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PM3 Series
Non-Modular Surge Protection Device (SPD)
User's Manual

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990-0525 10/00

SurgeArrest® PM Series

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INTRODUCTION

Thank you for choosing the APC SurgeArrest PM3 Series Surge Protection Device.

The APC non-modular Surge Protection Device (SPD) is a high quality, high energy surge attenuation system that has been designed to protect sensitive equipment from damaging transient voltage surges. Proper installation is imperative to maximize the surge suppressor's effectiveness and performance.

Read and understand all information contained in this manual prior to installation. This manual is to be used as a guide for installing the device. The procedures contained in this manual are not intended to supercede local or national electical codes. **Check all applicable electrical codes to assure compliance.** In all instances, local and/or national electric code requirements are to be followed.

This device must be installed by a licensed electrician. The electrician should follow the steps outlined in this manual to insure proper installation. **A copy of the installer's invoice detailing the installation of this device is required in order to take advantage of the unit's product warranty**.

The PM Series non-modular product line is a parallel SPD designed for service entrance and downstream panelboard applications.

The PM Series provides surge protection per phase and is available with a 120kA per phase ratings. All APC products are extensively tested according to industry standards as set by IEEE C62.41, and C62.45, for Categories A, B, and C. The connection method of these devices may require several feet of wire. Increased lead length adversely affects clamping voltages.

Save this manual! It includes instructions regarding the product warranty and replacement parts.

Installation

During installation into an electrical system, SPD's 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 device and system must always be verified before energizing the SPD.

Failure to follow these guidelines can lead to abnormally high voltage being applied to the SPD. This may cause the SPD to prematurely fail or significantly shorten the effective life. The warranty does not cover an incorrectly installed device.

Testing

Any factory or on-site testing 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 run with the suppressor disconnected from the power source. For 4-wire TVSS devices, the neutral connection at the TVSS must also be disconnected prior to performing high-potential testing and then reconnected upon completion of the test.

Failure to disconnect this surge suppression device and its associated suppression components during elevated voltage testing will result in damage to the suppression components and/or other electronic components.

UNPACKING and PRELIMINARY INSPECTION

- Inspect the entire shipping container for damage or signs of mishandling before unpacking the unit.
- Remove the cardboard packing and further inspect the unit for any obvious shipping damages.
- If damage found is a result of shipping or handling, immediately file a claim with the shipping company and forward a copy to APC.

Storage

The unit should be stored in a clean, dry environment. Storage temperature is -40^{o} C (-40^{o} F) to +60^{o} C (+140^{o} F). Avoid exposing the unit to areas of high condensation. All of the packaging materials should be left intact until the unit is ready for installation. If the unit has been stored for an extended period of time, it may be necessary to clean the unit and make a complete inspection of the unit prior to installing and placing it into service.

LOCATION CONSIDERATIONS

Environment

The unit is designed to operate indoors in an ambient temperature* range of -40° C (-40° F) to +60° C (+140° F) with a relative humidity of 0% to 95% non-condensing. The standard unit is in a Type 1 industrial use enclosure intended for indoor use. Primarily, it provides a degree of protection against contact with the enclosed equipment. It should not be installed in areas with excessive dust, flammable materials, corrosive vapors or explosive atmospheres.

*Surge Counter option has an operating temperature range of 0° C (32° F) to +60° C (+140° F).

Audible Noise

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

Mounting and Cabinet Data

The PM Series SPD is designed to be wall mounted. The unit size is as shown if Figure 1, and weighs 17 pounds (7.71 kg). Shipping weight is 19 pounds (8.618 kg).

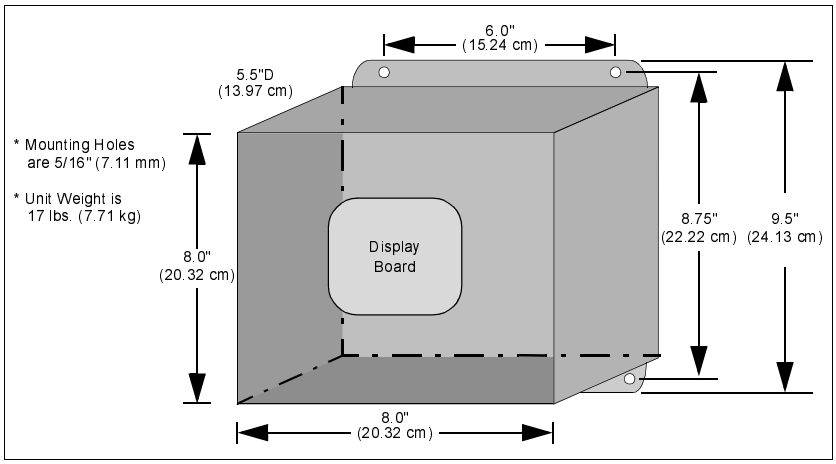


Figure 1. SPD Mounting Requirements

*****Surge Protection Devices are designed for use on the load side of the service entrance disconnect only*****

WARNING

- **MAINTENANCE OF THIS SURGE PROTECTION DEVICE SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY.**
- **DURING NORMAL OPERATION, HAZARDOUS VOLTAGES ARE PRESENT INSIDE THE UNIT.**
- **WHEN SERVICING THIS UNIT, BE SURE TO FOLLOW ALL ELECTRICAL SAFETY PRECAUTIONS.**
- **ALL POWER SOURCES TO THIS UNIT SHOULD BE LOCKED OFF BEFORE SERVICING. THIS WILL PREVENT THE RISK OF RECEIVING AN ELECTRICAL SHOCK.**

Service Clearance
In addition to national and local code requirements, 32 inches of service clearance is needed at the front of the SPD.

Equipment Performance
To obtain the maximum system performance, the unit must be located as close to the circuit to be protected as possible, minimizing the interconnecting wire length. For every foot of wire length, approximately one (1) nanosecond of turn-on/turn-off time will be added, and approximately 175 volts (6kV/3kA, 8/20 microseconds) will be added to the clamp voltage.

For optimum transient surge protection, staged surge suppression should be implemented at the service entrance and all other electrical connections to the building (telephone, CATV, etc.). It should also be implemented at recognized surge generating loads within the building (arc welding rigs, large motors, switched capacitors, etc.). Additionally, it should be implemented for sensitive electronic loads (computer equipment, facsimile machines, copy machines, solid state motor drives, variable frequency drives, etc.). For interconnected electronic loads (via data cabling), surge protection devices should also be utilized to protect the devices on either end of the interconnecting data cables.

APC manufactures a complete line of surge protection devices for both alternating current (AC) and direct current (DC) applications. Contact an authorized APC reseller, or order directly from APC at www.apc.com.

Product Orientation
To decode the Model Number and determine the unit's configuration, locate the printed nameplate on the inside of the unit door. ***Note:*** The Serial Number, Date of Manufacture, and UL 1449 Suppression Voltage Rating (SVR) are also on the unit identification nameplate. The Model Number can be decoded as follows:

- PM identifies a SurgeArrest Panel Mount product. The following letter indicates the voltage and wiring configuration of the device.
- Following this letter is the number 3. This number identifies the surge current ratings to be 120kA per phase.
- Following the number 3 is the letter X. This indicates that the unit is non-modular.
- Following the letter designation is optional equipment, shown as: D = Disconnect, S = Surge Counter.

Options are detailed later in this manual.

System Grounding
An equipment grounding conductor must be used on all electrical circuits connected to the SPD. This requirement is primarily for safety, although SPD performance is enhanced by proper grounding. Proper operation of any surge suppression system or device depends on a proper grounding system. Incorrect grounding practices will reduce the effectiveness or interfere with SPD system operation and performance, as well as endanger personnel and equipment. 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 sensitive electronics and computer systems, it is recommended that the ground impedance measurement be 25 ohms or less. When a 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. Do not use isolating bushings to interrupt a metallic raceway run. A separate isolated ground for the SPD is NOT recommended.

****On 4-Wire Power Systems, neutral to ground bonding should be installed per the NEC. Failure to do so could cause equipment damage.****

ELECTRICAL CONNECTIONS
Overcurrent Protection
The Surge Protection Device (SPD) draws very little current under normal conditions and will only conduct for a brief duration upon encountering a transient surge voltage. APC SPDs contain UL Listed internal fusing to protect against abnormal voltage conditions. Note: Fuses are not replaceable.

Voltage Rating
Prior to mounting the SPD, verify that the unit has the correct voltage rating by checking the nameplate voltage or model number. The service type should match the intended power source. See Table 1 for the voltage rating and service type of the SPD.

Table 1: Voltage Rating and Service Type (by Model)

Model Number	Voltage Rating and Service Type
PMP3X	120/240 Volts, Split Phase
PMF3X and PMF3XS	120/208 Volts, 3-Phase, WYE, 5 Wire
PMG3X	277/480 Volts, 3-Phase, WYE, 5 Wire
PML3X	347/600 Volts, 3-Phase, WYE, 5 Wire

Terminals

Terminals have been provided inside the APC non-modular SPD units for line (phase), neutral (if used), and equipment safety ground connections. Terminal wire size range for all models is #8 AWG - #1 AWG. Installation torque is 65 inch-pounds.

WARNING

VERIFY THAT ALL POWER CIRCUITS ARE DE-ENERGIZED BEFORE MAKING CONNECTIONS

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

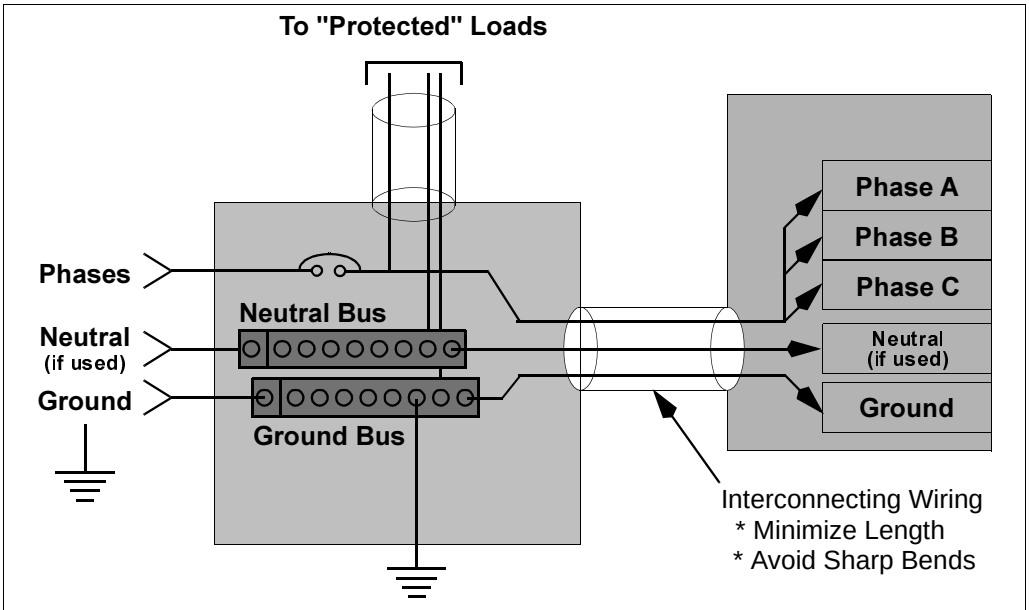


Figure 2. Typical Parallel Connections

Parallel Connection

When making a parallel type of connection (Figure 2), the length of the wiring to the Surge Protection Device (SPD) must be kept as short as possible to substantially enhance the performance. Long wire runs are to be avoided for the unit to perform as intended.

To reduce the impedance the wire displays to surge currents, the phase, neutral (if used), and ground conductors are to be routed within the same conduit and should be tightly bundled or twisted together to optimize performance of the unit. Sharp bends in the conductors are to be avoided.

Wire Size

With a parallel connection, the size of the wiring to the SPD is independent of the ampere rating of the circuit to be protected. The recommended wire size is based on the unit's transient surge current capabilities. #6 AWG is the recommended wire size for phase, neutral, and ground.

*****Surge Protection Devices are designed for use on the load side of the service entrance disconnect only*****

PM SERIES INSTALLATION INSTRUCTIONS

Typical Unit Installation - Three Phase WYE, 4 Wire, plus Ground

This section provides basic installation instructions for the PM3 SPD. Per UL 1449 Paragraph 1.4, SPDs "are intended for installation on the load side of the main overcurrent protection". Locate the SPD as close as possible to the circuit to be protected to minimize the wire length. This will optimize SPD performance.

Note that these instructions are not intended to supercede local or national codes. The installation should be performed by a licensed electrician. To install a PM3 SPD, refer to Figure 3 and proceed as follows:

1. Unpack and inspect the unit for signs of damage. If the unit is damaged, contact APC Customer Service (at 1-800-800-4APC). See Page 14 for obtaining service under the Warranty.

2. Locate where the SPD will be installed. Ensure the wire lengths from the SPD to the service panel are kept to a minimum.

3. Carefully remove the front cover by loosening the four (4) captive screws that secure the front cover to the chassis. Insure the ribbon cables attached to the diagnostic faceplate are not mechanically stressed or become unplugged. DO NOT ALLOW THE DIAGNOSTIC FACEPLATE TO HANG BY THE RIBBON CABLES!

4. Two holes are provided for the installation of wiring. The unit is shipped with a three (3) piece plug for use in plugging the unused hole. If the desired hole is plugged, remove the plug by removing the wing nut along with the inner and outer plug pieces.

5. In order to keep wiring length and bend radii at a minimum, APC recommends that wiring be installed through the left side of the SPD. APC also recommends that the hole be sealed with putty after wiring installation.

6. Drill four (4) pilot holes (mounting holes in the SPD are 5/16" in diameter) to provide for mounting of the SPD.

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

7. Mount the SPD to the wall or other mounting surface using the flanges. The SPD should be installed as close as possible to the panel being protected.

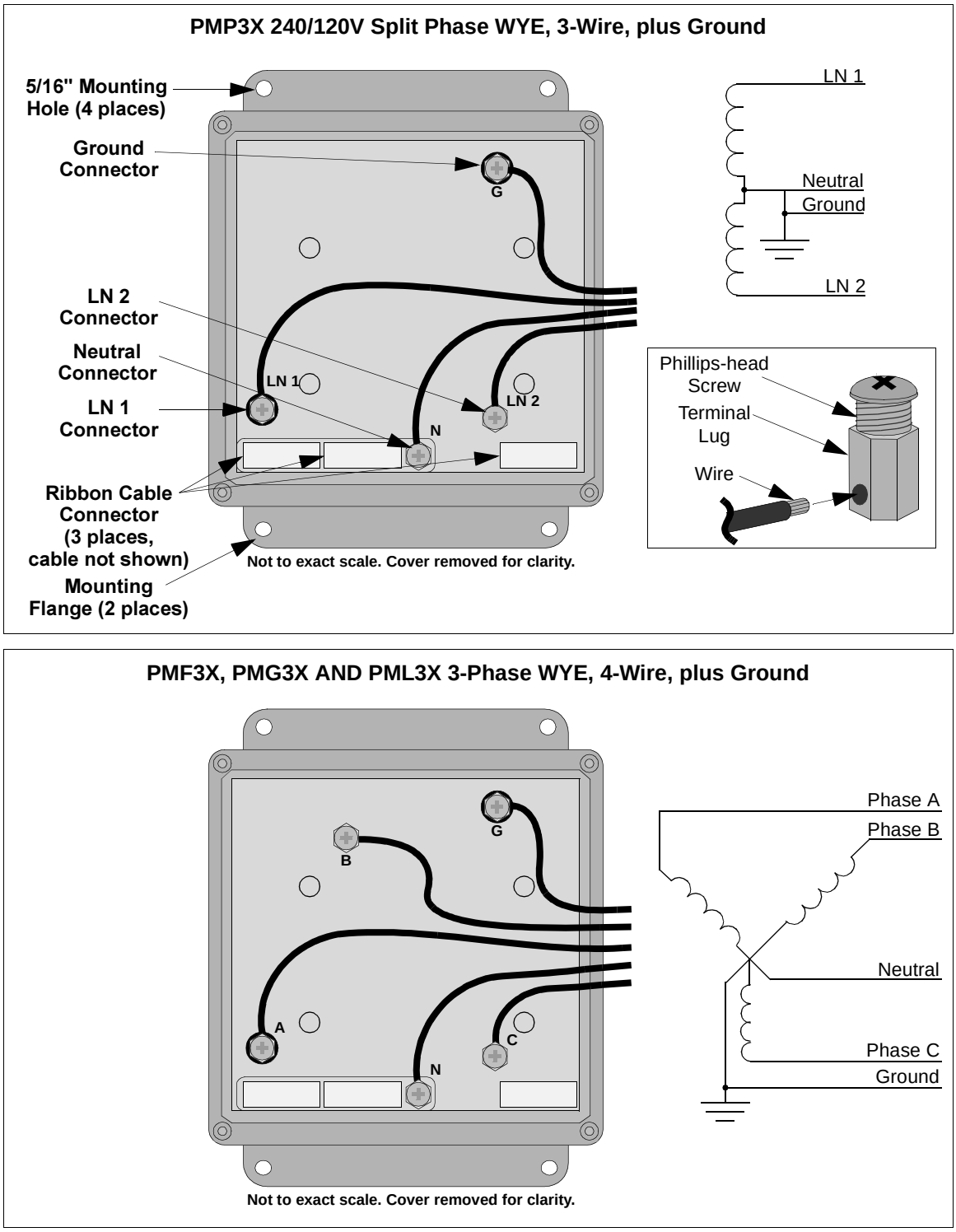


Figure 3. Installation Wiring Diagrams

8. Dress the power cables so the ribbon cables will not be pinched, crushed, or other wise damaged when the cover is installed. If connecting Dry Contacts, it may be effective to install communication lines prior to power conductors.

9. Connect the unit to the service panel through the UL approved conduit with anti-short bushings as follows:
   a. Strip about 3/8" (.95 cm) of the connecting wire insulation from each wire. Note: Terminal wire size range is #8 AWG to #1 AWG. The recommended wire size for phase, neutral, and ground is #6 AWG.
   b. Twist the end of each connecting wire so it is uniform.
   c. Slide the connecting wires through the hole in the side of the SPD.
   d. Loosen the screws at the terminal lugs and insert the appropriate wire into the hole in each terminal lug. Tighten the phillips-head screw down onto the wire and torque to 18 inch-pounds. Note: The connecting wires should be kept as short as possible to enhance the performance of the SPD.
   e. Connect a wire (in conduit) to the safety ground bus of the distribution panel, and to the ground connection of the SPD as shown in Figure 2, and as marked on the unit. Proper grounding is essential, use a green wire or yellow/green striped wire for the ground connection. Torque the phillips-head screws to 18 inch-pounds.
   f. Connect a wire (in conduit) to the NEUTRAL bus of the panel and to the NEUTRAL connector of the SPD as marked on the unit. Use a white wire or mark with a white band for the neutral connection. Torque the phillips-head screws to 18 inch-pounds.
   g. Connect a wire (in conduit) to each phase (HOT) feed on the LOAD side of the circuit breaker in the AC distribution panel. Use a 30A to 40A (40A preferred) circuit breaker with the appropriate number of poles. Turn the circuit breaker OFF before making any connection. Refer to Figure 2 to identify the lug phase connections when making phase connections.

For answers to questions about installation, call APC's Customer Service Department at: 800-800-4APC.

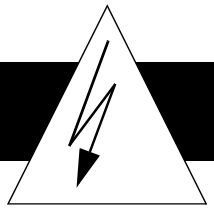
*****Always Install the SPD on the LOAD side of the main disconnect*****

After all connections have been made and no hazards exist, restore power to the AC distribution panel or breaker. If the SPD is installed and functioning properly, the green LED phase indicators on the front panel display will be lit and there will be no audible or visual alarms.

10. Use an AC voltmeter to check all voltages to ensure that the proper unit type has been installed for the service rating being protected.
11. Carefully install the front cover on the chassis. Ensure that the ribbon cables are dressed in a manner that they are not pinched or crushed when the cover is installed.
12. Tighten the captive screws that secure the cover to the chassis.

Circuit Breaker and Disconnect Switch

The PM3X Series is designed for connection to a 30A to 40A circuit breaker (40A preferred). The circuit breaker is the intended disconnect switch and provides short circuit protection to the connecting conductors. The PM3X Series has internal overload protection elements.



WARNING

- **MAINTENANCE OF THIS SURGE PROTECTIVE DEVICE SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY.**
- **DURING NORMAL OPERATION, HAZARDOUS VOLTAGES ARE PRESENT INSIDE THE UNIT.**
- **WHEN SERVICING THIS UNIT, BE SURE TO FOLLOW ALL ELECTRICAL SAFETY PRECAUTIONS.**
- **ALL POWER SOURCES TO THIS UNIT SHOULD BE LOCKED OFF BEFORE SERVICING. THIS WILL PREVENT THE RISK OF RECEIVING AN ELECTRICAL SHOCK.**

OPERATION and FEATURES

SPD's do not require alot of operator intervention after installation.

NOTE: The PM Series has a green LED for each phase which extinguishes when the module is no longer providing protection (fault condition).

All of the PM series of SPDs contain a diagnostic circuit which monitors the suppressors status continuously and automatically. If a fault condition were to occur, the built-in front panel audible alarm will sound and a red "Service" LED will light, indicating that the unit is in need of service by a qualified technician.

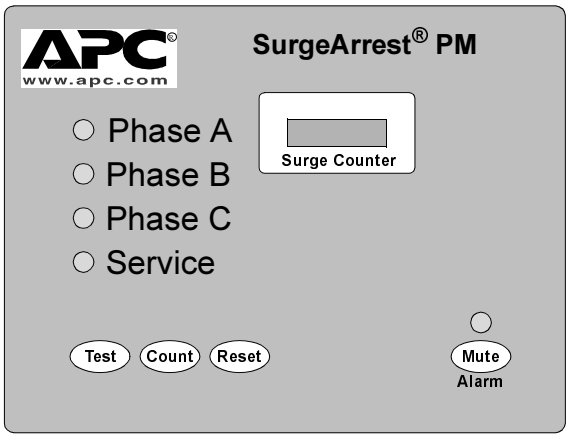
The audible alarm can be silenced by pressing the "Mute Alarm" button on the touchpad, until a qualified electrician or service person is available to service the unit. The red "Service" LED will continue to be illuminated even though the audible alarm has been silenced. This will continue until the fault condition has been cleared.

Use the troubleshooting section of this manual to locate and repair the fault.

Status Panel Controls, Indicators, and Alarms

All indicators and controls are located on the front diagnostic panel (Figure 4) of the PM3X unit. Each phase features a tri-color LED indicator. Green indicates correct operation. Amber indicates reduced protection. Red indicates loss of protection. If an inoperative condition were to occur, the built-in audible alarm will sound and the red Service LED will illuminate. This indicates that the unit needs evaluation by a qualified electrician or technician. Until a qualified person evaluates the unit, press the Mute Alarm touchpad to silence the alarm. (The LED indicator above the Mute Alarm touchpad illuminates when the alarm is deactivated. Normal operation occurs with the Mute Alarm LED extinguished.) The red Service LED will remain illuminated even though the Audible Alarm has been silenced. The Test touchpad tests the red Service LED and the Audible Alarm.

If LEDs are illuminated in a manner that suggests contradictory information, there may be an internal logic problem and the unit needs replacement. If none of the LEDs are illuminated, the unit may not be installed correctly. Please note that the internal storage capacitor for surge counter backup must be energized for about 15 minutes before the "count" push button will function. If a green LED is not illuminated and is suspect of being faulty, a qualified electrician or technician may attempt to diagnose the problem by de-energizing the unit, removing the front cover and exchanging ribbon cable leads with another phase (if available). Upon reenergizing the PM3X, the appropriate LED will illuminate if the suspect LED has failed. If troubleshooting indicates a failed LED, please contact APC Technical Support at: 800-800-4APC.



Test: Tests the red Service LED and audible alarm

Count: Increments the optional surge counter by one.

Reset: Resets the optional surge counter.

Mute Alarm: Turns the Alarm off. (Note that the alarm is de-activated when the LED is lit).

Phase A, **B**, and **C**: Tri-color LED status indicators:
Green = Full protection
Amber = Partial protection
Red = No protection
Service: LED illuminates for any amber or red indication.

Surge Counter: Displays the total number of surges encountered by the SPD.

Figure 4. Status Panel with Surge Counter Option

Audible Alarm and Control

The PM3X Series device is equipped with an audile alarm which will sound in the event of an alarm condition. In addition, the red Service LED will illuminate, indicating the device needs service. Press the Mute Alarm touchpad to silence the alarm. The red Service LED will remain on even though the alarm is silenced. The Audible Alarm can be tested by pressing the Test touchpad. This tests the alarm regardless of the Mute Alarm status. The Test touchpad tests the red Service LED and the Audible Alarm.

Surge Counter Option

The surge counter provides a means to total the number of transient voltage surges encountered since the counter was last reset. The surge counter circuitry includes a supercap. This will provide power up to four days to retain memory should a power outage occur. Please note: There is a 10 - 15 minute charging cycle after first energization, before the surge counter operates. The Surge Counter registers the sum of L-N and L-G transient surges. There are Count and Reset touchpads. Pressing the Count touchpad increments the counter by one. Pressing the Reset touchpad resets the counter to zero count.

Dry Contacts

The PM3X Series includes a set of Dry Contacts which utilize a DB-9 connector. This feature provides two sets of normally open (NO) and normally closed (NC) contacts through the DB-9 connector. These relay contacts can be used for remote indication of the PM's operating status by changing state when there is an alarm condition. Examples could include a computer interface board, and emergency management system, etc. The relay contact pin arrangement is outlined in Table 2. (Please note the jumpered connections. Pins 7, 8, & 9 do not represent a third set of contacts).

For applications using Dry Contacts, please note the following information:

- The Dry Contacts are designed for low voltage or control signals only. The maximum switching current is 1 amp. The maximum switching voltage is 24 volts, DC or AC.
- Higher energy application may require additional relay implementation outside the PM3X. Damage to the PM3X units relay caused by implementation with energy levels in excess of those discussed in this manual will not be covered by warranty.

Note that the Dry Contacts will allow the PM3X unit to communicate with one (1) external device.

Table 2: Relay Contact Pin Arrangement

Pin	Contact Type
1	Normally Closed (1)
2	Common (1)
3	Normally Open (1)
4,7	Normally Closed (2)
5,8	Common (2)
6,9	Normally Open (2)

***NOTE**:* Pin pairs 4 & 7, 5 & 8, and 6 & 9, are connected via jumper internally. The combined current of each pin pair may not exceed 1 Ampere.

CORRECTIVE MAINTENANCE (Repair)

SurgeArrest PM3X Series units are designed for years of reliable, trouble-free operation. However, even the most reliable equipment can fail.

Built-in diagnostics are an integral part of the PM3X and indicate if service is required. Audible Alarms and abnormal illumination of LEDs indicate problems within the PM3X and possibly within the electrical system.

Quality SPDs such as the PM3X Series are designed and tested to withstand severe duty. However, there are various electrical distribution problems that a PM3X will not protect against. Should a problem arise, a qualified technician should first perform an overview of the electrical distribution system, including verification of proper voltages and phasing. Regardless of the cause, PM3Xs will sacrifice themselves while attempting to protect their load. Accordingly, a failed PM3X may indicate other problems, as its failure is the effect rather than the cause.

Standard troubleshooting procedures should be used to isolate problems. See Figure 5 (Troubleshooting Flowchart) for assistance. Replace bad components with identically rated parts to continue proper operation and safety.

Troubleshooting

Troubleshooting of an SPD consists of performing the sequence of steps provided in the Troublshooting Flow Chart in Figure 5. Perform the steps in this chart only to the extent necessary to clear the fault.

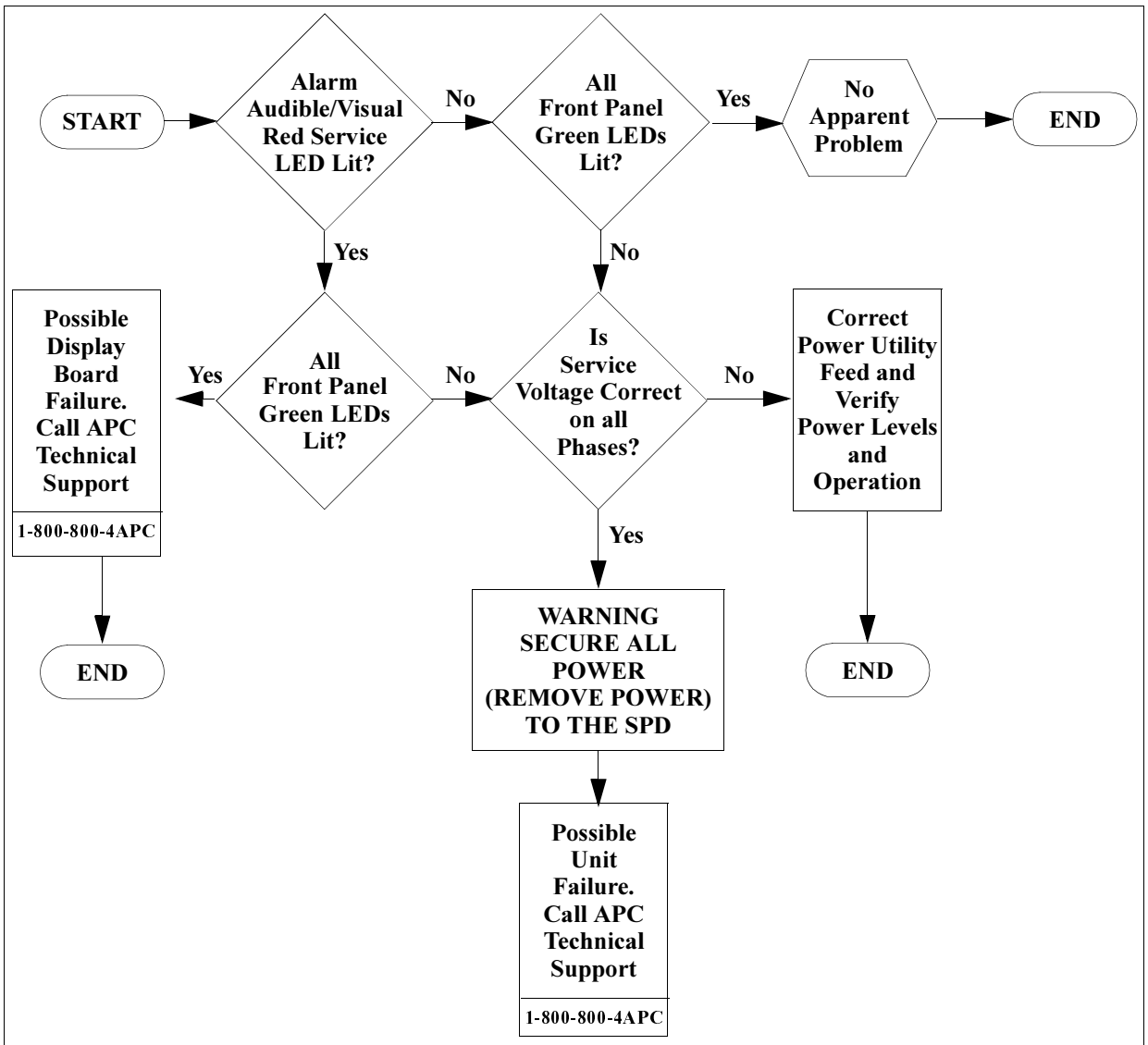
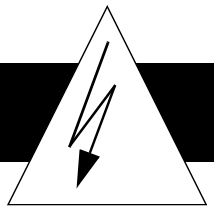


Figure 5. Troubleshooting Flow Chart



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Display Board Removal and Replacement Instructions

To remove the Display board, refer to Figure 6 and proceed as follows:

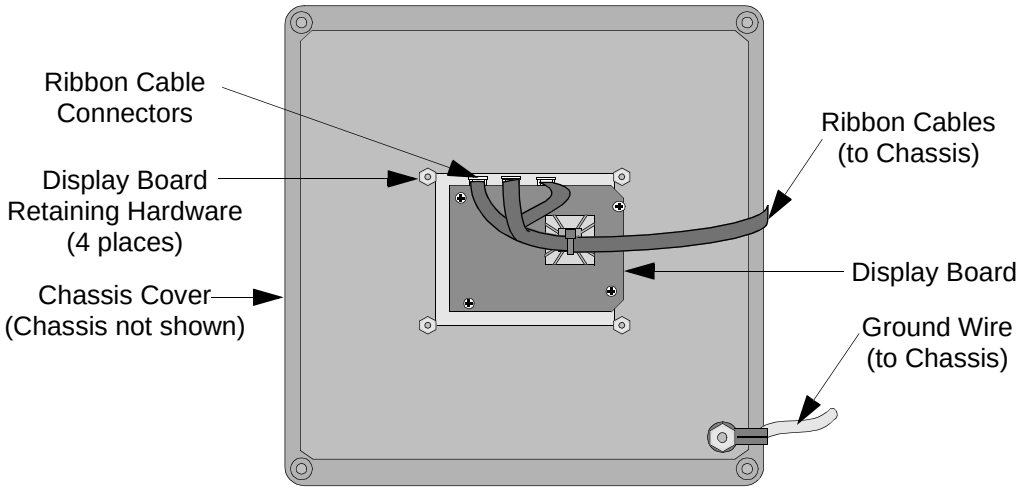
1. Disconnect power to the SPD.
2. Carefully remove the front cover by loosening the four (4) captive screws that secure the front cover to the chassis. Insure the ribbon cables attached to the diagnostic board are not mechanically stressed or become unplugged. DO NOT ALLOW THE DIAGNOSTIC FACEPLATE TO HANG BY THE RIBBON CABLES!
3. Remove the connectors one at a time from the existing board and insert them into the appropriate connector on the replacement board.
4. Remove the four (4) machine screws, hex nuts, and toothed washers that secure the display board to the front cover. Set the faulty display board to one side.
5. Install the replacement board into the panel, install the machine screws, hex nuts and toothed washers; tighten securely.
6. Carefully replace the front cover ensuring that the ribbon cables are not pinched or crushed by the front cover, apply power to the SPD.

PREVENTIVE MAINTENANCE - Inspection and Cleaning

Inspection of the SPD should be performed periodically to maintain reliable system performance and continued transient voltage surge protection. While it is difficult to establish a preventive maintenance schedule because conditions vary from location to location, inspections for failed modules and other signs of trouble utilizing the built-in diagnostics should be performed on a routine basis (weekly or monthly).

REPLACEMENT PARTS

The only replaceable item in the SPD is the display board (with or without the optional surge counter).



Not to exact scale.

Figure 6. Display Board Locator Diagram

LIMITED WARRANTY

APC warrants it's AC panel protection products against defects in workmanship and materials for 5 years from the date of original purchase. The panel protection device must be installed by a qualified and licensed electrician in order to qualify for warranty proctection.

Liability is limited to the replacement of the defective product. A Return Material Authorization must be given by APC prior to the return of any product (see Technical Support and Customer Service). A copy of the invoice from the installer (electrician or electrical service company) must accompany the defective device being returned. If the return of a device is authorized by APC, APC will immediately ship a replacement unit to the customer. Along with the replacement unit, APC will include a pre-paid shipping tag for the return of the originally defective unit. The replacement unit will not be warranteed unless the defective unit is received by APC.

Under no circumstance is APC responsible for the cost of removal or installation of any panel protection device.

APC also offers unlimited replacement of modular and component parts within the warranty period previously described.

APC specifically disclaims all other warranties, expressed or implied. Additionally, APC will not be responsible for incidental or consequential damages resulting from any defect in any product or component thereof.

TECHNICAL SUPPORT and CUSTOMER SERVICE

United States and Canada: 1-800-800-4APC

This manual, as well as information about the entire APC product line is available on the internet at: www.apc.com. Prior to calling APC for technical assistance or ordering parts, please have the following information available:

Model Number of unit: _____

Serial Number of unit: _____

Manufacture Date: _____

Purchase Date: _____

Your Order Number: _____

Return Shipment Address

American Power Conversion Corporation
132 Fairgrounds Road
P.O. Box 278
West Kingston, Rhode Island 02892 USA