








North American UL Type 1, 2 and 4, and data signal surge protective devices



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The need for surge protection



Today's world is full of electronic products and electrical devices that are susceptible to damage from overvoltage surges.

Surges caused by static discharge, capacitive and inductive loads or lightning can quickly destroy sophisticated electronic equipment and components used in industrial and commercial applications. These surges cripple operations – particularly the data and communication systems that virtually every enterprise relies upon today, including UL 508A panels with their reliance on control circuits.

Also, updates to the 2014 NEC® 700.8 requires a listed SPD to be installed in or on all emergency system switchboards and panelboards.

Bussmann offers a wide selection of surge protection products that help assure power quality by eliminating damaging surges.

Surge protection case studies and references for industrial and commercial applications

- G.W. Allen and D. Segall with IBM – Two year study at over 200 location in 25 cities – 88.5% of AC power problems are transient voltage related.
- 2011 Erimar Systems Integration - A lightning strike entered the metals fabricating facility and destroyed \$20,000 worth of control panels, electrical infrastructure and Cisco infrastructure. Loss of data system also cost 11 days of production.
- IEEE Emerald Book and NFPA 780 both recommend using surge protection as a part of a building's lightning protection system. Suppressors at the service entrance only reduce, but not completely eliminate, the high-energy transient. A second surge protective device must be applied upstream of critical equipment. All SPDs should comply with UL 1449 3rd Edition or later.
- 1999-2001 Electric Power Research Institute (EPRI) Study – Concluded downtime from power sags, surges and transients cost US industry:
 - \$50 Billion+ in 1999
 - \$100 Billion+ in 2000
 - \$200 Billion+ in 2001
 - Continues to escalate as more electronic equipment is used
- *Plant Services Magazine* – 35% of lost production hours can be attributed to transient voltage problems.
- Florida Light and Power 1999 Study - Sources of Facility Surge and Overvoltage Events:
 - ~60% Internally Generated
 - ~40% Externally Generated

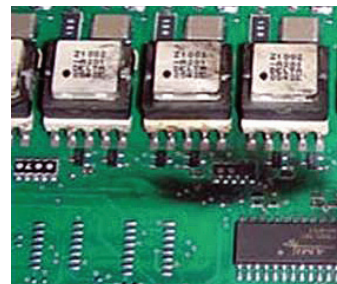
Causes and relevance of transients and surges

- **Lightning Strikes** - Large scale impact, high current and voltage, but least common occurrence.
- **Power Switching** - Increasing occurrences:
 - Utility and Customer Load Switching – Motors, large loads, faults, capacitor banks, fuse and circuit breaker operation*, etc.
 - Source Switching - Smart grid, gensets, photovoltaic power systems and wind power generation, etc.

* During overcurrent events, both circuit breakers and fuses can produce arc voltages 2-3 times the system voltage in accordance with the UL standards.

Damaging effects of transients and surges

- **Disruptive** – A voltage transient enters an electronic component and it interprets the transient as a valid logic command, resulting in system lock-up, malfunction, faulty output or corrupted files.
- **Dissipative** – Associated with short duration repetitive low energy level surges, resulting in equipment failure over time including electronic components, ballasts, motors and controllers, service entrance equipment, panelboards and switchgear.
- **Destructive** – Associated with high level energy surges, resulting in immediate equipment failure including electronic components, ballasts, motors and controllers, service entrance equipment, panelboards and switchgear.



Internal damage - PCB destroyed by a surge



Service entrance destroyed by a surge

UL and NEC® SPD definitions

Both UL and the NEC® define surge protective device *Types*, but they are NOT the same. They differ significantly by the following.

UL SPD standards

SURGE PROTECTIVE DEVICES - UL 1449, 3rd Edition, Section 1 effective September 29, 2009, states the following on UL Types:

- 1.1 These requirements cover Surge Protective Devices (SPDs) designed for repeated limiting of transient voltage surges as specified in the standard on 50 or 60 Hz power circuits not exceeding 1000 V and designated as follows:
 - **Type 1** – Permanently connected SPDs intended for installation between the secondary of the service transformer and the lineside of the service equipment overcurrent device, as well as the loadside, including watt-hour meter socket enclosures and intended to be installed without an external overcurrent protective device.
 - **Type 2** – Permanently connected SPDs intended for installation on the loadside of the service equipment overcurrent device; including SPDs located at the branch panel.
 - **Type 3** – Point of utilization SPDs, installed at a minimum conductor length of 10 meters (30 feet) from the electrical service panel to the point of utilization, for example cord connected, direct plug-in, receptacle type and SPDs installed at the utilization equipment being protected. See marking in 64.2. The distance (10 meters) is exclusive of conductors provided with or used to attach SPDs.
 - **Type 4** Component Assemblies – Component assembly consisting of one or more Type 5 components together with a disconnect (integral or external) or a means of complying with the limited current tests in 39.4.
 - **Type 1, 2, 3** Component Assemblies – Consists of a Type 4 component assembly with internal or external short circuit protection.

NEC® SPD installation/connection*

NEC® Article 285, Surge-Protective Devices (SPDs), 1kV or Less states the following on where in an electrical system SPDs can be installed and or connected.

III. Connecting SPDs

285.21 Connection. Where an SPD device is installed, it shall comply with 285.23 through 285.28.

285.23 Type 1 SPDs. Type 1 SPDs shall be installed in accordance with 285.23(A) and (B).

(A) Installation. Type 1 SPDs shall be installed as follows:

- (1) Type 1 SPDs shall be permitted to be connected to the supply side of the service disconnect as permitted in 230.82(4) or
- (2) Type 1 SPDs shall be permitted to be connected as specified in 285.24.

(B) At the Service. When installed at services, Type 1 SPDs shall be connected to one of the following:

- (1) Grounded service conductor
- (2) Grounding electrode conductor
- (3) Grounding electrode for the service
- (4) Equipment grounding terminal in the service equipment

285.24 Type 2 SPDs. Type 2 SPDs shall be installed in accordance with 285.24(A) through (C).

(A) Service-Supplied Building or Structure. Type 2 SPDs shall be connected anywhere on the loadside of a service disconnect overcurrent device required in 230.91, unless installed in accordance with 230.82(8).

(B) Feeder-Supplied Building or Structure. Type 2 SPDs shall be connected at the building or structure anywhere on the loadside of the first overcurrent device at the building or structure.

(C) Separately Derived System. The SPD shall be connected on the loadside of the first overcurrent device in a separately derived system.

285.25 Type 3 SPDs. Type 3 SPDs shall be permitted to be installed on the loadside of branch-circuit overcurrent protection up to the equipment served. If included in the manufacturer's instructions, the Type 3 SPD connection shall be a minimum 10 m (30 ft) of conductor distance from the service or separately derived system disconnect.

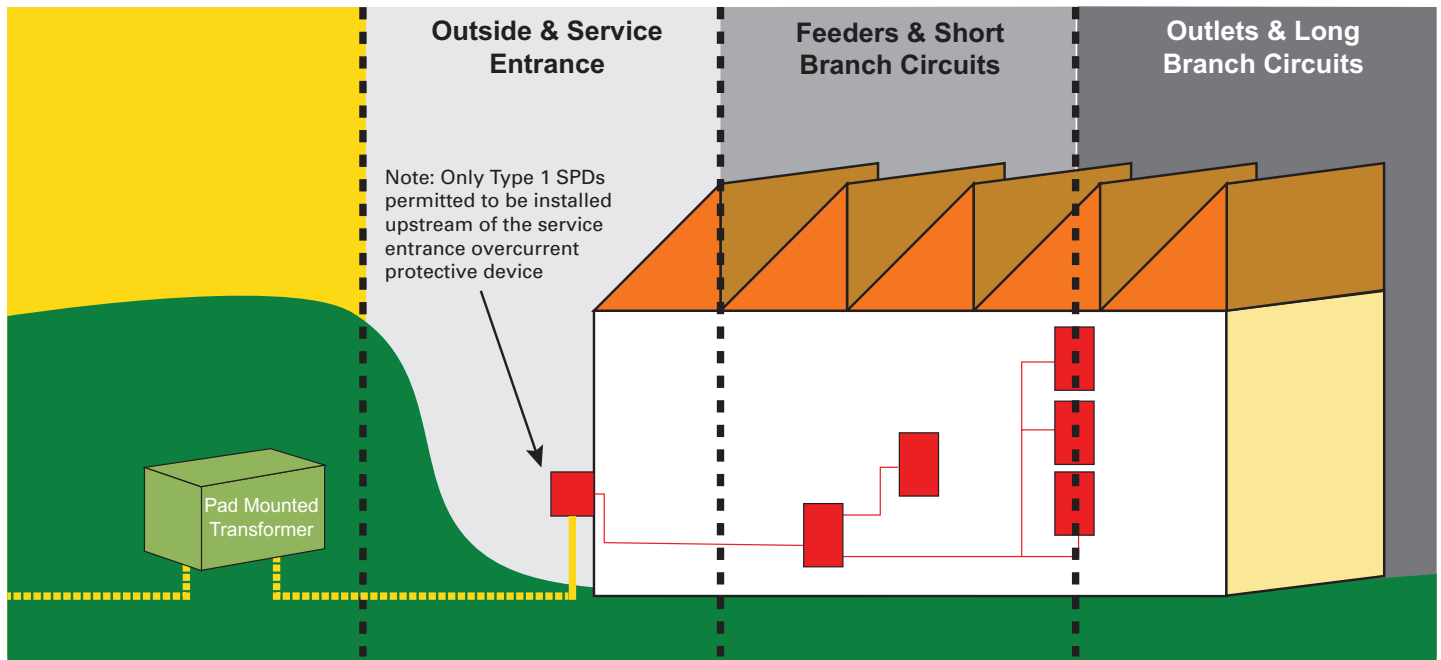
285.26 Conductor Size. Line and grounding conductors shall not be smaller than 14 AWG copper or 12 AWG aluminum.

285.27 Connection Between Conductors. An SPD shall be permitted to be connected between any two conductors — ungrounded conductor(s), grounded conductor, equipment grounding conductor, or grounding electrode conductor. The grounded conductor and the equipment grounding conductor shall be interconnected only by the normal operation of the SPD during a surge.

285.28 Grounding Electrode Conductor Connections and Enclosures. Except as indicated in this article, SPD grounding connections shall be made as specified in Article 250, Part III. Grounding electrode conductors installed in metal enclosures shall comply with 250.64(E).

* From the NFPA 70® National Electrical Code® 2014 Edition.

North American application of UL SPD Types by NEC® location



NEC® 285 Type 1

Type 1 SPDs (surge arresters*) shall be installed as follows:

- (1) Type 1 SPDs (surge arresters) shall be permitted to be connected to the supply side of the service disconnect as permitted in 230.82(4) or... as well as the loadside, including watt-hour meter socket enclosures and intended to be installed without an external overcurrent protective device.
- (2) Type 1 SPDs (surge arresters) shall be permitted to be connected as specified in 285.24.

NEC® 285 Type 2 **

Type 2 SPDs shall be installed in accordance with 285.24(A) through (C).

(A) Service-Supplied Building or Structure. Type 2 SPDs shall be connected anywhere on the loadside of a service disconnect overcurrent device required in 230.91, unless installed in accordance with 230.82(8).

(B) Feeder-Supplied Building or Structure. Type 2 SPDs shall be connected at the building or structure anywhere on the loadside of the first overcurrent device at the building or structure.

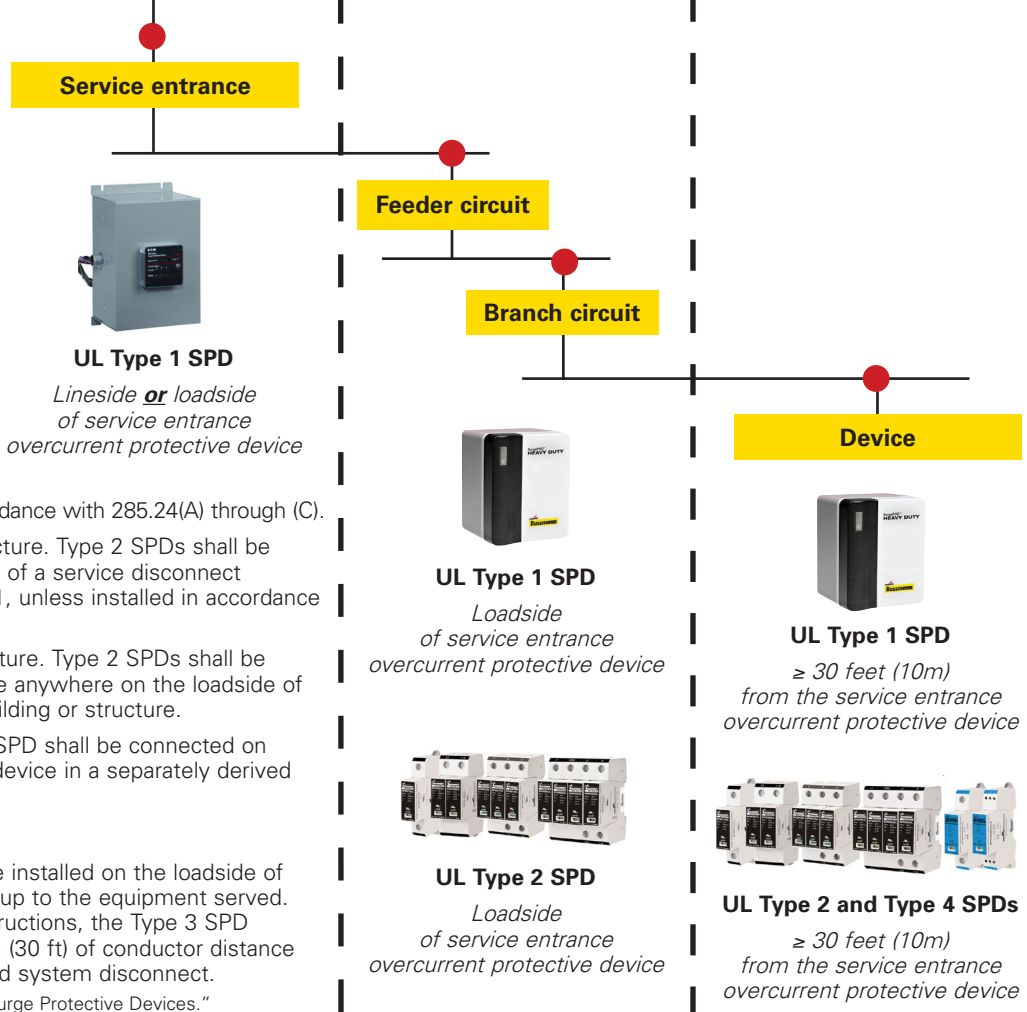
(C) Separately Derived System. The SPD shall be connected on the loadside of the first overcurrent device in a separately derived system.

NEC® 285 Type 3**

Type 3 SPDs shall be permitted to be installed on the loadside of branch-circuit overcurrent protection up to the equipment served. If included in the manufacturer's instructions, the Type 3 SPD connection shall be a minimum 10 m (30 ft) of conductor distance from the service or separately derived system disconnect.

* Note: UL now refers to these only as "Surge Protective Devices."

** Includes Type 4 component assemblies for use in Type 2 and Type 3 applications



UL power, control and data signal SPD product lineup

Type 1 UL Listed



BSPD

- For switchgear and power distribution panels
- Configured product from catalog number system
- NEMA 1 and 4X enclosures
- AC voltages 120 to 600Vac
- Surge current capacity 120kA to 400kA
- Three configuration levels:
 - Basic
 - Standard (Form C contact, EMI/RFI Filter)
 - Standard with Surge Counter (Form C contact, EMI/RFI Filter, counter)



SurgePOD™ HEAVY DUTY (black label)

- For critical commercial and industrial applications
- Defined catalog numbers
- NEMA 4X enclosure
- AC voltages 120 to 600Vac
- Surge current capacity 50kA



SurgePOD™ PRO (grey label)

- For residential and light commercial applications
- Defined catalog numbers
- NEMA 4X enclosure
- AC voltages 120 to 480Vac
- Surge current capacity 40kA

Type 2 and 3 DIN-Rail UL Recognized



Type 2 high SCCR (black label)

- 1-, 2-, 3-, and 4-pole Type 2 versions
- 200kA SCCR
- Voltages up to 600Vac



Type 4 low voltage power (blue label)

- 1-pole Type 4* power versions for Type 2 applications
- Non SCCR rated
- AC and DC voltages from 48 to 600V

* See *UL Types* on page 63 for definitions.



Type 4 low voltage control (blue label)

- 2-pole Type 4* control voltage versions for Type 3 applications
- Non SCCR rated
- AC and DC voltages from 24 to 230V

* See *UL Types* on page 63 for definitions.

UL 497B data signal



DIN-Rail universal 4 wire

- For nominal voltages up to 180V



DIN-Rail BNC 50/75Ω coaxial cable

- For nominal voltages up to 5V



Inline BNC 50/75Ω coaxial cable

- For nominal voltages up to 5V



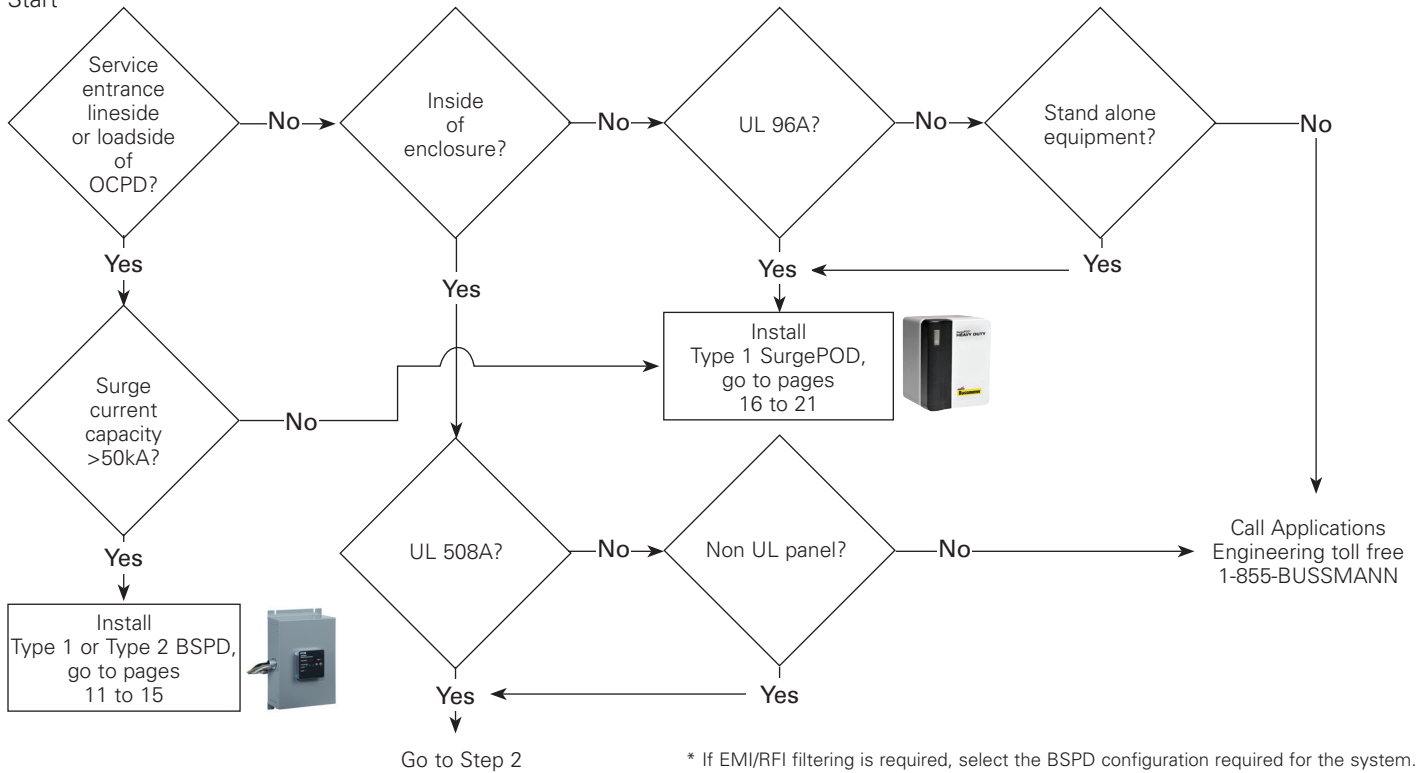
DIN-Rail RJ45/Ethernet cable

- For nominal voltages up to 48V

UL power and control SPD Type 1, 2 and 3 selection flowchart for ≤600V systems

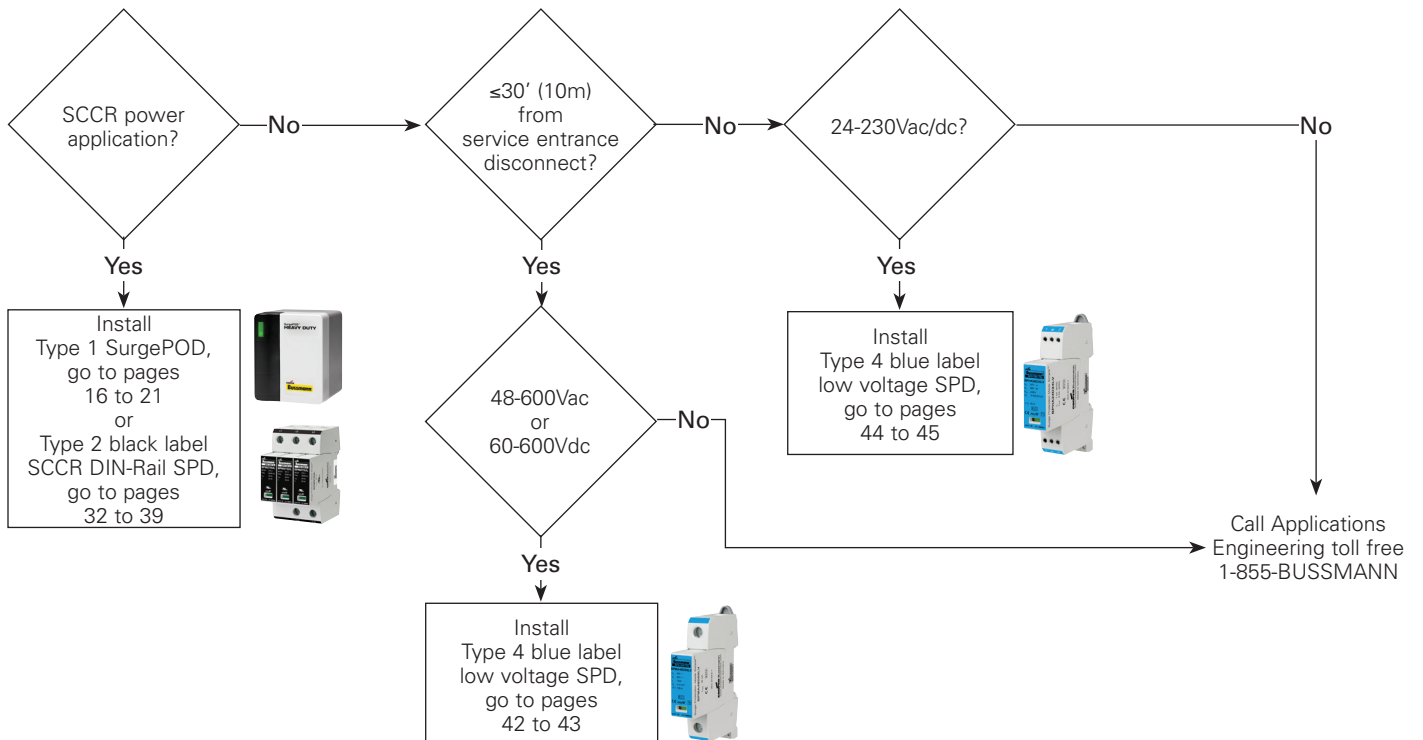
Step 1. Determine location and suitable type*

Start



Step 2. Determine Type 1, or Type 2 and Type 3 DIN-Rail SPD

Start



<i>UL Types</i>	UL Listed Type 1 and Type 2	DIN-Rail UL Recognized Type 2 and Type 4	
Markets	UL Listed Type 1 and Type 2 SPDs SCCR rated 120-600Vac SurgePOD™ Module MOV (HD) and thermal disconnect MOV (Pro) technology	UL Recognized Type 2 SPDs SCCR rated black label 120-600Vac MOV technology	UL Recognized Type 4 power and control blue label SPDs 24-600Vac/dc MOV or hybrid technology
Agriculture	<ul style="list-style-type: none"> • Pump panels requiring SCCR ratings • Service panels 	<ul style="list-style-type: none"> • Pump panels requiring SCCR ratings 	<ul style="list-style-type: none"> • AC/DC Pump panels not requiring SCCR ratings
Commercial - institutional	<ul style="list-style-type: none"> • Elevator control • Emergency generator control • Feeders • Fire pump control • HVAC • Lighting panels • Main switchgear • Motor control centers • Step down transformer primary • UL 508A panels requiring SCCR ratings • UPS 	<ul style="list-style-type: none"> • Elevator control • Emergency generator control • Fire pump control • HVAC • Mission critical panelboards • UPS • UL 508A panels requiring SCCR ratings • VFD 	<ul style="list-style-type: none"> • Elevator control • Emergency generator control • Fire alarm • Fire pump control • HVAC • Security systems • UPS
Contractor	<ul style="list-style-type: none"> • Installation on outside of enclosure or ahead of service entrance disconnect 	—	—
Data centers	<ul style="list-style-type: none"> • Emergency generator control • Feeders • HVAC • Main switchgear • Power distribution unit • Remote power panel • UPS 	<ul style="list-style-type: none"> • Emergency generator control • HVAC • Power distribution unit • Remote power panel • UPS 	<ul style="list-style-type: none"> • Emergency generator control • HVAC • Servers • UPS
Industrial	<ul style="list-style-type: none"> • Emergency generator control • HVAC • Lighting panels • Main switchgear • Motor control centers • Step down transformer primary • UL 508A panels requiring SCCR ratings • UPS • VFD 	<ul style="list-style-type: none"> • Conveyor systems • Crane control • HVAC • Power supplies • Step down transformer primary • UL 508A panels requiring SCCR ratings • VFD 	<ul style="list-style-type: none"> • Discrete control • HMI • HVAC • PLCs • Power supplies • Sensors
OEM	<ul style="list-style-type: none"> • Installation on outside of enclosure • UL 508A panels requiring SCCR ratings 	<ul style="list-style-type: none"> • I/Os • PLCs • Power supplies • Step down transformer primary • UL 508A panels requiring SCCR ratings • VFD 	<ul style="list-style-type: none"> • HMI • I/Os • PLCs • Power supplies • Sensors • Step down transformer primary
Oil and gas	<ul style="list-style-type: none"> • Emergency generator control • Lighting panels • Main switchgear • Motor control centers • Step down transformer primary • UL 508A panels requiring SCCR ratings • UPS • VFD 	<ul style="list-style-type: none"> • Conveyor systems • Crane control • Power supplies • Step down transformer primary • UL 508A panels requiring SCCR ratings • VFD 	<ul style="list-style-type: none"> • Discrete control • HMI • PLCs • Power supplies • Sensors
Residential	<ul style="list-style-type: none"> • Service entrance 	N/A	N/A
UL 508A shops	<ul style="list-style-type: none"> • Installation on outside or inside of enclosure or ahead of service entrance disconnect 	<ul style="list-style-type: none"> • I/Os • Installation on the lineside of the enclosure disconnect OCPD • PLC • Power supplies • Step down transformer primary • VFD 	<ul style="list-style-type: none"> • HMI • I/Os • PLCs • Power supplies • Sensors • Step down transformer primary
Waste water - water treatment	<ul style="list-style-type: none"> • Main switchgear • Motor control centers • UL 508A panels requiring SCCR ratings 	<ul style="list-style-type: none"> • Control panels • UL 508A panels requiring SCCR ratings • VFD 	<ul style="list-style-type: none"> • PLC • Power supplies • Sensors

General application of Bussmann Type 1, Type 2 and Type 4 SPD products by surge current capacity (I_{max})

Product	Installation location	Surge current capacity (I_{max})
BSPD Type 1 and Type 2	Switchboards, service entrance	200kA to 400kA
BSPD Type 2	Large panelboards	120kA to 200kA
SurgePOD™ HEAVY DUTY Type 1	Panelboards, control panels	50kA
SurgePOD™ PRO Type 1	Panelboards, control panels	40kA
1-, 2-, 3- and 4-pole high SCCR Type 2 (black label)	Control panels	40kA
1-pole non SCCR Type 4 (blue label)	Control panels (power)	25kA-40kA
2-pole non SCCR Type 4 (blue label)	Control panels (control)	1kA-3kA

Type 1 SPDs for UL Listed 1449 3rd Edition loadside and lineside protection

- Type 1 UL Listed 1449 3rd Edition SPDs are easily selected and installed on the loadside or lineside of the service entrance overcurrent protective device
- Voltage specific models precisely match and protect electrical systems and equipment better than “One-Size-Fits-All” SPDs
- NEMA 4X enclosures for indoor or outdoor installation
- NEMA 1 enclosure for indoor installation
- LED status indication provides surge protection status at a glance



BSPD

Type 1* SPDs provide ultimate surge protection for high surge current capacity critical commercial and industrial applications.

- NEMA 1 or 4X enclosures
- 120/208, 240, 277/480 and 600Vac
- 200kA SCCR
- Up to 400kA surge current capacity
- Wye and Delta systems
- Bussmann SurgePOD thermal disconnect MOV technology
- Optional Form C contact
- Optional EMI/RFI filtering
- Optional surge counter with reset button
- Ten-year warranty

* Basic configuration only. *Standard* and *Standard with Surge Counter* configurations are Type 2.



SurgePOD™ HEAVY DUTY

Robust Type 1 SPDs provide ultimate surge protection for critical commercial and industrial applications

- NEMA 4X enclosure
- 120 to 600Vac
- 200kA SCCR
- 50kA Surge current capacity
- Single-phase, split-phase, Wye, Delta and Highleg Delta systems
- Bussmann SurgePOD thermal disconnect MOV technology
- Five-year warranty



SurgePOD™ PRO

Type 1 SPDs provide optimal surge protection for light commercial and residential applications

- NEMA 4X enclosure
- 120 to 480Vac
- 200kA SCCR
- 40kA Surge current capacity
- Single-phase, split-phase, Wye, Delta systems
- Thermal disconnect MOV technology
- Two-year warranty

BSPD, SurgePOD™ HEAVY DUTY and SurgePOD PRO comparisons

SPD model / color	BSPD - grey	HEAVY DUTY - black	PRO - grey
Markets	Commercial and industrial with high surge current	Commercial and industrial	Residential, light commercial and UL 508A panels
Product warranty	10 years*	5 years*	2 years*
System types	Delta and Wye	Single, Split, Delta, Highleg Delta and Wye**	Single, Split, Delta and Wye
Nominal system voltages	120/208, 240, 277/480, 480, 600	120, 208, 240, 277, 347, 480, 600	120, 208, 240, 480
Max. continuous operating AC voltage (MCOV) [V _c]	Sized to nominal voltage (150V to 640V)	Sized to nominal voltage (150V to 550V)	Sized to nominal voltage (150V to 550V)
SCCR	200kA	200kA	200kA
Nominal discharge current (8x20μs) I _n	20kA	20kA	10kA
Surge current capacity (8x20μs) I _{max}	120, 200, 300, 400kA	50kA	40kA
Installation connections	3, 5 Wires	2, 3, 4, 5 Wires	2, 3, 4 Wires
N-G protection	Yes	Yes	No
Response time (ns) t _A	<25ns	<25ns	<25ns
Frequency	50/60Hz	50/60Hz	50/60Hz
Operating status/fault indication	One red and green LED per phase	One bi-color LED Green (Good) / Red (Replace)	One bi-color LED Green (Good) / Red (Replace)
Conductor gauge / length	10AWG stranded copper / 48 inches	10AWG Stranded copper/ 18 inches	10AWG Stranded copper/ 18 inches
Mounting	Chase nipple (NEMA 1) internal hub (NEMA 4X)	Chase nipple or customer supplied bracket	Chase nipple or customer supplied bracket
Enclosure rating	NEMA 1 or NEMA 4X	NEMA 4X - UL 94-5VA	NEMA 4X - UL 94-5VA
Degree of protection (installed state)	IP20 (finger-safe)	IP20 (finger-safe)	IP20 (finger-safe)
Circuit location	Lineside/loadside***	Lineside/loadside	Lineside/loadside
Standards/agency information	UL 1449 3 rd Edition Type 1 Listed SPD, UL 1283 Type 2 Recognized, CSA Certified	UL 1449 3 rd Edition Type 1 Listed SPD, cULus, CSA**, RoHS Compliant	UL 1449 3 rd Edition Type 1 Listed SPD, cULus, RoHS Compliant
Operating temperature	-40°C to +50°C	-40°C to +85°C	-40°C to +65°C
Operating altitude	16,000 Feet	16,000 Feet	12,000 Feet
Options***	Form C contact relay EMI/RFI filter (up to 50db 10kHz to 10MHz) Surge counter	—	—
Data sheets	10209	2163	10033

* See Bussmann SPD Limited Warranty Statement (3A1502) for details at www.cooperbussmann.com/surge.

** 600V Wye versions not CSA Certified.

*** BSPD models ordered with Form C contact relay and/or surge counter options are UL Type 2 SPDs and cannot be located on the lineside of the service entrance overcurrent protective device.

SurgePOD™ SPD module technology

At the heart of the BSPD Type 1 and Type 2, and SurgePOD HEAVY DUTY Type 1 SPDs is the Bussmann SurgePOD™ Module. These are board-mounted devices with a voltage clamping feature that becomes conductive upon encountering an overvoltage condition and safely shunts the surge to ground.

Capable of meeting the highest NEC® requirements each module has a maximum surge current rating of 50kA and SCCR of 200kA. The SurgePOD module features patented thermal disconnect technology that eliminates the need for additional overcurrent protection.

Each SurgePOD module is UL 1449 3rd Edition Recognized for use in Type 1 or Type 2 SPD assemblies. Each module features an internal element that safely disconnects the device upon reaching an overvoltage breakdown condition.

Agency information

- UL 1449 3rd Edition Recognized Type 1 Surge Protective Device; File E340782.

Traceability and environmental

- All SurgePOD devices are individually marked with a serial number for easy identification and tracking.
- Flammability rating UL 94-V0
- Operating and storage temperature range -40°C to 85°C

See data sheet # 1170 for details.



BSPD

Description

BSPD Surge Protective Devices (SPDs) are UL Listed 1449 3rd Edition Type 1 or UL Recognized 1283 5th Edition Type 2 surge protectors, depending on the configuration. The BSPD is available for installation external to an electrical enclosure or panelboard. Application of BSPD units throughout a facility will help ensure that equipment is protected.

BSPD units are available for common Delta and Wye voltage systems in a variety of surge current capacity ratings from 120kA through 400kA. Available in three configurations, the BSPD's configurations and options make it easy to specify units for many electrical applications; including service entrances, distribution switchboards, panelboards and point-of-use.

- Basic, Standard and Standard with Surge Counter configurations UL Listed 1449 3rd Edition File E316410 Guide VZCA, CSA Certified Notice 516 File 243397
- Standard and Standard with Surge Counter configurations are also UL Recognized 1283 5th Edition File E316410 Guide VZCA2, CSA Component Acceptance Std. C22.2
- RoHS compliant
- Uses Bussmann SurgePOD™ thermally protected Metal Oxide Varistor (MOV) technology
- 20kA nominal discharge current (I_n) rating (maximum rating assigned by UL)
- 120kA through 400kA per phase surge current capacity (I_{max}) ratings
- 200kA Short-Circuit Current Rating (SCCR)
- Two color LED status indicators for each phase on Delta and Wye units, plus N-G on Wye units
- 10-Year warranty

Configurations

The BSPD provides users with the option of selecting between three configurations:

- Basic (Type 1)
- Standard with Form C contact and EMI/RFI filter (Type 2)
- Standard with Surge Counter (Type 2)

The appropriate configuration can be specified from the catalog number system based on the application's requirements or specifications.



NEMA 1 steel enclosure
120kA and 200kA maximum surge
current capacity



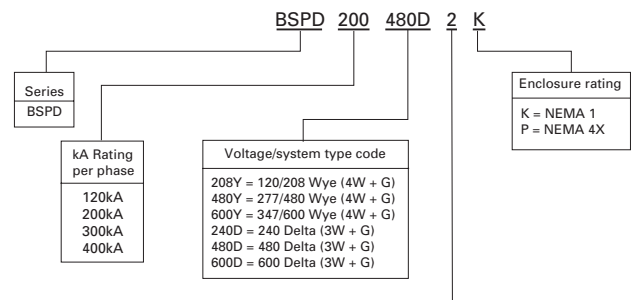
NEMA 1 steel enclosure
300kA and 400kA maximum surge
current capacity



NEMA 4X 304 Stainless Steel
enclosure, all surge current capacities

Catalog number system

The catalog numbering system permits specifying any combination to meet requirements.

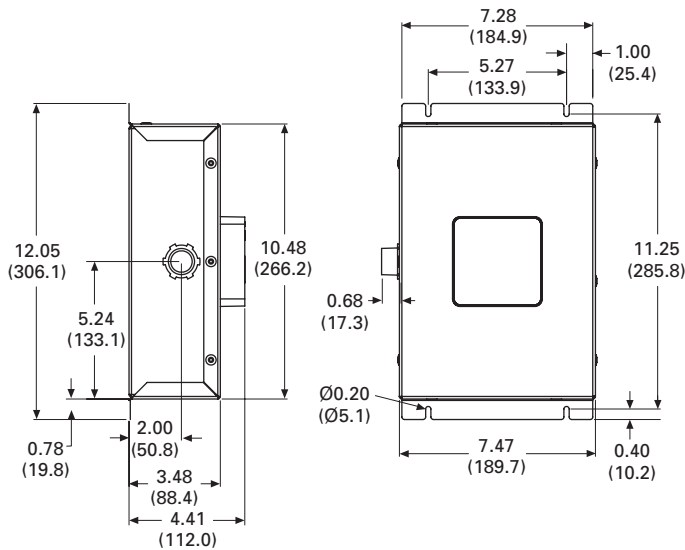


Configurations	
1 = Basic	Green and red LEDs per phase to indicate protection status Green and red LEDs on Wye units to indicate protection status of the Neutral-to-Ground mode
2 = Standard	Green and red LEDs per phase to indicate protection status Green and red LEDs on Wye units to indicate protection status of the Neutral-to-Ground mode Audible alarm with Silence button Form C contact relay. See Table 3, Specifications EMI/RFI filtering providing up to 50dB of noise attenuation from 10kHz to 100MHz
3 = Standard With Surge Counter	Green and red LEDs per phase to indicate protection status Green and red LEDs on Wye units to indicate protection status of the Neutral-to-Ground mode Audible alarm with silence button Form C contact relay EMI/RFI filtering providing up to 50dB of noise attenuation from 10kHz to 100MHz Surge counter with reset button

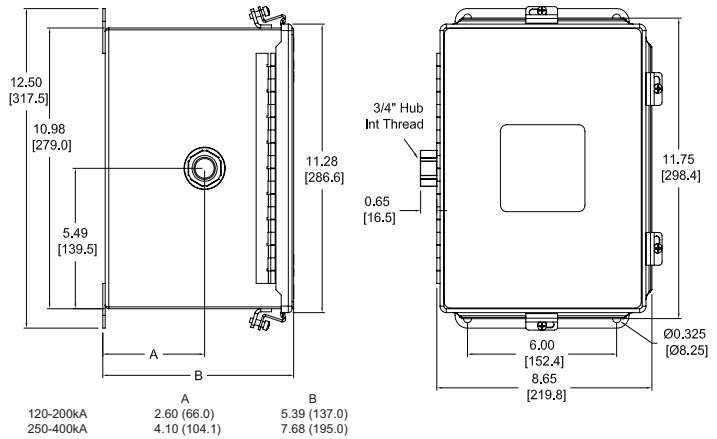
BSPD configuration comparisons

Features	Configuration		
	Basic (Type 1)	Standard (Type 2)	Standard with Surge Counter (Type 2)
Surge protection using Bussmann SurgePOD™ MOV technology	X	X	X
Two color LED protection status indicators for each phase	X	X	X
Two color LED protection status indicators for the neutral-ground protection mode (Wye systems only)	X	X	X
Audible alarm with silence button		X	X
Form C contact relay		X	X
EMI/RFI filtering, providing up to 50dB of noise attenuation from 10kHz to 100MHz		X	X
Surge counter with reset button			X

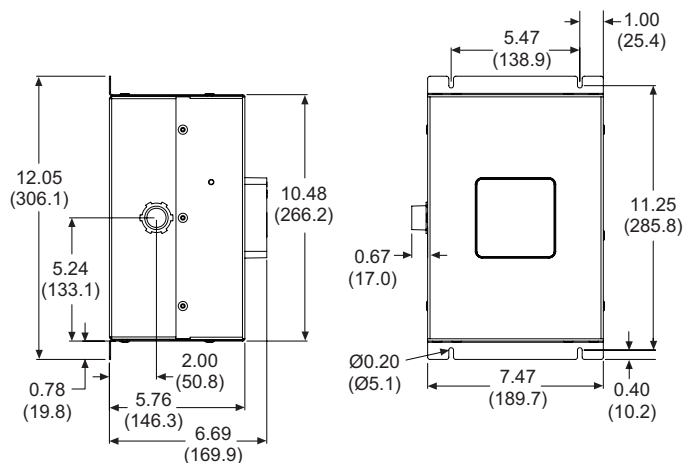
Dimensions - in (mm)



120kA and 200kA Units/NEMA 1

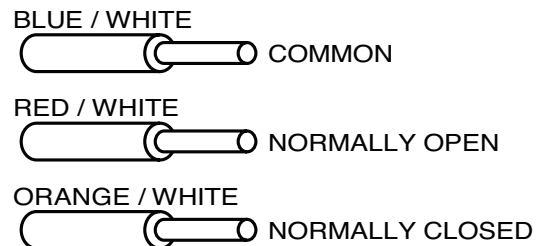


120kA to 400kA Units/NEMA 4X



300kA and 400kA Units/NEMA 1

Form C Contact Relay Wire Color Codes



BSPD specifications

Description	Specification
Available system voltages	
Three-phase Wye	120/208, 277/480 and 347/600
Three-phase Delta	240, 480 and 600
Input power frequency	50/60Hz
Maximum Continuous Operating Voltage (MCOV)	
208Y, and 240D voltage/system type codes	150 L-N, 150 L-G, 150 N-G, 300 L-L
480Y Voltage/system type code	320 L-N, 320 L-G, 320 N-G, 640 L-L
600Y Voltage/system type code	420 L-N, 420 L-G, 420 N-G, 840 L-L
480D Voltage/system type code	640 L-G, 640 L-L
600D Voltage/system type code	840 L-G, 840 L-L
Short-Circuit Current Rating (SCCR)	200kA
Nominal discharge current (I_n)	20kA
Surge current capacity per phase (I_{max})	120kA, 200kA, 300kA and 400kA ratings available
SPD Types	Type 1 (<i>Basic</i> configuration, can also be used in Type 2 applications) Type 2 (<i>Standard</i> and <i>Standard With Surge Counter</i> configurations)
Enclosure types	NEMA 1, NEMA 4X 304 Stainless Steel
Ports	1
SPD Conductor length/gauge	48" (1.22m) 10AWG Stranded copper
Form C contact relay (<i>Standard</i> and <i>Standard With Surge Counter</i> configurations only)	
Contact ratings	150Vac or 125Vdc, 1A maximum
Lead length/gauge	48 inches (1.22m) / 14AWG
Contact logic	Power ON, normal state; N.O. contact = OPEN, N.C. contact = CLOSED Power OFF, fault state; N.O. contact = CLOSED, N.C. contact = OPEN
Power consumption	
Basic configuration	
208Y and 240D voltage/system type codes	0.5W
480Y and 480D voltage/system type codes	1.1W
600Y and 600D voltage/system type codes	1.3W
Standard and Standard with Surge Counter configurations	
208Y and 240D voltage/system type codes	0.6W
480Y, and 480D voltage/system type codes	1.7W
600Y and 600D voltage/system type codes	2.1W
Protection modes	Three-phase Delta; L-G, L-L Three-phase Wye; L-N, L-G, N-G, L-L
Operating temperature / humidity	-40 to +50°C (-40 to +122°F) / 5% to 95%, non-condensing
Operating altitude - ft (m)	16,000 (5000)
EMI/RFI filtering attenuation	Up to 50dB from 10kHz to 100MHz (<i>Standard</i> and <i>Standard With Surge Counter</i> configurations)
Weight - lbs (kg)	NEMA 1: 120kA-200kA - 6.8 (3.1), 300kA- 400kA -13.5 (6.1) NEMA 4X: 120kA-200kA - 14.6 (6.6), 300kA-400kA - 21.0 (9.5)
Agency information	- <i>Basic</i> , <i>Standard</i> and <i>Standard with Surge Counter</i> configurations UL Listed 1449 3 rd Edition File E316410 Guide VZCA, CSA Certified Notice 516 File 243397 - <i>Standard</i> and <i>Standard with Surge Counter</i> configurations are also UL Recognized 1283 5 th Edition File E316410 Guide VZCA2, CSA Component Acceptance Std. C22.2 No. 8-M1986 File 243397
RoHS compliant	Yes
Seismic withstand capability	Meets or exceeds the requirements specific to I.B.C. 2006, C.B.C. 2007 and U.B.C. Zone 4
Warranty	10 Years (see warranty statement 3A1502 for details at www.cooperbusmann.com/surge)

Voltage protection ratings

ANSI/UL 1449 3rd Edition voltage protection ratings

Voltage Protection Rating (V_{PR}) data for all units is included in the following tables. The data varies based upon the configuration and NEMA enclosure. V_{PR} values for the *Basic* configurations are on the left-hand side of the page. Tables on the right-hand side contain VPR values for the *Standard* or *Standard with Surge Counter* configurations.

NEMA 1: Basic (cat. nos. ending with 1K)

120-200kA

Voltage/ System Code	Protection Mode			
	L-N	L-G	N-G	L-L
208Y	700	700	700	1200
480Y	1200	1200	1200	2000
600Y	1500	1500	1500	2500
240D	—	1000	—	1000
480D	—	2000	—	2500
600D	—	2500	—	2500

300kA

Voltage/ System Code	Protection Mode			
	L-N	L-G	N-G	L-L
208Y	700	700	700	1000
480Y	1200	1200	1200	1800
600Y	1500	1500	1500	2500
240D	—	1000	—	1000
480D	—	1800	—	2000
600D	—	2500	—	2500

400kA

Voltage/ System Code	Protection Mode			
	L-N	L-G	N-G	L-L
208Y	700	700	700	1000
480Y	1200	1200	1200	1800
600Y	1500	1500	1500	2500
240D	—	1000	—	1000
480D	—	1800	—	2000
600D	—	2500	—	2500

NEMA 1: Standard or Standard w/ Surge Counter (cat. nos. ending with 2K or 3K)

120-200kA

Voltage/ System Code	Protection Mode			
	L-N	L-G	N-G	L-L
208Y	600	800	600	1000
480Y	1200	1200	1200	1800
600Y	1500	1500	1500	2500
240D	—	1000	—	1000
480D	—	2500	—	2500
600D	—	2500	—	2500

300kA

Voltage/ System Code	Protection Mode			
	L-N	L-G	N-G	L-L
208Y	600	700	600	1000
480Y	1000	1200	1000	1800
600Y	1500	1500	1500	2500
240D	—	1000	—	1000
480D	—	1800	—	2000
600D	—	2500	—	2500

400kA

Voltage/ System Code	Protection Mode			
	L-N	L-G	N-G	L-L
208Y	600	700	600	1000
480Y	1000	1200	1000	1800
600Y	1500	1500	1500	2500
240D	—	1000	—	1000
480D	—	1800	—	2000
600D	—	2500	—	2500

**NEMA 4X: Basic
(cat. nos. ending with 1P)**

120–200kA

Voltage/ System Code	Protection Mode			
	L-N	L-G	N-G	L-L
208Y	700	800	700	1200
480Y	1200	1200	1000	2000
600Y	1500	1500	1500	2500
240D	—	1000	—	1000
480D	—	2000	—	2500
600D	—	2500	—	2500

300kA

Voltage/ System Code	Protection Mode			
	L-N	L-G	N-G	L-L
208Y	700	800	700	1200
480Y	1200	1200	1200	2000
600Y	1500	1500	1500	2500
240D	—	1000	—	1000
480D	—	1800	—	2000
600D	—	2500	—	2500

400kA

Voltage/ System Code	Protection Mode			
	L-N	L-G	N-G	L-L
208Y	700	800	700	1200
480Y	1200	1200	1200	2000
600Y	1500	1500	1500	2500
240D	—	1000	—	1000
480D	—	1800	—	2000
600D	—	2500	—	2500

**NEMA 4X: Standard or Standard w/ Surge Counter
(cat. nos. ending with 2P or 3P)**

120–200kA

Voltage/ System Code	Protection Mode			
	L-N	L-G	N-G	L-L
208Y	900	900	700	1500
480Y	1200	1200	1000	2500
600Y	1500	1500	1500	2500
240D	—	1000	—	1000
480D	—	2500	—	2500
600D	—	2500	—	2500

300kA

Voltage/ System Code	Protection Mode			
	L-N	L-G	N-G	L-L
208Y	800	900	700	1500
480Y	1200	1200	1000	2000
600Y	1500	1500	1500	2500
240D	—	1000	—	1000
480D	—	2000	—	2000
600D	—	2500	—	2500

400kA

Voltage/ System Code	Protection Mode			
	L-N	L-G	N-G	L-L
208Y	800	900	700	1500
480Y	1200	1200	1000	2000
600Y	1500	1500	1500	2500
240D	—	1000	—	1000
480D	—	2000	—	2000
600D	—	2500	—	2500

SurgePOD™ HEAVY DUTY

Description

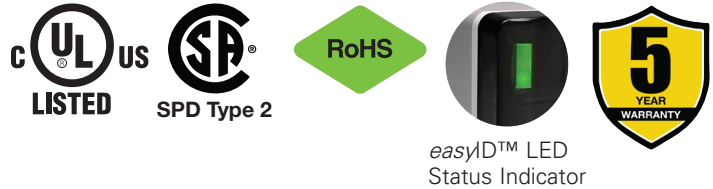
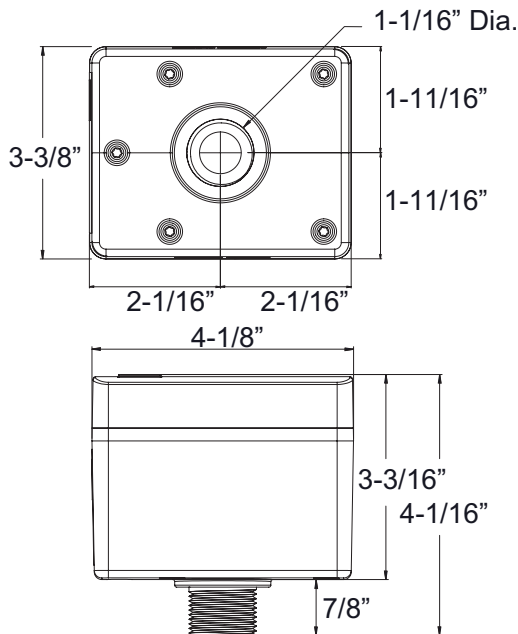
The Bussmann SurgePOD HEAVY DUTY is a Type 1 UL Listed 1449 3rd Edition surge protective device suitable for installation on the lineside or loadside of the service entrance overcurrent protective device.

Available in voltage and system specific versions to match electrical requirements, the SurgePOD HEAVY DUTY delivers optimum surge protection using the advanced, patented SurgePOD™ Module with thermal disconnect technology.

Parallel connection to the electrical system permits the SurgePOD HEAVY DUTY SPD to be installed on any ampacity panel.

- Type 1 UL Listed 1449 3rd Edition SPDs are easily selected and installed on the lineside or loadside of the service entrance overcurrent protective device
- Voltage specific models precisely match and protect electrical systems and equipment up to 600Vac
- Compact NEMA 4X for indoor or outdoor applications
- *easyID*™ LED status indicators provide surge protection status at a glance

Dimensions - in



Available catalog numbers

Below are the available SurgePOD HEAVY DUTY catalog numbers. See catalog number explanation below for details.

SPH50SP1120SN	SPH50SP2480PN	SPH50SP3208WYG
SPH50SP1240SN	SPH50SP3240PNG	SPH50SP3480WYG
SPH50SP1347SN	SPH50SP3480PNG	SPH50SP3600WYG
SPH50SP2120SNG	SPH50SP3240DLG	SPH50SP4208WYNG
SPH50SP2240SNG	SPH50SP3480DLG	SPH50SP4480WYNG
SPH50SP2347SNG	SPH50SP4240HLG	SPH50SP4600WYNG
SPH50SP2240PN	SPH50SP4480HLG	

Catalog number explanation

	SPH	50S	Px	xxx	xxx
SPH = Product series					
Surge rating 50kA surge current capacity					
Number of wires P1 = 1, P2 = 2, P3 = 3, P4 = 4					
System voltage (Vac) 120, 208, 240, 347, 480, 600					
System type/wires and connection points					
SN = Single-phase 2 wire, 2 connection points					
SNG = Single-phase 2 wire + G, 3 connection points					
PN = Split-phase 3 wire, 3 connection points					
PNG = Split-phase 3 wire + G, 4 connection points					
DLG = Three-phase Delta 3 wire + G, 4 connection points					
HLG = Three-phase Highleg Delta 4 wire + G, 5 connection points					
WYG = Three-phase Wye 3 wire, 4 connection points					
WYNG = Three-phase Wye 3 wire + G, 5 connection points					

easyID™ LED status indicator

The *easyID* LED status indicator will illuminate when the unit is properly installed and the system or equipment being protected is energized. The following LED color/status indicates:



GREEN LED = Good

The circuit is energized and protected.



RED LED = Replace

The circuit is energized and unprotected.
The unit needs replacing.



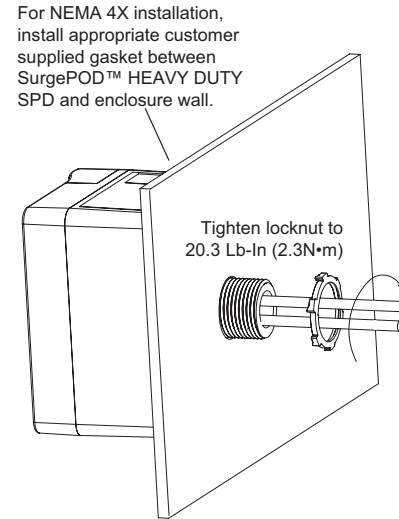
LED is Out / Unlit:

- The circuit is most likely deenergized
- The unit's leads are disconnected
- The unit is damaged

Authorized personnel should follow all prescribed lockout/tagout and safety procedures in troubleshooting the cause for the above conditions. Opening SurgePOD HEAVY DUTY enclosure will void the warranty.

Mounting

SurgePOD HEAVY DUTY is a panel mount device. It may also be mounted using a customer supplied bracket or directly onto a female threaded conduit fitting.



SurgePOD HEAVY DUTY technical information

Catalog number	Nominal system voltage	Max. continuous operating AC voltage (MCOV) (V _c)	System type	Connection points
SPH50SP1120SN	120V	150V	Single-phase 2 Wire	2
SPH50SP1240SN	240V	320V	Single-phase 2 Wire	2
SPH50SP1347SN	347V	420V	Single-phase 2 Wire	2
SPH50SP2120SNG	120V	150V	Single-phase 2 Wire + G	3
SPH50SP2240SNG	240V	320V	Single-phase 2 Wire + G	3
SPH50SP2347SNG	347V	420V	Single-phase 2 Wire + G	3
SPH50SP2240PN	120/240V	150V	Split-phase 3 Wire	3
SPH50SP2480PN	240/480V	320V	Split-phase 3 Wire	3
SPH50SP3240PNG	120/240V	150V	Split-phase 3 Wire + G	4
SPH50SP3480PNG	240/480V	320V	Split-phase 3 Wire + G	4
SPH50SP3240DLG	240V	320V	Three-phase Delta 3 Wire + G	4
SPH50SP3480DLG	480V	550V	Three-phase Delta 3 Wire + G	4
SPH50SP4240HLG	120/240V	150/320V	Three-phase Highleg Delta 4 Wire + G	5
SPH50SP4480HLG	240/480V	320/550V	Three-phase Highleg Delta 4 Wire + G	5
SPH50SP3208WYG	208V	150V	Three-phase Wye 3 Wire + G	4
SPH50SP3480WYG	480V	320V	Three-phase Wye 3 Wire + G	4
SPH50SP3600WYG†	600V	420V	Three-phase Wye 3 Wire + G	4
SPH50SP4208WYNG	208Y/120V	150V	Three-phase Wye 4 Wire + G	5
SPH50SP4480WYNG	480Y/277V	320V	Three-phase Wye 4 Wire + G	5
SPH50SP4600WYNG†	600Y/347V	420V	Three-phase Wye 4 Wire + G	5

† 600V Wye version is not CSA Certified.

SurgePOD™ HEAVY DUTY technical information

Specifications (for all SurgePOD HD units)	Values
Short-Circuit Current Rating (SCCR)	200kA
Nominal discharge current (8x20µs) (I _n)	20kA
Surge current capacity (8x20µs) (I _{max})	50kA
Response time (t _A)	<25ns
Frequency	50/60Hz
Operating state/fault indication	Bi-color LED - Green (good) / Red (replace)
Conductor length / gauge	18 inches, 10 AWG stranded copper
Mounting	Chase nipple / bracket*
Enclosure / flammability ratings	NEMA 4X - UL 94-5VA
Degree of protection (installed state)	IP20 (finger-safe)
SPD install location	Indoor/outdoor
Circuit location	Lineside or loadside of service entrance overcurrent protective device
Operating temperature	-40°C to +85°C
Maximum operating altitude	16,000FT
Agency information	cULus, CSA**, RoHS Compliant
Standard	UL 1449 3 rd Edition Type 1 Listed SPD
Warranty	Five Years***

* Customer-supplied bracket.

** 600V Wye version is CSA Certified.

*** See Bussmann SPD Limited Warranty Statement (3A1502) for details at www.cooperbussmann.com/Surge.

Voltage Protection Ratings (VPR)

Catalog number	Rated system voltage (V _r)	MCOV (V _c)	Voltage Protection Ratings (VPR)			
			L-N	L-L	L-G	N-G
SPH50SP1120SN	120V	150V	700	—	—	—
SPH50SP1240SN	240V	320V	1200	—	—	—
SPH50SP1347SN	347V	420V	1500	—	—	—
SPH50SP2120SNG	120V	150V	700	—	1200	700
SPH50SP2240SNG	240V	320V	1200	—	2500	1200
SPH50SP2347SNG	347V	420V	1500	—	2500	1500
SPH50SP2240PN	120V/240V	150V	700	1200	—	—
SPH50SP2480PN	240V/480V	320V	1200	2500	—	—
SPH50SP3240PNG	120V/240V	150V	700	1200	1200	700
SPH50SP3480PNG	240V/480V	320V	1200	2500	2500	1200
SPH50SP3240DLG	240V	320V	—	2500	1200	—
SPH50SP3480DLG	480V	550V	—	3000	1800	—
SPH50SP4240HLG	120/240V	150V/320V	700/1200	1200/2500	1200/2500	700/1200
SPH50SP4480HLG	240/480V	320V/550V	1200/1800	2500/3000	2500/3000	1200/1800
SPH50SP3208WYG	208V	150V†	—	1200	700	—
SPH50SP3480WYG	480V	320V†	—	2500	1200	—
SPH50SP3600WYG††	600V	420V†	—	2500	1500	—
SPH50SP4208WYNG	208Y/120V	150V	700	1200	1200	700
SPH50SP4480WYNG	480Y/277V	320V	1200	2500	2500	1200
SPH50SP4600WYNG††	600Y/347V	420V	1500	2500	2500	1500

† SPD voltages are measured from Line-to-Neutral, or Line-to-Ground on systems where there is no Neutral present. These units do not have a Line-to-Neutral, so the Line-to-Ground voltage is 120V for the 208V Wye L-G, 277V for the 480V L-G and 347V for the 600V Wye L-G, making the normal voltage applied to the unit less than the MCOV values listed in the table.

†† 600V Wye version is not CSA Certified.

SurgePOD™ PRO

Description

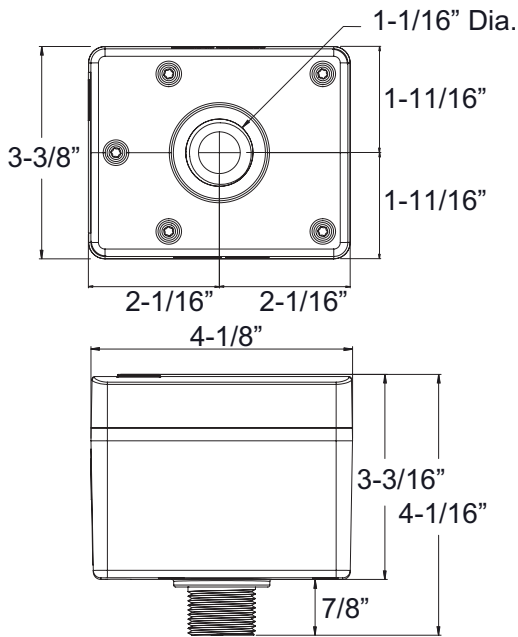
The Bussmann SurgePOD PRO is a Type 1 UL Listed 1449 3rd Edition surge protective device suitable for installation on both the lineside or loadside of the service entrance overcurrent protective device.

Available in popular voltage and system specific versions to match common residential and light commercial electrical system and equipment requirements, the SurgePOD PRO delivers superior surge protection using MOV thermal disconnect technology.

Parallel connection to the electrical system permits the SurgePOD PRO SPD to be installed on any ampacity panel.

- Type 1 UL Listed 1449 3rd Edition SPDs are easily selected and installed on the lineside or loadside of the service entrance overcurrent protective device
- Voltage specific models precisely match and protect electrical systems and equipment better than “one-size-fits-all” SPDs
- Thermal disconnect technology eliminates the need for additional fusing
- Compact NEMA 4X enclosure for indoor or outdoor applications
- *easyID*™ LED status indicator provides surge protection status at a glance

Dimensions - in



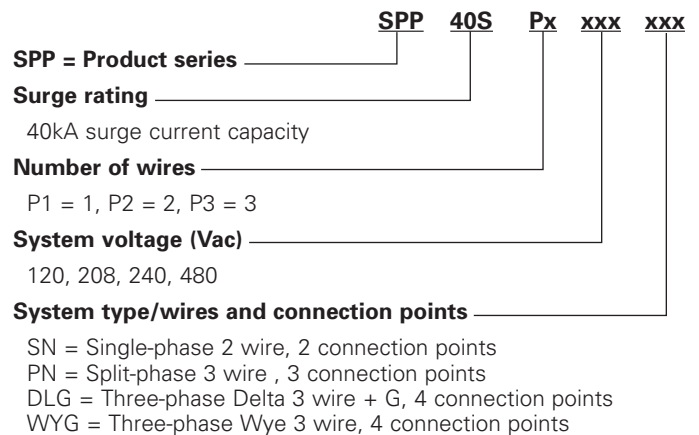
easyID™ LED Status Indicator

Available catalog numbers

Below are the available SurgePOD PRO catalog numbers. See catalog number explanation below for details.

SPP40SP1120SN	SPP40SP3240DLG	SPP40SP3208WYG
SPP40SP2240PN	SPP40SP3480DLG	SPP40SP3480WYG

Catalog number explanation



easyID™ LED status indicator

The *easyID* LED status indicator will illuminate when the unit is properly installed and the system or equipment being protected is energized. The following LED color/status indicates:



GREEN LED = Good

The circuit is energized and protected.



RED LED = Replace

The circuit is energized and unprotected.
The unit needs replacing.



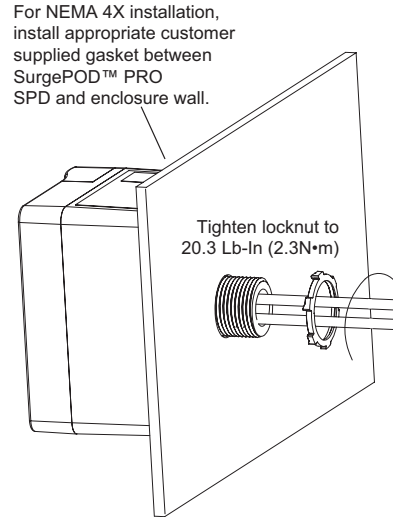
LED is Out / Unlit:

- The circuit is most likely deenergized
- The unit's leads are disconnected
- The unit is damaged

Authorized personnel should follow all prescribed lockout/tagout and safety procedures in troubleshooting the cause for the above conditions. Opening SurgePOD PRO enclosure will void the warranty.

Mounting

SurgePOD HEAVY DUTY is a panel mount device. It may also be mounted using a customer supplied bracket or directly onto a female threaded conduit fitting.



SurgePOD™ PRO technical information

Catalog number	Nominal system voltage	Max. continuous operating AC voltage (MCOV) (V _c)	System type	Connection points
SPP40SP1120SN	120V	150V	Single-phase 2 Wire	2
SPP40SP2240PN	120/240V	150V	Split-phase 3 Wire	3
SPP40SP3240DLG	240V	320V	Three-phase Delta 3 Wire + G	4
SPP40SP3480DLG	480V	550V	Three-phase Delta 3 Wire + G	4
SPP40SP3208WYG	208V	150V	Three-phase Wye 3 Wire + G	4
SPP40SP3480WYG	480V	320V	Three-phase Wye 3 Wire + G	4

Specifications (for all SurgePOD PRO units)	Values
Short-Circuit Current Rating (SCCR)	200kA
Nominal discharge current (8x20μs) (I _n)	10kA
Surge current capacity (8x20μs) (I _{max})	40kA
Response time (ns) (t _d)	<25ns
Frequency	50/60Hz
Operating state/fault indication	Bi-color LED - Green (good) / Red (replace)
Conductor length / gauge	18 inches, 10 AWG stranded tinned copper
Mounting	Chase nipple / bracket*
Enclosure / flammability ratings	NEMA 4X - UL 94-5VA
Degree of protection (installed state)	IP20 (finger-safe)
SPD install location	Indoor/outdoor
Circuit location	Lineside or loadside of service entrance overcurrent protective device
Operating Temperature	-40°C to +65°C
Maximum Operating Altitude	12,000FT
Agency information	cULus, RoHS Compliant
Standard	UL 1449 3 rd Edition Type 1 Listed SPD
Warranty	Two Years**

* Customer-supplied bracket.

** See Bussmann SPD Limited Warranty Statement (3A1502) for details at www.cooperbussmann.com/Surge.

Voltage Protection Ratings (VPR)

Catalog number	Nominal system voltage	MCOV (V _c)	Voltage Protection Ratings (VPR)		
			L-N	L-L	L-G
SPP40SP1120SN	120V	150V	700	—	—
SPP40SP2240PN	120V/240V	150V	700	1200	—
SPP40SP3240DLG	240V	320V	—	2500	1200
SPP40SP3480DLG	480V	550V	—	3000	1800
SPP40SP3208WYG	208V	150V [†]	—	1200	700
SPP40SP3480WYG	480V	320V [†]	—	2500	1200

† SPD voltages are measured from Line-to-Neutral, or Line-to-Ground on systems where there is no Neutral present. These units do not have a Line-to-Neutral, so the Line-to-Ground voltage is 120V for the 208V Wye L-G and 277V for the 480V L-G, making the normal voltage applied to the unit less than the MCOV values listed in the table.

Installing UL Type 1 and Type 2 SPDs

While differences will arise in the installation of different models of SPDs on various electrical systems and locations inside an electrical system, the following are general procedures and considerations to follow.

At the end of this section are diagrams indicating the connection points for the Type 1 and Type 2 SPDs contained in this guide and the electrical system to which they can be connected.

Installation steps

1. Inspect the electrical panelboard to be sure it is properly grounded in accordance with prevailing code requirements.
2. Inspect the SPD unit to determine:
 - It has the correct nominal system and MCOV voltage rating and is the correct configuration for the installation.
 - It is not damaged; If the unit is damaged or not correct for the system, do not install it. Secure a proper replacement before proceeding with the installation.
3. Deenergize panelboard and follow established lockout / tagout procedures. Remove panelboard cover(s) to gain access to the interior. Check to make sure the entire panelboard is deenergized before proceeding.
4. Select a location on the panelboard that accommodates mounting the SPD and allows the leads to reach their intended connection points. Be sure the SPD unit can be positioned so that the LED status indicator(s) is visible. A location that permits the shortest lead lengths (but not less than six (6) inches) is preferred.
5. Remove a 3/4" knockout or make a 1-1/16" diameter hole where the SPD is to be mounted.
6. Remove the locknut from the unit and insert leads through the panelboard wall to the interior being careful not to damage the conductor insulation. (For NEMA 4X installations, use appropriate gaskets or sealing means to retain the NEMA 4X rating on the installation - see Figure 1.) Reinstall locknut and tighten to specified torque.

If using conduit, keep the run as straight and short as possible, and avoid using 90 elbows.

NOTE: For optimum performance, trim the leads to the shortest length possible, but not less than six (6) inches and avoid sharp bends. Lead lengths shorter than six (6) inches will void the warranty. Make electrical connections appropriate for the application.

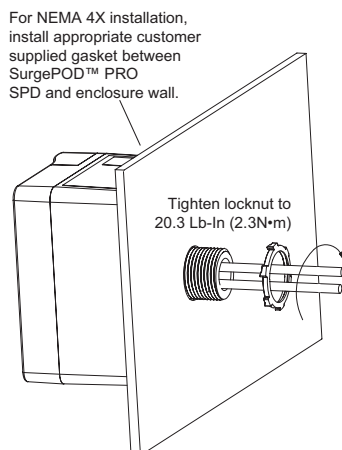


Figure 1.

Installation option A: using feed through lugs

7. Determine if the lugs are rated for stranded 10AWG conductors. If lugs are not rated for this size conductor, DO NOT install the SPD unit, or replace lugs with appropriately rated lugs before proceeding, or install the unit using installation option A.
8. Route and trim the leads so they reach their connection points with the least amount of length, but not less than six (6) inches.
9. Strip the lead ends to lug manufacturer's specifications, insert them into the appropriate lugs and torque to the specified value
NOTE: DO NOT install more than one lead into the same lug.

Go to step 13.

Installation option B: circuit breaker or fused switch

When using a circuit breaker or fused switch, see suggested ampacities in Table A for the SPD family product being installed.

10. Place in the OFF position and install a new, dedicated common trip circuit breaker or fusible switch with fuses sized by SPD family and located as close as possible to where the SPD unit is mounted.
11. Route and trim the leads so they reach their intended connection points with the least amount of length, but not less than six (6) inches.
12. Strip the lead end to fit the connection points, insert into the terminals and torque to the specified value.

Go to step 13.

Finishing the installation

13. Reinstall the panelboard cover(s).
14. Test the SPD installation by energizing the panelboard and placing the circuit breaker or fusible switch (requires fuses to be installed) in the ON position. Verify the LED status indicators are functioning according to the SPD model that was installed. If LEDs are not properly displaying for a correctly installed and functioning SPD (per model), see the respective troubleshooting procedures for specific SPD model for possible causes and remedy.

Table A - Circuit breaker and fused switch sizing guide

SPD family	Suggested minimum ampacity	
	Fused switch	Circuit breaker
SurgePOD PRO (SPP)	30A	20A
SurgePOD HEAVY DUTY (SPH)	60A	30A
BSPD	100A	30A

Electrical system connections

The following diagrams show the SPD connection points for the various electrical systems likely to be encountered, along with the Bussmann SPD models that may be applied.

Understanding the following points will help assure that the correct surge protective device is specified for the electrical system or equipment.

- Typical North American electrical systems include single-phase, split-phase, Delta and Wye.
- Selecting the wrong SPD generally arises from misunderstanding the nominal system voltage, ground and neutral connections.
- General convention has it that a “ground” wire is not counted as a wire in the system description (e.g., 3 wire, 4 wire, etc.), but it is counted as a connection point if the selected SPD has a ground wire.
- Selection of a device voltage rating for Wye systems must be based upon its nominal system voltage rating and not on the leg-to-leg voltages in the Wye.
- Bonded N-G configurations do not require protection at the service entrance transformer, but protection is suggested in downstream bonded N-G systems if the length of conductor making the bond is greater than 10 feet (3m)*.

* See FAQ #24 for more information.

The following are the BSPD, SurgePOD HEAVY DUTY and SurgePOD PRO catalog numbers, and the electrical systems and voltages to which they can be applied along with any notes that help in understanding the context of the application.

The examples show circuit breakers as the most typical means of making connections to the panel phases, although connection with fusible switches and lug connections are permitted, provided the terminals are rated for the 10AWG conductors used by the SurgePOD HEAVY DUTY and PRO, and BSPD of SPDs.

Note: UL does not require the using overcurrent protective devices such as circuit breakers or fused switches as the SPD’s thermal disconnect technology will safely take the SPD offline in the event of a failure. Use of these devices is for facilitating connection to the panel buses and installation convenience.

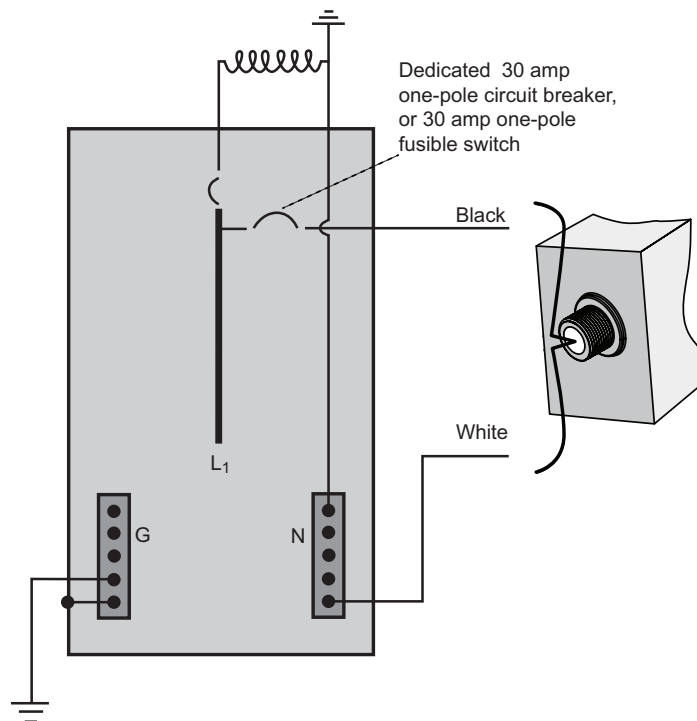
Contact Bussmann Application Engineering for electrical systems not covered in this section.

Two wire single-phase - 2 connection points

Application: Sub-panel or feeder panel

Volts: 120, 240, 347 (L-N)

Note: Less common than believed and often for one leg or piece of equipment. Must be installed within 10 feet (3m) of a bonded neutral ground connection per IEEE C62.41-1991.



Applicable SPD models and part numbers:

SurgePOD HEAVY DUTY

- SPH50SP1120SN
- SPH50SP1240SN
- SPH50SP1347SN

SurgePOD PRO:

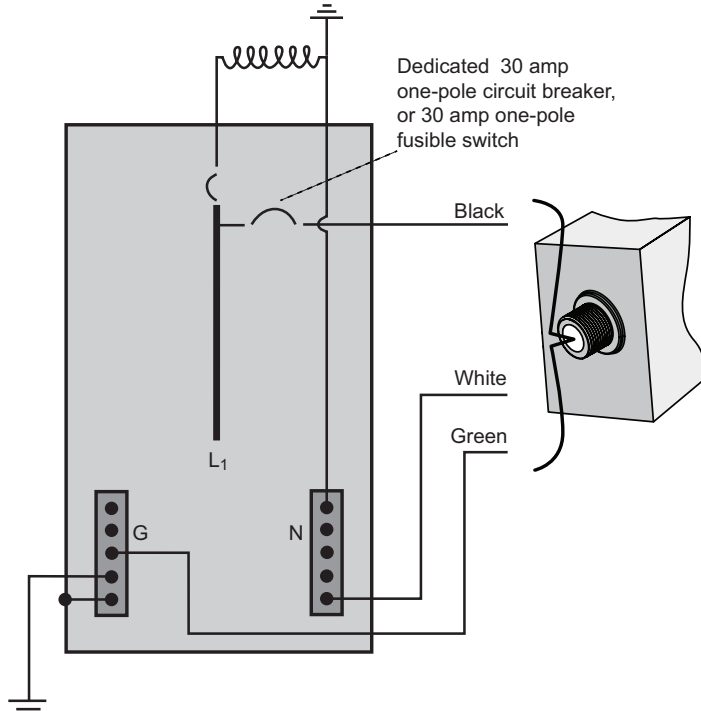
- SPP40SP1120SN

Three wire split-phase/two-pole - 3 connection points

Application: Service entrance panel

Volts: 120, 240, 347 (L-N)

Note: A very common system. Installation is for where the SPD is located greater than 10 feet (3m) of a bonded neutral-ground connection. The Neutral is usually pulled into facility and is bonded to ground.



Applicable SPD models and part numbers:

SurgePOD HEAVY DUTY:

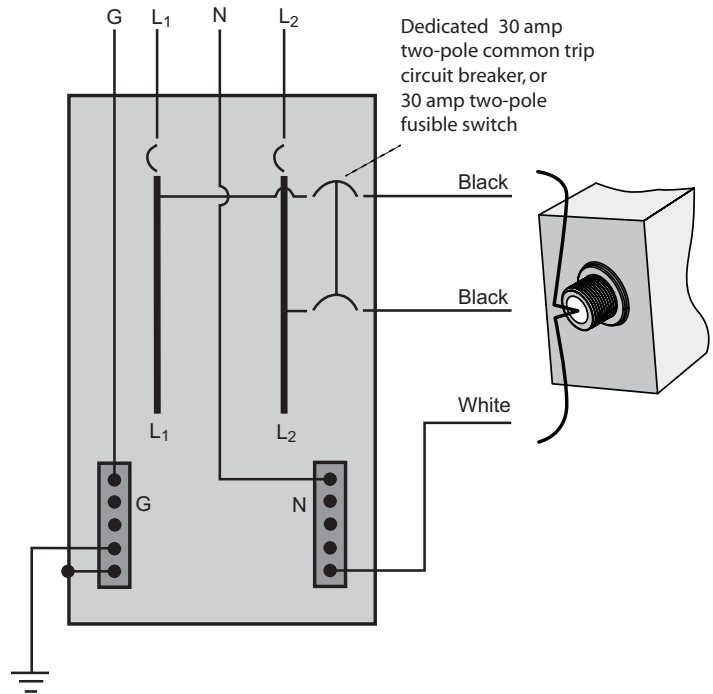
- SPH50SP2120SNG
- SPH50SP2240SNG
- SPH50SP2347S

Three wire split-phase/two-pole - 3 connection points

Application: Sub-panel or feeder panel

Volts: 120, 240 (L-N), 240, 480 (L1-L2)

Note: For installations at or less than 10 feet (3m) from the transformer. A very common system. The Neutral is usually pulled into facility and is bonded to ground. The SPD should be installed within 10 feet (3m) of a bonded-neutral ground connection.



Applicable SPD models and part numbers:

SurgePOD HEAVY DUTY:

- SPH50SP2240PN
- SPH50SP2480PN

SurgePOD PRO:

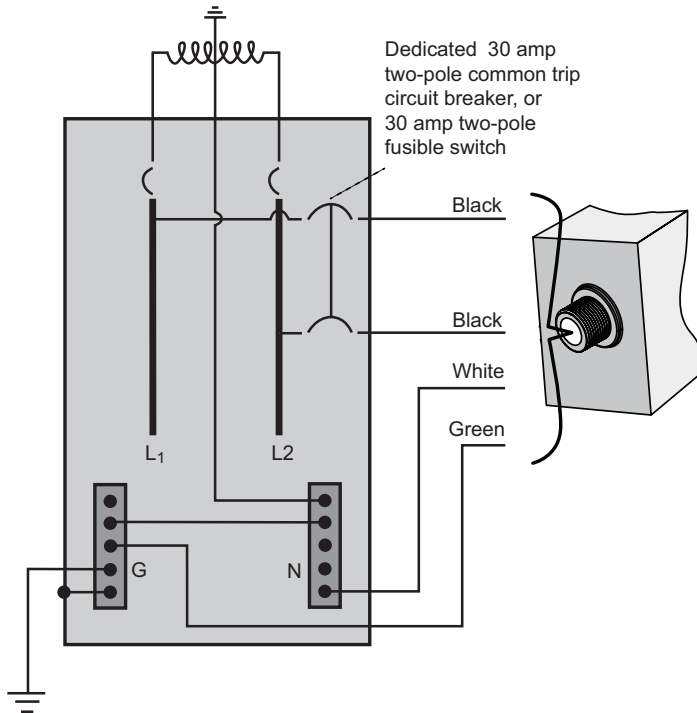
- SPP40SP2240PN

Three wire split-phase/two-pole plus ground - 4 connection points

Application: Service entrance equipment

Volts: 120, 240 (L-N), 240, 480 (L1-L2)

Note: For installation when located greater than 10 feet (3m) of a bonded-neutral ground connection. A very common system. The Neutral is usually pulled into facility and is bonded to ground.



Applicable SPD models and part numbers:

SurgePOD HEAVY DUTY:

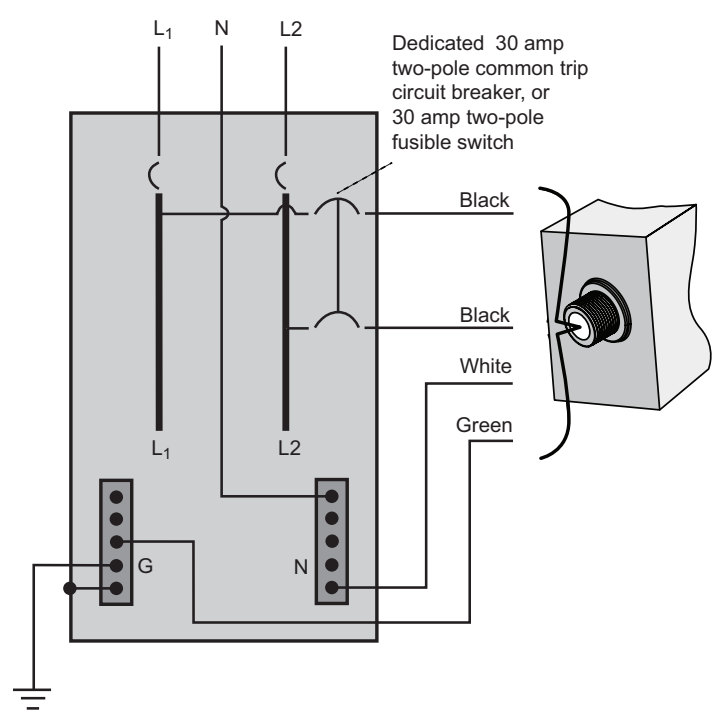
- SPH50SP3240PNG
- SPH50SP3480PNG

Three wire split-phase/two-pole plus ground - 4 connection points

Application: Sub-panel or feeder panel

Volts: 120, 240 (L-N), 240, 480 (L1-L2)

Note: For installation when located greater than 10 feet (3m) of a bonded-neutral ground connection. A very common system. The Neutral is usually pulled into facility and is bonded to ground.



Applicable SPD models and part numbers:

SurgePOD HEAVY DUTY:

- SPH50SP3240PNG
- SPH50SP3480PNG

Contact Bussmann Application Engineering for electrical systems not covered in this section.

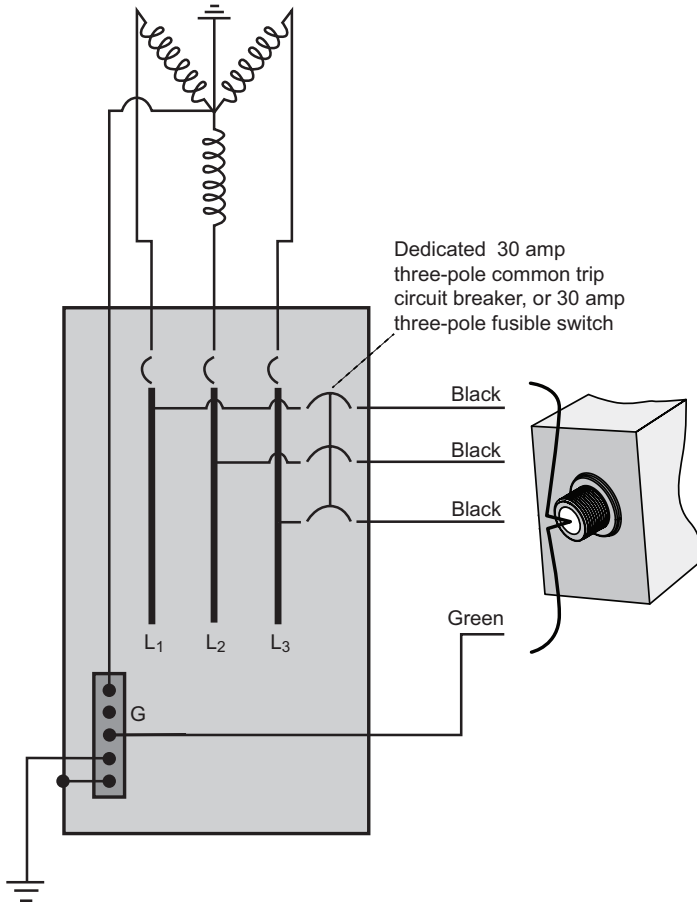
Installation instructions 10207 (BSPD), 3A1984 (SurgePOD HEAVY DUTY) and 3A2204 (SurgePOD PRO)

Three wire Wye plus ground - 4 connection points

Application: Sub-panel or feeder panel

Volts: 208, 480, 600 (L-L)

Note: A common MCC configuration for pumping and water/waste water treatment. Neutral NOT pulled into the facility, but is bonded to ground.



Applicable SPD models and part numbers:

SurgePOD HEAVY DUTY:

- SPH50SP3208WYG
- SPH50SP3480WYG
- SPH50SP3600WYG

SurgePOD PRO:

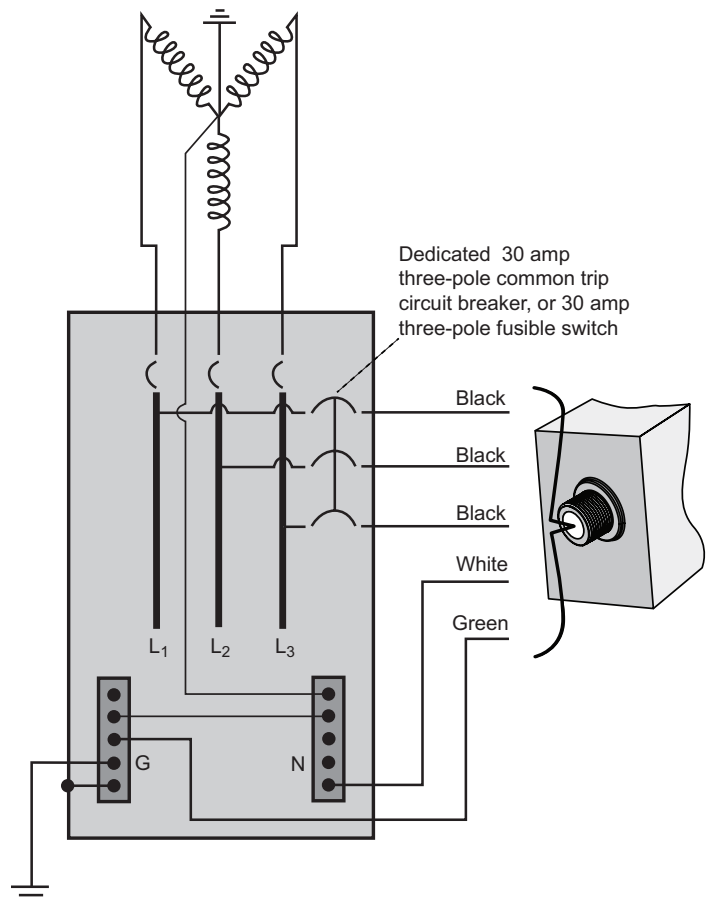
- SPP40SP3208WYG
- SPHP4SP3480WYG

Four wire Wye plus ground - 5 connection points

Application: Service entrance equipment

Volts: 120, 127, 277, 347 (L-N), 208, 220, 480, 600 (L-L)

Note: Common system configuration with Neutral pulled into facility and bonded to ground.



Applicable SPD models and part numbers:

SurgePOD HEAVY DUTY:

- SPH50SP4208WYNG
- SPH50SP4480WYNG
- SPH50SP4600WYNG

BSPD

Specify from build-a-code catalog number system:

- Surge current capacity (I_{max}): 120kA, 200kA, 300kA or 400kA
- Voltage/system type: 208Y, 480Y or 600Y
- Configuration: *Basic*, *Standard* or *Standard with Surge Counter*
- Enclosure rating: NEMA 1 or NEMA 4X

Contact Bussmann Application Engineering for electrical systems not covered in this section.

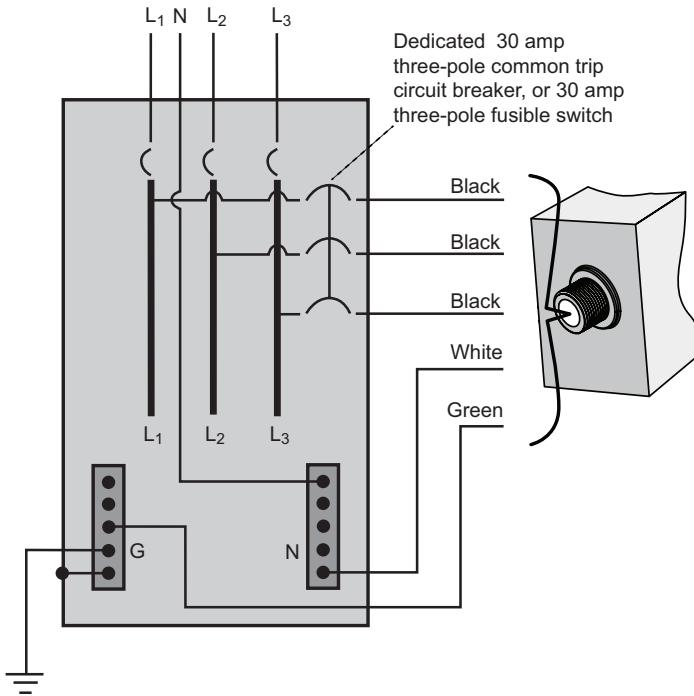
Installation instructions 10207 (BSPD), 3A1984 (SurgePOD HEAVY DUTY) and 3A2204 (SurgePOD PRO)

Four wire Wye plus ground - 5 connection points

Application: Sub-panel or feeder panel

Volts: 120, 127, 277, 347 (L-N), 208, 220, 480, 600 (L-L)

Note: Common system configuration with Neutral pulled into facility and bonded to ground.



Applicable SPD models and part numbers:

SurgePOD HEAVY DUTY:

- SPH50SP4208WYNG
- SPH50SP4480WYNG
- SPH50SP4600WYNG

BSPD

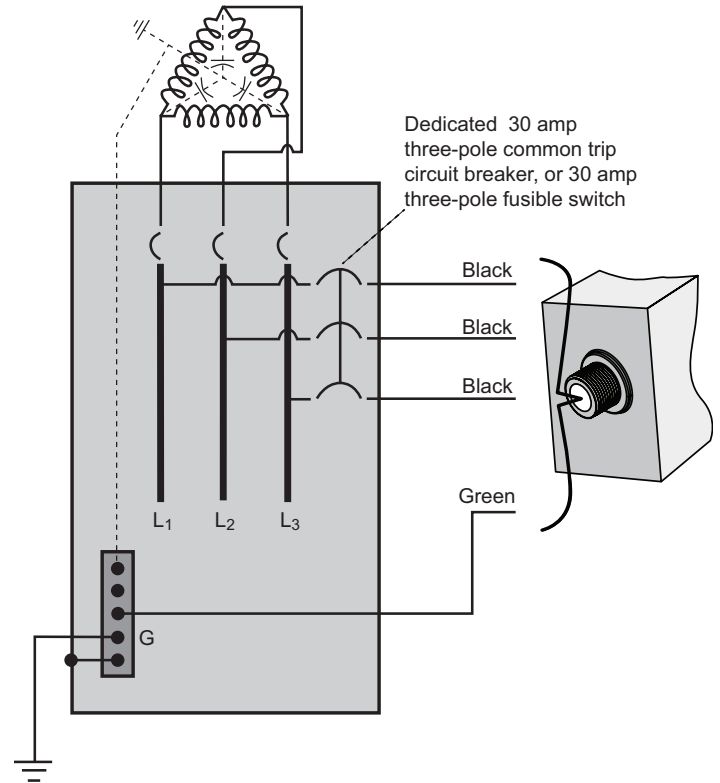
Specify from build-a-code catalog number system:

- Surge current capacity (I_{max}): 120kA, 200kA, 300kA or 400kA
- Voltage/system type: 208Y, 480Y or 600Y
- Configuration: *Basic*, *Standard* or *Standard with Surge Counter*
- Enclosure rating: NEMA 1 or NEMA 4X

Three wire Delta plus ground - 4 connection points

Application: Service entrance equipment, sub-panel or feeder panel

Volts: 240, 480, 600 (L-L)



Applicable SPD models and part numbers:

SurgePOD HEAVY DUTY:

- SPH50SP3240DLG
- SPH50SP3480DLG

SurgePOD PRO:

- SPP40SP3240DLG
- SPP40SP3480DLG

BSPD

Specify from build-a-code catalog number system:

- Surge current capacity (I_{max}): 120kA, 200kA, 300kA or 400kA
- Voltage/system type 240D, 480D or 600D
- Configuration: *Basic*, *Standard* or *Standard with Surge Counter*
- Enclosure rating: NEMA 1 or NEMA 4X

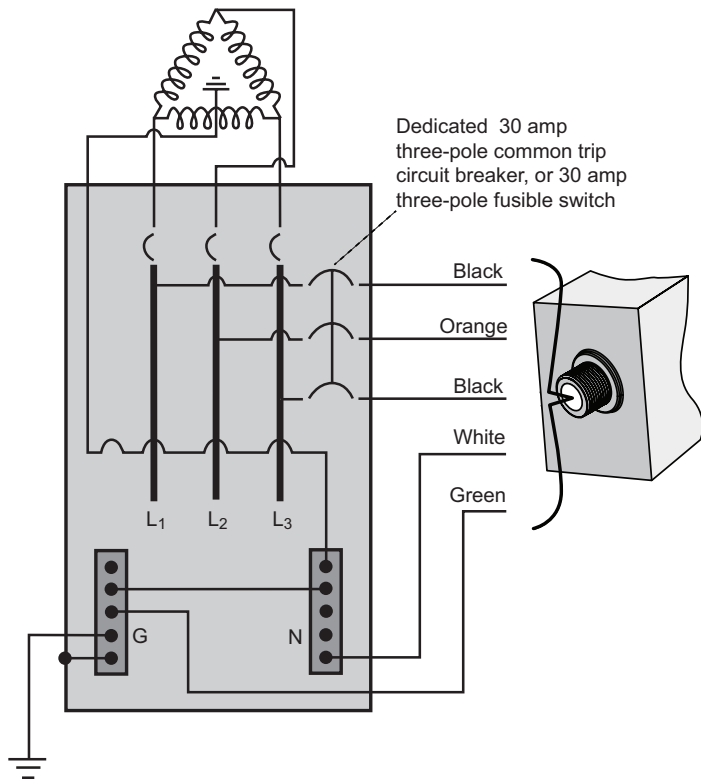
Contact Bussmann Application Engineering for electrical systems not covered in this section.

Installation instructions 10207 (BSPD), 3A1984 (SurgePOD HEAVY DUTY) and 3A2204 (SurgePOD PRO)

Four wire Highleg Delta - 5 connection points

Application: Service entrance equipment

Volts: 120V (L1 / L3-N) / 240V (L-L), 240V (L1 / L3-N) /480V (L-L)



Applicable SPD models and part numbers:

SurgePOD HEAVY DUTY:

- SPH50SP4240HLG
- SPH50SP4480HLG

Contact Bussmann Application Engineering for electrical systems not covered in this section.
Installation instructions 10207 (BSPD), 3A1984 (SurgePOD HEAVY DUTY) and 3A2204 (SurgePOD PRO)

**Black label DIN-Rail SPDs provide a comprehensive high
SCCR surge protection solutions for North American
UL 508A applications**

- UL 1449 3rd Edition Recognized SPD devices provide optimum surge protection for the United States and Canadian panel markets
- Module locking system with module release button makes module replacement easy without tools
- *easyID*[™] Visual indication and optional remote contact signaling make status monitoring simple
- Vibration and shock resistant according to EN 60068-2 standards to withstand harsh environments
- IP20 Finger-safe design improves electrical safety

The need for surge protection

Today's world is full of electronic products and devices that are susceptible to damage from overvoltage surges.

Whether the cause is static discharge or lightning, overvoltage surges can quickly destroy industrial, commercial and consumer electronics.

Surge protection products from Bussmann help provide power quality that's free from damaging surges.



Available with optional remote signal Form C contact

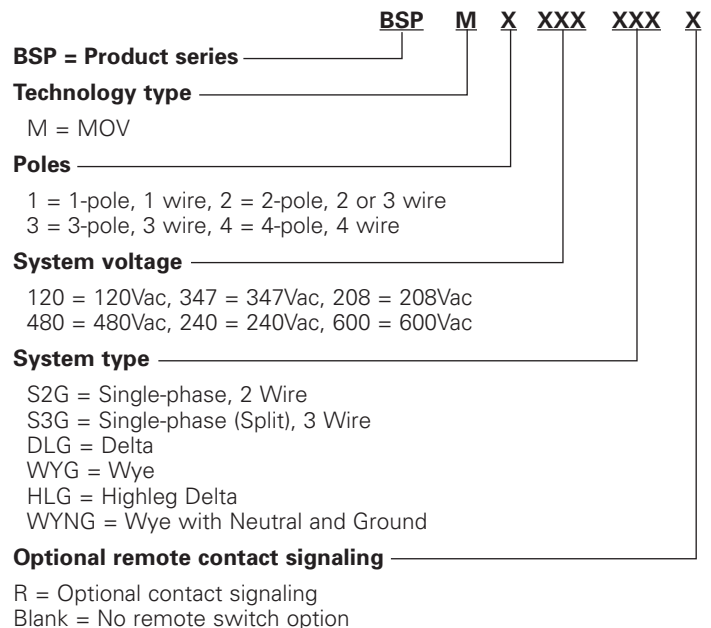


easyID[™]
Standard visual status indication

Customer testimonial

A manufacturing facility in Van Wert, Ohio has a surface treatment line that is a core process that cannot afford down time. Every part shipped out of this facility depends on this process. In effort to reduce the risk of an electrical power surge compromising this process, Bussmann surge protective devices were installed. These components were easy to install in the existing machine control panel. The result is a process that is more reliable and available as well as easier to maintain. Prior to the use of this product, a lightning-caused surge, damaged the HMI device that resulted in multiple days of unscheduled down time and a large unexpected expense to replace it. Since the install no problems have occurred.

UL-SPD part number explanation*



* This is not a catalog number system for configuring and ordering an SPD for a particular application. It is an explanation of the available black label high SCCR DIN-Rail SPD catalog numbers.

Black label BSP UL Type 4 recognized SCCR rated SPD specification overview* - no additional fusing required

Family designation	Technology	Poles/wires	Nominal voltage	System type	Remote contact signaling
BSP	M = MOV	1 = 2 wire 2 = 2 wire / 3 wire 3 = 3 wire 4 = 4 wire	120 = 120V 208 = 208V 240 = 240V 347 = 347V 480 = 480V 600 = 600V	S2G = single-phase 2 wire w/ Gnd S3G = single-phase (Split) 2 wire / 3 wire w/ Gnd DLG = Delta w/ Gnd HLG = Highleg Delta w/ Gnd WYG = Wye w/ Gnd WYNG = Wye w/ Neutral and Gnd	Blank = no remote R = with remote

* See descriptions below for specific values by part number.

UL Type 4 Recognized SPD for UL Type 2 applications - (for remote signaling contact, add "R" suffix to the part number)

Part number	Description (country)	Replacement module (Qty)	Poles	Volts (AC)	SCCR (kA)	Figure	UL/cUL Recognized, CSA
BSPM1120S2G	120V single-phase (USA) 127V single-phase (Mexico)	BPM275UL (1x)	1	120	200	A	Y
BSPM1240S2G	240V single-phase (USA) 254V single-phase (Mexico) 277V single-phase (USA)	BPM385UL (1x)	1	240	200	A	Y
BSPM1347S2G	347V single-phase (USA)	BPM600UL (1x)	1	347	125	A	Y
BSPM2240S3G	127/254V split-phase - 1Ø 3W + Gnd (Mexico) 240V corner Gnd Delta - 1Ø 2W + Gnd (USA)	BPM275UL (2x)	2	240	200	B	Y
BSPM2480S3G	240/480 split-phase - 1Ø 3W + Gnd (USA) 480V corner Gnd Delta, 1Ø 2W + Gnd (USA)	BPM385UL (2x)	2	480	200	B	Y
BSPM3240DLG	240V Delta - 3Ø 3W + Gnd (USA)	BPM275UL (3x)	3	240	200	C	Y
BSPM3480DLG	480V Delta - 3Ø 3W + Gnd & HRG Wye (USA)	BPM600UL (3x)	3	480	125	C	Y
BSPM3208WYG	120/208 Wye 3Ø 3W + Gnd	BPM275UL (3x)	3	208	200	C	Y
BSPM3480WYG	277/480 Wye 3Ø 3W + Gnd	BPM385UL (3x)	3	480	200	C	Y
BSPM3600WYG	347/600 Wye 3Ø 3W + Gnd	BPM600UL (3x)	3	600	125	C	Y
BSPM4240HLG	120/240 Highleg Delta - B High (USA)	BPM275UL (4x)	4	240	200	D	Y
BSPM4480HLG	240/480 three-phase Highleg 3Ø 3W + Gnd	BPM385UL (3x), BPM600UL (1x)	4	480	125	D	Y
BSPM4208WYNG	120/208 Wye - 3Ø 4W + Gnd (USA) 127/220 Wye - 3Ø 4W + Gnd (Mexico)	BPM275UL (4x)	4	208	200	D	Y
BSPM4480WYNG	277/480 Wye - 3Ø 4W + Gnd (USA)	BPM385UL (3x), BPM275UL (1x)	4	480	200	D	Y
BSPM4600WYNG	347/600 Wye - 3Ø 4W + Gnd (Canada)	BPM600UL (3x), BPM275UL (1x)	4	600	125	D	Y



Fig. A†

BSPM1120S2G
BSPM1240S2G
BSPM1347S2G



Fig. B†

BSPM2240S3G
BSPM2480S3G



Fig. C†

BSPM3208WYG
BSPM3480WYG
BSPM3600WYG
BSPM3240DLG
BSPM3480DLG



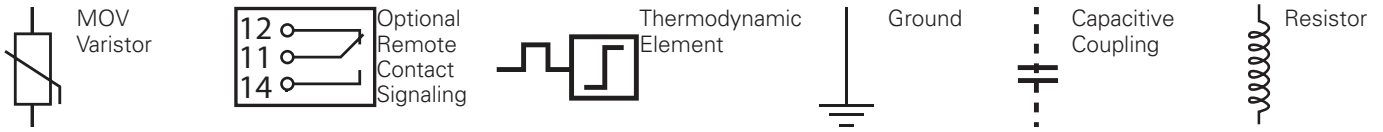
Fig. D†

BSPM4208WYNG
BSPM4480WYNG
SPM4600WYNG
BSPM4240HLG
BSPM4480HLG

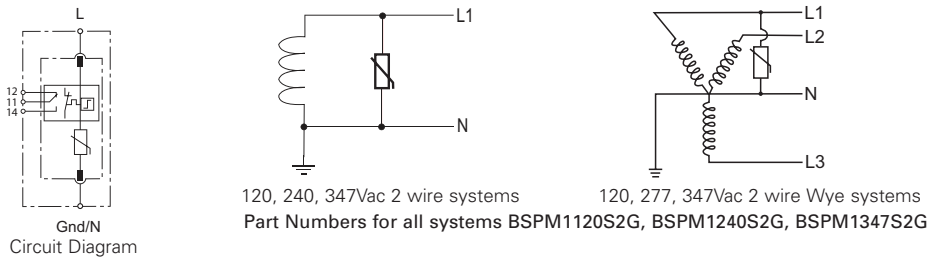
† For remote signaling contact, add "R" suffix to the part number. E.g., BSPM1347S2GR

Selecting black label high SCCR BSP UL SPDs by circuit diagrams, wiring configurations and voltages

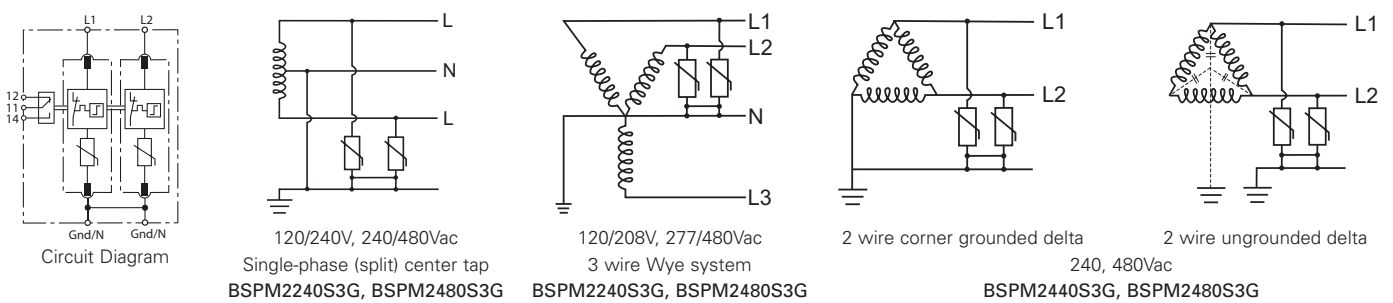
Legend



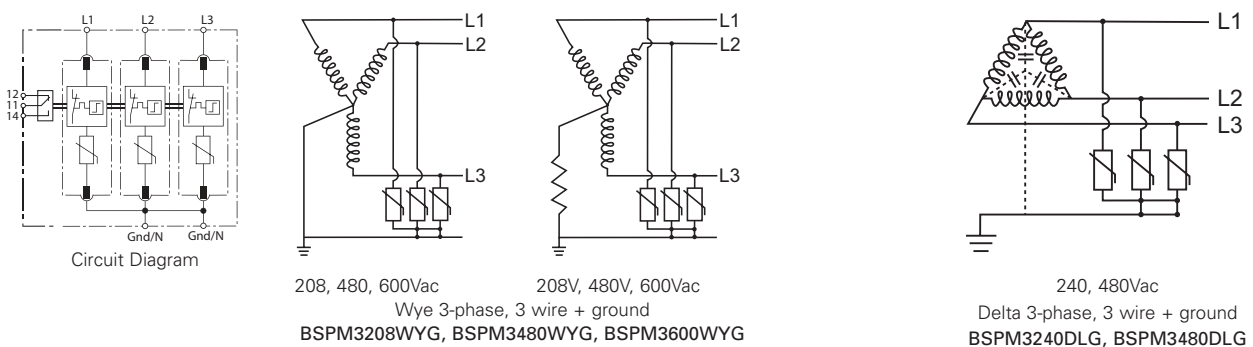
1-Pole (2 wire) and single-phase two (2) connection points



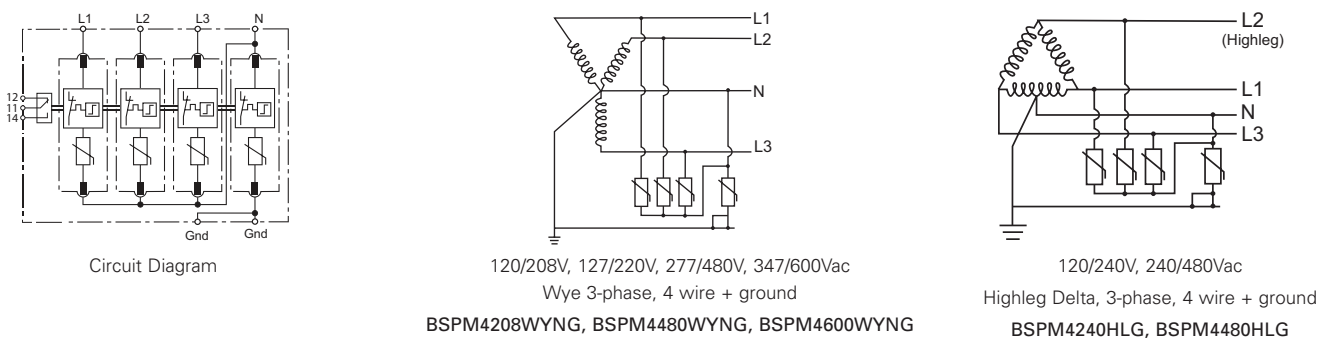
2-Pole (2 wire / 3 wire) three (3) connection points



3-Pole (3 wire) 3-phase four (4) connection points



4-Pole (4 wire) 3-phase five (5) connection points



Single-pole UL SCCR rated BSP for 120, 240 and 347Vac single-phase 2 wire systems

Description

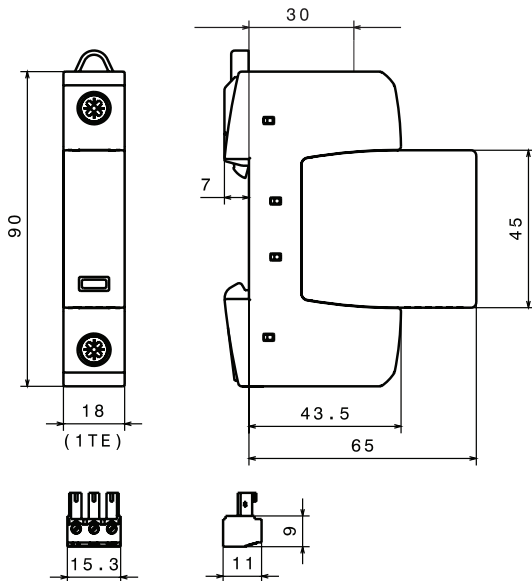
The Bussmann single-pole UL modular surge arresters for 120, 240 and 347Vac single-phase systems feature local, *easyID*[™] visual indication and optional remote contact signaling. The unique module locking system fixes the protection module to the base part. Modules can be easily replaced without tools by simply depressing the release buttons. Integrated mechanical coding between the base and protection module ensures against installing an incorrect replacement module.

- Surge arrester according to UL 1449 3rd Edition for Type 2 applications helps meet UL 508A requirements
- Heavy-duty zinc oxide varistors for high discharge capacity
- "Thermodynamic Control" SPD monitoring device ensures high reliability against surge events
- Module locking system with module release button makes module replacement easy without tools
- Up to 200kA Short-Circuit Current Rating (SCCR) makes higher assembly SCCR ratings possible
- Optional remote signaling of all protection modules makes status monitoring easy and accurate in any monitoring scheme
- Vibration and shock tested according to EN 60068-2 to withstand harsh environments

Optional remote signaling Form C contact

The remote signaling contact versions have a floating changeover contact for use as a break or make contact for easy adoption in any monitoring application.

Dimensions - mm



Shown with optional remote contact signaling



BSPM1120S2G
BSPM1240S2G
BSPM1347S2G

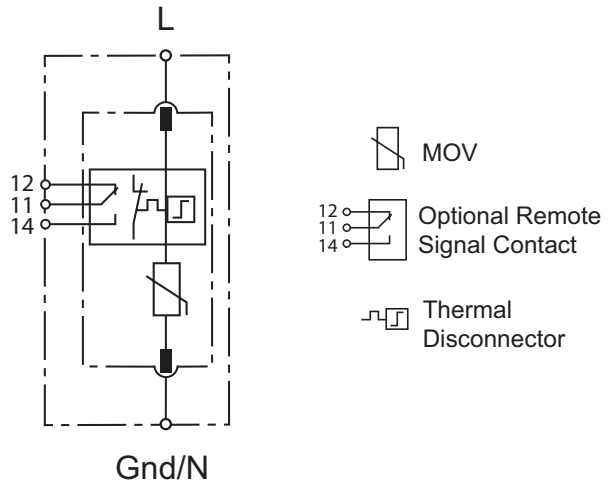


Available with optional remote signal Form C contact



easyID[™]
Standard visual status indication

Circuit diagram



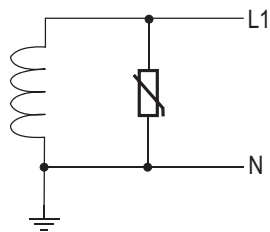
BSPM1120S2G, BSPM1240S2G, BSPM1347S2G*

Shown with optional remote contact signaling

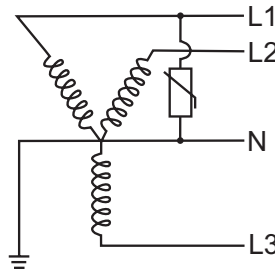
* For remote signaling Form C contact, add "R" suffix to the part number.
E.g., BSPM1347S2GR

Ordering information				
Nominal system voltage	120Vac	240 and 277Vac	347Vac	
Maximum Continuous Operating AC Voltage (MCOV) [V _c]	275Vac	385Vac	600Vac	
Catalog numbers:	Without remote signaling	BSPM1120S2G	BSPM1240S2G	BSPM1347S2G
	With remote signaling	BSPM1120S2GR	BSPM1240S2GR	BSPM1347S2GR
Replacement module	MOV technology	BPM275UL	BPM385UL	BPM600UL
Specifications				
Rated voltage	120-127Vac	240-277Vac	347Vac	
Voltage Protection Rating VPR	1kV	1.5kV	2kV	
Short-circuit Current Rating (SCCR)	200kA	200kA	125kA	
Nominal discharge current (I _n)		20kA		
Surge current capacity (I _{max})		40kA		
Response time (t _A)		≤25ns		
Frequency		50/60Hz		
Number of poles		1		
Number of wires/connection points		2 wires / 2 connection points		
Operating temperature range		-40°C to +80°C		
Operating state/fault indication		Green (good) / Red (replace)		
Cross-sectional area (minimum)		14AWG - Cu stranded, solid or fine		
Cross-sectional area (maximum)		2AWG - Cu solid or stranded / 4AWG - Cu fine		
Terminal torque		45 lb-in		
Mounting		35mm DIN-Rail per EN 60715		
Enclosure material		Thermoplastic, UL 94V0		
Degree of protection		IP20 (finger-safe)		
Location category		Indoor		
Capacity		1 module, DIN 43880		
Application		UL Type 4 for Type 2 applications		
Agency information		cURus, CSA, RoHS compliant		
Standard		UL 1449, 3 rd Edition		
Warranty		Five years*		
Remote contact signaling				
Remote contact signaling type		Changeover contact		
AC switching capacity (volts/amps)		250V/0.5A		
DC switching capacity (volts/amps)		250V/0.1A; 125V/0.2A; 75V/0.5A		
Conductor ratings and cross-sectional area for remote contact signal terminals		60/75°C Maximum 14AWG solid/stranded		
Ordering information		Order from catalog numbers above		

*See Bussmann SPD Limited Warranty Statement (3A1502) for details at www.cooperbussmann.com/surge.



120, 240, 347Vac 2 wire systems



120, 277, 347Vac 2 wire Wye systems

Part numbers for all systems: BSPM1120S2G, BSPM1240S2G, BSPM1347S2G

See document 3A1636 for black label single-pole UL SCCR rated BSPM installation instructions.

Two-Pole UL SCCR rated BSP for 120/240, 120/208, 127/254, 240, 240/480, 277/480 and 480Vac single-phase and three-phase 2 wire / 3 wire systems

Description

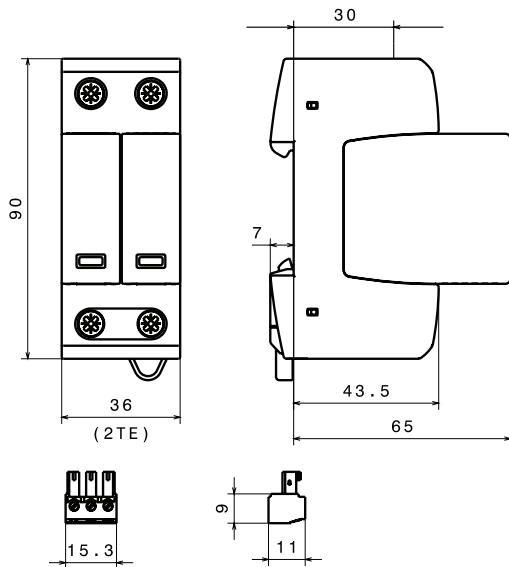
The Bussmann 2-pole UL modular surge arresters for 120/240, 120/208, 127/254, 240, 240/480, 277/480 and 480Vac (split-phase) systems feature local, easyID™ visual indication and optional remote contact signaling. The unique module locking system fixes the protection module to the base part. Modules can be easily replaced without tools by simply depressing the release buttons. Integrated mechanical coding between the base and protection module ensures against installing an incorrect replacement module.

- Surge arrester according to UL 1449 3rd Edition for Type 2 applications helps meet UL 508A requirements
- Heavy-duty zinc oxide varistors for high discharge capacity
- "Thermodynamic Control" SPD monitoring device ensures high reliability against surge events
- Module locking system with module release button make module replacement easy without tools
- Up to 200kA Short-Circuit Current Rating (SCCR) make higher assembly SCCR ratings possible
- Optional remote signaling of all protection modules make status monitoring easy and accurate in any monitoring scheme
- Vibration and shock tested according to EN 60068-2 to withstand harsh environments

Optional remote signaling Form C contact

The remote signaling contact versions have a floating changeover contact for use as a break or make contact for easy adoption in any monitoring application.

Dimensions - mm



Shown with optional remote contact signaling



**BSPM2240S3G
BSPM2480S3G**

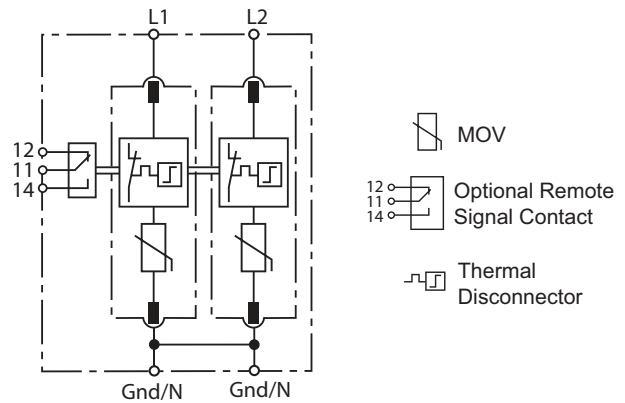


Available with optional remote signal Form C contact



easyID™
Standard visual status indication

Circuit diagram



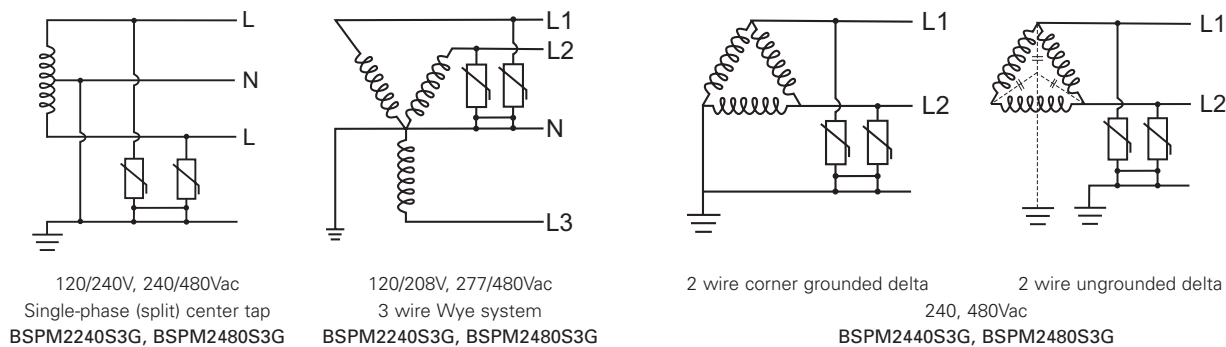
BSPM2240S3G, BSPM2480S3G*

Shown with optional remote contact signaling

* For remote signaling Form C contact, add "R" suffix to the part number.
E.g., BSPM2480S3GR

Ordering information			
Nominal system voltage		120/240, 240Vac	240/480Vac
Maximum Continuous Operating Voltage MCOV [L-G/L-L]		275/550Vac	385/770Vac
Catalog numbers:	Without remote signaling	BSPM2240S3G	BSPM2480S3G
	With remote signaling	BSPM2240S3GR	BSPM2480S3GR
Replacement module	MOV technology	BPM275UL	BPM385UL
Specifications			
Rated voltage		120-127Vac, 240-254Vac, 240Vac	240-480Vac, 480Vac
Voltage Protection Rating VPR [L-G/L-L]		1kV/1.8kV	1.5kV/2.5kV
Short-Circuit Current Rating (SCCR)		200kA	
Nominal discharge current (I_n)		20kA	
Surge current capacity (I_{max})		40kA	
Response time (t_A)		≤25ns	
Frequency		50/60Hz	
Number of poles		2	
Number of wires/connection points		2 wires or 3 wires / 3 connection points	
Operating temperature range		-40°C to +80°C	
Operating state/fault indication		Green (good) / Red (replace)	
Cross-sectional area (minimum)		14AWG - Cu stranded, solid or fine	
Cross-sectional area (maximum)		2AWG - Cu solid or stranded, 4AWG - Cu fine	
Terminal torque		45 lb-In	
Mounting		35mm DIN-Rail per EN 60715	
Enclosure material		Thermoplastic, UL 94V0	
Degree of protection		IP20 (finger-safe)	
Location category		Indoor	
Capacity		2 modules, DIN 43880	
Application		UL Type 4 for Type 2 applications	
Agency information		cURus, CSA, RoHS compliant	
Standard		UL 1449, 3 rd Edition	
Product warranty		Five years*	
Remote contact signaling			
Remote contact signaling type		Changeover contact	
AC switching capacity (volts/amperes)		250V/0.5A	
DC switching capacity (volts/amperes)		250V/0.1A; 125V/0.2A; 75V/0.5A	
Conductor ratings and cross-sectional area for remote contact signal terminals		60/75°C Maximum 14AWG solid/stranded	
Ordering Information		Order from catalog numbers above	

*See Bussmann SPD Limited Warranty Statement (3A1502) for details at www.cooperbussmann.com/Surge.



See document 3A1637 for black label two-pole UL SCCR rated BSPM installation instructions.

Three-pole UL SCCR rated BSP for 240 and 480Vac three-phase 3 wire delta, 208, 480 and 600Vac three-phase 3 wire Wye and 240, 480Vac impedance grounded systems

Description

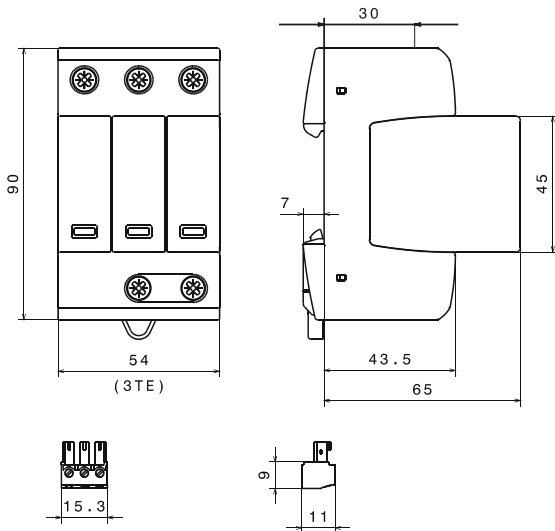
The Bussmann 3-pole UL modular surge arresters for 240 and 480 3-phase Delta, and 120/208, 277/480 and 347/600Vac 3-phase Wye systems feature local, *easyID™* visual indication and optional remote contact signaling. The unique module locking system fixes the protection module to the base part. Modules can be easily replaced without tools by simply depressing the release buttons. Integrated mechanical coding between the base and protection module ensures against installing an incorrect replacement module.

- Surge arrester according to UL 1449 3rd Edition for Type 2 applications helps meet UL 508A requirements
- Heavy-duty zinc oxide varistors for high discharge capacity
- "Thermodynamic Control" SPD monitoring device ensures high reliability against surge events
- Module locking system with module release button make module replacement easy without tools
- Up to 200kA Short-Circuit Current Rating (SCCR) make higher assembly SCCR ratings possible
- Optional remote signaling of all protection modules make status monitoring easy and accurate in any monitoring scheme
- Vibration and shock tested according to EN 60068-2 to withstand harsh environments

Optional remote signaling Form C contact

The remote signaling contact versions have a floating changeover contact for use as a break or make contact for easy adoption in any monitoring application.

Dimensions - mm



Shown with optional remote contact signaling



- BSPM3208WYG**
- BSPM3480WYG**
- BSPM3600WYG**
- BSPM3240DLG**
- BSPM3480DLG**

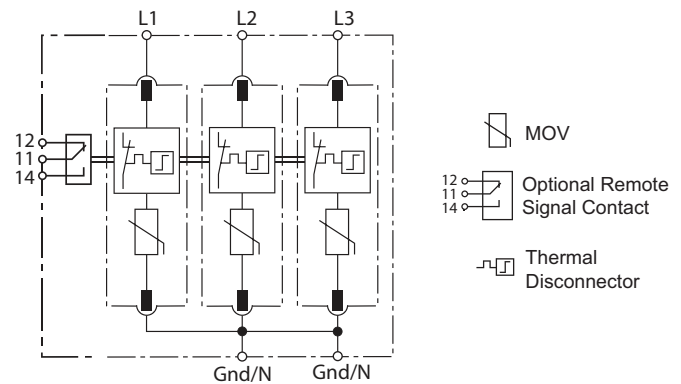


Available with optional remote signal Form C contact



easyID™
Standard visual status indication

Circuit diagram



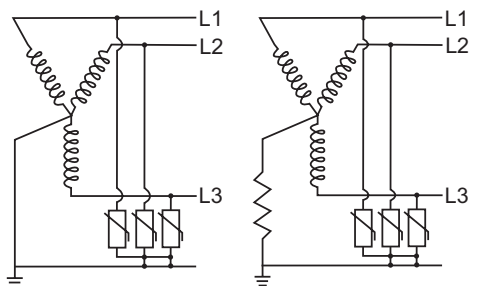
**BSPM3208WYG, BSPM3480WYG, BSPM3600WYG,
BSPM3240DLG, BSPM3480DLG***

Shown with optional remote contact signaling

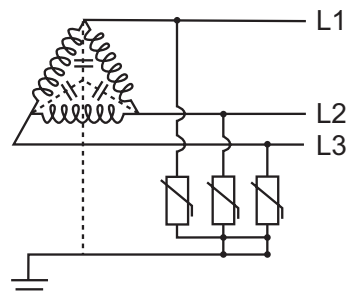
* For remote signaling Form C contact, add "R" suffix to the part number.
E.g., BSPM3208WYGR

Ordering information						
Nominal system voltage		120/208Vac	240Vac	277/480Vac	480Vac	347/600Vac
Max. Continuous Operating AC Voltage MCOV [L-G/L-L]		275/550Vac	275/550Vac	385/770Vac	600/1200Vac	600/1200Vac
Catalog numbers:	Without remote signaling	BSPM3208WYG	BSPM3240DLG	BSPM3480WYG	BSPM3480DLG	BSPM3600WYG
	With remote signaling	BSPM3208WYGR	BSPM3240DLGR	BSPM3480WYGR	BSPM3480DLGR	BSPM3600WYGR
Replacement module	MOV technology	BPM275UL	BPM275UL	BPM385UL	BPM600UL	BPM600UL
Specifications						
Rated Voltage		120-127Vac, 208-220Vac	240Vac	277/480Vac	480Vac	347/600Vac
Voltage Protection Rating VPR [L-G/L-L]		1kV/1.8kV	1kV/1.8kV	1.5kV/2.5kV	2kV/4kV	2kV/4kV
Short-Circuit Current Rating (SCCR)		200kA	200kA	200kA	125kA	125kA
Nominal discharge current (I_n)		20kA				
Surge current capacity (I_{max})		40kA				
Response time (t_A)		≤25ns				
Frequency		50/60Hz				
Number of poles		3				
Number of wires/connection points		3 wires / 4 connection points				
Operating temperature range		-40°C to +80°C				
Operating state/fault indication		Green (good) / Red (replace)				
Cross-sectional area (minimum)		14AWG - Cu stranded, solid or fine				
Cross-sectional area (maximum)		2AWG - Cu solid or stranded, 4AWG - Cu fine				
Terminal torque		45 lb-in				
Mounting		35mm DIN-Rail per EN 60715				
Enclosure material		Thermoplastic, UL 94V0				
Degree of protection		IP20 (finger-safe)				
Location category		Indoor				
Capacity		3 modules, DIN 43880				
Application		UL Type 4 for Type 2 applications				
Agency information		cURus, CSA, RoHS compliant				
Standard		UL 1449, 3 rd Edition				
Warranty		Five years*				
Remote Contact Signaling						
Remote contact signaling type		Changeover contact				
AC switching capacity (volts/amps)		250V/0.5A				
DC switching capacity (volts/amps)		250V/0.1A; 125V/0.2A; 75V/0.5A				
Conductor ratings and cross-sectional area for remote contact signal terminals		60/75°C maximum 14AWG solid/stranded				
Ordering information		Order from catalog numbers above				

*See Bussmann SPD Limited Warranty Statement (3A1502) for details at www.cooperbussmann.com/Surge.



208, 480, 600Vac 208V, 480V, 600Vac
Wye 3-phase, 3 wire + ground
BSPM3208WYG, BSPM3480WYG, BSPM3600WYG



240, 480Vac
Delta 3-phase, 3 wire + ground
BSPM3240DLG, BSPM3480DLG

See document 3A1638 for black label three-pole UL SCCR rated BSPM installation instructions.

Four-pole UL SCCR rated BSP for 120/240, 240/480Vac three-phase 4 wire Highleg Delta and 120/208, 127/220, 277/480 and 347/600Vac three-phase 4 wire Wye systems

Description

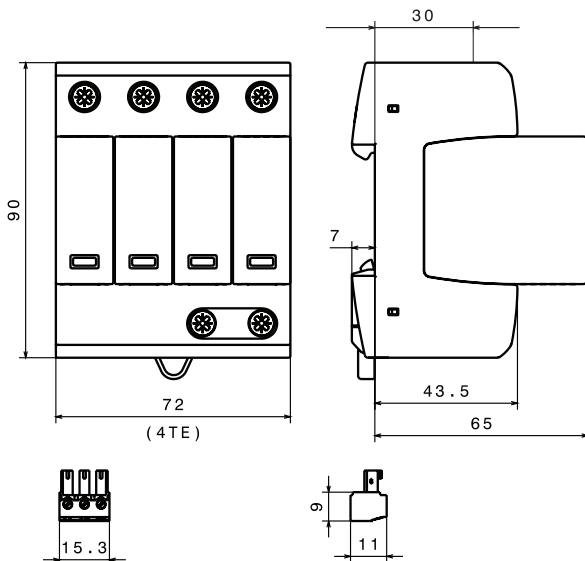
The Bussmann 4-pole UL modular surge arresters for 120/240, 240/480Vac 3-phase Highleg Delta and 120/208, 127/220, 277/480 and 347/600Vac 3-phase 4 wire Wye systems feature local, *easyID*[™] visual indication and optional remote contact signaling. The unique module locking system fixes the protection module to the base part. Modules can be easily replaced without tools by simply depressing the release buttons. Integrated mechanical coding between the base and protection module ensures against installing an incorrect replacement module.

- Surge arrester according to UL 1449 3rd Edition for Type 2 applications helps meet UL 508A requirements
- Heavy-duty zinc oxide varistors for high discharge capacity
- "Thermodynamic Control" SPD monitoring device ensures high reliability against surge events
- Module locking system with module release button make module replacement easy without tools
- Up to 200kA Short-Circuit Current Rating (SCCR) make higher assembly SCCR ratings possible
- Optional remote signaling of all protection modules make status monitoring easy and accurate in any monitoring scheme
- Vibration and shock tested according to EN 60068-2 to withstand harsh environments

Optional remote signaling Form C contact

The remote signaling contact versions have a floating changeover contact for use as a break or make contact for easy adoption in any monitoring application.

Dimensions - mm



Shown with optional remote contact signaling



- BSPM3208WYG**
- BSPM3480WYG**
- BSPM3600WYG**
- BSPM3240DLG**
- BSPM3480DLG**

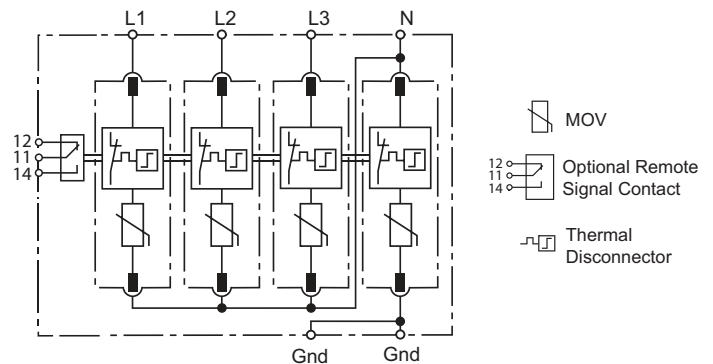


Available with optional remote signal Form C contact



easyID[™]
Standard visual status indication

Circuit diagram



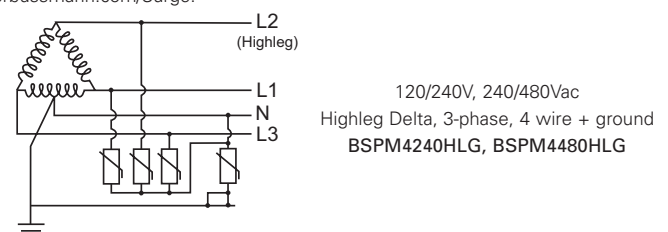
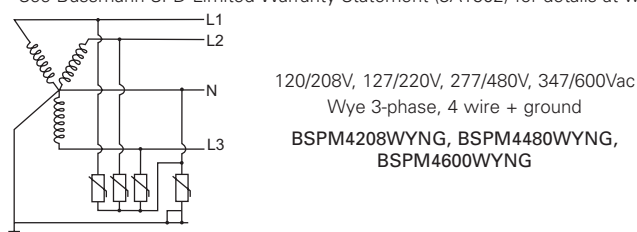
BSPM4208WYNG, BSPM4480WYNG, BSPM4600WYNG, BSPM4240HLG, BSPM4480HLG*

Shown with optional remote contact signaling

* For remote signaling Form C contact, add "R" suffix to the part number.
E.g., BSPM4208WYNGR

Ordering information							
Nominal system voltage		120/208Vac, 127/220Vac	120/240Vac	240/480Vac	277/480Vac	347/600Vac	
Max. Continuous Operating AC Voltage MCOV	[L-N]/[L-G]	275/550Vac	275/550Vac	385/770Vac	385/660Vac	600/875Vac	
	[N-G]/[L-L]	275/550Vac	275/550Vac	385/770Vac	275/770Vac	275/1200Vac	
	[H-N]/[H-G]	—	275/550Vac	600/985Vac	—	—	
	[H-L]	—	550Vac	985Vac	—	—	
Catalog numbers	Without remote signaling	BSPM4208WYNG	BSPM4240HLG	BSPM4480HLG	BSPM4480WYNG	BSPM4600WYNG	
	With remote signaling	BSPM4208WYNGR	BSPM4240HLGR	BSPM4480HLGR	BSPM4480WYNGR	BSPM4600WYNGR	
Replacement modules MOV technology four (4) total required	Module positions	L1 or L3	BPM275UL	BPM275UL	BPM385UL	BPM385UL	BPM600UL
		L2	BPM275UL	BPM275UL	BPM600UL	BPM385UL	BPM600UL
		N	BPM275UL	BPM275UL	BPM385UL	BPM275UL	BPM275UL
Specifications							
Rated Voltage		120/208Vac, 127/220Vac	120/240Vac	240/480Vac	277/480Vac	347/600Vac	
Voltage Protection Rating VPR	[L-N/L-G]	1kV/1.8kV	1kV/1.8kV	1.5kV/2.5kV	1.5kV/2.5kV	2kV/3kV	
	[N-G/L-L]	1kV/1.8kV	1kV/1.8kV	1.5kV/2.5kV	1kV/2.5kV	1kV/4kV	
	[H-N/H-G]	—	1kV/1.8kV	2kV/3kV	—	—	
	[H-L]	—	1.8kV	3kV	—	—	
Short-Circuit Current Rating (SCCR)		200kA	200kA	125kA	200kA	125kA	
Nominal discharge current (I_n)		20kA					
Surge current capacity (I_{max})		40kA					
Response time (t_A)		≤25ns					
Frequency		50/60Hz					
Number of poles		4					
Number of wires/connection points		4 wires / 5 connection points					
Operating temperature range		-40°C to +80°C					
Operating state/fault indication		Green (good) / Red (replace)					
Cross-sectional area (minimum)		14AWG - Cu stranded, solid or fine					
Cross-sectional area (maximum)		2AWG - Cu solid or stranded, 4AWG - Cu fine					
Terminal torque		45 lb-in					
Mounting		35mm DIN-Rail per EN 60715					
Enclosure material		Thermoplastic, UL 94V0					
Degree of protection		IP20 (finger-safe)					
Location category		Indoor					
Capacity		4 modules, DIN 43880					
Application		UL Type 4 for Type 2 applications					
Agency information		cURus, CSA, RoHS compliant					
Standard		UL 1449, 3 rd Edition					
Warranty		Five years*					
Remote contact signaling							
Remote contact signaling type		Changeover contact					
AC switching capacity (volts/amps)		250V/0.5A					
DC switching capacity (volts/amps)		250V/0.1A; 125V/0.2A; 75V/0.5A					
Conductor ratings and cross-sectional area for remote contact signal terminals		60/75°C Maximum 14AWG solid/stranded					
Ordering information		Order from catalog numbers above					

*See Bussmann SPD Limited Warranty Statement (3A1502) for details at www.cooperbussmann.com/Surge.



See document 3A1639 for black label four-pole UL SCCR rated BSPM installation instructions.

Blue label non-SCCR power and control BSP AC/DC Type 4 surge protective devices

Efficient and reliable protection for UL 508A AC/DC control and power applications:

- Type 4 component assembly for use in Type 2 (power) and Type 3 (control) applications
- Modular DIN-Rail design with color-coding and rejection feature makes it easy to identify, install and maintain
- Combination of spark-gap and heavy-duty zinc oxide varistors provide high surge discharge capacity
- *easyID*[™] Visual indication and optional remote contact signaling make status monitoring simple
- Optional remote signaling of all protection modules make status monitoring easy and accurate in any monitoring scheme
- Vibration and shock resistant according to EN 60068-2 standards for reliability in harsh environments
- Easily coordinated with other Bussmann DIN-Rail surge protective devices
- Ideal for telecom and UL 508A low voltage applications

The need for surge protection

Today's world is full of electronic products and devices that are susceptible to damage from overvoltage surges.

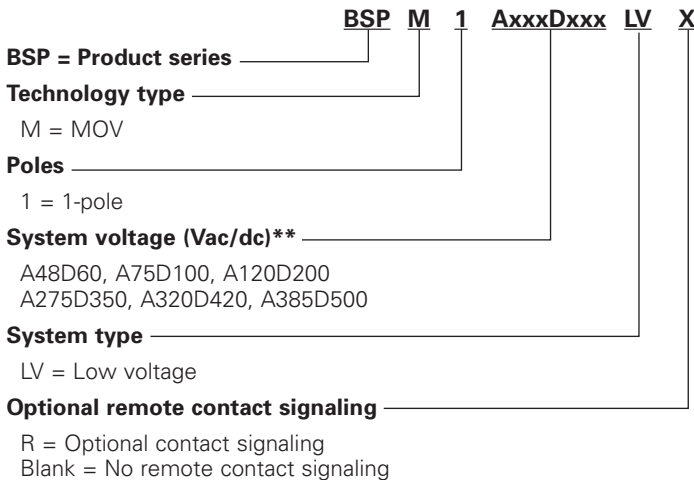
Whether the cause is static discharge or lightning, overvoltage surges can quickly destroy industrial, commercial and consumer electronics.

Surge protection products from Bussmann help provide power quality that's free from damaging surges.

Safe and simple

- IP20 Finger-safe construction and suppressor rejection feature make it easy to know the suppressor system is installed and properly operating to protect your low voltage control system investment
- Simply specify the system voltage, circuit configuration and whether optional remote contact signaling is desired

1-pole, Type 4 power SPD catalog number explanation*

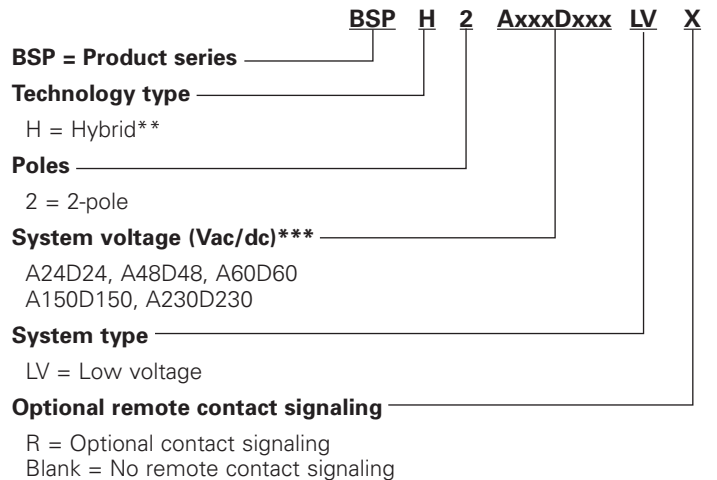


* This is not a catalog number system for configuring and ordering an SPD for a particular application. It is an explanation of the available blue label low voltage power DIN-Rail SPD catalog numbers.

** See specific catalog numbers for exact combinations of AC and DC ratings.



2-pole, Type 4 control SPD catalog number explanation*



* This is not a catalog number system for configuring and ordering an SPD for a particular application. It is an explanation of the available blue label low voltage control DIN-Rail SPD catalog numbers.

** Hybrid technology is a combination of one or more technologies in one module such as an MOV with a Gas Discharge Tube (GDT).

*** See specific catalog numbers for exact combinations of AC and DC ratings.

Blue label BSP non-SCCR AC/DC control and power series specification overview

Family designation	Technology	Poles	System type	AC/DC voltage	Remote contact signaling
BSP	M = MOV	1 = 2 Wire	Type 4 component assembly for use in Type 2 applications	48Vac/60Vdc	Blank = no remote R = with remote
				75Vac/100Vdc	
				120Vac/200Vdc	
				275Vac/350Vdc	
				320Vac/420Vdc	
				385Vac/500Vdc	
				440Vac/585Vdc	
BSP	H = Hybrid*	2 = 4 Wire	Type 4 component assembly for use in Type 3 applications	24Vac/24Vdc	Blank = no remote R = with remote
				48Vac/48Vdc	
				60Vac/60Vdc	
				120Vac/120Vdc	
				230Vac/230Vdc	

*Hybrid technology is a combination of one or more technologies in one module such as an MOV with a Gas Discharge Tube (GDT).

UL Type 4 Recognized SPD for Type 2 and Type 3 assemblies (for remote contact signaling, add "R" suffix to the part number)

Part number	Description	Replacement module	UL Type	Poles	Vac	Vdc	I _n (kA)	I _{max} (kA)	KEMA	CSA	cURus	Figure
BSPM1A48D60LV	48Vac / 60Vdc MOV DIN LV SPD	BPMA48D60LV	4	1	48	60	10	25	N	N	N	A
BSPM1A75D100LV	75Vac / 100Vdc MOV DIN LV SPD	BPMA75D100LV	4	1	75	100	10	40	Y	Y	Y	A
BSPM1A150D200LV	150Vac / 200Vdc MOV DIN LV SPD	BPMA150D200LV	4	1	120	200	15	40	Y	Y	Y	A
BSPM1A275D350LV	275Vac / 350Vdc MOV DIN LV SPD	BPMA275D350LV	4	1	275	350	20	40	Y	Y	Y	A
BSPM1A320D420LV	320Vac / 420Vdc MOV DIN LV SPD	BPMA320D420LV	4	1	320	420	20	40	Y	Y	Y	A
BSPM1A385D500LV	385Vac / 500Vdc MOV DIN LV SPD	BPMA385D500LV	4	1	385	500	20	40	Y	Y	Y	A
BSPM1A440D585LV	440Vac / 585Vdc MOV DIN LV SPD	BPMA440D585LV	4	1	440	585	20	40	Y	Y	Y	A
BSPM1A600D600LV	600Vac / 600Vdc MOV DIN LV SPD	BPMA600D600LV	4	1	600	600	15	30	Y	Y	Y	A
BSPH2A24D24LV	24V Hybrid DIN LV SPD	BPHA24D24LV	4	2	24	24	1	2	Y	Y	Y	B
BSPH2A48D48LV	48V Hybrid DIN LV SPD	BPHA48D48LV	4	2	48	48	1	2	Y	Y	Y	B
BSPH2A60D60LV	60V Hybrid DIN LV SPD	BPHA60D60LV	4	2	60	60	2	4	Y	Y	Y	B
BSPH2A150D150LV	150V Hybrid DIN LV SPD	BPHA150D150LV	4	2	120	120	2	4	Y	Y	Y	B
BSPH2A230D230LV	230V Hybrid DIN LV SPD	BPHA230D230LV	4	2	230	230	3	5	Y	Y	Y	B



Fig. A†

One-pole Type 4 component assembly power voltage SPD for Type 2 applications

BSPM1A48D60LV, BSPM1A75D100LV
BSPM1A150D200LV, BSPM1A275D350LV
BSPM1A320D420LV, BSPM1A385D500LV
BSPM1A440D585LV, BSPM1A600D600LV



Fig. B†

Two-pole Type 4 component assembly control voltage SPD for Type 3 applications

BSPH2A24D24LV, BSPH2A48D48LV
BSPH2A60D60LV, BSPH2A150D150LV
BSPH2A230D230LV

† For remote signaling contact, add "R" suffix to the part number. E.g., BSPM1A48D60LV**R**

Blue label one-pole UL non SCCR Type 4 power BSP low voltage SPDs for 48Vac/60Vdc, 75Vac/100Vdc, 120Vac/200Vdc 275Vac/350Vdc, 320Vac/420Vdc, 385Vac/500Vdc, 440Vac/585Vdc and 600Vac/dc systems

Description

The Bussmann UL non SCCR Type 4 48Vac/60Vdc, 75Vac/100Vdc, 120Vac/200Vdc, 275Vac/350Vdc, 320Vac/420Vdc, 385Vac/500Vdc, 440Vac/585Vdc and 600Vac/dc single pole modular surge arresters feature local *easyID*™ visual indication and optional remote contact signaling. The unique module locking system fixes the protection module to the base. Modules can be easily replaced without tools by simply depressing the release buttons. Integrated mechanical coding between the base and protection module ensures against installing an incorrect replacement module.

Low voltage power arresters

The features of these single-pole devices are for use as a single device or in combination with other devices for AC and DC voltage systems.

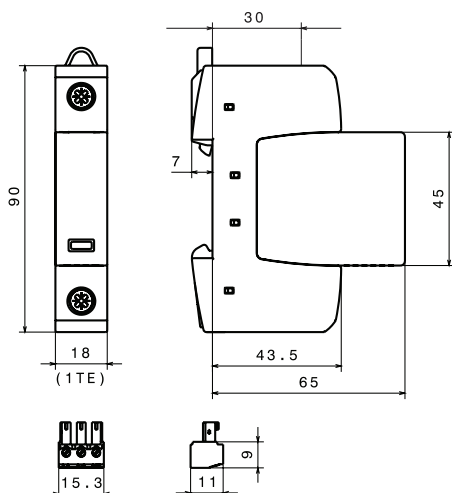
- Surge arrester according to UL 1449 3rd Edition Type 4 component assembly for use in Type 2 applications helps meet UL 508A requirements*
- Proven MOV technology for reliable surge protection
- "Thermodynamic Control" SPD monitoring device ensures high reliability against surge events
- Module locking system with module release button make module replacement easy without tools
- Optional remote signaling of all modules make status monitoring easy and accurate in any monitoring scheme
- Vibration and shock tested according to EN 60068-2 to withstand harsh environments

Optional remote signaling Form C contact

The remote signaling contact versions have a floating changeover contact for use as a break or make contact for easy adoption in any monitoring application.

* Except as noted in data sheets.

Dimensions - mm



Shown with optional remote contact signaling



- BSPM1A48D60LV***
- BSPM1A75D100LV**
- BSPM1A150D200LV**
- BSPM1A275D350LV**
- BSPM1A320D420LV**
- BSPM1A385D500LV**
- BSPM1A440D585LV**
- BSPM1A600D600LV**

* No KEMA, UL or CSA agency information.

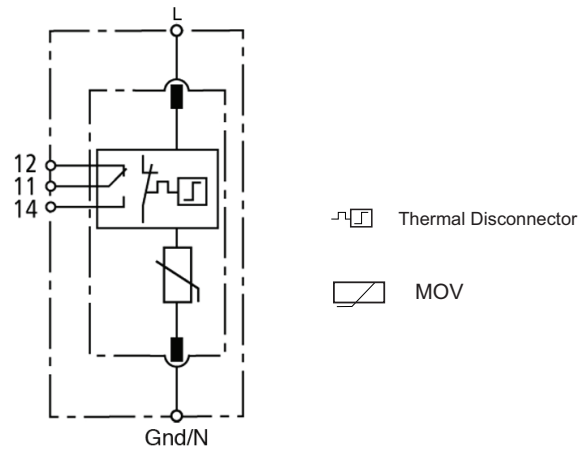


Available with optional remote signal Form C contact



easyID™
Standard visual status indication

Circuit diagram



- BSPMA48D60LV, BSPMA75D100LV, BSPMA150D200LV, BSPM1A275D350LV, BSPM1A320D420LV, BSPM1A385D500LV, BSPM1A440D585LV, BSPM1A600D600LV***

Shown with optional remote contact signaling

* For remote signaling contact, add "R" suffix to the part number.
E.g., BSPMA150D200LVR

Ordering information — for 48Vac/60Vdc to 275Vac/350Vdc					
System voltage		48Vac/60Vdc	75Vac/100Vdc	120Vac/200Vdc	275Vac/350Vdc
Catalog numbers (base + modules)	W/O remote signaling	BSPM1A48D60LV	BSPM1A75D100LV	BSPM1A150D200LV	BSPM1A275D350LV
	With remote signaling	BSPM1A48D60LVR	BSPM1A75D100LVR	BSPM1A150D200LVR	BSPM1A275D350LVR
Replacement Modules		BPMA48D60LV	BPMA75D100LV	BPMA150D200LV	BPMA275D350LV
Specifications					
Max. continuous operating AC voltage [V _c]		48Vac	75Vac	150Vac	275Vac
Voltage protection level [VPL]		≤0.33kV	≤0.4kV	≤0.7kV	≤1.5kV
Voltage protection level at 5kA [VPL]		≤0.25kV	≤0.35kV	≤0.55kV	≤1kV
Max. continuous operating DC voltage [V _c]		60Vdc	100Vdc	200Vdc	350Vdc
Nominal discharge current (8/20μs) [I _n] AC		7.5kA	10kA	15kA	20kA
Nominal discharge current (8/20μs) [I _n] DC		7.5kA	10kA	12.5kA	12.5kA
Surge current capacity(8/20μs) [I _{max}]		25kA	40kA	40kA	40kA
Temporary overvoltage (TOV)		70V / 5 sec.	90V / 5 sec.	175V / 5 sec.	335V / 5 sec
Agency information*		—	UL / cUL, CSA, KEMA	UL / cUL, CSA, KEMA	UL / cUL, CSA, KEMA

Ordering information — for 320Vac/420Vdc to 600Vac/dc					
System voltage		320Vac/420Vdc	385Vac/500Vdc	440Vac/585Vdc	600Vac/600Vdc
Catalog numbers: (base + modules)	W/O remote signaling	BSPM1A320D420LV	BSPM1A385D500LV	BSPM1A440D585LV	BSPM1A600D600LV
	With remote signaling	BSPM1A320D420LVR	BSPM1A385D500LVR	BSPM1A440D585LVR	BSPM1A600D600LVR
Replacement modules		BPMA320D420LV	BPMA385D500LV	BPMA440D585LV	BPMA600D600LV
Specifications					
Max. continuous operating AC voltage [V _c]		320Vac	385Vac	440Vac	600Vac
Max. continuous operating DC voltage [V _c]		420Vdc	500Vdc	585Vdc	600Vdc
Voltage protection level [VPL]		≤1.5kV	≤1.75kV	≤2kV	≤2.5kV
Voltage protection level at 5kA [VPL]		≤1.2kV	≤1.35kV	≤1.7kV	≤2kV
Nominal discharge current (8/20μs) [I _n] AC		20kA	20kA	20kA	15kA
Nominal discharge current (8/20μs) [I _n] DC		12.5kA	5kA	5kA	5kA
Surge current capacity(8/20μs) [I _{max}]		40kA	40kA	40kA	30kA
Temporary overvoltage (TOV)		335V / 5 sec.	385V / 5 sec.	580V / 5 sec.	600V / 5 sec.
Agency information*		UL / cUL, CSA, KEMA	UL / cUL, CSA, KEMA	UL / cUL, CSA, KEMA	UL / cUL, CSA, KEMA

Specifications — all catalog numbers	
SPD according to EN 61643-11	Type 2
SPD according to IEC 61643-1	Class II
Response time [t _A]	≤25ns
TOV characteristics	Withstand
Operating temperature range [T _U]	-40°C to +80°C
Operating state/fault indication	Green (good) / Red (replace)
Number of ports	1
Cross-sectional area (minimum)	14AWG solid/stranded
Cross-sectional area (maximum)	1AWG solid — 2AWG stranded
Mounting	35mm DIN-Rail per EN 60715
Enclosure material	Thermoplastic, UL 94V0
Location category	Indoor
Degree of protection	IP20
Capacity	1 module, DIN 43880
Warranty	Five Years**
Remote contact signaling	
Remote contact signaling type	Changeover contact
AC switching capacity (volts/amps)	250V/0.5A
DC switching capacity (volts/amps)	250V/0.1A; 125V/0.2A; 75V/0.5A
Conductor ratings / cross-sectional area for remote contact signal terminals	60/75°C Max. 14AWG solid/stranded
Ordering information	Order from catalog numbers above

* Agency information not applicable to DC ratings.

** See Bussmann SPD Limited Warranty Statement (3A1502) for details at www.cooperbussmann.com/Surge.

See document 3A1502 for blue label one-pole low voltage power non-SCCR rated BSPM installation instructions.

Blue label two-pole UL non SCCR Type 4 control BSP low voltage SPDs for 24Vac/dc to 230Vac/dc systems

Description

The Bussmann UL Type 4 24Vac/dc, 48Vac/dc, 60Vac/dc, 120Vac/dc and 230Vac/dc, two-pole, modular surge arresters feature local, *easyID*™ visual indication and optional remote contact signaling. The unique module locking system fixes the protection module to the base part. Modules can be easily replaced without tools by simply depressing the release buttons. Integrated mechanical coding between the base and protection module ensures against installing an incorrect replacement module.

LV Control System Arresters

The features of these two-pole devices are for use in coordination with other upstream SPDs in UL 508A applications*.

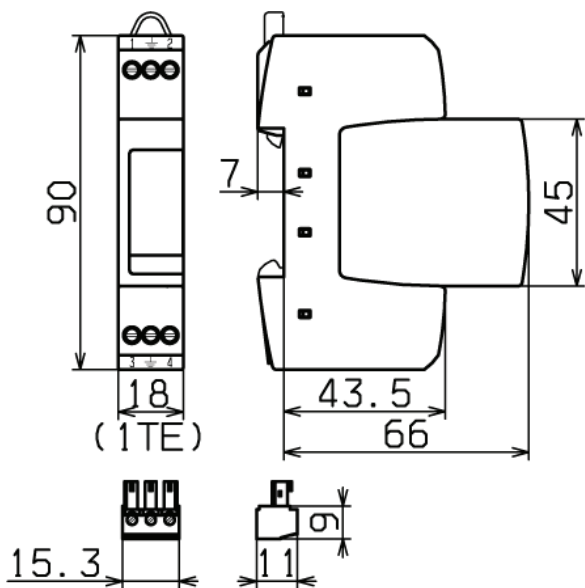
- Surge arrester according to UL 1449 3rd Edition Type 4 component assembly for Type 3 applications helps meet UL 508A requirements
- Proven MOV and GDT hybrid technology for reliable surge protection
- “Thermodynamic Control” SPD monitoring device ensures high reliability against surge events
- Module locking system with module release button make module replacement easy without tools
- Optional remote signaling of all modules make status monitoring easy and accurate in any monitoring scheme
- Vibration and shock tested according to EN 60068-2 to withstand harsh environments

Optional remote signaling Form C contact

The remote signaling contact versions have a floating changeover contact for use as a break or make contact for easy adoption in any monitoring application.

* Except as noted in data sheets.

Dimensions - mm



Shown with optional remote contact signaling



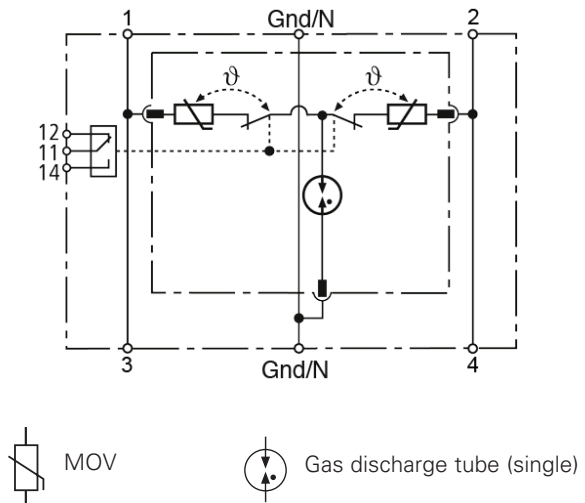
- BSPH2A24D24LV
- BSPH2A48D48LV
- BSPH2A60D60LV
- BSPH2A150D150LV
- BSPH2A230D230LV



Available with optional remote signal Form C contact



Circuit diagram



**BSPH2A24D24LV, BSPH2A48D48LV, BSPH2A60D60LV,
BSPH2A150D150LV, BSPH2A230D230LV***

Shown with optional remote contact signaling

* For remote signaling contact, add "R" suffix to the part number.
E.g., BSPH2A230D230LVR

Ordering information						
System Voltage		24Vac/dc	48Vac/dc	60Vac/dc	120Vac/dc	230Vac/dc
Max. continuous operating AC voltage (MCOV) [V _c]		30Vac/dc	60Vac/dc	75Vac/dc	150Vac/dc	255Vac/dc
Catalog numbers (base + modules)	W/O remote signaling	BSPH2A24D24LV	BSPH2A48D48LV	BSPH2A60D60LV	BSPH2A150D150LV	BSPH2A230D230LV
	With remote signaling	BSPH2A24D24LVR	BSPH2A48D48LVR	BSPH2A60D60LVR	BSPH2A150D150LVR	BSPH2A230D230LVR
Replacement Modules		BPHA24D24LV	BPHA48D48LV	BPHA60D60LV	BPHA150D150LV	BPHA230D230LV
Specifications						
Nominal AC voltage [V _n]		24V	48V	60V	120V	230V
Max. continuous operating AC voltage [V _c]		30V	60V	75V	150V	255V
Max. continuous operating DC voltage [V _c]		30V	60V	75V	150V	255V
Nominal discharge current (8/20μs) [I _n]		1kA	1kA	2kA	2kA	3kA
Total discharge current (8/20μs) [L+N-Gnd] [I _{total}]		2kA	2kA	4kA	4kA	5kA
Nominal load current AC [I _l]		25A	25A	25A	25A	25A
Combined impulse [U _{oc}]		2kV	2kV	4kV	4kV	6kV
Combined impulse [L+N-Gnd] [U _{oc} total]		4kV	4kV	8kV	8kV	10kV
Voltage protection level [L-N] [VPL]		≤180V	≤350V	≤400V	≤640V	≤1250V
Voltage protection level [L/N-Gnd] [VPL]		≤630V	≤730V	≤730V	≤800V	≤1500V
Temporary overvoltage (TOV) [L-N]		—	—	—	—	335V / 5 sec.
Temporary overvoltage (TOV) [L/N-Gnd]		—	—	—	—	400V / 5 sec.
Temporary overvoltage (TOV) [L+N-Gnd]		—	—	—	—	1200V + V ₀ / 20
TOV characteristics [L-N]		—	—	—	—	Withstand
TOV characteristics [L/N-Gnd]		—	—	—	—	Withstand
TOV characteristics [L+N-Gnd]		—	—	—	—	Failure
SPD according to EN 61643-11						Type 3
SPD according to IEC 61643-1						Class III
Response time [L-N] [t _A]						≤25ns
Response time [L/N-Gnd] [t _A]						≤100ns
Operating temperature range [T _U]						-40°C to +80°C
Operating state/fault indication						Green (good) / Red (replace)
Number of ports						1
Cross-sectional area (min.)						18AWG solid/stranded
Cross-sectional area (max.)						10AWG solid/12AWG stranded
For mounting on						35mm DIN-Rail per EN 60715
Enclosure material						Thermoplastic, UL 94V0
Location category						Indoor
Degree of protection						IP20
Capacity						1 Module, DIN 43880
Agency information*						UL / cUL, CSA, KEMA
Product warranty						Five years**
Remote contact signaling						
Remote contact signaling type						Changeover contact
AC switching capacity (volts/amps)						250V/0.5A
DC switching capacity (volts/amps)						250V/0.1A; 125V/0.2A; 75V/0.5A
Conductor ratings and cross-sectional area for remote contact signal terminals						60/75°C Max. 14AWG solid/stranded
Ordering information						Order from catalog numbers above

* Agency information not applicable to DC ratings.

** See Bussmann SPD Limited Warranty Statement (3A1502) for details at www.cooperbussmann.com/Surge.

See document 3A1565 for blue label two-pole low voltage control non-SCCR rated BSPH installation instructions.

UL Listed surge protective devices for telecom and instrumentation data signal applications

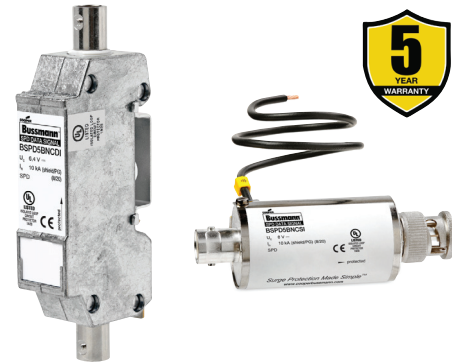
- UL 497B Listed to protect equipment and wiring against the effects of excessive currents caused by lightning
- BNC coax cable, RJ45 / Ethernet data cable and universal 4 wire versions available for popular data signal applications
- DIN-Rail mount makes installation easy
- Universal 4 wire SPD is easy to apply in most instrumentation applications up to 180V
- Data signal SPDs complement BSPD and SurgePOD HEAVY DUTY Type 1, and DIN-Rail UL SCCR and non SCCR low voltage surge product lines for comprehensive system surge protection
- Five year warranty on all data signal SPDs



Universal 4 wire data signal SPDs for measurement, control and regulation circuits, and twisted pairs

Universal 4 wire, DIN-Rail mounted surge arresters provide effective protection with a minimum footprint and are designed for stringent requirements on the availability of measurement, control and regulation circuits, and bus systems.

- Function-optimized design for safe use and easy installation
- Module removal without signal interruption via “make-before-break” circuitry
- 0-180V BSPD0180DINL automatically adjusts to system operating voltage and can protect data circuits of different voltages to a maximum 100mA load current



BNC connector SPDs for coaxial video and data cables

BNC Cable surge protective devices for coaxial cable-connected systems. The BSPD5BNCDD features direct (V_{CD}) shield connection while the BSPD5BNCDI features indirect shield connection (V_{CID}) to prevent leakage pickups.

- Plug-in surge protective devices with BNC sockets for easy retrofitting
- BSPD5BNCDD and BSPD5BNCDI mount on supplied rail terminal lug or standard 35mm DIN-Rail
- Inline BSPD5BNCSI plugs into terminal equipment to provide surge protection



RJ45 connector SPD for Ethernet data cables

The DIN-Rail mount BSPD48RJ45 SPD for Ethernet cable systems is easy to install between the patch panel and the active component in new, or retrofitting into existing installations. It is well suited for Gigabit Ethernet, ATM, ISDN, Voice over IP and Power over Ethernet (PoE).

- CAT 6 according to ISO/IEC 11801 and in the channel (Class E)
- Power over Ethernet (PoE+ according to IEEE 802.3at) up to 57 volts

Specifications

Value	Data signal SPD type		
	Universal 4 wire	BNC coaxial cable	RJ45 Ethernet
Terminals/connectors	Screws	BNC	RJ45
System voltages	0-180V	5V	48V
MCOV DC	6-180V	6.4-8V	48V
Grounding	DIN-Rail	DIN-Rail/conductor	DIN-Rail
Protection	IP20	IP20	IP20
Operating temperature range	-40°C to +80°C	-40°C to +80°C	-40°C to +80°C
Housing material	Polyamide PA 6.6	Die cast zinc	Die cast zinc
Agency information	UL Listed 497B	UL Listed 497B	UL Listed 497B
RoHS compliant	Yes	Yes	Yes

UL Listed 497B DIN-Rail mount universal surge protective devices for measuring and control signal circuits, bus systems and twisted pair data cables

Description

The Bussmann universal 4 wire, DIN-Rail mounted surge arresters provide effective protection with a minimum footprint and are designed for stringent requirements on the availability of measuring and control circuits, bus systems and twisted pair data cables.

To ensure safe operation, the arresters provide protection against vibration and shock up to a 30-fold acceleration of gravity. The function-optimized design of the devices allows quick and easy removal of protection modules via "make-before-break" terminals that assure continuity of data signals in the protected and unprotected state.

For IEC applications - instruction for surge protective device use in Zone 2 explosive atmospheres per ATEX

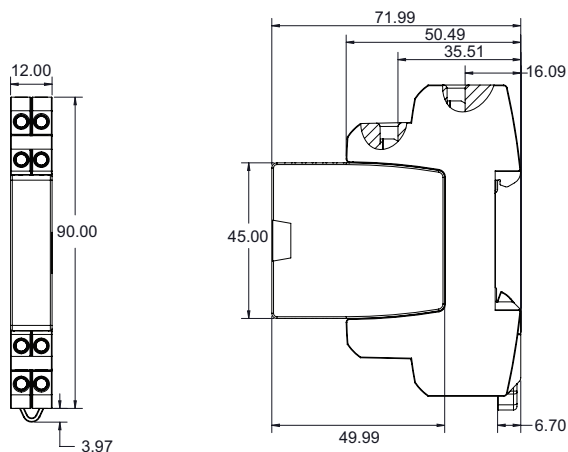
1. When installed in potentially explosive atmospheres, the Data Signal DIN Series shall be installed into an enclosure which meets the requirements of a recognized type of protection, in accordance with EN 60079-0.
2. The Data Signal DIN Series as transient suppressor. This approval applies to the following equipment types:

BSPD5DING, BSPD12DING, BSPD24DING, BSPD48DING, BSPD5DINLHF, BSPD24DINLHF

Ambient and temperature class

- 40°C to +80°C, T4: DEKRA 12ATEX0254 X: II 3 G Ex nA IIC T4 Gc
- Standards used for: ATEX: EN60079-0: 2009, EN 60079-15: 2005
- UL 497B Listed
- Function-optimized design for safe use and easy installation
- 4 wire base mounts on grounded 35mm DIN-Rail
- Module removal without signal interruption via "make-before-break" circuitry
- 0-180V BSPD0180DINL automatically adjusts to system operating voltage and can protect data circuits of different voltages up to 100mA load current.

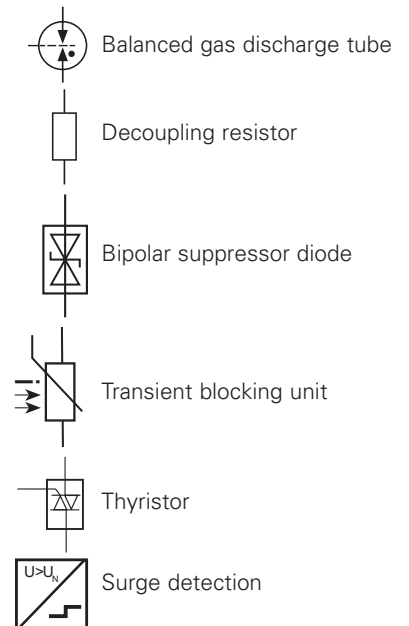
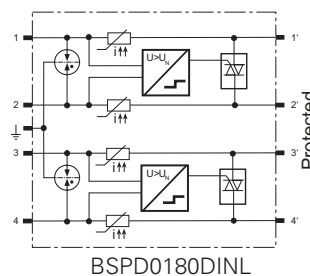
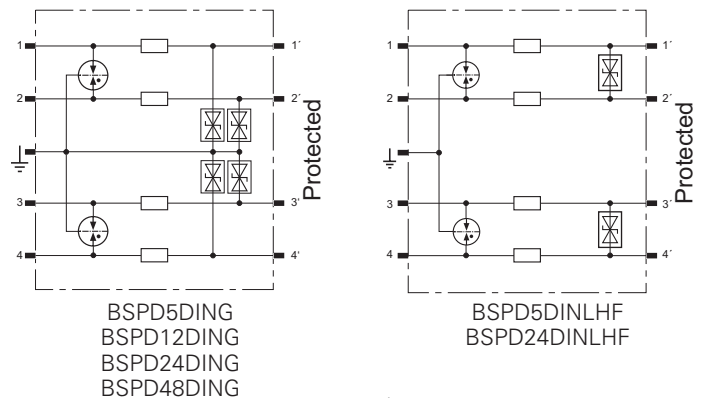
Dimensions-mm



- BSPD5DING
- BSPD12DING
- BSPD24DING
- BSPD48DING
- BSPD5DINLHF
- BSPD24DINLHF
- BSPD0180DINL



Circuit diagrams



Technical data

Catalog number (Prefix BSPD...)	5DING	12DING	24DING	48DING	5DINLHF	24DINLHF	0180DINL
Nominal voltage (U_N)	5V	12V	24V	48V	5V	24V	0-180V
Max. continuous operating DC voltage (U_C)	6V	15V	33V	54V	6V	33V	180V
Max. continuous operating AC voltage (U_C)	4.2V	10.6V	23.3V	38.1V	4.2V	23.3V	127V
Nominal current at 45°C (I_N)	1.0A	0.75A	0.75A	0.75A	1.0A	1.0A	≤0.1A@80°C
VPL line-line for I_{imp} D1 (U_p)	≤29V	≤50V	≤102V	≤160V	≤25V	≤65V	≤ $U_N + 53V$
VPL line-PG for I_{imp} D1 (U_p)	≤27V	≤37V	≤66V	≤95V	≤550V	≤550V	—
VPL line-line at 1kV/μs C3 (U_p)	≤18V	≤38V	≤90V	≤140V	≤11V	≤47V	see Note 1
VPL line-PG at 1kV/μs C3 (U_p)	≤9V	≤19V	≤45V	≤70V	≤550V	≤550V	-
VPL line-line for I_n C2 (U_p)	—	—	—	—	—	—	see Note 2
VPL line-PG for C2 / C3 / D1	—	—	—	—	—	—	≤550V
D1 Total lightning impulse current (10/350μs) (I_{imp})	10kA	10kA	10kA	10kA	10kA	10kA	10kA
D1 Lightning impulse current (10/350μs) per line (I_{imp})	2.5kA	2.5kA	2.5kA	2.5kA	2.5kA	2.5kA	2.5kA
C2 Total nominal discharge current (8/20μs) (I_n)	20kA	20kA	20kA	20kA	20kA	20kA	20kA
C2 Nominal discharge current (8/20μs) per line (I_n)	10kA	10kA	10kA	10kA	10kA	10kA	10kA
Series impedance per line	1.0Ω	1.8Ω	1.8Ω	1.8Ω	1.0Ω	1.0Ω	10Ω/7.5Ω typ
Frequency of the operating voltage (f_{U_N})	-	-	-	-	-	-	0-400Hz
Permissible superimposed signal voltage (U_{Signal})	—	—	—	—	—	—	± 5V
"Nominal current at 80°C (I_N) (corresponds to max. short-circuit current)"	—	—	—	—	—	—	100mA
Cut-off frequency line-PG (f_G)	1.0MHz	2.7MHz	6.8MHz	8.7MHz	100MHz	100MHz	—
Cut-off frequency line-line (U_{Signal} , balanced 100Ω) (f_G)	—	—	—	—	—	—	50MHz
Capacitance line-line (C)	≤2.7nF	≤1.0nF	≤0.5nF	≤0.35nF	≤25pF	≤25pF	≤80pF
Capacitance line-PG (C)	≤5.4nF	≤2.0nF	≤1.0nF	≤0.7nF	≤16pF	≤16pF	≤16pF
ATEX approvals	†	†	†	†	†	†	—
Agency information	††	††	††	††	††	††	‡
IEC 61643-21 test category	D1, C2, C3						
Operating temperature range	-40°C to +80°C						
Degree of protection	IP20						
For mounting on	35mm DIN-Rails per EN 60715						
Grounding	Via base part						
Color / enclosure material	Grey / polyamide PA 6.6						
Test standards	IEC 61643-21 / EN 61643-21, UL 497B						
Connection (input / output)	Screw terminal						
Conductors	Solid			12-28AWG			
	Flexible			14-28AWG			
Terminal torque	3.5 Lb-In						
Warranty	Five years*						

* See Bussmann SPD Limited Warranty Statement (3A1502) for details at www.cooperbussmann.com/surge.

0-180V self-adjusting SPD application and mode of operation

The BSPD0180DINL surge protective device automatically adjusts to the operating voltage (from 0 to 180 volts) of the protected device.

When a surge occurs, the SPD voltage protection level adjusts itself based upon the output terminal operating voltage of the base.

Note 1 - See Diagram 1 - VPL line-line graph line C3.

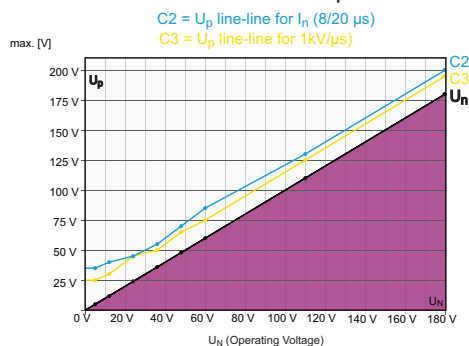
Note 2 - See Diagram 1 - VPL line-line graph line C2.

† DEKRA 12ATEX0254 X: II 3 G Ex nA IIC T4 Gc

†† ATEX, UL, CSA

‡ UL 497B

Diagram 1: voltage protection level U_p (V) (line-line)



For installation instructions, see document 3A1980 (5-48V) and 3A1981 (0-180V).

DIN-Rail universal 4 wire data signal SPDs and applications

Universal 4 wire data signal SPD products are specified by communication technology. The table below contains the specific SPD product, by part number, and the applications to which they are suited to be used.



Catalog numbers	BSPD5DING	BSPD12DING	BSPD24DING	BSPD48DING	BSPD5DINLHF	BSPD24DINLHF	BSPD0180DINL
Bus systems and measuring systems, and control technology							
0-20mA, 4-20mA Signals			X			X (4-20mA only)	X
Binary Signals	X	X	X	X			
CAN-Bus (data line only)					X		X
C-Bus (Honeywell)					X		X
Data Highway Plus							X
Device Net (data line only)					X		X
Dupline							X
E-Bus (Honeywell)							X
Fieldbus Foundation						X	X
FIPIO / FIPWAY						X	
FSK					X		X
IEC-Bus (RS485)					X		X
Interbus INLINE (I/O)							X
Interbus INLINE,					X		X
Long-distance bus							
K Bus						X	
LON - TP/XF 78					X		
LUXMATE Bus						X	X
M Bus							X
MODBUS					X		X
MPI Bus					X		X
Procontic CS31 (RS232)		X					
Procontic T200 (RS422)					X		X
PROFIBUS DP/FMS					X		X
PROFIBUS PA						X	X
PROFIBUS SIMATIC NET					X		X
PSM EG RS422 and RS485					X		X
Rackbus (RS485)					X		X
R Bus					X		X
RS485					X		X
RS422, V11					X		X
SafetyBUS p					X		X
Securilan LON Bus					X		
SIGMASYS				X			
SS97 SIN/X (RS 232)		X					
SUCONET					X		X
Resistance Temp. Measuring Ni1000, PT100, PT1000 Wire NTC and PTC Thermistors		X					
TTL		X					
TTY 4-20mA			X				

DIN-Rail universal 4 wire data signal SPDs and applications (continued)

Catalog numbers	BSPD5DING	BSPD12DING	BSPD24DING	BSPD48DING	BSPD5DINLHF	BSPD24DINLHF	BSPD0180DINL
Telecommunication, telephony							
a/b Wires							X
ADSL, ADSL 2+							X
ISDN S0, S2m/U2m, UKO/UPO							X
Modem M1		X					
SDSL, SHDSL						X	X
Telephony Systems (e.g., Siemens, HICOM, Alcatel)							X
T-DSL							X
Telecommunication Systems (e.g., Siemens, HICOM, Alcatel)							X
VDSL							X
Data networks							
V 24 (RS232 C)		X					

UL Listed 497B DIN-Rail mount BNC connector video and data signal surge protective devices for coaxial cable systems

Description

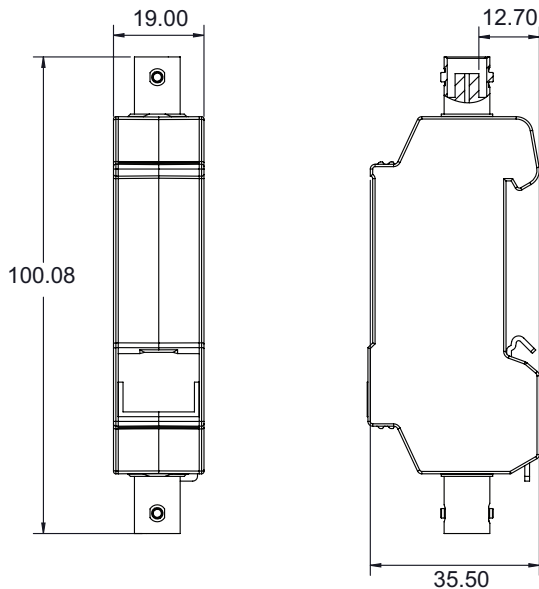
The Bussmann BSPD5BNCDD and BSPD5BNCDI two-stage DIN-Rail mounted surge arresters are for protecting coaxial cable-connected systems (such as video and camera systems) from potential damage. The BSPD5BNCDD features direct (VCD) shield connection while the BSPD5BNCDI features indirect shield connection (VCID) to prevent leakage pickups.

The BSPD5BNCDD and BSPD5BNCDI shielded surge arresters are mounted on the supplied bracket with cable lug or mounted on a rack mounted DIN-Rail with suitable grounding. BNC connector terminated data or video signal cables are plugged into surge arrester with the equipment plugged into the protected side.

Common applications include protecting outdoor video surveillance systems or video control centers or coaxial data lines. For BSPD5BNCDI, the cable shield is indirectly grounded via a gas discharge tube to avoid being influenced by leakage pickups.

- UL 497B Listed
- Plug-in surge protective device for easy retrofitting
- The space-saving surge arrester with BNC socket is mounted on supplied rail terminal lug or standard 35mm DIN-Rail
- Integrated direct or indirect shield grounding avoids leakage pickups
- Female BNC sockets for easy connection

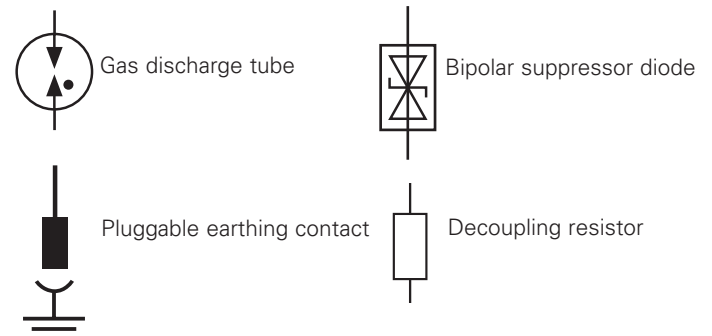
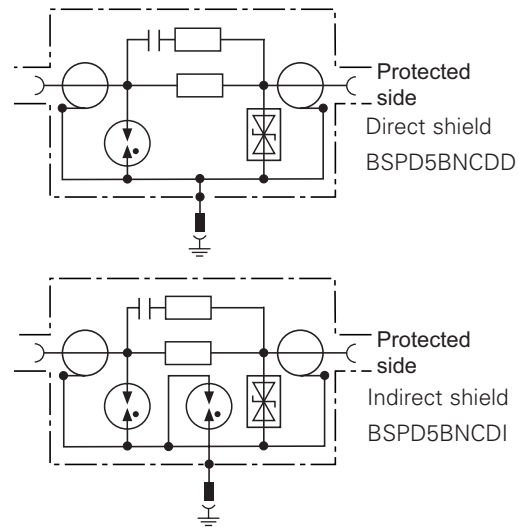
Dimensions-mm



BSPD5BNCDD
BSPD5BNCDI



Circuit diagrams



Technical data

Catalog number		BSPD5BNCDD		BSPD5BNCDI	
Nominal voltage (U_N)		5V			
Max. continuous operating DC voltage (U_C)		6.4V			
Nominal current (I_N)		0.1A			
C2 Nominal discharge current (8/20 μ s) shield-PG (I_n)		10kA			
C2 Nominal discharge current (8/20 μ s) line-shield (I_n)		5kA			
Voltage protection level line-shield for I_n C2 (U_p)		$\leq 35V$			
Voltage protection level line-shield at 1kV/ μ s C3 (U_p)		$\leq 13V$			
Frequency range		0-300MHz			
Capacitance shield-PG (C)		—		$\leq 20pF$	
Voltage protection level shield-PG for I_n C2 (U_p)		—		$\leq 650V$	
Voltage protection level shield-PG at 1kV/ μ s C3 (U_p)		—		$\leq 600V$	
Cable impedance (Z)		50 Ω	75 Ω	50 Ω	75 Ω
Insertion losses	$\leq 0.4dB$	160MHz	80MHz	160MHz	80MHz
	$\leq 3dB$	300MHz	300MHz	300MHz	300MHz
Return Losses	$\geq 10dB$	200MHz	100MHz	300MHz	100MHz
	$\geq 20dB$	130MHz	30MHz	130MHz	30MHz
Series impedance per line		4.7 Ω			
Capacitance line-shield (C)		$\leq 25pF$			
Operating temperature range		-40°C to +80°C			
Degree of protection		IP10			
Mounting		35mm DIN-Rail per EN 60715			
Connection (input / output)		BNC socket (female) / BNC socket (female)			
Grounding		Via 35mm DIN-Rail per EN 60715			
Enclosure material		Die cast zinc			
Color		Bare surface			
Test standards		IEC 61643-21 / EN 61643-21			
Agency information		UL 497B			
Warranty		Five years*			

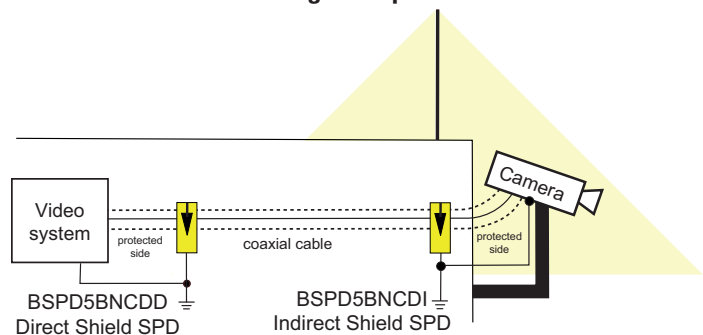
*See Bussmann SPD Limited Warranty Statement (3A1502) for details at www.cooperbussmann.com/Surge.



DIN-Rail BNC SPD applications

Catalog numbers	BSPD5BNCDD	BSPD5BNCDI
Bus systems and measuring systems, and control technology		
Control Net	X	X
Melsec Net 2	X	X
N1 LAN	X	X
Data networks		
Arcnet	X	X
Video systems		
Video (coax)	X	X

Direct vs. indirect shielding example



Apply the BSPD5BNCDD (direct shield) at the equipment location and apply the BSPD5BNCDI (indirect shield) near exterior protected equipment. The indirect shield grounding at the exterior device will help avoid picking up leakage currents that can degrade signal quality while providing surge protection when needed.

See document 3A1977 for DIN-Rail BNC coaxial cable SPD installation instructions.

UL Listed 497B In-line BNC connected surge protective device for coaxial video and data cable systems

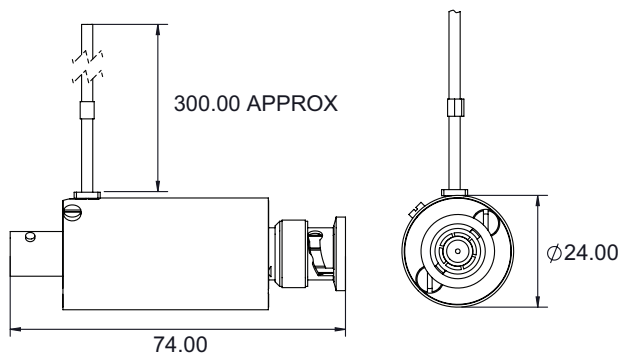
Description

The Bussmann BSPD5BNCSI two-stage in-line surge arrester is for protecting coaxial cable-connected systems (such as video and camera systems) from potential damage.

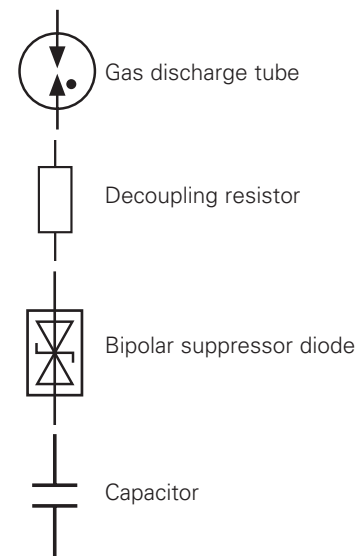
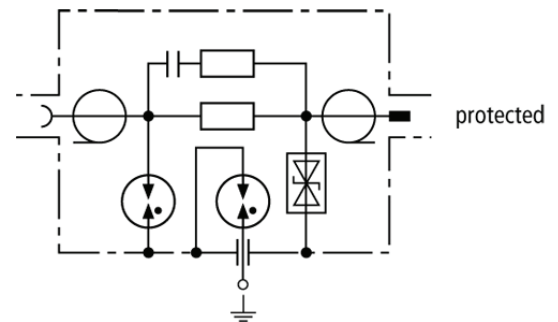
The BSPD5BNCSI shielded surge arrester is plugged into coaxial terminal equipment or connections. Common applications include protecting outdoor video surveillance systems or video control centers. The cable shield is indirectly grounded via a gas discharge tube to avoid being influenced by leakage pickups. The arrester input is used as a socket and the protected output as a plug.

- UL 497B Listed
- Plug-in surge protective device for easy retrofitting
- Directly plugs into terminal equipment with BNC coaxial connections
- Integrated indirect shield grounding avoids leakage pickups

Dimensions - mm



Circuit diagrams



Technical data

Catalog number	BSPD5BNCSI	
Nominal voltage (U_N)	5V	
Max. continuous operating DC voltage (U_C)	8V	
C2 Nominal discharge current (8/20 μ s) per line (I_n)	2.5kA	
C2 Nominal discharge current (8/20 μ s) shield-PG (I_n)	10kA	
Voltage protection level line-shield for I_n C2 (U_p)	$\leq 25V$	
Voltage protection level line-shield at 1kV/ μ s C3 (U_p)	$\leq 15V$	
Voltage protection level shield-PG at 1kV/ μ s C3 (U_p)	$\leq 600V$	
Cable impedance (Z)	50 Ω	75 Ω
Insertion loss at ≤ 3 db	300MHz	265MHz
Return loss at ≥ 20 db	40MHz	40MHz
Series impedance per line	10 Ω	
Capacitance line-shield (C)	≤ 50 pF	
Operating temperature range	-40°C to +80°C	
Connection (input / output)	BNC Socket (female) / BNC Plug (male)	
Grounding	Via outgoing earth conductor 18AWG	
Shield grounding	Indirectly via an integrated spark gap element	
Test standards	IEC 61643-21 / EN 61643-21	
Agency information	UL 497B	
Warranty	Five years*	

*See Bussmann SPD Limited Warranty Statement (3A1502) for details at www.cooperbussmann.com/Surge.



In-line BNC SPD applications

Catalog number	BSPD5BNCSI
Bus systems, and measuring and control technology	
Control Net	X
Melsec Net 2	X
Data networks	
Archnet	X
Video systems	
Video (coax)	X

See document 3A1978 for in-line BNC coaxial cable SPD installation instructions.

UL Listed 497B universal DIN-Rail mount RJ45 connector surge protective device for Ethernet data cable systems

Description

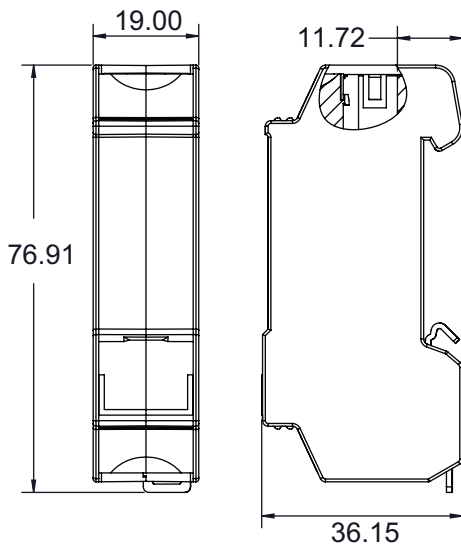
The Bussmann DIN-Rail mount BSPD48RJ45 Surge Protective Device (SPD) for Ethernet cable systems with RJ connectors is easy to install in new, or retrofitting into existing, installations.

The BSPD48RJ45 is installed between the patch panel and the active component (a switch for example). The snap-in mechanism of the supporting foot allows the SPD to be safely grounded via the DIN-Rail. For single applications, the BSPD48RJ45 comes with supplied mounting bracket with cable lug.

Fulfilling the requirements of Category 6, the BSPD48RJ45 can be universally used for all data services up to nominal voltages of 48V. It is well suited for existing services such as Gigabit Ethernet, ATM, ISDN, Voice over IP and Power over Ethernet (PoE+ according to IEEE 802.3at up to 57V) and similar applications in structured cabling systems according to Class E up to 250MHz. Protection of all pairs by means of powerful gas discharge tubes and one adapter filter matrix per pair.

- UL 497B Listed
- Easy to install or retrofit for protection of all lines
- CAT 6 according to ISO/IEC 11801
- CAT 6 in the channel (Class E)
- Power over Ethernet (PoE+ according to IEEE 802.3at)

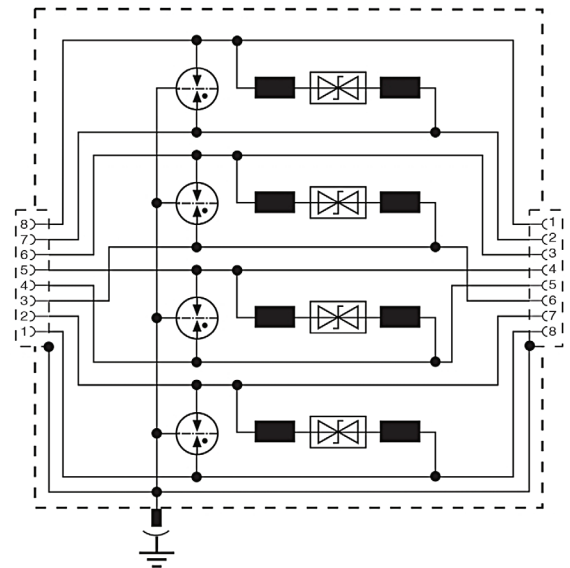
Dimensions -mm



BSPD48RJ45



Circuit diagrams



Balanced gas discharge tube



Bipolar suppressor diode



Pluggable earthing contact



Inductor

Technical data

Catalog number	BSPD48RJ45
Nominal voltage (U_N)	48V
Max. continuous operating DC voltage (U_c)	48V
Max. continuous operating AC voltage (U_c)	34V
Max. continuous DC voltage pair-pair (PoE) (U_c)	57V
Nominal current (I_n)	1A
C2 Nominal discharge current (8/20 μ s) line-line (I_n)	150A
C2 Nominal discharge current (8/20 μ s) line-PG (I_n)	2.5kA
C2 Total nominal discharge current (8/20 μ s) line-PG (I_n)	10kA
C2 Nominal discharge current (8/20 μ s) pair-pair (PoE) (I_n)	150A
Voltage protection level line-line for In C2 (U_p)	$\leq 190V$
Voltage protection level line-PG for In C2 (U_p)	$\leq 600V$
Voltage protection level line-line for In C2 (PoE) (U_p)	$\leq 600V$
Voltage protection level line-line at 1kV/ μ s C3 (U_p)	$\leq 180V$
Voltage protection level line-PG at 1kV/ μ s C3 (U_p)	$\leq 500V$
Voltage protection level pair-pair at 1kV/ μ s C3 (PoE) (U_p)	$\leq 600V$
Insertion loss at 250MHz	$\leq 3dB$
Capacitance line-line (C)	$\leq 30pF$
Capacitance line-PG (C)	$\leq 25pF$
Operating temperature range	-40°C to +80°C
Degree of protection	IP10
Mounting	35mm DIN-Rail per EN 60715
Connection (input / output)	RJ45 socket / RJ45 socket
Pinning	1 / 2, 3 / 6, 4 / 5, 7 / 8
Grounding	Via 35mm DIN-Rail per EN 60715
Enclosure material	Die cast zinc
Color	Bare surface
Test standards	IEC 61643-21 / EN 61643-21
Agency information	UL 497B
Warranty	Five years*

* See Bussmann SPD Limited Warranty Statement (3A1502) for details at www.cooperbussmann.com/Surge.



DIN-Rail RJ45 SPDs Applications

Catalog number	BSPD48RJ45
Bus systems, and measuring and control technology	
Industrial Ethernet	X
Data networks	
ATM	X
Ethernet 10/100/1000	X
FDDI, CDDI	X
Industrial Ethernet	X
Power over Ethernet (PoE)	X
Token Ring	X
VG any LAN	X
Video systems	
Video (2 wire)	X

See document 3A1979 for RJ45 connector SPD for Ethernet cable installation instructions.

Frequently Asked Questions (FAQs)

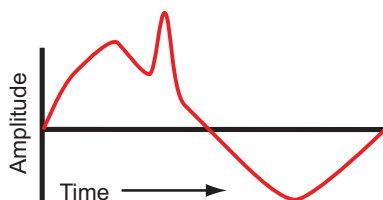
1. What are surges, transients and temporary overvoltages (TOVs)?

All these are various forms of voltage disturbances and they are often used interchangeably. The true definition of these terms is related to their defined duration.

Transients as defined by IEEE Standard 1313.1-1996 are “a short-duration highly damped, oscillatory or non-oscillatory overvoltage, having duration of a few milliseconds or less. Transient overvoltage is classified as one of the following types: lightning, switching and very fast front, short duration.” These can be generated by voltage spikes which contain very little energy but are sufficient in voltage to cause damage to sensitive electronics.

Surge is an overvoltage condition that usually lasts longer in duration, >10 μ s and <1Ms and has higher energy to them that can cause damage to electrical and electronic equipment.

Temporary Overvoltage (TOV) are created by faults on the utility power distribution system and can cause extensive damage since their time domain is much longer (ms to seconds to hours).



Surges & Transients

2. What is a surge protector?

A surge protector is a device that limits transient overvoltages to a safe level, thus protecting equipment it is connected to from damage. A surge protector is generally referred to as an SPD (Surge Protective Device). There are different variations of SPDs such as lightning arresters and surge arresters or secondary surge arresters.

3. What is the difference between terms “Surge Arrester,” “Surge Protective Devices (SPD)” and “Transient Voltage Surge Suppressor (TVSS)”?

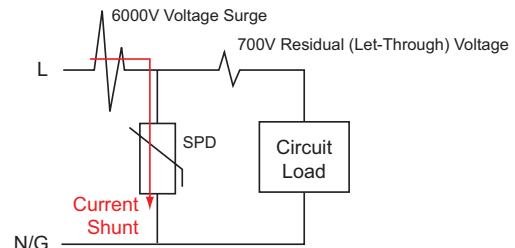
These terms are often used interchangeably and rather loosely. However, the two terms have different meanings as determined by the National Electrical Code® (NEC®) (www.nfpa.org), their UL listing, and applicable IEEE/ANSI standards.

According to NEC® 2011 Article 285 TVSSs have been redefined as “Surge Protective Devices (SPDs) 1kV or Less.” Previously titled “Transient Voltage Surge Suppressors: TVSSs,” this Article now uses the “type” designations that parallel the new requirements in UL 1449, 3rd Edition. It also includes general, installation, and connection requirements for these SPD types installed on premises wiring systems rated 1kV or less.

4. How does a SPD work?

A surge protector works by momentarily “switching” from a high impedance state into a highly conductive, low impedance state and shunting the surge energy to the ground and in doing so, limits the overvoltage to a lower, acceptable level. When the surge event is over, the protector returns to its high impedance state, ready for the next event or at end of life, fails open safely until replaced.

In other words, the SPD acts as a pressure relief valve. The pressure relief valve (SPD) does nothing until an overpressure (voltage surge) occurs in the supply (power) similar to the pressure relief valve.



5. What is Shunting?

Shunting is the term used to describe the process by which an SPD redirects voltage transient energy to ground through a low impedance path.

6. How do I select and specify an SPD?

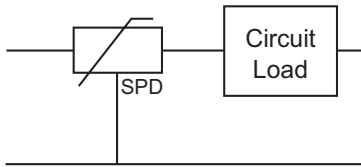
When it is determined an SPD is desired or required, specifying an SPD involves first knowing the installation location and whether you can use a Type 1, Type 2 or Type 3. Next, determine the system type (single-phase, split-phase, Wye or Delta). Last, determine the system voltage. Once all three of these are known, you can start the specification process by going to the appropriate product group and selecting the catalog number (SurgePOD HEAVY DUTY or PRO [Type 1 UL Listed], black label high SCCR DIN-Rail [Type 2 UL Recognized] or blue label low voltage power and control [Type 2 and Type 3 UL Recognized]) or configuring the BSPD (Type 1 or Type 2 UL Listed) that meets you location, system and voltage requirements. See page 5 for determining SPD location and suitable Type, and page 7 for SPD specifying.

7. Can anyone install an AC or DC SPD?

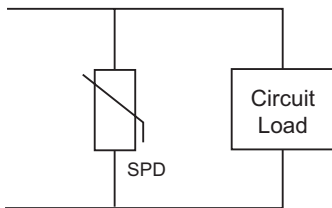
All SPDs, whether AC or DC, should be installed by qualified personnel following established safety procedures. This will help ensure that all the safety requirements and all local codes are met. The most common installation is in “parallel” to the load/device.

8. What are the differences between Series vs. Parallel SPDs?

Series installed SPD are typically used at the equipment level, either right in front of, or within the equipment they are protecting. These SPD have an “input” and an “output” whereas parallel SPD do not. A common example of a series connected SPD is a “surge strip.” Since they are connected in series with the equipment, they conduct load current. It is also common for a series AC SPD to contain a EMI/RFI noise filter. This filtering is useful when it is right in front of the equipment to filter out noise generated by other loads.



Parallel SPDs do not conduct load current and are commonly used where large surge energies exist. They're used on service entrance panels and switchgear, plus branch and local panels. Parallel connected protectors are essential for all commercial and industrial AC applications.



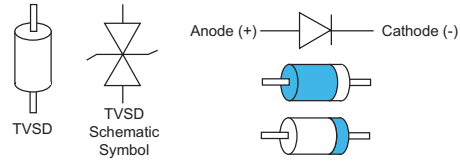
9. What is a DIN-Rail SPD with replaceable modules?

Replaceable module SPDs contain one or more field removable/replaceable modules. The replaceable modules make maintenance easy and minimize downtime. The modules are the heart of the surge protector and usually contain the metal oxide varistors (MOV) and thermal disconnect. In some instances external fusing is required and or used in place of thermal disconnect.

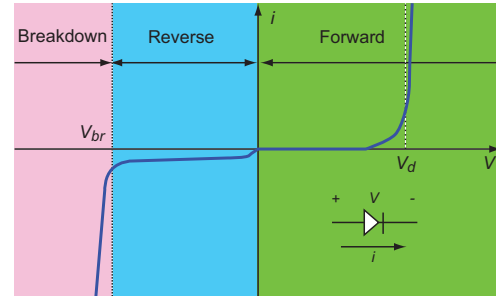


10. What Technologies are used in making an SPD?

Silicon Avalanche Diode (SAD) technology:



The diode is installed reverse-biased under normal conditions. When the voltage rises above normal conditions the diode becomes forward-biased.



Not to scale

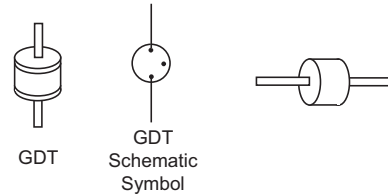
Advantages

- Excellent voltage clamping
- Sub-nanosecond response time
- Repeatable
- Low capacitance
- Compact

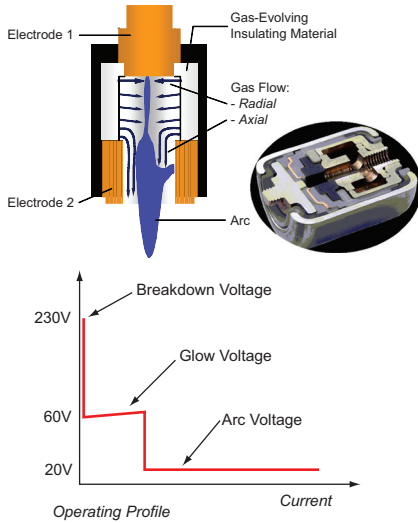
Disadvantages

- Limited impulse or current capability

Gas Discharge Tube (GDT):



The GDT may be regarded as a very fast acting switch having conducting properties that change very rapidly when breakdown occurs and transforms from an open-circuit to a quasi-short circuit. The result is an arc voltage of about 20Vdc. There are four stages of operation before the tube fully switches.



1. Non-operating domain: Characterized by practically infinite insulation resistance.
2. Glow domain: At the breakdown, the conductance increases suddenly. If the current is drained off by the gas discharge tube is less than about 0.5A (rough value that differs from component to component) , the glow voltage across the terminals will be in the 80-100V range.
3. Arc regime: As the current increases, the gas discharge tube shifts from glow voltage to the arc voltage (20V). It is this domain that the gas discharge tube is most effective because the current discharge can reach several thousand amps without the arc voltage across the terminals increasing.
4. Extinction: At a bias voltage roughly equal to the glow voltage, the gas discharge tube recovers to its initial insulating properties.

Advantages:

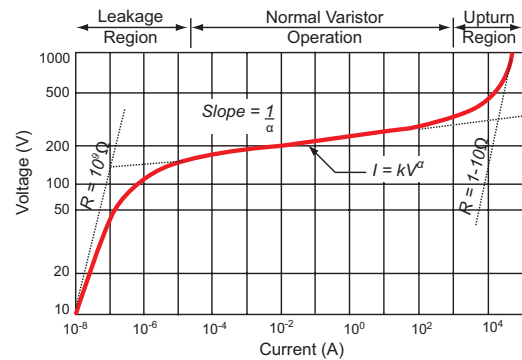
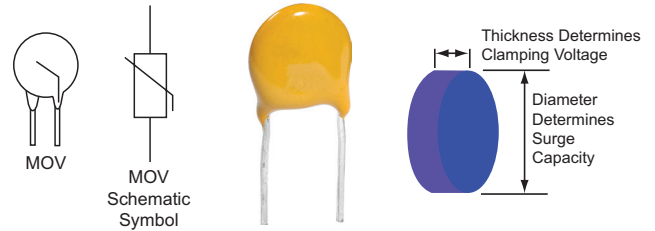
- Handles very high impulse currents, makes it ideal for lightning arresters
- Low capacitance
- Rugged and compact
- Low conduction voltage
- Repeatable

Disadvantages:

- Slower, 2 to 3µs response time
- Extinguishing it is a challenge
- Breakdown voltage depends on transient rise time allowing high overshoot voltage

Metal Oxide Varistor (MOV):

An MOV is a variable resistor typically made of a large block of zinc oxide grains. They act like semiconductors, an insulator below the conduction voltage and a low value resistor above it. In conduction mode, the MOV diverts and dissipates the transient. MOVs generally connects in parallel to load. The thickness of the MOV determines the clamping voltage and Diameter determines the current capacity.



Advantages:

- Fast, sub micro-second response time
- Good voltage conduction clamping, makes it ideal for surge arresters
- Handles high impulse currents
- Rugged
- Repeatable

Disadvantages:

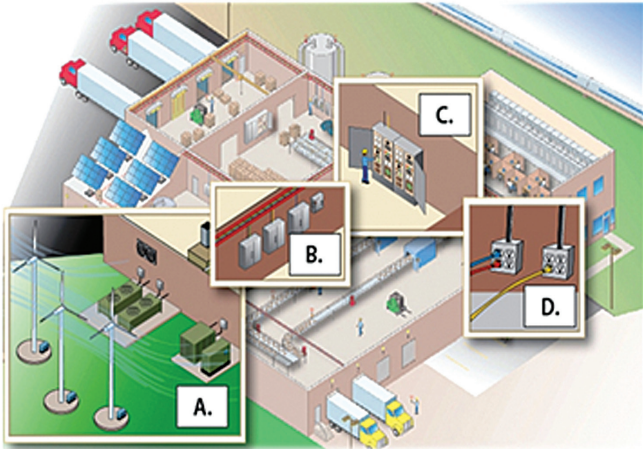
- Large relative size
- High relative capacitance

11. What is a hybrid SPD?

A hybrid protector is a protector that uses more than one protection technology.

12. Where is the best place to install an SPD?

Ideally, a SPD should be installed at the main service entrance as close to the neutral-to-ground bond as possible, as shown below. This will ensure that surge energies are routed to earth by the most direct path. In larger facilities where distances between this primary protection and the equipment being protected are long, it is also good practice to use distributed protection all the way to point-of-use.



Locations

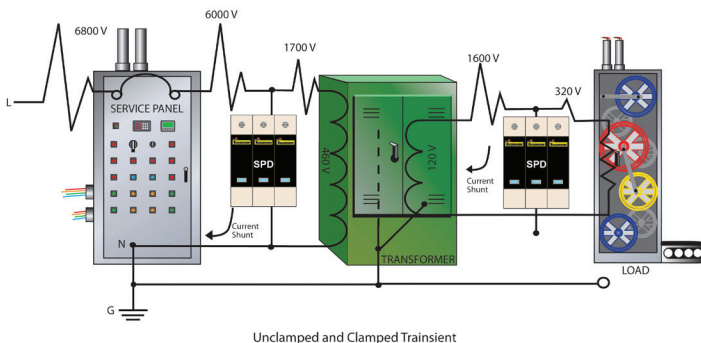
A-Very Exposed, B-Outside & Service Entrance, C-Feeders & Branch Circuits, D-Outlet and Point of Use

13. What is distributed (cascaded) surge protection?

Distributed protection, cascaded protection or coordination is the process of coordinating protection between the primary service entrance of a large facility and the internal branch distribution panels. Generally a surge protective device (SPD) with high surge handling capacity is installed at the service entrance while SPDs of lower surge ratings will be installed on the branch panels or dedicated supplies feeding sensitive equipment. This approach can be taken further to include point-of-use SPDs on long lines where they terminate to sensitive or critical equipment. A further example of such a distributed protection philosophy might include hardwired SPDs at the main and sub-panels and additional plug-in protectors on select equipment. (See pages 5 for SPD Types and installation locations.)

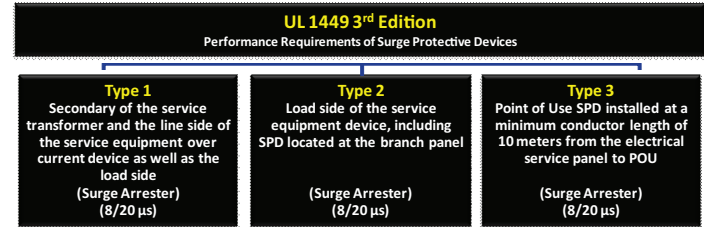
Surge Protection Applications

SPD Locations- Coordination (IEC)/ Cascading (UL)



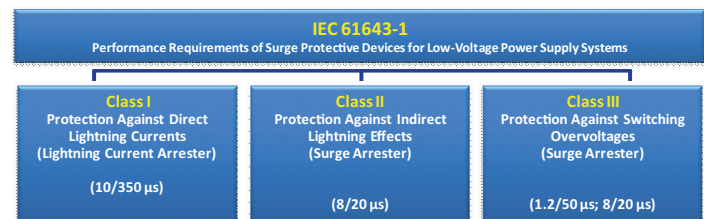
14. What standards govern SPDs?

NORTH AMERICA - ANSI - UL 1449 3rd Edition



Standard for Surge Protective Devices (SPDs) designed for repeated limiting of transient voltage surges as specified in the UL 1449 3rd Edition for 50 or 60Hz power circuits not exceeding 1000V. Based upon the 1449 3rd Edition standard, SPDs are either Listed or Recognized.

INTERNATIONAL STANDARD - IEC 61643-1



Low voltage surge protective devices – Part 1: Surge protective devices connected to 50/60Hz AC and DC power circuits, and equipment rated up to 1000V_{rms} or 1500Vdc. The IEC standard is a self certification or third party certification, such as KEMA, that will test and validate the results.

15. How is the North American surge suppression industry defined by safety standards and regulations?

2014 National Electrical Code® (NEC®) Requirements that SPDs follow:

- Changes to 2014 NEC® 700.8 requires a listed SPD to be installed in or on all emergency system switchboards and panelboards.
- Installation of the SPD (Articles 280 and 285)

Institute of Electrical and Electronic Engineers (IEEE) Manages SPD:

- Surge environment C62.41.1
- Characterization C62.41.2
- Testing practices C62.45

National Electrical Manufacturers Association (NEMA) Standards that SPDs follow:

- Receptacles and plugs
- Enclosures

Underwriters Laboratories (UL) Certifies to SPD Standards:

- Standard 1449 3rd Edition – SPD standard
- As required: Standard 1283 – EMI/RFI filters
- NEMA ratings 1449 3rd Edition current standard for SPDs

16. What is UL 1449?

UL 1449 is the safety standard for AC surge protective devices (SPD) used on systems with voltages of 600Vac and less. This standard addresses SPDs that are installed on the loadside of the main disconnect. A UL 1449 Listed or Recognized surge protector has been thoroughly tested for safe operations. A VPR (Voltage Protection Rating) is assigned to a UL 1449 Listed SPD as a result of these tests to help users compare SPDs. UL 1449 3rd Edition went into effect in September, 2009, making all previous 2nd Edition SPDs obsolete. Any older SPDs should be inspected and may be replaced to meet the new safety standard prescribed by NEC® (NEC® 2011 Articles 280 and 285) which calls for SPD Type products certified to the UL 1449 3rd Edition.

17. What is NEMA LS 1?

NEMA LS 1 was a surge protector performance standard. A surge protector which meets this standard is typically used in the most hostile surge environments, at the service entrance location. Other protector locations such as branch panel and local panel protection usually do not require such a formidable protector. NEMA LS 1 was rescinded in 2009 because the document was determined to be out of date and many industry standards related to the surge environment and surge suppression had been significantly updated since the original LS 1 standard was published in 1992.

18. I have a PV (photovoltaic) system with net metering; does it need a surge protection system?

Yes. For PV systems, DC surge protection should be installed where the DC voltage from the PV arrays terminates at the charge controller/inverter. AC protection should be installed at the inverter's AC output to protect it from transients on the utility power lines. This can be caused by lightning or utility switching transients. In certain cases, protection should be located at the PV array locations, and at the array's local DC control circuits — where applicable. See PV SPD data sheets and installation instructions for more application details. For details on PV SPDs and the entire line of SPD products from Bussmann, visit www.cooperbussmann.com/surge

19. Why is the lead (wire) length of an AC SPD so critical?

The shorter the lead length between the protector and your panel, the lower the let-through voltages will be to your equipment. This is crucial to the effectiveness of all parallel-connected surge protectors.

SPDs are typically connected in parallel with the load. This means that the protector does not carry load current. But more importantly, it means that the SPD must efficiently divert transient currents through it during an overvoltage event. The SPD must momentarily "look" like an electrical short-circuit in order to efficiently divert large amounts of current. The longer the wire, the more inductance it has, and the greater the (L x d/d.) factor will be. So when installing parallel surge protectors, keep the leads as close to, but not less than, six inches as possible for best performance.

20. What are the different designations for ratings between UL 1449 and IEC 61643-1.

The rating designations used in UL and IEC are in the table below.

Ratings	Agency Designation	
	UL 1449	IEC 61643-1
Nominal system voltage	V_o	U_n
Surge current capacity 8x20 μ s	I_{max}	I_{max}
Nominal discharge current 8x20 μ s	I_n	I_n
Impulse Current 10x350 μ s	—	I_{imp}
Voltage protection rating/level	VPR	U_p
Maximum continuous operating voltage (MCOV)	V_c	U_c
Temporary overvoltage	TOV	U_t

21. How long does an SPD last?

How long an MOV-based SPD lasts depends upon how often it experiences a surge and for how long. Every time an MOV becomes conductive to shunt the surge to ground, its life is slightly degraded. The greater the surge, the greater the degradation of the MOV. One hit of 20kA may degrade the MOV's life just as much as 15 hits at 0.2kA. So, based upon the size and duration of surges an SPD encounters, it may last a day suppressing a large surge, or years suppressing smaller surges.

22. By VPR, what are the IEEE C62.41 defined withstand categories of equipment?

Category I:	Sensitive electronic circuits	<1500V overvoltage
Category II:	Domestic electrical equipment	<2500V overvoltage
Category III:	Distribution panels, switchgear	<4000V overvoltage
Category IV:	Industrial equipment, meters	<6000V overvoltage

23. Can a SurgePOD HEAVY DUTY insulated conductor be permanently identified for equipment grounding at each end using color tape?

No, the 2011 NEC® only permits changing identification on 6AWG and larger conductors. The SurgePOD HEAVY DUTY conductors are 10AWG and too small. Details are contained in section 250.119 *Identification of Equipment Grounding Conductors*.

NEC® 250.119 (A) contains these specific words: "An insulated or covered conductor larger than 6AWG shall be permitted, at the time of installation, to be permanently identified as an equipment grounding conductor at each end and at every point where the conductor is accessible."

24. Why are there requirements for installing some Type 1 or Type 2 SPDs not more than 10 feet from a bonded neutral-ground connection or greater than 10 feet from the bonded neutral-ground connection?

These requirements reflect a best practice for SPD wiring, as opposed to any code requirements. When an SPD is located within 10 feet (3m) of the main service panel, the system can make use of the neutral line as an effective ground, due to the close proximity to the service entrance grounding conductor.

For distances greater than 10 feet (3m), it is a best practice to select an SPD that has neutral-to-ground protection. This helps ensure a proper grounding is available for an SPD, which is critical to effectively protect the electrical system.

25. Where can I find the Agency Certificates for these SPDs?

To see the complete UL and CSA and other agency certificates go online to www.cooperbussmann.com/Surge. Then go to the web page of the desired product and click on the certificate links available.

26. Why should I install data signal SPDs in addition to power SPDs?

The need for surge suppression in general is driven by the increased use of sensitive electronic equipment that can be impaired or destroyed by surges on power circuits. And much of the electronic equipment used today is also connected via coaxial cable, twisted pair or Ethernet cables. Using data signal SPDs in addition to power SPDs helps assure the entire data or video system is protected from surges, regardless of the source.

SPD Glossary

IEC Classes - per IEC 61643-1 Standard

Class I: Protection Against Direct Lightning Currents; based on 10/350 μ s wave test (Lightning Current Arrester).

Class II: Protection Against Indirect Lightning Effects; based on 8/20 μ s wave test (Surge Arrester).

Class III: Protection Against Switching Overvoltages; based on 1.2/50 μ s; 8/20 μ s wave test (Surge Arrester).

I_{imp} - impulse current rating (10/350 wave current impulse)

This rating is used for the classification of the SPD for test Class I Lightning Arresters per IEC 61643-1 Standard for surges with a virtual front time of 10 μ s and a time to half-value of 350 μ s. Defined by three parameters, a current peak value (I_{peak}), a charge Q and a specific energy. Note: This is used for the classification of the SPD for test Class I SPDs under IEC 61643-1 Standard. UL *DOES NOT* have this RATING.

I_{max} - surge current capacity

Crest value of a current through the SPD having an 8/20 μ s wave shape and magnitude; I_{max} is the voltage and current development must not show any marks of disruptive obvious damage or aberration from the temperature stability; records of greater than I_n ; arrester must safely discharge this current without an discharge or spark over. An SPD can withstand a single shot of surge current. In UL markets, this is a self certification rating.

I_n - nominal discharge current (8/20 wave current impulse)

This rating has a current impulse with a virtual front time of 8 μ s and a time to half-value of 20 μ s as defined by UL 1449 3rd Edition and IEC 61643-1 Standards. Peak value of the current, selected by the manufacturer, through the SPD having a current wave shape of 8/20 μ s where the SPD remains functional after 15 surges.

Lightning arrester

An SPD that has an I_{imp} rating based on IEC 61643-1 Standard. These products are typically DIN-Rail style SPDs.

MCOV/ V_c / U_c - Maximum Continuous Operating Voltage

The maximum designated root mean-square (rms) value of the power frequency voltage that may be continuously applied to the mode of protection of an SPD. This is also the maximum voltage a system will see under the variance of normal operation and is the voltage at which an SPD starts to conduct and suppress a surge event.

MOV - Metal Oxide Varistor

MOV is a ceramic mass of zinc oxide grains, in a matrix of other metal oxides (such as small amounts of bismuth, cobalt, manganese) sandwiched between two metal plates (the electrodes).

NEMA 4X - electrical enclosure rating

Type 4X Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (windblown dust); to provide a degree of protection with respect to harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); that provides an additional level of protection against corrosion; and that will be undamaged by the external formation of ice on the enclosure.

SCCR (I_{sc}) - Short-Circuit Current Rating

The suitability of an SPD for use on an AC power circuit that is capable of delivering not more than a declared rms symmetrical current at a declared voltage during a short-circuit condition.

SPD - Surge Protective Device

A surge protector is a device that limits transient overvoltages to a safe level, thus protecting equipment it is connected to from damage. A surge protector may also be expressed using the following terms:

- SPD — Surge Protective Device
- TVSS — Transient Voltage Surge Suppressor

There are different variations of SPD such as lightning arresters and surge arresters or secondary surge arresters.

Surge arrester

An SPD that has an I_n rating based on IEC 61643-1 or UL 1449 3rd Edition. These products can be either DIN-Rail Style SPD in an assembly or NEMA Style SPDs (BSPD, SurgePOD HEAVY DUTY and SurgePOD PRO). Typically in North American markets, surge arresters are installed at the service entrance to handle large external surges, with additional surge arresters (SPDs) installed throughout the electrical system down to individual equipment panels.

Surge current

Normal operation - current through MOV/SPD while conducting a surge – tends to be momentary.

Thermal disconnect

A means of disconnecting the SPD from the circuit upon reaching a predetermined temperature caused by conducting a surge to ground. This protects the MOV from going into a thermal runaway condition on commonly misapplied voltages or when an end-of-life condition is reached.

Thermal runaway

Operational condition when the sustained power dissipation of an SPD exceeds the thermal dissipation capability of the housing and connections, leading to a cumulative increase in the temperature of the internal elements culminating in failure.

TOV - Temporary Overvoltage

Temporary Overvoltages (TOVs) are created by faults on the utility power distribution system and can cause extensive damage since their time domain is much longer (ms to seconds to hours).

UL SPD Types - Per 1449 3rd Edition

Type 1: These are permanently connected SPDs intended for installation between the secondary of the service transformer and the lineside of the service equipment overcurrent protective device as well as the loadside (including watt-hour meter adapters). Previously known as surge arresters, these devices are intended to be installed without an external overcurrent protective device.

DIN-Rail SPDs are NOT Type 1.

Type 2: These are permanently connected SPDs intended for installation on the loadside of the service equipment overcurrent protective device, including SPDs located at the branch panel. UL 508A Power Applications

Type 3: These are point-of-utilization SPDs, which are installed at a minimum conductor length of 10 meters (approximately 30 feet) from the electrical service panel to the point of utilization (e.g., cord-connected, direct plug-in, receptacle type, and SPDs installed at the utilization equipment being protected). The 10 meter distance is exclusive of conductors provided with or used to attach SPDs. UL 508A Control Applications

Note: Type 2 and 3 SPDs were previously known as TVSSs.

Type 4: These are RECOGNIZED COMPONENTS tested to either UL Type 1, 2 or 3 categories. DIN-Rail SPD falls under this category and are typically tested to Type 2 and Type 3 categories.

V_o/U_n - nominal system voltage

A nominal value assigned to designate a system of a given voltage class in accordance with ANSI C84.1. Typical voltages include 120, 208, 240, 277, 347, 480, 600Vac.

VPR - Voltage Protection Rating

A rating selected from a list of preferred values as given in Table 63.1 of UL 1449 3rd Edition and assigned to each mode of protection. The value of VPR is determined as the nearest highest value taken from Table 63.1 to the measured limiting voltage determined during the surge test using the combination wave generator at a setting of 6kV, 3kA. It is also known as "let-through voltage."

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