet".

NEC Article 285-21(B) requires surge suppressor connecting conductors to be at least #14 copper or #12 aluminum.

Over-current Protection: The SPD unit conducts practically no current under normal operation and only conducts very short duration transient surge currents.

The following is from the National Electric Code 2002 Edition:

285.21 Connection. Where the TVSS is installed, it shall be connected as follows:

(A) **Location**

(1) **Service Supplied Building or Structure.** The transient voltage surge suppressor shall be connected on the load side of a service disconnect over-current device required in 230.91.

(2) **Feeder Supplied Building or Structure.** The transient voltage surge suppressor shall be connected on the load side of the first over-current device at the building or structure.

Exception to (1) and (2): Where the TVSS is also listed as a surge arrestor, the connection shall be as permitted by Article 280.

(3) **Separately Derived System.** The TVSS shall be connected on the load side of the first over-current device in a separately derived system.

Disconnect Switch (if provided): All TVSS units must still be connected to the load side of the main service disconnect, or load side of a protected circuit's disconnecting means.

Surge Voltage Ratings: To obtain the suppression voltage ratings (SVRs) as obtained by Underwriters Laboratory, Incorporated, in accordance with the Standard for Safety, Transient Voltage Surge Suppressors (TVSS), Standard 1449, Second Edition, dated February 9, 2007, the wire size listed for each product must be utilized to connect the unit to your facilities' power grid. Connections made with conductors other than the wire size listed may result in different SVRs.

Circuit Ampacity Limitations: Representative samples of these products have been investigated by Underwriters Laboratories, Incorporated to withstand, without exposing live circuits or components at system voltages and fault currents up to 200,000 AIC, as described in the Standard for Safety, Transient Voltage Surge Suppressor (TVSS), Standard 1449, Second Edition, dated February 9, 2007. Verify each product's fault current rating on the installation pages that follow.

System Grounding and Bonding

The performance and safety of any SPD system is dependent on proper grounding and bonding. Grounding is required for safety. Correct implementation also enhances equipment performance. Incorrect grounding can reduce or impede the SPD's operation.

All electrical circuits to the SPD must include an equipment-grounding conductor as required by the NEC and local codes.

An insulated grounding conductor is required in addition to any metallic raceway, which may be used as a grounding conductor. For parallel connected SPDs, the grounding conductor should be the same wire size as the associated power conductors. Grounding conductors must be routed with the associated power conductors in the same raceway (conduit).

When metallic raceways are used, adequate electrical continuity must be maintained at all raceway connections, particularly raceway terminations to the electrical enclosures.

The use of isolating bushings or other means to interrupt a metallic conduit run is a potential safety hazard and is not recommended.

Grounding Electrode: Surge protective devices do not discharge all surges to ground (earth). Surge protective devices divert the surge current back to its source to complete the electrical circuit.

In the case of lightning, where potential is developed with respect to the earth, the SPD diverts the surge current to the grounding electrode (earth connection). However, for most transient surges that are developed by switching loads, the SPD diverts the surge current back to its source without involving the grounding electrode.

For proper SPD performance, the service entrance grounding electrode system must comply with the NEC by having all available electrodes (building steel, metal water pipe, driven rods, concrete encased electrodes, etc.) properly bonded together and connected to the power system grounding.

The use of a separate grounding electrode to ground the SPD defeats the effectiveness of the SPD, is a potential safety hazard, may cause equipment damage, is an NEC violation (reference NEC 250-51 and 250-54), and is not recommended.

System Neutral: For proper and safe operation, the neutral (if provided) must be reliably connected to the neutral of the source. Failure to provide a reliable neutral connection may result in module failure.

SPD Monitoring

External Status Indicators: These indicators provide a summary of the status of the surge SPD module. For normal conditions, the green “OK” LED is illuminated and the red “Service” LED is extinguished. If the surge SPD module requires replacement, the green “OK” LED is turned off and the red “Service” LED is illuminated.

Summary Alarm Contact: Summary alarm Form C relay contacts may be provided for remote indication of the failed surge SPD module.

Contacts are rated 5 A at 250 V ac maximum with a power factor of 1.0. For units with Summary Alarm Contacts, access to the contacts are typically provided via contact terminals located on the printed circuit board mounted on the inside of the unit’s cover.

Transient Counter (optional): Transient counters are provided for transient voltage surge monitoring. The counter totalizes surges monitored since the last counter reset.

The transient counter monitors line transient voltages. The circuit counts all surges that deviate from the line sine wave. The factory setting is 30% over nominal line voltage. Other settings include 50%, 70%, and 100%.

Audible Alarm: If the surge SPD module requires replacement, an audible alarm is activated to draw attention to the fact that repair service is required to restore the system to normal operation. An audible alarm disable is provided to silence the alarm. The system will automatically reset itself after repair. The audible alarm switch and “Service” LED can be tested by activating the “Test” switch on the system monitor panel.

SPD Interconnect Assembly

Installation Instructions

All electrical connections shall be installed by a qualified (licensed) electrician. All wiring must comply with the National Electrical Code (NEC) and applicable local codes.

National Electrical Code (NEC) Considerations

The National Electrical Code Article 240-21 details specific tap rules that should be considered before installation.

NEC 240.21 Location in Circuit. Over current protection shall be provided in each ungrounded circuit conductor and shall be located at the point where the conductors receive their supply except as specified in 240.21(A) through (G). No conductor supplied under the provisions of 240.21(A) through (G) shall supply another conductor under those provisions, except through an over current protective device meeting the requirements of 240.4.

(A) **Branch-Circuit Conductors.** Branch-circuit tap conductors meeting the requirements specified in 210.19 shall be permitted to have over current protection located as specified in that section.

(B) **Feeder Taps.** Conductors shall be permitted to be tapped, without over current protection at the tap, to a feeder as specified in 240.21(B)(1) through (5).

(1) **Taps Not Over 3 m (10 ft.) Long.** Where the length of the tap conductors does not exceed 3 m (10 ft.) and the tap conductors comply with all of the following:

(1) The Ampacity of the tap conductors (25 Amps in our case) is:

a. Not less than the combined computed loads on the circuits supplied by the tap conductors, and

b. Not less than the rating of the device supplied by the tap conductors or not less than the rating of the over current protective device at the termination of the tap conductors.

(2) The tap conductors do not extend beyond the switchboard, panel board, disconnecting means, or control devices they supply.

(3) Except at the point of connection to the feeder, the tap conductors are enclosed in a raceway, which shall extend from the tap to the enclosure of an enclosed switchboard, panel board, or control devices, or to the back of an open switchboard.

(4) For field installations where the tap conductors leave the enclosure or vault in which the tap is made, the rating of the over current device on the line side of the tap conductors shall not exceed 10 times the Ampacity of the tap conductor.

(2) **Taps Not Over 7.5 m (25 ft.) Long.** Where the length of the tap conductors does not exceed 7.5 m (25 ft.) and the tap conductors comply with all of the following:

(1) The Ampacity of the tap conductors is not less than one-third of the rating of the over current device protecting the feeder conductors (75 Amp maximum in our case).

(2) The tap conductors terminate in a single circuit breaker or a single set of fuses that will limit the load to the Ampacity of the tap conductors. This device shall be permitted to supply any number of additional over current devices on its load side.

(3) The tap conductors are suitably protected from physical damage or are enclosed in a raceway.

(3) **Taps Supplying a Transformer.** Not Applicable

(4) **Taps Over 7.5 m (25 ft.) Long.** Not Applicable

(5) **Outside Taps of Unlimited Length.** Not Applicable

Flexible liquid tight non-metallic conduit in lengths greater than six feet must be installed in accordance with NEC 351-27.

Installation

1. Ensure that all power is removed before beginning installation. A qualified licensed electrician shall install all electrical connections.
2. The STV 200/400K is provided in a NEMA 12 enclosure type. NEMA 12 enclosures are suitable for indoor installations. Optional NEMA 3R, NEMA 4 or NEMA 4X enclosures are suitable for indoor or outdoor installations.
3. Determine where the STV 200/400K is to be mounted, allowing for minimum length of wire between the unit and the input power terminals of the service panel. Punch or cut the proper hole size in the side of the STV 200/400K closest to the knockout to be utilized in the service panel. Drill mounting holes in the wall at the location picked for the SPD using 1/4 in. mounting hardware.
4. The STV 200/400K has obtained the short circuit current rating of 200,000 Symmetrical Amperes (200 kAIC).

   Circuit Ampacity Limitations. Representative samples of these products have been investigated by Underwriters Laboratories, Incorporated to withstand, without exposing live circuits or components at system voltages and fault currents of up to the rating shown above, as described in the Standard for Safety, Transient Voltage Surge Suppressor (TVSS), Standard 1449, Second Edition, dated February 9, 2007.

   An external circuit breaker is not necessary for over-current protection for most units. However, it is recommended that the SPD be connected in series with a circuit breaker (see table on page 15). The SPD shall be connected in accordance with all national and local electrical codes.
5. Connect the black wires (line or phase) marked L1/A, L2/B, or L3/C; the white wire (neutral) marked N; and the green wire (ground) marked G. Refer to the table on page 15 for suggested wire sizes. To yield the best performance of the SPD within the electrical distribution system, keep all conductors as short as possible and avoid sharp bends.

⚠ CAUTION **If the SPD model is a Wye configured unit (4 W + G), and a neutral connection is not available, please contact SolaHD Technical Support at (800) 377-4384 or (847) 268-6000 for further assistance.**

6. Connection to Form C contacts shall be with #18-22 AWG. The ratings of the Form C contacts are 5 amps at 250 V ac (maximum) with a power factor of 1.0.

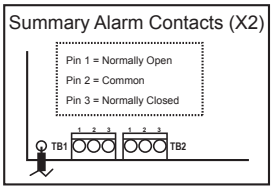
7. Apply power. The surge protector is fully operational when the front door of enclosure and the green LEDs on the modules are illuminated. If the green LEDs are extinguished or a red LED is illuminated, check to ensure that power is applied to the SPD. If an abnormal indication is present, remove power to the SPD and contact SolaHD Technical Support at (800) 377-4384 or (847) 268-6000.
8. Periodically monitor the status of the LEDs. Reduced protection exists if the green LEDs are extinguished or the red LED is illuminated. Contact SolaHD Technical Support at (800) 377-4384 or (847) 268-6000 for further assistance.
9. The protection modules in these SPDs may be replaceable. Contact SolaHD Technical Support at (800) 377-4384 or (847) 268-6000 for more information.

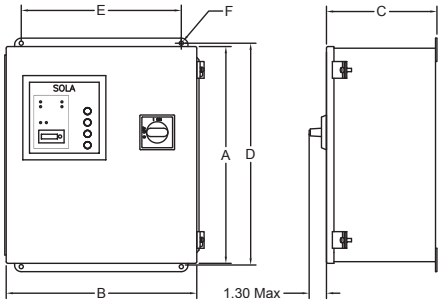
Technical Specifications

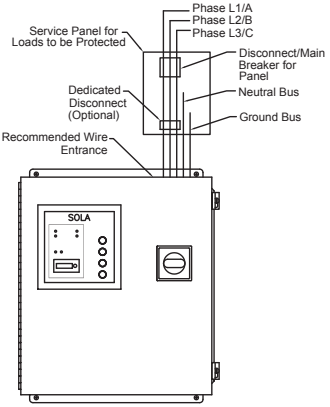
Description	Catalog Number					
	STV 200K-10Y	**STV 200K-27Y**	**STV 200K-48D**	**STV 400K-10Y**	**STV 400K-27Y**	**STV 400K-48D**
Input Voltage	120Y/208 V	277Y/480 V	480 V	120Y/208 V	277Y/480 V	480 V
	Three Phase Wye, 4 W + G	Three Phase Wye, 4 W + G	Three Phase Delta, 3 W + G	Three Phase Wye, 4 W + G	Three Phase Wye, 4 W + G	Three Phase Delta, 3 W + G
Maximum Continous Operating Voltage (MCOV)	120 V = 125% All other voltages = 115%					
Line Frequency	47–63 Hz					
Response Time	< 0.5 ns					
Enclosure	NEMA 12 (NEMA 3R, 4, 4x optional)					
Connection/ Mounting Type	Internally connected/Wall Mounted (Mounting hardware 1/4 in.)					
Status Indication	Red and green LED status indicators, Audible alarm, and Form C contact relay					
Operating Temperature	-40°C to +50°C					
Operating Humidity	0% to 95% Non-condensing					
Noise Attenuation	50 dB Maximum					
Modes of Protection	All Modes: L–N, L–L, L–G, N–G[1]					
AIC Rating	200 kAIC					
Saftey Agency Approvals	UL 1449, UL 1283, cUL					
Warranty	5 year limited warranty					
UL 1449 (2nd Edition) Suppressor Classification						
Line to Neutral	400 V	700 V	N/A	400 V	700 V	N/A
Line to Line	700 V	1,500 V	1,500 V	700 V	1,500 V	1,500 V
Line to Ground	400 V	700 V	1,500 V	400 V	700 V	1,500 V
Neutral to Ground	400 V	700 V	N/A	400 V	700 V	N/A
Circuit Ampacity Limitations						
Per Phase	200 kA	400 kA	200 kA	400 kA	200 kA	400 kA
Line to Neutral	100 kA	200 kA		200 kA	100 kA	
Line to Line	100 kA	200 kA	100 kA	200 kA	100 kA	200 kA
Line to Ground	100 kA	200 kA	100 kA	200 kA	100 kA	200 kA
Neutral to Ground	100 kA	200 kA		200 kA	100 kA	

[1]Delta Model does not offer N–G mode of protection

System Information







STV 200/400K Series											
Catalog Number	Dimensions (in.)						Weight lb.	Suggested Breaker Size	Suggested Wire Size (AWG)	Allowable Breaker Range	Allowable Wire Range
	A	B	C	D	E	F					
STV 200K	16	14	8	16.75	12	.31	35	40 A	#8	15 A–100 A	#14–#2
STV 400K	16	14	8	16.75	12	.31	42	100 A	#2	15 A–100 A	#14–#2

STV 200/400K Series with Rotary Disconnect											
Catalog Number	Dimensions (in.)						Weight (lb.)	Suggested Breaker Size	Suggested Wire Size (AWG)	Allowable Breaker Range	Allowable Wire Range
	A	B	C	D	E	F					
STV 200K	16	14	8	16.75	12	.31	41	40 A	#8	15 A–175 A	#14–#2/0
STV 400K	16	14	8	16.75	12	.31	45	100 A	#2	15 A–175 A	#14–#2/0

Troubleshooting

If status failure indication occurs or Form C relay has changed states, a qualified electrician shall first determine if the system's voltage and proper phasing exists.

If it remains in an alarm condition once the electrician is satisfied that the electrical system and its connections are normal, the unit should be repaired. At this point consult SolaHD Technical Support at (800) 377-4384 or (847) 268-6000, having available the following information:

- **Unit identification number:** Refers to the model and serial numbers detailed on the data label and is located on the front or upper left [hinge] side of the enclosure.
- **Nature of problem:** Including status of all indicators and alarms.

Service

For service assistance, contact your local SolaHD Representative or Technical Support at (800) 377-4384/(847) 268-6000.

⚠ DANGER

Only qualified personnel should perform maintenance on the system.

Hazardous voltages are present inside the unit during normal operations.

Electrical safety precautions must be followed when servicing this unit.

To prevent risk of electrical shock, turn off and lock out all power sources to the unit before servicing.

Maintenance

Corrective Maintenance

The SPD is designed for years of trouble-free operation. However, even the most reliable equipment may fail under abnormal conditions.

Diagnostic indicators are provided to indicate when the unit needs to be repaired. To ensure continuity of surge protection, failed units should be replaced as soon as possible.

When replacing surge modules, other components should be inspected for damage and replaced if necessary. Standard electrical troubleshooting procedures should be used to isolate problems other than failed surge current diverter modules.

When replacing components—for continued proper operation and safety—only use identically rated components. Please contact the SolaHD Technical Support Group for more information on replacement parts.

Preventative Maintenance (Inspection and Cleaning)

Periodic system inspections, cleaning, and connection checks are recommended to ensure reliable system performance and continued surge transient protection.

It is difficult to establish a schedule for preventative maintenance since conditions vary from site to site. Inspections for failed surge modules using available diagnostics should be done routinely (weekly or monthly).

Product Registration & Warranty Information

Product Registration

To register your product for updates and information on service and support:

- Visit the Technical Support section of our Web site at: http://www.solaheviduty.com/support/registration.htm
- Click on the Product Registration link and fill in the form. This will register your product with SolaHD.

Warranty Information

Please see “Terms and Conditions” and “Sales Policies and Procedures”.

SOLAHD

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