WARNINGS

- This manual shall be read in its entirety prior to installation.
- All instructions must be completely followed to ensure proper and safe installation and performance.
- Failure to follow these instructions can result in death, serious injury, and/or equipment damage.
- Safety First - Hazardous Voltage & Shock Hazard.
- Hazardous voltages exist within SPDs.
- SPDs should never be installed or serviced when energized.
- Only qualified licensed electricians should install or service SPDs.
- Use appropriate safety precautions including Personal Protection Equipment.
- PQ Protection products shall be installed and used only as indicated in PQ Protection documents.
- PQ Protection products must never be used for a purpose other than the purpose for which they were designed, or in a manner that exceeds specified ratings.
- Improper installation, misuse, misapplication, or other failure to completely follow PQ Protection's instructions and warnings may cause product malfunction, property damage, serious bodily injury and/or death; in addition to voiding the product warranty.

Bonding and Grounding Hazard

Verify that the neutral conductor in the service entrance equipment is bonded to ground in accordance with the National Electric Code (NEC®) and all applicable codes. During installation into an electrical system the SPD must not be energized until the electrical system is completely installed, inspected, and tested. All conductors must be connected and functional including the neutral (if required).

The voltage rating of the SPD and system must be verified before energizing the SPD. Failure to follow these guidelines can lead to abnormally high voltages at the SPD. This may cause the SPD to fail.

The warranty is voided if the SPD is incorrectly installed and/or if the neutral conductor in the service entrance equipment or downstream of separately derived systems is not bonded to ground in accordance with the NEC®.

SPDs on Ungrounded Systems

Caution - ungrounded systems are inherently unstable and can produce excessively high line-to-ground voltages during certain fault conditions. During these fault conditions, any electrical equipment including an SPD may be subjected to voltages which exceed their designed ratings. An SPD designed specifically for ungrounded systems should be used.

Do Not Hi-Pot Test SPDs

Any factory or on-site testing of power distribution equipment that exceeds normal operating voltage such as high-potential insulation testing, or any other tests where the suppression components will be subjected to voltage higher than the Maximum Continuous Operating Voltage (MCOV) rating must be conducted with the SPD disconnected from the power source.

For 4-wire systems, the neutral connection at the SPD must also be disconnected prior to performing high-potential testing. Failure to disconnect SPD and associated components during elevated voltage testing will damage the SPD and will void the warranty.

Unpacking & Preliminary Inspection

Inspect the entire shipping container for damage or signs of mishandling. Remove the packing materials and further inspect the unit for any obvious shipping damage. If any damage was found and is a result of shipping or handling, immediately file a claim with the shipping company and forward a copy to PQ Protection.

Storage Environment

This SPD should be stored in a clean, dry environment. Storage temperature range is -35°C (-31°F) to +75°C (+167°F). Avoid exposure to condensation.

PRE-INSTALLATION & INSTALLATION PLANNING

Operating Environment

The standard unit uses a Type 4 enclosure. Before installing, ensure that your enclosure type and application are appropriate regarding moisture, dirt, excessive dust, flammable materials or atmospheres, corrosive vapors, etc. Please consult the manufacturer if the enclosure needs to be changed. This SPD is designed to operate in an ambient temperature range of -35°C (-31°F) to +75°C (+167°F) with a relative humidity of 0% to 95% (noncondensing). Excessive temperature may inadvertently operate internal thermal overtemperature protectors.

Line Side versus Load Side Installation

The PQ360 and PQ480 series are listed as UL Type 1 or Type 2 SPDs per UL 1449 Fifth Edition.

The PQ360-F and PQ480-F series are listed as UL Type 2 SPDs per UL 1449 Fifth Edition.

Type 1 SPDs can be installed on the Line Side of the service overcurrent device. Type 1 SPDs may also be installed in Type 2 applications. As a generalization, it may be more practical to install the SPD as a Type 2 on the load side of main overcurrent device to facilitate future maintenance activities.

Audible Noise

SPD emitted audible noise is negligible or non-existent and does not restrict the location of installation.

Lead Lengths & Maximizing SPD Performance

SPDs must be located as close to the circuit as possible to minimize let-through voltage. Use the shortest & straightest possible leads. Pre-plan installations and ensure that the nearest breaker positions / connection points are used. If new construction, adjust breaker locations as appropriate. When longer leads are unavoidable, gently twist leads together (one to two twists per foot), or cable tie leads together.

Voltage Rating

Before installing the SPD, verify that it has the same voltage rating as the power distribution system. Compare the SPDs nameplate voltage or model number and ensure that SPD configuration matches the intended power source.

Circuit Breaker Connected

The PQ360 & PQ480 are rated at 200kA SCCR (Short Circuit Current Rating) and have internal overload protection elements within the SPD. When connected on the load side of the main disconnect, we suggest connecting via a 60A circuit breaker. The circuit breaker provides a convenient disconnect to enable (de-energized) servicing of the SPD.

System Grounding

An equipment grounding conductor must be used on all electrical circuits connected to the SPD. 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 142-2007). For sensitive electronics and computer systems, we recommend that the ground impedance measurement be as low as possible. When metallic raceway is used as an additional grounding conductor, an insulated grounding conductor should be run inside the raceway. Adequate electrical continuity must be maintained at all raceway connections. A separate isolated ground for the SPD is NOT recommended. Proper equipment connections to grounding system and ground grid continuity should be verified via inspections and testing on a regular basis as part of a comprehensive electrical maintenance program. On 4-wire (4W+G) power systems, neutral to ground bonding (Main Bonding Jumper) must be installed per the NEC®. Failure to do so WILL damage SPDs.

UL 1283 7th Ed. required language concerning the installation of EMI Filters

a) An insulated grounding conductor that is identical in size and insulation material and thickness to the grounded and ungrounded circuit supply conductors, except that it is green with or without one or more yellow stripes, is to be installed as part of the circuit that supplies the filter. Reference should be made to Table 250-122 of the National Electrical Code regarding the appropriate size of the grounding conductor.

b) The grounding conductor mentioned in item a is to be grounded to earth at the service equipment or other acceptable building earth ground such as the building frame in the case of a high-rise steel-frame structure.

c) Any attachment-plug receptacles in the vicinity of the filter are to be of a grounding type, and the grounding conductors serving these receptacles are to be connected to earth ground at the service equipment or other acceptable building earth ground such as the building frame in the case of a high-rise steelframe structure.

d) Pressure terminal or pressure splicing connectors and soldering lugs used in the installation of the filter shall be identified as being suitable for the material of the conductors. Conductors of dissimilar metals shall not be intermixed in a terminal or splicing connector where physical contact occurs between dissimilar conductors unless the device is identified for the purpose and conditions of use.

Retro-fit Into Existing Panel with No Available Breaker Positions

Follow all applicable Codes.

Consider consolidating loads in a manner that might free breaker positions.

A ten-foot tap rule in NEC® 240.21(B)(1) allows you to tap the bus if the tap conductors are rated at least 10% of the ampacity of the panel. In the case where the ampacity of the panel is larger than the wires of the SPD, consider tapping the bus per NEC® 240.21(B)(1) and running appropriate size conductors to a safety switch fused to 60A. Mount the SPD immediately adjacent to the safety switch.

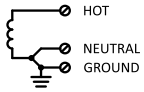
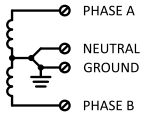
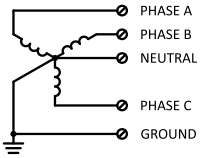
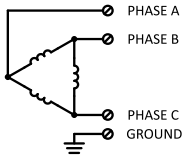
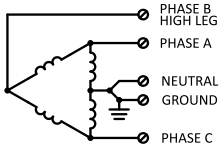
INSTALLATION

Pre-Plan your installation

1. Comply with all governing National and Local codes and regulations, Owner's standards, and NEC Article 242 (Article 285 prior to NEC 2020) addressing SPDs.
2. Make sure the system is grounded per NEC® and clear of faults before energizing SPD.
3. Identify connection/breaker location and SPD location.
    a. Mount SPD as close to panel or equipment as possible to keep the leads short.
    b. Ensure leads are as short and straight as possible, including neutral and ground.
    c. Consider a breaker position that is closest to the SPD and the panel's neutral & ground.
4. The suggested breaker size is 60A.

Installation

1. Use a voltmeter to check all voltages to ensure correct SPD.
2. Remove power for panel. Confirm panel is deenergized.
3. Remove an appropriately sized knockout from panel.
4. Mount SPD. Connect to equipment using an approved wiring method, including seals appropriate for the enclosure rating.
5. Connect Conductors as appropriate:
    a. G = Ground.
    b. N = Neutral (Not present on Delta configurations).
    c. L1, L2, L3 = Line 1, Line 2, Line 3, wire to disconnect switch.
    d. Label or mark conductors as appropriate:
        i. Ground: green.
        ii. Neutral: white.
        iii. Energized e.g.: black, black/red/blue, brown/orange/yellow, etc., as appropriate.
        iv. Hi-Leg (Delta units only): orange.
6. Make sure the system is bonded per NEC® and is clear of hazards or faults before energizing (*N-G bonding that is not per NEC® will damage SPDs - #1 cause of SPD failures*).
7. Monitoring contacts are available via connectors on LCD pocket in the door assembly.
    a. Dry contacts are rated for a maximum of 240V AC/DC @ 5A.
    b. 18 AWG stranded wire recommended.
    c. Higher energy applications require additional relay implementation outside of the SPD.
8. Energize and confirm proper operation of indicators. If Red LED flashes & Audible Alarm cycles, deenergize immediately and contact PQ Protection.

ELECTRICAL DISTRIBUTION SYSTEM - CONFIGURATION				
SINGLE PHASE (1P)	SPLIT PHASE (SP)	WYE (3Y)	DELTA (3D)	HIGH LEG DELTA (HLD)
				

OPERATION

LED Operation

Each SPD contains two (2) tri-color LEDs per phase shown in the appropriate voltage configuration. When the LEDs are green complete protection is present. During partial MOV stack failure the LED will change state to amber. Upon full MOV stack failure the LED will change state to red. During any failure, the red ALARM LED will illuminate. LED will illuminate during Temporary Overvoltage (TOV) and Surge Events.

Audible Alarm

The Audible Alarm will sound upon partial or full MOV stack (suppression element) failure. The Audible Alarm will also sound during TOV, Surge, or disconnection events. The Audible Alarm can be disabled or enabled, when enabled – the Audible Alarm can be temporarily silenced.

LCD Panel Operation

Screen Saver

Immediately upon power-up of the SPD the scrolling screen saver will be shown.

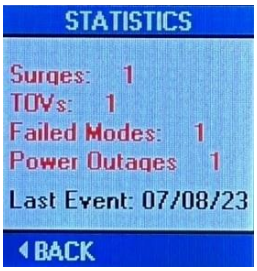
When any of the buttons are pressed, the SPD will stop showing the screen saver and advance to the Main Screen.

After 5 minutes without user activity the screen saver will be displayed again.

Main Screen

The Main Screen is the starting point for navigating through the SPDs menus. It will also show the logged data for the most recent event and the current time and date.

Pressing the left button (MENU) will move to the Main Menu screen.
Pressing the right button (STATS) will move to the Statistics screen.



Statistics Screen

The Statistics Screen shows the total counts by event type.

Pressing the left button (BACK) will return you to the Main Screen.

Main Menu Screen

The Main Menu Screen will allow you to navigate to the Setup Menu, Event Menu, About Screen, System Screen, and Event Memory Screen.

Use the UP/DOWN buttons to select the menu or screen of interest.
Pressing the left button (BACK) will return you to the Main Screen.
Pressing the right button (SELECT) will advance you to the menu or screen you have selected.

Setup Menu Screen

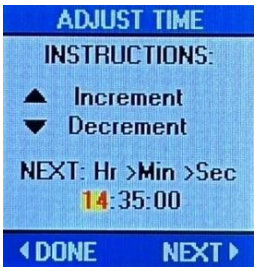
The Setup Menu Screen will allow you to set the time and date of the SPD. Accurately setting the date and time is particularly important for this SPD. All events are recorded with a timestamp.

Use the UP/DOWN buttons to select whether to adjust the time or the date.
Pressing the left button (BACK) will return you to the Main Menu Screen.
Pressing the right (SELECT) button will advance you to the menu or screen you have selected.

Adjust Date Screen

The Adjust Date Screen will allow you to set the date of the SPD.

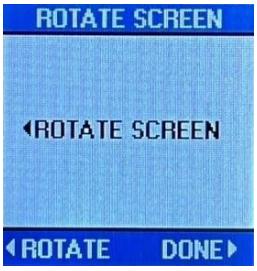
Use the UP/ DOWN buttons to adjust the value in the selected field until you have the correct value.
Pressing the right button (NEXT) will advance the cursor to the next date field.
Pressing the left button (DONE) will finalize your changes and save them to the SPD memory. You will automatically be brought back to the Setup Menu.



Adjust Time Screen

The Adjust Time Screen will allow you to set the time of the SPD.

Use the UP/ DOWN buttons to adjust the value in the selected field until you have the correct value.
Pressing the right button (NEXT) will advance the cursor to the next time field.
Pressing the left button (DONE) will finalize your changes and save them to the SPD memory. You will automatically be brought back to the Setup Menu.



Rotate Screen

The Rotate Screen will allow you to rotate the LCD screen and button orientation of the SPD.

Hold the left button (ROTATE) to rotate the screen.
Pressing the right button (DONE) will return you to the Setup Menu Screen.

Adjust Alarm Screen

The Adjust Alarm Screen will allow you to enable, disable, or silence the audible alarm.

Use the UP/DOWN buttons to select which operation to perform.
Pressing the left button (BACK) will return you to the Main Menu Screen.
Pressing the right button (SELECT) will select the audio alarm option.

Event Menu Screen

The Event Menu Screen will allow you to review the SPD's TOV and Surge event history or clear it.

Use the UP/DOWN buttons to select which operation to perform.
Pressing the left button (BACK) will return you to the Main Menu Screen.
Pressing the right button (SELECT) will advance you to the screen you have selected.

Event History Screen

The Event History Screen will allow you to review each event the SPD has on record.

Use the UP/DOWN buttons to scroll through the event log.
Pressing the left button (BACK) will return you to the Event Menu Screen.
Pressing the right button (CLEAR) will send you to the Clear Event History Screen.

Clear Event History Screen

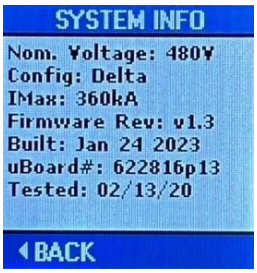
The Clear Event History Screen will allow you to clear the SPD's event log.

Pressing the left button (YES) will clear the event log.
Pressing the right button (NO) will keep the current event log intact.
Either operation will return you to the Event History Screen.

About Screen

From the Main Menu screen, the About Screen can be accessed to display the manufacturer's information, the model number, and the serial number for this specific SPD.

Pressing the left button (BACK) will return you to the "Main Menu" Screen.



System Info Screen

The System Screen displays the important electrical information for this system. This includes the nominal operating voltage, system configuration (i.e., Wye, Delta, Split-Phase) and maximum current rating for each mode of the SPD. The processor serial number, firmware edition, build and test dates are also shown on this page.

Pressing the left button (BACK) will return you to the Main Menu Screen.

Event Memory Screen

The Event Memory Screen will allow you to review the system memory capacity, memory in use and memory remaining.

Pressing the left button (BACK) will return you to the Main Menu Screen.

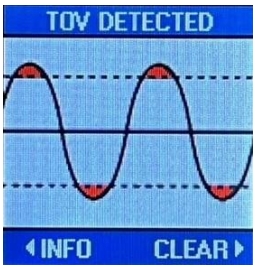
System Event Alarms

Surge Event

When the SPD detects a surge event the "Surge Detected" animation will be shown. It will remain on screen until acknowledged by an operator.

Any subsequent events that occur while the Surge event animation is on screen will be registered and queued for acknowledgment. Along with displaying the Surge animation, the Audio alarm will sound, and the monitoring contacts will change state.

Pressing the left button (INFO) will display additional information about the event. Pressing the right button (CLEAR) will acknowledge the event and silence the alarms.



Temporary Overvoltage Event

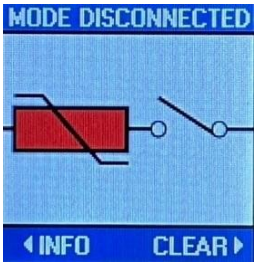
When the SPD detects a Temporary Overvoltage Event (TOV) the "TOV Detected" animation will be shown. It will remain on screen until acknowledged by an operator. Any subsequent events that occur while the TOV event animation is on screen will be registered and queued for acknowledgment. Along with displaying the TOV animation, the Audio alarm will sound, and the monitoring contacts will change state.

Pressing the left button (INFO) will display additional information about the event. Pressing the right button (CLEAR) will acknowledge the event and silence the alarms.

Extended TOV Event

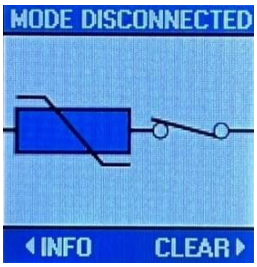
In the event of an operator attempting to clear a "TOV Detected" event while the TOV event is still occurring, the "TOV IN PROGRESS" screen will be displayed.

Pressing the left button (MENU) will move to the Main Menu screen.
Pressing the right button (STATS) will move to the Statistics screen.



Mode Disconnection

When the SPD detects a MOV disconnection the "Mode Disconnect" animation will be shown. It will remain on screen until acknowledged by an operator. Any subsequent events that occur while the disconnection event animation is on screen will be registered and queued for acknowledgment. Along with displaying the disconnection animation, the Audio alarm will sound, and the monitoring contacts will change state. A corresponding LED will also change state during an MOV disconnection.



Pressing the left button (INFO) will display additional information about the event. Pressing the right button (CLEAR) will acknowledge the event and silence the alarms.

Power Failure (Outage)

Should the SPD be subjected to a power outage this animation will be shown upon restoration of power – alternating between the two screens with the audible alarm sounding. It will remain on screen until acknowledged by an operator. Any subsequent events that occur while the power outage event animation is on screen will be registered and queued for acknowledgment.

During the power outage the monitoring contacts will change state.

Pressing the left button (INFO) will display additional information about the event. Pressing the right button (CLEAR) will acknowledge the event and silence the alarms.

This SPD's timekeeping is equipped to survive several days of a power outage. When power returns the SPD will record the date and time of the power loss and when power was restored. Should the SPD be exposed to an extended power outage the SPD's time and date should be checked for accuracy.

On initial installations where power may be cycled several times, the power outage alarm is designed to be suspended until the SPD has been energized for at least 1 hour.

MAINTENANCE

SPDs require minimal maintenance:

- We recommend periodic inspection of diagnostic indicators to ensure proper operation.
- We also recommend keeping the SPD clean as appropriate.

TROUBLESHOOTING & SERVICE

Please contact PQ Protection for any service-related issues.