



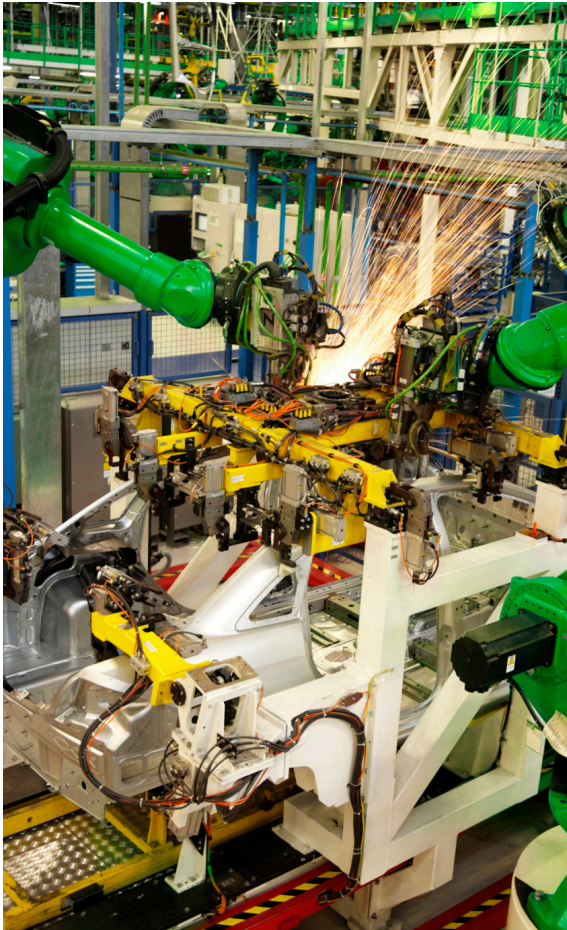
## Power Conversion and Power Quality Solutions

**SolaHD™ Assessment Program  
for Surge Protective Devices**  
Reference and Installation Guide.





# Prevent threats to the reliability and performance of sensitive electronic equipment.



Employing an entire facility protection strategy will safeguard the electrical system against most transients. That is why Emerson™ is constantly looking for ways to improve your operational performance and protect your equipment. Our SolaHD™ surge protection devices protect these critical operations across facilities from the continuous threat of transient spikes.

Electrical power surges can be caused by many different things such as lightning or downed power lines. Even the utility companies themselves can cause power surges by switching capacitors or doing line work. These surges or transients can get induced on virtually any copper wire within a facility, like power lines, but even often overlooked low voltage data lines including network cables, telephone wires and cable TV coax.

Transients are very short in duration, but very high in energy, and have the ability to destroy sensitive electronic equipment in a residence, factory or commercial building. For this reason, it is important that the proper protection is in place to make sure equipment damage is reduced or eliminated. Before that is done, it is important the terms associated with surge protective units are defined and understood.

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# Glossary of Terms

**Alternating Current (AC)** – Electrical current which reverses direction periodically, expressed in hertz or cycles per second. The number of such cycles per second equals the frequency in hertz, i.e. 60 cycles per second = 60 hertz (Hz).

**Attenuation** – The reduction of a signal or electrical surge from one point to another. Wire resistance, arresters, and power conditioners attenuate surges to varying degrees.

**Branch Circuit** – A division of a load circuit with current limited by a fuse or circuit breaker.

**Brownout** – A long-duration under-voltage condition, usually hours or days in length. Brownouts can be caused by heavy usage during peak hours, or they may be planned as an energy conservation strategy.

**Clamping Voltage** - Clamping voltage refers to the maximum amount of voltage that can pass a surge protector or electrical breaker before it restricts further voltage from passing to a device. It is a process through which a device or equipment is protected from electrical surges.

**Critical Load** – That portion of electrical equipment for which power quality is a vital consideration.

**Ground** – A conducting connection, whether incidental or accidental, between an electrical circuit or equipment and earth, or to some conducting body that serves in place of earth.

**IEEE** – The Institute of Electrical and Electronic Engineers (IEEE) is an international society of engineers that develops its own standards.

**Impedance** – Measured in Ohms, impedance is the total opposition to current flow in a circuit where alternating current is flowing. This includes inductive reactance, capacitive reactance, and resistance.

**Impulse** – Transient voltage or current condition of positive or negative amplitude.

**kA rating (per phase/mode) • I<sub>max</sub> also known as surge rating, max discharge current, or kA rating** - Per mode rating is a voltage of Line to Neutral (L-N) OR Line to Ground (L-G). Per phase rating is the summation of the capacities of the peak ampere rating of the individual suppression components used within a particular protection mode. Both line-neutral (L-N) and line-ground (L-G) modes are added together to represent a peak ampere rating per phase. (I.e. L-N 100 kA, L-G 100 kA provides 200 kA/phase).

**Metal Oxide Varistor (MOV)** – A solid state device which becomes conductive when the voltage across it exceeds a certain level. When the voltage exceeds the MOV's threshold, current flows through the MOV.

**Nominal Discharge Current (I<sub>n</sub>):** The peak value of the current, that can be passed through the SPD having a waveshape of 8x20  $\mu$ s where the SPD remains functional after 15 surges.

**Short Circuit Current Rating (SCCR)** – is a rating on components and assemblies representing the maximum level of short-circuit current that a component or assembly can withstand.

**Surge** – A surge is a transient voltage or current with duration of a few microseconds.

# Glossary of Terms

**Surge Protective Device (SPD)** – An SPD is a non-linear protective device for limiting surge voltages on equipment by discharging, bypassing or diverting surge current; it prevents continued flow of follow current and is capable of repeating these functions as specified.

**Transient** – An electrical event of a non-repetitive nature. A short duration, fast-rise-time voltage caused by lightning, large motors starting, utility switching operations and other appliances switching.

**Transient Voltage Surge Suppressor (TVSS)** – see surge protective device above.

**Utility Grid Switching** – Connecting and disconnecting of transmission lines or other components to and from the system. Switching may cause spikes, swells, and electrical noise.

**Voltage Let-Through or Let Through Voltage** - refers to the amount of transient voltage passed through a power conditioning device to the load. A transient is a high amplitude, short duration spike or surge superimposed on the normal waveform.

# What Is a Surge Protective Device (SPD)?

By definition, SPDs limit the amount of surge voltage and divert surge energy away from electrical loads. SPDs are designed to reduce potentially damaging short-duration transients present on utility power lines, data networks, telephone lines, closed circuit and cable feeds. Also called transient voltage surge suppressors, or TVSS, SPDs can range in size from a single component on a printed circuit board to a large metal enclosure protecting an entire facility. No matter what the size they all share the same function which is to protect downstream equipment from surge damage.



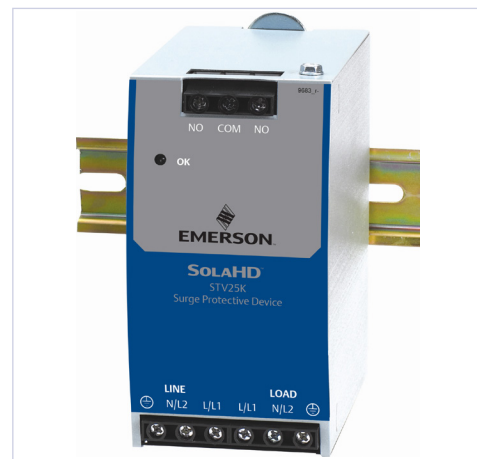
**Facility-Wide Service  
Entrance Surge Protective**



**Distribution Panel Surge Protective**



**Branch Panel Surge Protective**



**Critical Point of Use - DIN Rail Mount Style**

# How Do SPDs Protect Equipment?

When a transient enters an unprotected facility, it can make its way through the building's wiring systems all the way down to the outlet level destroying sensitive electronics. By placing an SPD in parallel with the sensitive equipment, high-voltage transients are suppressed and high current transients are diverted to ground (see Figure 1).

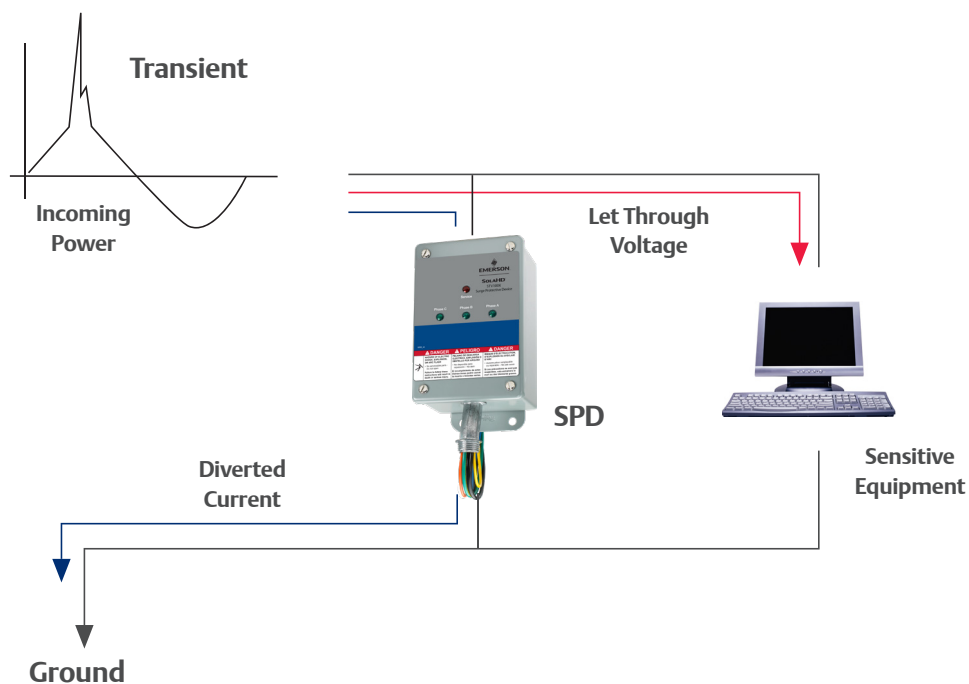


Figure 1

The surge components within the SPD begin to conduct once it experiences voltages above a predesigned threshold like in the event of a surge. The dangerous transient is suppressed or reduced to a level that is safe, but not totally removed. Figure 2 shows a suppressed transient on a 60 Hz AC sine wave.

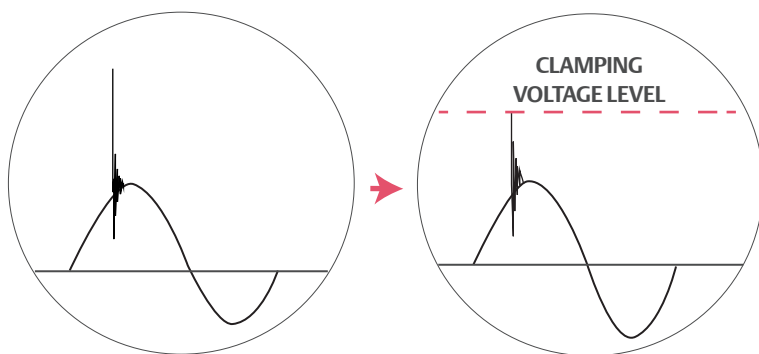
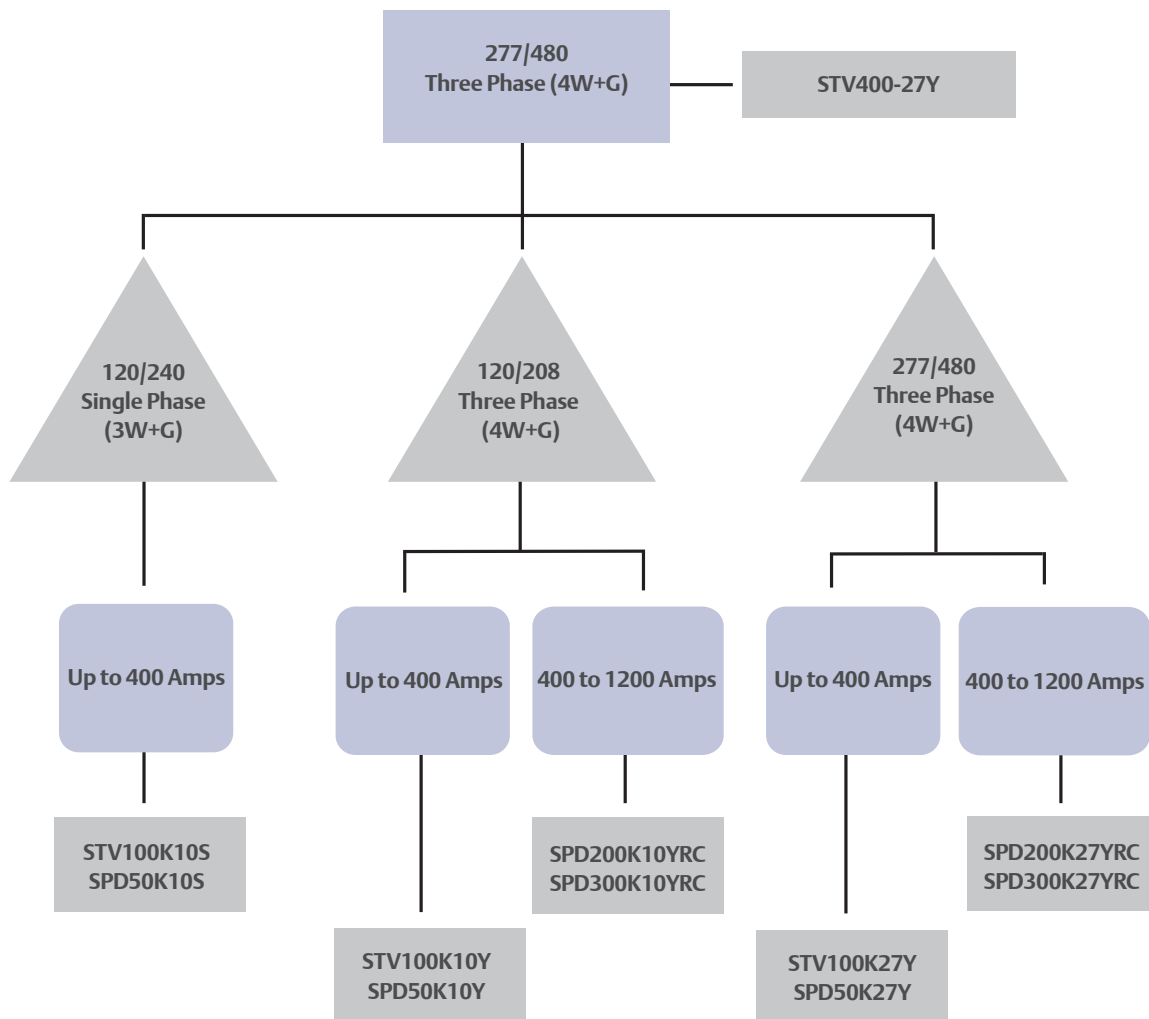


Figure 2

# Where to Apply SPDs Within a Facility?

There is no cut and dry method of deciding where an SPD should be installed within a facility's power system. Every facility is different which makes every situation different. Surge protective needs for a large commercial entity differs from that of a small business. However, the one-line diagrams below shows how SPDs of different sizes should be placed in key locations throughout a facility. It demonstrates the logical progression when sizing a surge protective unit to a specific commonly sized panel found in either a commercial or industrial facility. If the panel in question does not fall into one of the categories outlined, please call 1-800-377-4284 to speak with a technical support specialist.



# How to Select the Appropriate Sized SPD

When selecting a unit, consider what type of service is present. The following table categorizes the service size in amperage, the exposure level, the voltage and the configuration. To use the table, determine if you have a three phase (4 Wire + Ground) or (3 Wire + Ground) service or a single phase (3 Wire + Ground) service. The next thing you will want to determine is the size of the service. Once you have determined this, the final considerations would be the perceived exposure level and/or the cost of downtime. The higher exposure you have to transients or lightning and/or the higher the cost of downtime, the larger the unit you would want to choose.

**Commercial/Industrial Facility Power — Service, Distribution and Brand**

Service Size	Surge Rating	Single Phase	Three Phase		
		120/240V (3 Wire + Ground)	120/208V (4 Wire + Ground)	277/480V (4 Wire + Ground)	480V ( $\Delta$ , 3 Wire + Ground)
Up to 400 A	50 kA/phase	SPD50K10S	SPD50K10Y	SPD50K27Y	SPD50K48D
Up to 400 A (Branch)	100 kA/phase	STV100K10S	STV100K10Y	STV100K27Y	STV100K48D
400 A to 1200 A (Distribution)	200 kA/phase	—	SPD200K10Y	SPD200K27Y	SPD200K48D
1200 A and up (Service Entrance)	300 kA/phase	—	SPD300K10Y	SPD300K27Y	SPD300K48D

$\Delta$  = DELTA



# How to install an SPD

## (STV100K SERIES REFERENCED)

This guide contains important safety instructions that should be followed during the installation and maintenance of a hardwired surge protective device. Please read the manual thoroughly before attempting to install or operate the SPD. Adhere to all warnings on the unit and in the manual provided with your SPD. The installer should perform the following steps to assure a quality installation. These instructions do not replace national or local electrical codes. Check applicable electrical codes to ensure compliance. Installation of the SPD system should only be performed by qualified personnel.

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## SolaHD™ STV100K Series – Installation

### Mounting Considerations

**Mounting Orientation** – The unit can be mounted in any direction (horizontal, vertical, upside down, etc).

**Knockout Size/Location** – A ½" knockout must be selected for connection to the panel. The knockout location should be selected based on the proximity to the circuit breaker being used. (Shorter SPD hook-up wires will increase the unit's performance).

**Mounting Hardware** – 10-32 hardware should be used to mount/secure the SPD unit.

### Electrical and Connection Considerations

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

**SPD Unit Ratings** – Confirm the unit's electrical ratings are correct for the source power prior to installation. (Example: STV100K-10Y if only for 120/208 V, 3 Phase Wye, 4 Wire + Ground source).

**Phase/Neutral/Ground Connection Wires** – The units are supplied with a minimum of 18 inches of wire for connection. For performance reasons, extra wire should not be attached to the unit.

**Circuit Breaker Size** – A 30 A circuit breaker should be used for STV100K models. Note: Because of the UL tested and approved fusing utilized in the SPD200K and SPD300K, the units can be direct-connected. However, it is recommended that it still be connected using a circuit breaker for ease of disconnect for maintenance purposes.

**Circuit Breaker Location** – The SPD circuit breaker can be located anywhere in the panel (top left, bottom right, etc).

### Performance Effecting Factors

- All connection wires should be trimmed to the shortest length possible.
- All connection wires should be as straight as possible. Avoid sharp bends.
- It is recommended that the phase, neutral and ground conductors be twisted together and routed in the same raceway (conduit).

### System Grounding

The safety of any SPD system is dependent on proper grounding. Correct implementation also enhances equipment performance. 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. 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).

# Step-By-Step Installation

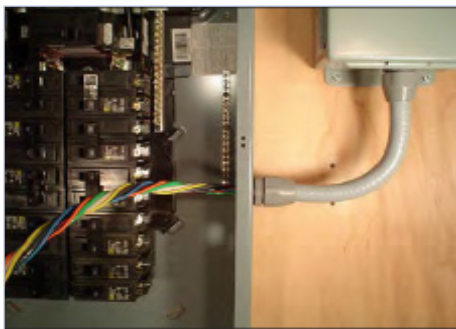


## WARNING

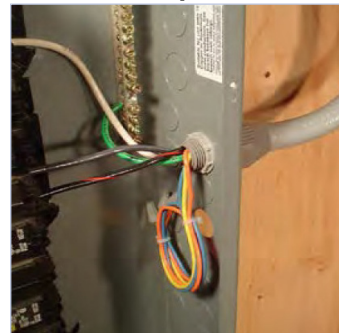
**VERIFY THAT ALL POWER CIRCUITS ARE DE-ENERGIZED AND LOCKED OUT BEFORE MAKING ELECTRICAL CONNECTIONS.**

1. Ensure the electrical power to the panel/equipment has been removed. Remove the cover from the panel.  
*Installation Note: Always confirm that the voltage/configuration rating matches the voltage and configuration of the panel - 480/277 V wye SPD will NOT work when connected to 480 V delta power.*
2. All Units – Select the location where the SPD will be installed. Remove the knockout or drill/punch a 7/8" diameter hole in the panel.
3. All Units – Twist wires and feed through the knockout and into the panel. Secure the SPD unit in place using the unit's Chase Nipple and Conduit Nut.
4. All Units – Secure the unit to the wall using #10 hardware.
5. Optional (but recommended) step:  
Model numbers including "STV100K" – Install a 30 A circuit breaker in panel.
6. All Units – Trim and connect all wires.
  - a. Phase wires to the circuit breaker.
  - b. Neutral wire to the neutral bar.
  - c. Ground wire to the panel equipment ground.
  - d. Summary alarm wires to facility monitoring system. If not using, insulate wires to code.
7. Install the panel cover and apply power to the panel.
8. Apply power to the SPD unit.
9. If any/all of the Green LEDs do not illuminate or the red LED is illuminated, remove power, check all connections and test again. If the problem remains, see the "Maintenance" section of this manual.

**Steps 2 – 6**



**Step 7**



*Installation Note: Confirm the AIC rating of the panel does not exceed the SCCR rating of the SPD - refer to NEC Article 285 for additional information.*

# Operating/Monitoring

**External Status Indicators** – These indicators provide a summary of the status of the unit. For normal conditions, the green LEDs are illuminated and the red “Service” LED is extinguished. The unit requires replacement when a green LED is off and the red “Service” LED is illuminated.

**Summary Alarm Contact** – Summary alarm Form C (1 N.O. and 1 N.C.) relay contacts are provided for remote indication of the unit. Contacts are rated 5 amps at 250 Vac maximum with a power factor of 1.0.

**Audible Alarm** – If the unit 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.

## SolaHD™ STV100K Units

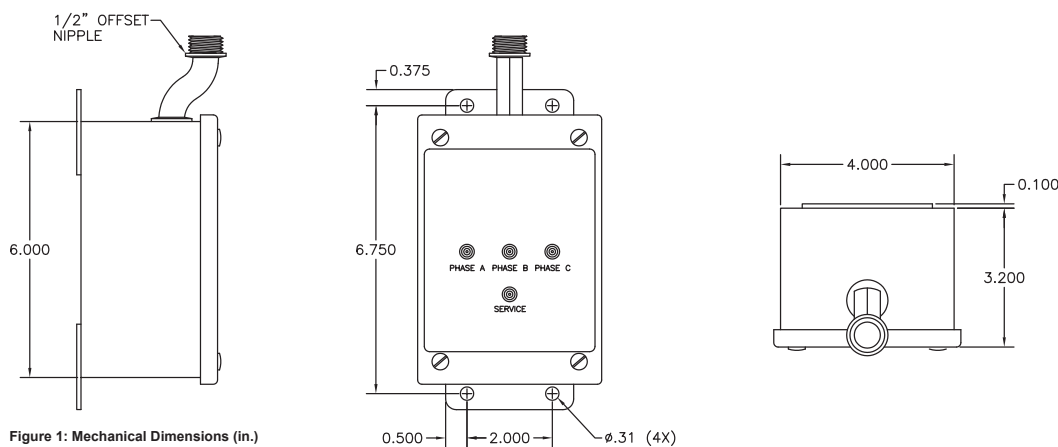
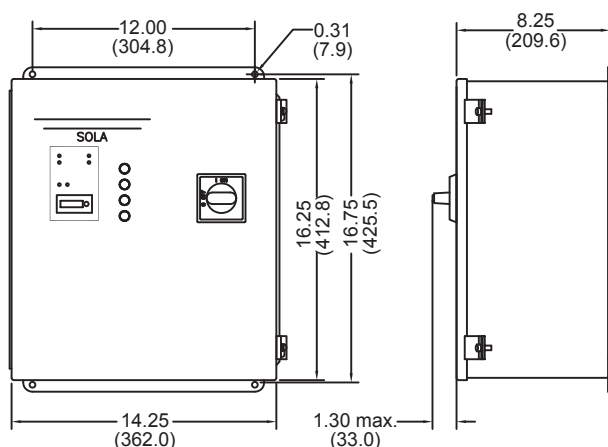
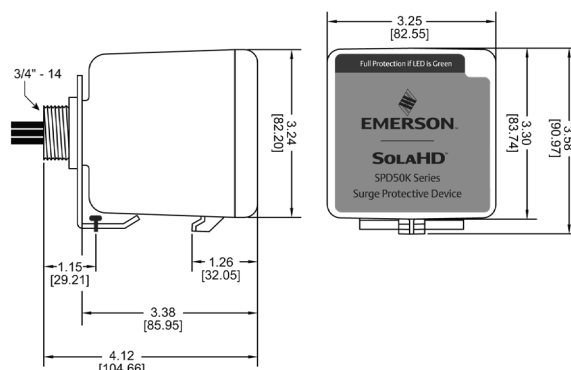


Figure 1: Mechanical Dimensions (in.)  
Unit shown is a three-phase wye

## SolaHD™ SPD200K\300K Units



## SolaHD™ SPD50K Units



**Innovative solutions to optimize operational performance, improve efficiencies, preserve data and increase equipment longevity.**



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