Power Switching & Controls
For *Business-Critical Continuity™*

500 Series

510 Surge Protective Device

Installation, Operation and Maintenance Manual

EMERSON™
Network Power

EMERSON NETWORK POWER SURGE PROTECTIVE DEVICE INSTALLATION, OPERATION AND MAINTENANCE MANUAL

TABLE OF CONTENTS

UNPACKING AND 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 damages.
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 Emerson Network Power Surge Protection Sales Representative.

Handling Considerations

Larger units are bolted to a shipping pallet to facilitate handling by forklift or pallet jack. Check the size and weight. Refer to the cabinet data furnished with the unit.

Storage

The unit should be stored in a clean, dry environment. 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

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).

Environment — Unit is designed for operation indoors 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 its placement within almost any room if desired.

Service Clearances — 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.

Mounting — Unit is intended to be wall mounted. Refer to installation instructions for mounting dimensions and weight.

Warnings Defined —

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

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.

MODEL NUMBER CONFIGURATION

Model #: _ _ _ _ _ _ _ _ _ _ _ _ _

1 2 3 4 5 6 7 8 9 10 11 12 13

(1-3) Series
510 = Modular/Non-Modular MOV

(4-5) Configuration & Voltage
See Chart Below

(6-7) Surge Rating Per Mode
06 = 65kA
08 = 80kA
10 = 100kA
12 = 125kA
16 = 160kA
20 = 200kA
25 = 250kA

(8) Modes of Protection
A = All Modes of Protection
B = L-N & N-G
E = L-L
F = L-N
G = L-G

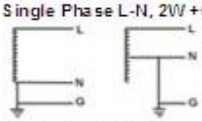
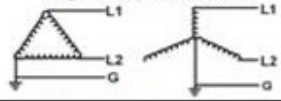
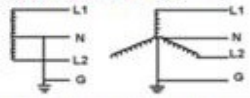
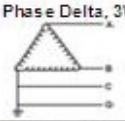
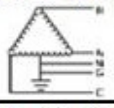
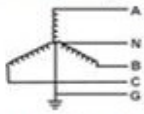
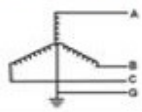
(9) Connection Type
N = Wiring terminals/Lugs
R = Rotary Disconnect Switch
W = Wire Leads

(10) Monitoring Options
R = LED/Relay
A = LED/Alarm/Relay
C = LED/Alarm/Counter/Relay

(11) Enclosure
R = Type 3R (metal)
G = Type 4 (metal)
H = Type 4X (Stainless Steel)
J = Type 4X (Non-Metallic)
L = Type 12 (metal)
F = Panelboard Flush (metal)
S = Panelboard Surface (metal)

(12) UL 1449 Type
0 = No UL
1 = Type 1
2 = Type 2

(13) MOV Option
S= Standard
Q = High Rated

Source Configurations		Nominal Operating Voltage				MCOV	Configuration & Voltage
		L-N	L-G	L-L	Tolerance		
Single Phase	Single Phase L-N, 2W +G 	120	120	N/A	±25%	150 L-N	"NA"
		220,230,240	220,230,240	N/A	±15%	275 L-N	"NB"
		277	277	N/A	±15%	320 L-N	"NC"
		347	347	N/A	±15%	420 L-N	"ND"
	Single Phase L-L, 2W + G 	N/A	208, 240	208, 240	±15%	320 L-L	"LB"
		N/A	400	400	±15%	580 L-L	"LE"
		N/A	480	480	±15%	580 L-L	"LF"
		N/A	600	600	±15%	680 L-L	"LG"
	Split Single Phase, 3W + G 	120	120	208, 240	±25%	150 L-N	"SA"
		240	240	480	±15%	320 L-N	"SB"
		277	277	480	±15%	320 L-N	"SC"
		347	347	600	±15%	420 L-N	"SD"
Three Phase DELTA	Three Phase Delta, 3W + G 	N/A	208, 240	208, 240	±15%	320 L-L	"DB"
		N/A	380,400,415	380,400,415	±15%	580 L-L	"DE"
		N/A	480	480	±15%	580 L-L	"DF"
		N/A	600	600	±15%	680 L-L	"DG"
	Three Phase Delta Hi Leg, 4W + G 	120/208/120	120/208/120	208	±15%	150 L-N	"HB"
		120/240/120	120/240/120	240	±15%	150 L-N	"HB"
		240/480/240	240/480/240	480	±15%	320 L-N	"HF"
Three Phase WYE	Three Phase Wye, 4W + G 	120	120	208	±25%	150 L-N	"YA"
		127	127	220	±25%	150 L-N	"YA"
		220,230,240	220,230,240	380.400,415	±15%	320 L-N	"YB"
		254	254	440	±15%	320 L-N	"YC"
		277	277	480	±15%	320 L-N	"YC"
		347	347	600	±15%	420 L-N	"YD"
	Three Phase Wye, 3W + G No 	N/A	120	208	±25%	150 L-G	"XA"
		N/A	127	220	±25%	150 L-G	"XA"
		N/A	220,230,240	380.400,415	±15%	320 L-G	"XB"
		N/A	254	440	±15%	320 L-G	"XC"
		N/A	277	480	±15%	320 L-G	"XC"
		N/A	347	600	±15%	420 L-G	"XD"

ELECTRICAL CONNECTIONS

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.

⚠ DANGER

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

Voltage Ratings and Power Source Configurations — 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 chart on page 3 for voltage rating applications with typical power source configurations.

⚠ CAUTION

Wire Connections — With parallel connection, the size of the wiring to the SPD unit is independent of the protected circuit's ampacity. NEC Article 285-21(B) requires surge suppressor connecting conductors to be at least #14 copper or #12 aluminum. 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.

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

NEC Considerations - The following is from the National Electric Code 2008 Edition.

NEC 285.21 Connections

NEC 285.23 Type 1 SPD's. Shall be installed in accordance with 285.35(A) and (B).

(A) Installation. Type 1 SPD's shall be installed as follows:

(1) Type 1 SPD's shall be permitted to be connected to the supply side of the service disconnect as permitted in 230.82(4) or

(2) Type 1 SPD's shall be permitted to be connected in Type 2 locations as specified in 285.24.

(B) At the service. When installed at the services, the grounding conductor of a Type 1 SPD shall be connected to one of the following:

(1) Grounded service conductor

(2) Grounded electrode conductor

(3) Grounding electrode for service

(4)Equipment grounding terminal in the service equipment

Voltage Protection Ratings — To obtain the voltage protection ratings (VPR's), as obtained by Underwriters Laboratory, Incorporated, in accordance with the *Standard for Safety, Surge Protective Devices (SPD's), Standard 1449, Third Edition, released (2009)*, marked on this product, 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 VPR's.

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, Surge Protective Devices (SPD's), Standard 1449, Third Edition, released (2009).*

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.

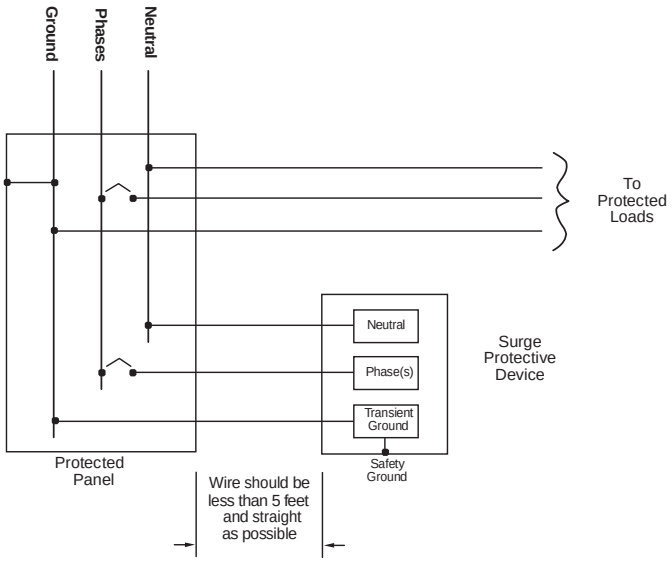
⚠ CAUTION

UNGROUNDED POWER 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. THIS INFORMATION IS BEING PROVIDED TO THE USER SO THAT AN INFORMED DECISION CAN BE MADE BEFORE INSTALLING ANY ELECTRICAL EQUIPMENT ON AN UNGROUNDED POWER SYSTEM. CONTACT FACTORY FOR UNGROUNDED APPLICATIONS.

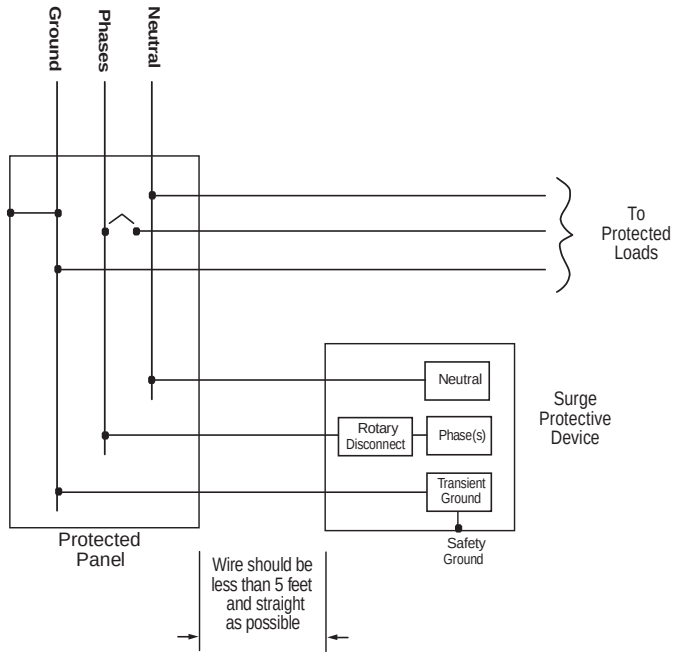
An insulated grounding conductor is required in addition to any metallic raceway, which may be used as a grounding conductor. For parallel-connected SPDs, the grounding conductor should be the same wire size as the associated power conductors.

PARALLEL CONNECTIONS

Typical Parallel Connections (without Internal Rotary Disconnect)



Typical Parallel Connections (with Internal Rotary Disconnect)



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 can also divert the surge current back to its source to complete the electrical circuit.

In the case of lightning whose 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.

Neutral Connection –

CAUTION FOR PROPER AND SAFE OPERATION, THE SPD's NEUTRAL, MUST BE RELIABLY CONNECTED TO THE NEUTRAL OF THE SOURCE. FAILURE TO PROVIDE A RELIABLE NEUTRAL CONNECTION MAY RESULT IN FAILURE!

INSTALLATION INSTRUCTIONS

The Emerson Network Power 510 Series Surge Protective Devices (SPDs) are high quality, high energy surge current diversion systems designed to protect sensitive equipment from damaging transient voltage surges. Proper installation is required for maximum system performance.

The installer should perform the following steps to assure a quality installation. The entire installation manual should be read before starting 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.

1. Insure that all power is removed before beginning installation. A qualified licensed electrician shall install all electrical connections.

2. The standard SPD is provided in a NEMA 1 (indoor), NEMA12 (indoor) or NEMA 4X (outdoor) rated enclosures suitable for use in indoor or outdoor installations. Verify the SPD enclosure rating by referencing position 11 in the "Model Number Configuration" tool on page 3.

3. Determine where the SPD is to be mounted, allowing for minimum length of wire between itself and the input power terminals of the service panel. Punch or cut the proper hole size in the side of the SPD closest to the knockout to be utilized in the service panel. (NEMA 4X plastic enclosure units include a flexible conduit/nipple accessory – no punching/drilling required in SPD) Drill mounting holes in wall at location picked for SPD next to service panel using mounting dimensions shown in the table below. Mount surge suppressor to wall using appropriate size & type mounting hardware.

4. Connect 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, of the SPD using the wire range listed below. To yield the best performance of the SPD within the electrical distribution system, keep all conductors as short as possible and avoid sharp bends.

5. Connection to the unit's summary alarm contacts shall be with #18 – 22 AWG. The ratings of the Form 'C' contacts are 5 amps at 250 VAC maximum with a power factor of 1.0. For additional information, see "Monitoring" section.

6. Apply power. The surge protector is fully operational when the GREEN LED's on the modules (when applicable), and the front of the enclosure are illuminated. If the GREEN LED's 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 Emerson Network Power Surge Protection at **1-800-288-6169 or 1-607-721-8840**.

7. Periodically monitor the status of the LED's. Reduced protection exists if the GREEN LED's are extinguished or the RED LED is illuminated. Please contact Emerson Network Power Surge Protection at **1-800-288-6169 or 1-607-721-8840.**

8. The protection modules in these SPD's may be replaceable, contact Emerson Network Power Surge Protection for replacement.

If the SPD model is a Wye configured unit (4W+G), and a Neutral connection is not available, please contact factory.

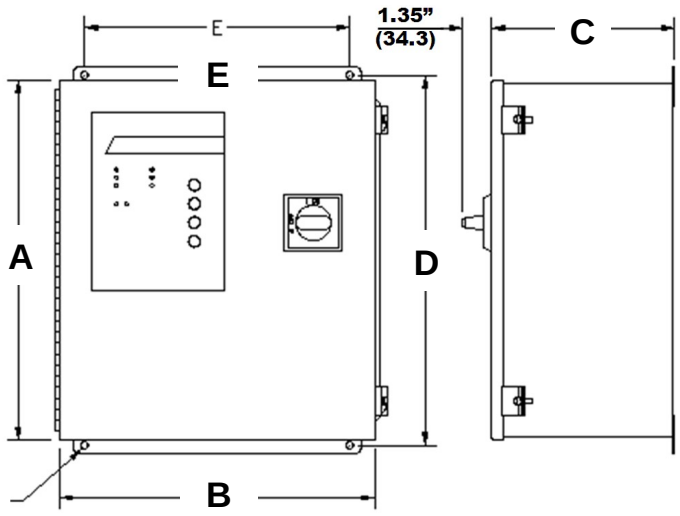
NEMA 12 (Metal) Enclosure Option

SUGGESTED CIRCUIT BREAKER AND WIRE SIZE

Surge Rating Per Mode	Allowable Range				Factory Suggested Size	
	Circuit Breaker Size		Connection Wire Size		Circuit Breaker Size	Connection Wire Size
	With Disconnect	Without Disconnect	With Disconnect	Without Disconnect		
60kA-80kA	40A-150A	15A-100A	#8-1/O	#14-#2	40 Amp	#8 AWG
100kA-160kA					40 Amp	#8 AWG
200kA-250kA					100 Amp	#2 AWG

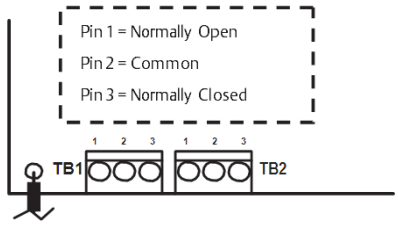
DIMENSIONAL INFORMATION

Surge Rating Per Mode	A	B	C	D	E	F	Weight
60kA-80kA	16" (406)	14" (356)	8" (203)	16.8" (426)	12" (305)	0.31" (8)	32 lb. (14.5 kg)
100kA-160kA							41 lb. (18.6 kg)
200kA-250kA	20" (508)	16" (406)	9" (229)	21.3" (540)	10" (254)	0.44" (11)	56 lb. (25.4 kg)



Summary Alarm Contacts

Connection shall be with #18 – 22 AWG. Form 'C' contacts are rated 5 amps at 250 VAC max.



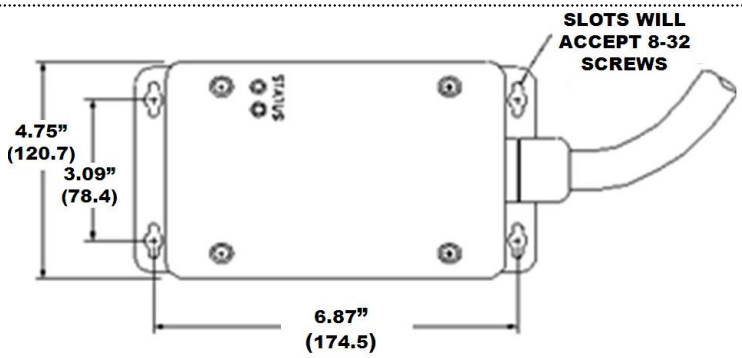
(Located on PCB behind monitoring panel)

NEMA 4X (Non-Metallic) Enclosure Option

Overcurrent Protection (Circuit Breaker):
Allowable Range: 15A - 30A Suggested Size: 30A

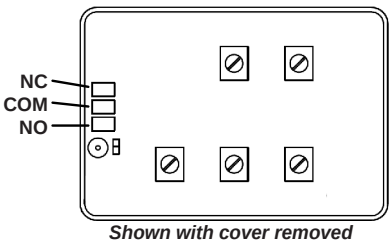
Connection Wire:
Allowable Range: #14 - #10 Suggested Size: #10

Weight:
6.5 lb. (3 kg)

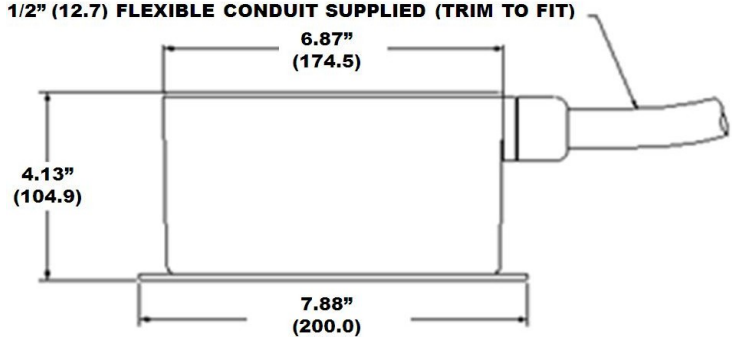


Summary Alarm Contacts

Connection shall be with #18 – 22 AWG. Form 'C' contacts are rated 5 amps at 250 VAC max.



Shown with cover removed



NEMA 1 Panelboard Extension Enclosure Option

SUGGESTED CIRCUIT BREAKER AND WIRE SIZE

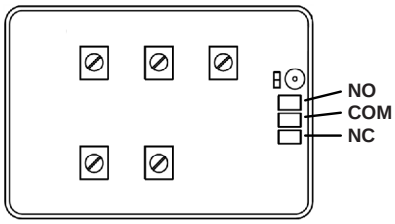
Overcurrent Protection (Circuit Breaker):
Allowable Range: 15A - 100A Suggested Size: 30A

Connection Wire:
Allowable Range: #14 - #2 Suggested Size: #10

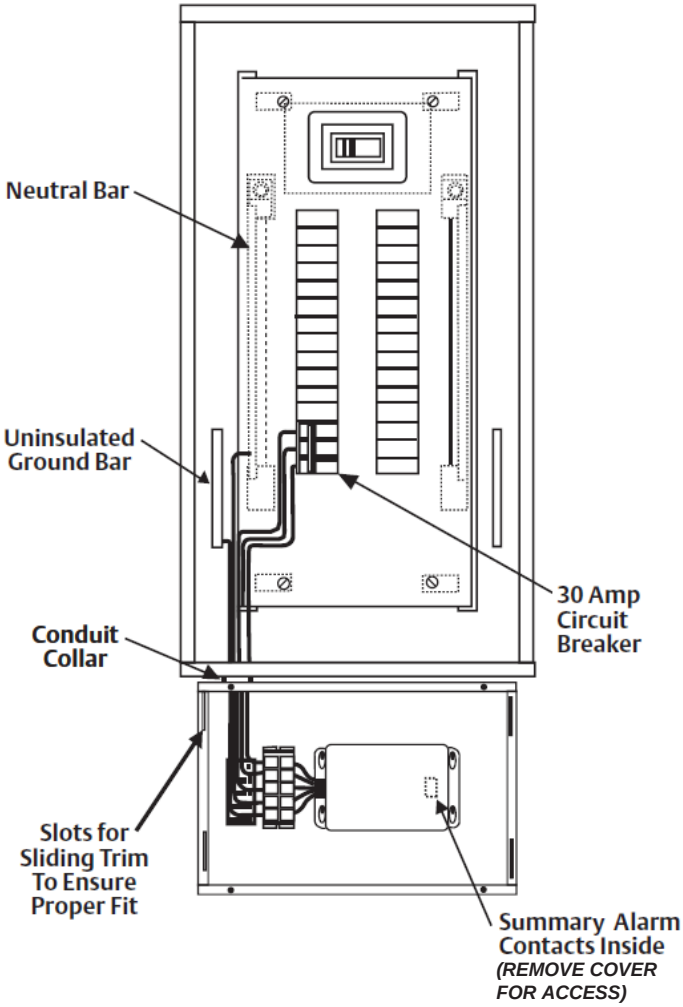
Weight:
30 lb. (13.6 kg)

Summary Alarm Contacts

Connection shall be with #18 – 22 AWG. Form 'C' contacts are rated 5 amps at 250 VAC max.

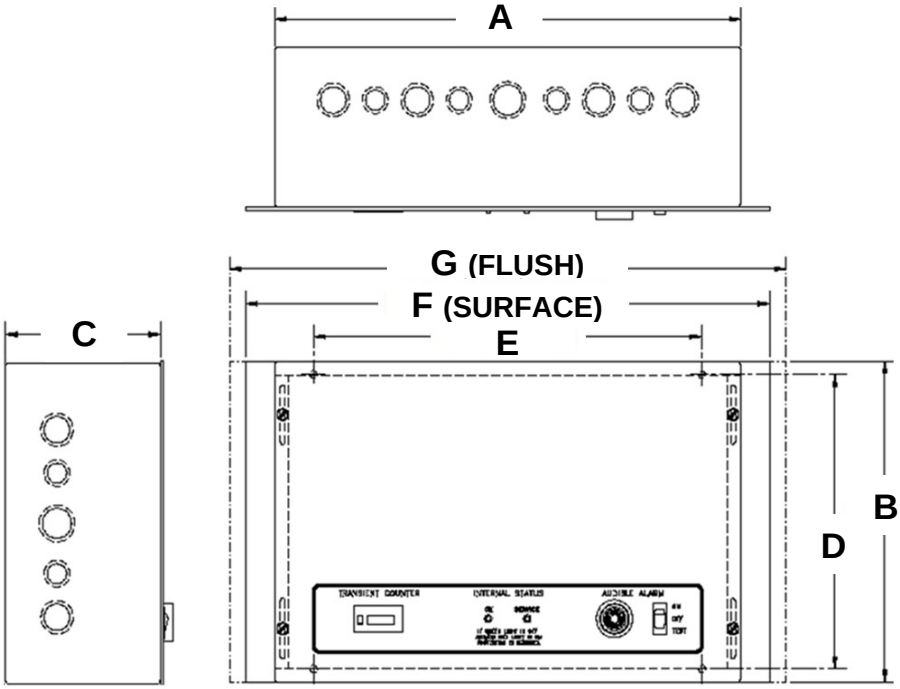


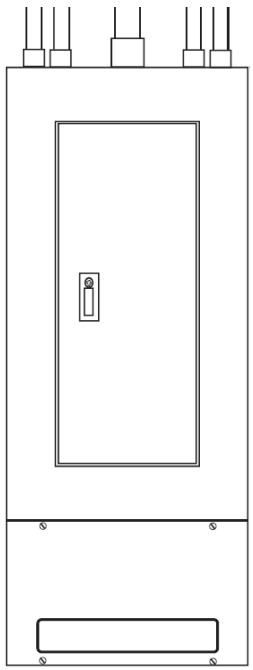
Shown with module cover removed



DIMENSIONAL INFORMATION

A	B	C	D	E	F	G
18" (457)	12" (305)	6" (152)	11" (279)	15" (381)	20.25" (514)	21.5" (546)





MONITORING FEATURES

External Status Indicators (Standard) — 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 or module requires replacement, the green “OK” LED is turned off and the red “Service” LED illuminated.

Audible Alarm (Standard/Optional) — If the surge SPD module requires replacement, an audible alarm may be 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.

Summary Alarm Contact (Standard/Optional) — One or two sets of summary alarm Form C relay contacts (N.O. and N.C.) are provided for remote indication of the failed surge SPD module. Contacts are rated 5 amps at 250 VAC maximum with a power factor of 1.0. Access to the contacts is provided via contact terminals located inside of the unit’s cover.

Surge Counter (Optional) – The surge counter is provided for transient voltage surge monitoring. The counter totalizes line surges monitored since the last time the counter was reset. 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%.

TROUBLESHOOTING/ SERVICING/ MAINTENANCE

Troubleshooting

If status failure indication occurs or summary alarm contacts have changed state, a qualified electrician shall first determine if the systems voltage and proper phasing exists.

If the SPD 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 the factory, 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 of the enclosure.)
- Nature of problem – (including status of all status indicators and alarms).

Servicing

The Emerson Network Power 510 Series comes with a ten year warranty. For servicing assistance, contact your local Sales Representative or Emerson Network Power, Surge Protection at **800-288-6169 or 607-721-8840.**

⚠ DANGER

ONLY QUALIFIED PERSONNEL SHOULD PERFORM MAINTENANCE ON THE SYSTEM.

HAZARDOUS VOLTAGES ARE PRESENT INSIDE THE UNIT DURING NORMAL OPERATIONS.

ELECTRICAL SAFETY PRE-CAUTIONS 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 UNIT.

Corrective Maintenance - The Emerson Network Power 510 Series 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 repair or replacement. To ensure continuity of surge protection, failed units should be repaired or replaced at the earliest convenient service opportunity. 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, use identically rated components for continued proper operation and safety. Please contact factory for 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).

Emerson Network Power

100 Emerson Parkway
Binghamton, NY 13905
800 288 6169 Phone (U.S. & Canada Only)
607 721 8840 (Outside U.S.)
607 722 8713 FAX
United States of America

Emerson Network Power
European Headquarters
Via Leonardo Da Vinci 8
Zona Industriale Tognana
35028 Piove Di Sacco (PD)
Italy
39 049 9719 111 Phone
39 049 5841 257 FAX

Emerson Network Power Asia Pacific
29/F, The Orient Square Building
F. Ortigas Jr. Road, Ortigas Center
Pasig City 1605
Philippines
+63 2 687 6615
+63 2 730 9572 FAX

Technical Support
800 288 6169 Toll-Free
607 721 8840 Phone
607 722 8713 FAX

IO-70103 Rev 0, (1/2013) Printed in USA