Polyphaser, Transtector, RO Associates

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Solutions Provided by a Family of Experts

PolyPhaser

Since 1979

Coaxial RF surge protection, patented DC block and DC pass technology

TRANSTECTOR

Since 1967

Specialist in non-degrading, fast-acting silicon technology
AC, DC, data line, EMP protection, integrated cabinets, power distribution

RO Associates – Smiths Professional Services

Smiths Power is a leading supplier of power distribution, conditioning, protection and monitoring solutions for data centers, wireless communications and other mission-critical or high-value electrical systems. Through the Professional Services arm, Smiths Power helps organizations with:

- **Site Audits** – Grounding, Power, Surge Protection, and Physical Lightning Protection systems. Comprehensive inspections to industry standards and engineering best practices.

- **Consulting** – Design review and expert consultation on grounding, power distribution, and protection systems.

- **Training** – Accredited classroom and hands-on training in a range of topics related to our area of expertise: grounding, power, and protection. Our 2015 course schedule is published below, and **we also offer in-house training for private groups upon request.**

Ground it – Bond it – Protect it

Upcoming RO Courses

Columbus, OH - Grounding and Protection of Communication Sites

Tuesday, August 25, 2015 - Columbus, OH
One-Day Training Seminar Event Details >

Macon, GA - Grounding and Protection of Communication Sites

Tuesday, September 1, 2015 - Macon, GA
One-Day Training Seminar Event Details >

Richmond, VA - Grounding and Protection of Communication Sites

Tuesday, September 15, 2015 - Richmond, VA
One-Day Training Seminar Event Details >

Indianapolis, IN - Grounding and Protection of Communication Sites

Tuesday, September 22, 2015 - Indianapolis, IN
One-Day Training Seminar Event Details >

Tulsa, OK - Grounding and Protection of Communication Sites

Tuesday, September 29, 2015 - Tulsa, OK
One-Day Training Seminar Event Details >

Three Essentials of Equipment and Personnel Protection

GROUNDING

An essential electrical support system that releases energy into earth safely. The result of low impedance ground conductors intentionally connected together with sufficient current-carrying capacity to prevent the buildup of voltages that may result in undue hazards to connected equipment or personnel.

BONDING

The permanent joining of metallic parts to form an electrically conductive path that ensures electrical continuity and the capacity to conduct safely any current likely to be imposed.

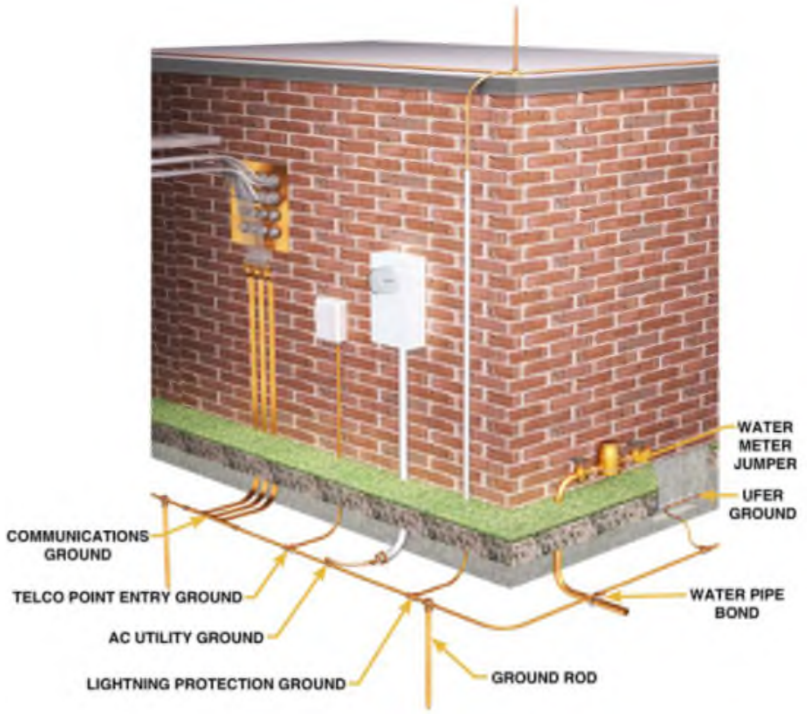
SURGE PROTECTION

Surge protectors are an appliance designed to protect electrical devices from power surges and voltage spikes. Surge protectors are low impedance circuits that attempt to regulate voltage by either blocking or shunting to earth any voltage that exceeds design threshold.

Ground it – Bond it – Protect it

Purpose of Grounding

- Personal Safety
  - NEC Article 250 – Grounding and Bonding discusses the minimum requirements of grounding for life safety
  - We should always attempt to install grounding systems above and beyond the minimum requirements of NEC 250
- Facilitate the operation of overcurrent protection devices under fault conditions
- Protect equipment and structure from lightning damage
- Drain leakage, static and unwanted high frequency noise currents to earth



Allowable Ground Current

- An equipment grounding conductor is **NOT** a current carrying conductor, except for conducting temporary fault and lightning currents
- The continuous flow of objectionable ground current must be prevented. NEC 250.6 (A)
- A ground current in excess of **0.25 Amps** should be a source of concern and must be investigated
- Earth is Ground (NEC Article 100)
- The objective is to use earth with supplemental electrodes to obtain ground earth resistance of **5 Ohms** or less (NEC 250.56 requires 25 Ohms or less)

Purpose of Bonding

- Bonding is required at electrical services (NEC 205.92), at enclosures (NEC 250.96) and at equipment (NEC 250.102) in order:
  - To ensure that the equipment-grounding systems has:
    - Continuity
    - Permanency
    - Capacity to conduct
    - Lowest impedance path
  - To collapse any potential build-up between fixed metallic parts that are within 8 feet vertically or 5 feet horizontally of grounded metallic objects (NEC 250.110)

Bonding

- Electrical continuity of metal surfaces in relation to the Grounding Electrode System
  - NEC requires proper bonding of all available GESs available at site
  - Size of grounding electrode mandated by NEC 250.66 but methods and practices not discussed
- Permanently bridging metallic parts that could become energized (AC Service, Telephone Service, Lightning Protection System, Ground Ring, Tower Grounding, Communication Cables Grounding, Metal Water Pipe, Building Steel, Concrete Encased Electrode, RF, Noise or System Grounding, DC Grounding per NEC 250.106)
- Enhances human safety and equipment reliability

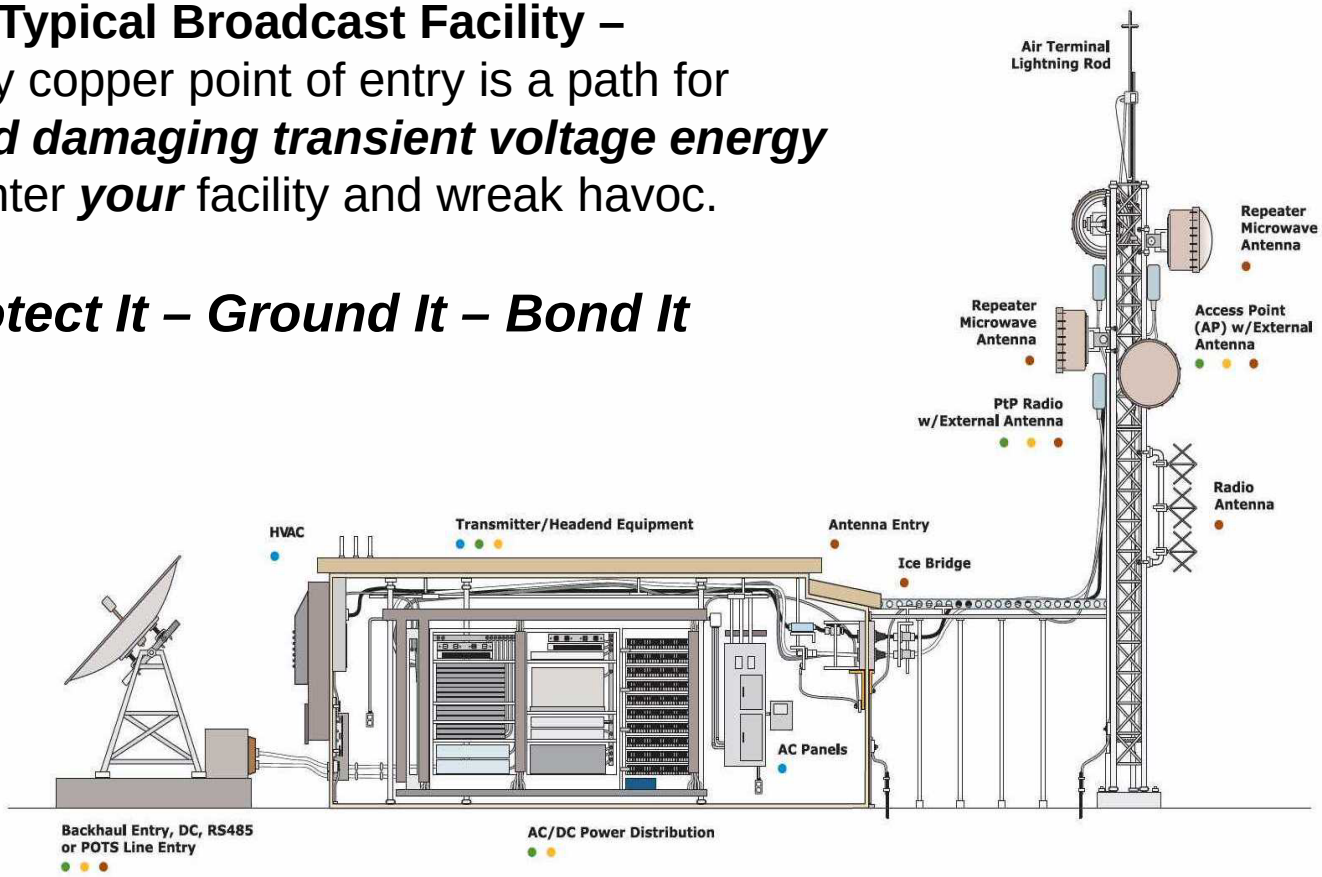
Surge Protection

- An Appliance, low impedance, filter or shunt, diverts and limits overvoltage events
- AC Circuits
- DC Circuits
- RF
- Data Telephony
- Most common types of Surge Protection Devices (SPD) are gas tube, MOV and SASD

SPD's should be applied to every Copper Entry Point

Typical Broadcast Facility –
Every copper point of entry is a path for
unwanted damaging transient voltage energy
to enter ***your*** facility and wreak havoc.

Protect It – Ground It – Bond It

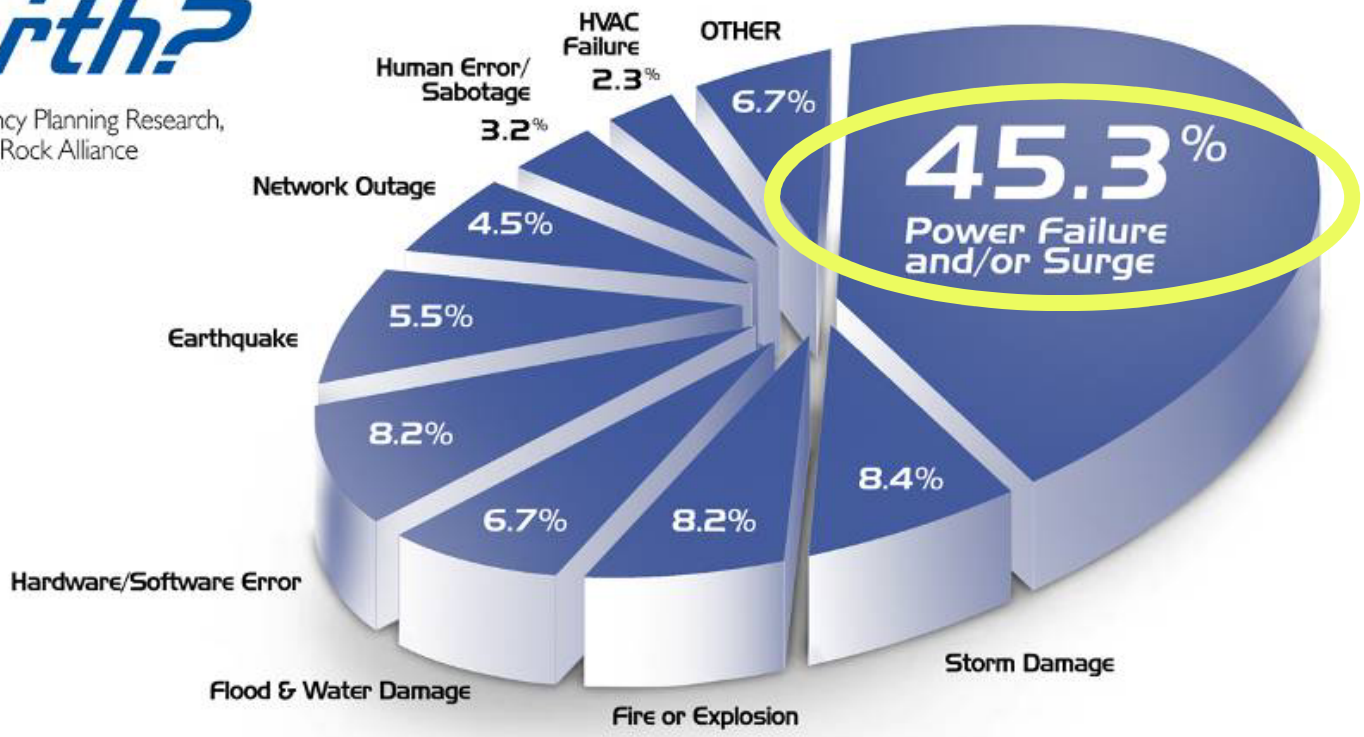


APPLICATION LEGEND ● AC Protection ● DC Protection ● Data Protection ● RF Protection

How Much Is Your Uptime Worth?

SOURCE: Contingency Planning Research, a Division of Eagle Rock Alliance

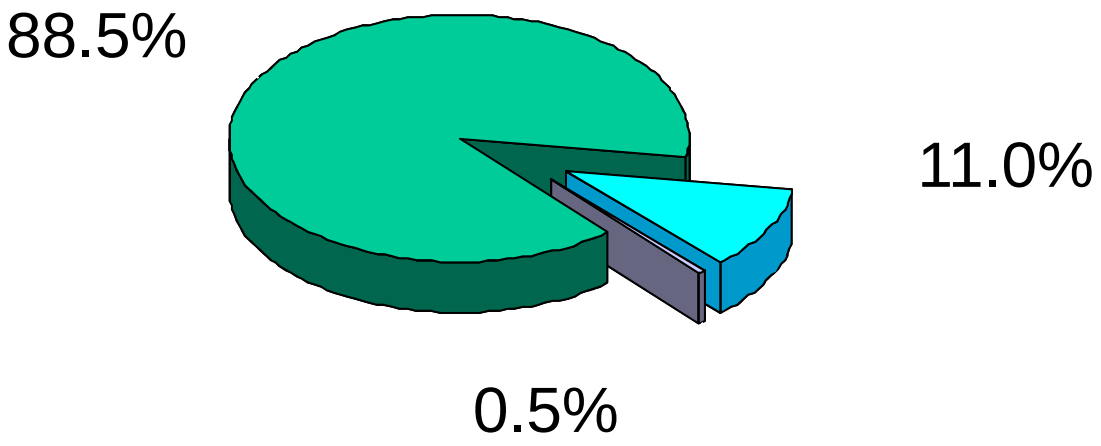
According to an IBM study, VOLTAGE TRANSIENTS represent almost 90% of all power line disturbances



Power Problems – the single largest cause of data loss

What's the fuss about Surge Protection?

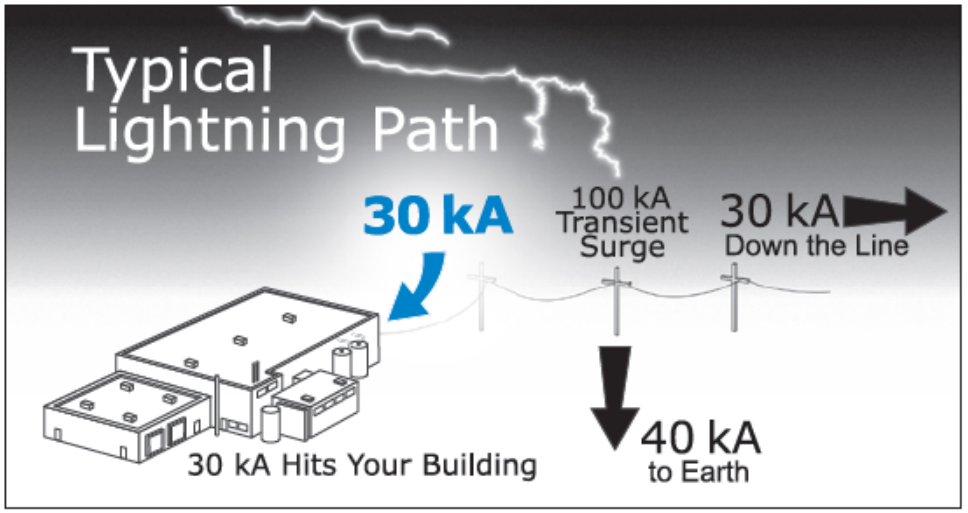
- Voltage Transients
- Undervoltages & Overvoltages
- Voltage Outages



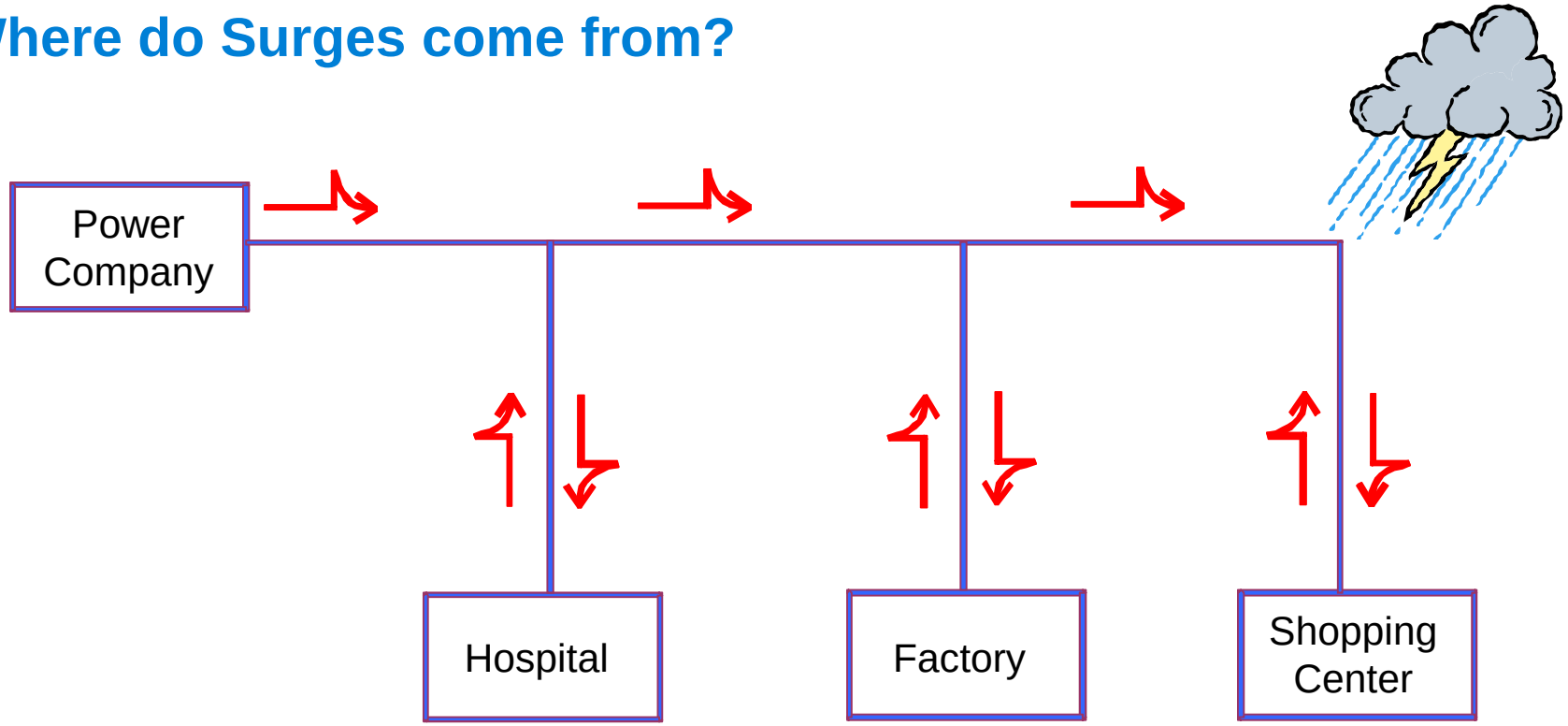
Source: Allen-Segal IBM Study 1974

WHAT IS A SURGE?

- Brief overvoltage spikes or disturbances on a power waveform that can damage, degrade or destroy electronic equipment
- High frequency events ranging from 5 kHz to 100 kHz, can reach GHz level
- Short duration (microseconds)
- Every piece of equipment is designed to operate at specific nominal voltages, variations depending on their magnitude can be very damaging to nearly all equipment
- Most common transients are under 30 kA, can exceed over 100 kA



Where do Surges come from?



Sources of Transients

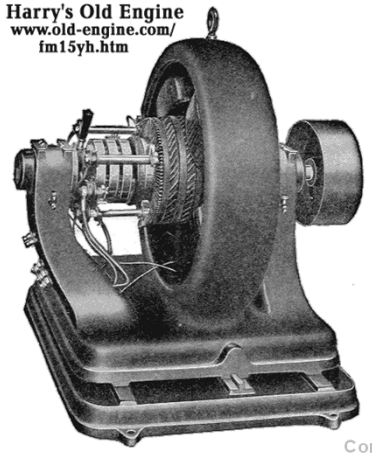
- **8% Lightning**

  Direct lightning hit to structure
  Direct or induced lightning hit to:
  - Power lines, telephone lines, antennas, coaxial cables and wave guides

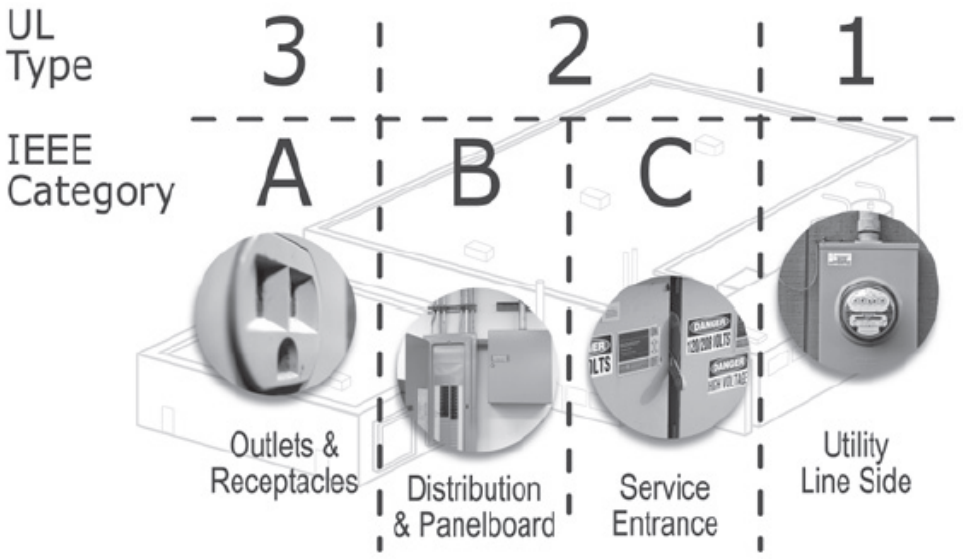
- **12% Power line load switching**

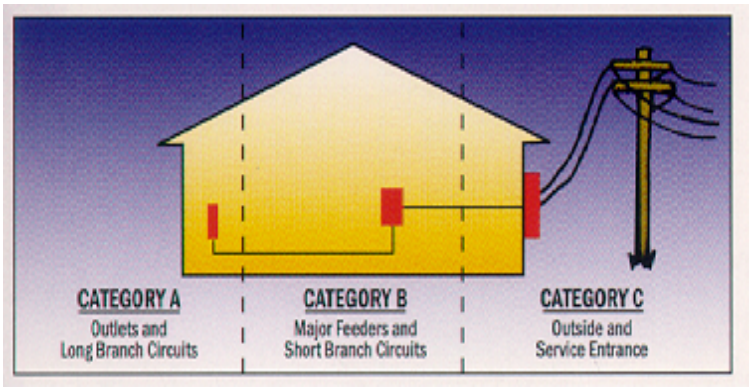
  Utility power generation vs demand

- **80% Inductive load & switching**
  - HVAC Systems
  - Refrigeration Systems
  - Fluorescent Light Ballast's
  - Elevators
  - Various Types of Motor Starter Contactors
  - Transformers
  - Transfer Switches



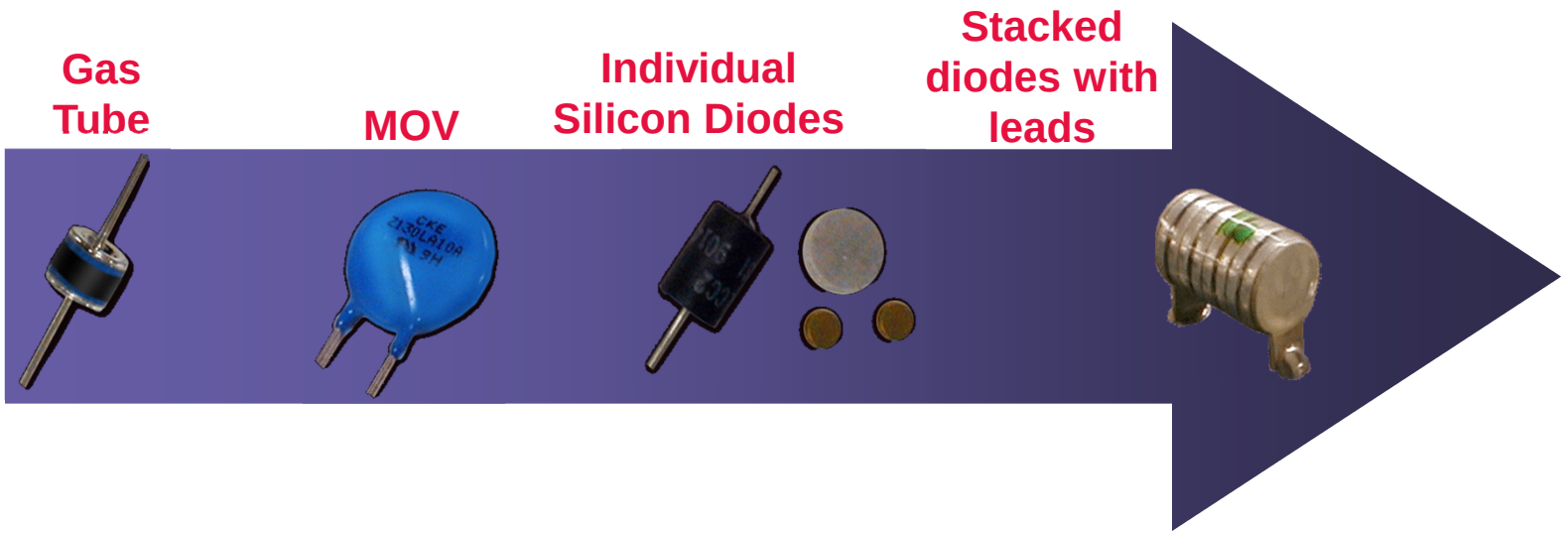
Location Type & Category





UL	IEEE Category	Surge Current Capacity Range	Surge Event Occurrences
Type 3	A	10 kA - 75 kA	80%
Type 2	B	100 kA - 200 kA	
Type 2	C	200 kA - 600 kA	20%

Evolution of Surge Suppression Technology

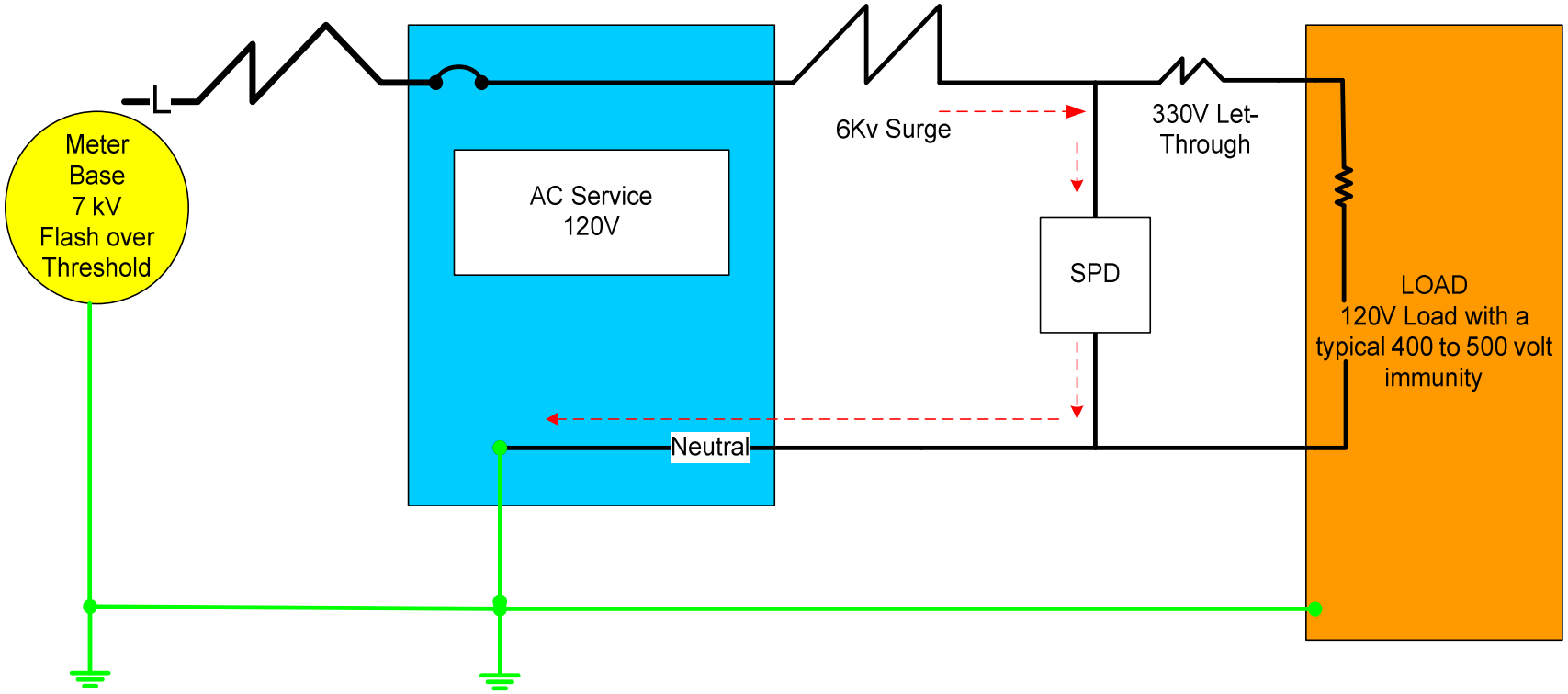


Selenium Rectifiers
- High surge capability
- High voltage clamping
- Slow reacting

Capacitors
- High surge capability
- Large energy storage
- Acts like short circuit

How an AC SPD Operates

A Surge Protection is a Voltage Limiting Device



Installation Criteria

Proper installation impacts suppressor performance

- Grounding (NEC - 25 ohms or less). SPD fails to function optimally with inadequate grounding.

- Verify voltage configurations – 3Y, 3D, SP etc …

Voltge Configurations	Phase	Conductors
120-1P	Single phase	1P + 1N + 1G
120/240-SP	Split phase	2P + 1N + 1G
120/208-3Y	3-phase wye	3P + 1N + 1G
240-1P	Single phase	1P + 1N + 1G
240-3D	3-phase delta	3P + 1G
277/480-3Y	3-phase wye	3P + 1N + 1G
480-3D	3-phase delta	3P + 1G

P = Phase, N = Neutral, & G = Ground

- Enclosures must be weatherized if mounted on the exterior of a structure or otherwise exposed to climatic conditions.

SP Product Family – Parallel Connected

SP100 = 100kA Protection Level

SP200 = 200kA Protection Level

Voltage Configurations:

240/120; 208/120; 480/277

UL 3rd Edition Listed

Standard Features:

Audible Alarm, Dry Relay Contacts, Visual Status Indication

Applications: Secondary Branch or Subpanels

Power Vantage Product Family – Parallel Connected

PV200 = 200kA Protection Level

PV400 = 400kA Protection Level

PV600 = 600kA Protection Level

Voltage Configurations:
240/120; 208/120; 480/277; 480VD

UL 3rd Edition Listed

Modular Plug & Play Design

Standard Features:
Audible Alarm, Dry Relay Contacts, Visual Status Indication, Surge Counter

Applications: Primary Electrical Panels

DS2S Product Family – In-Line Series Wired

<u>DS21S</u> = 225kA Protection Level

Service Panel Load or Branch Circuit Feeds = 80AMP and 225AMP Loads

Voltage Configurations:

240/120; 208/120; 480/277; 220/380

240/515; 240/120-CPGD; 240 DELTA

Features:

Visual Status Indication

Optional Features:

Remote Annunciation, Audible Alarm, Surge Counter

Applications: Primary Electrical Panel or Dedicated Equipment/Loads

DS30S Product Family – In-Line Series Wired

DS30S = 225kA Protection Level

Service Panel Ratings = 600A Max

Voltage Configurations:
240/120; 208/120; 480/277; 220/380; 240/415; 240/120-CPGD; 240 DELTA

Features:
Visual Status Indication

Optional Features:
Remote Annunciation, Audible Alarm, Surge Counter

Applications: Primary Electrical Panels

MCP Product Family – Parallel Connected

MCP 120TA-10M-OD

10kA SASD Protection w/ 50kA Back-up MOV

Service Panel Ratings = 200A

Voltage Configurations:

240/120; 208/120

UL 3rd Edition Listed

Features:

Visual Status Indication, Dry Relay Contacts

Applications: Secondary Branch or Subpanels; Studio/Production

APEX IMAX Product Family – Parallel Connected

APEX IMAX = 20kA SASD with 160kA MOV Hybrid per Phase or 160kA MOV Only

Voltage Configurations:

240/120; 208/120

UL 3rd Edition Listed

Features:

Visual Status Indication and Dry Relay Contacts

Plug and Play, easy replaceable modular design

Applications: Primary Electrical Service, Subpanels, Studio/Production

Point of Use SPD Protection – Plug-In

RMP Series 15A and 20A Plug-In

19” Rack Mount

RMP615A = 6 outlets

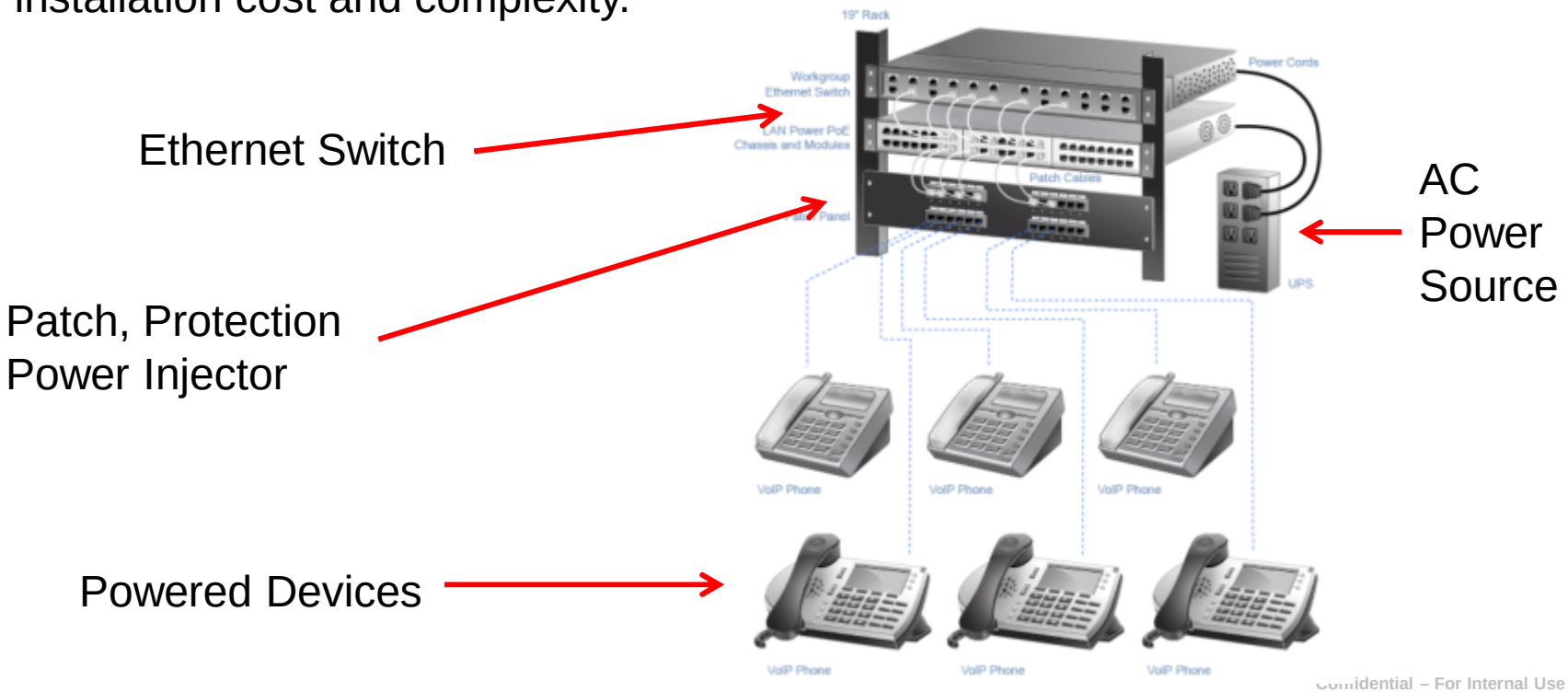
RMP915A = 9 outlets

SL-120

15A Single Outlet Dedicated Plug-in

PoE - What it does

- PoE avoids the requirement of having an AC outlet and DC power supply available at each of the remote equipment sites and avoids all of the electrical installation and NEC requirements.
- PoE allows a single cable to handle both the data *and* power to reduce installation cost and complexity.

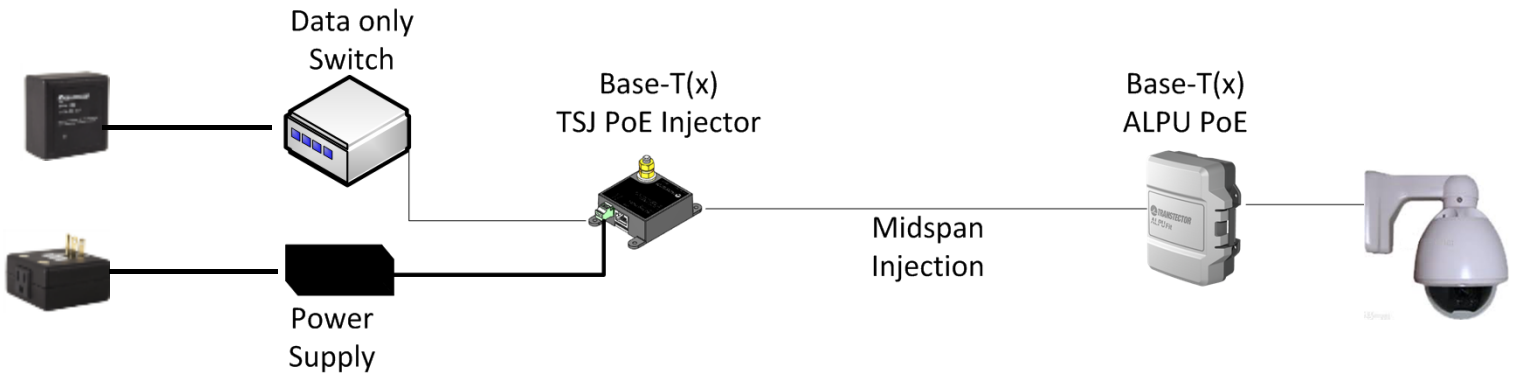


PoE Midspan

- “Midspan” power injection is where the dc voltage is injected between the switch and the powered-equipment where it is logical and convenient.

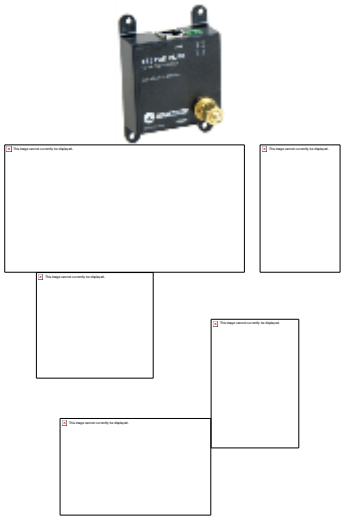
- Here we show a commercially available data switch with a separate power supply and dc voltage protector/injector connected to a pole mounted protector in close proximity to the PoE enabled camera.

- Both the switch and power supply will need surge protection on their respective ac power plugs.



PoE Protection Portfolio

Product Family	Indoor Outdoor	Shielded Un-Shielded	Mounting
TSJ	Indoor	Both types	Module Mounting
CPX	Indoor	Both types	19” Rack and Panel
DPR	Indoor	Unshielded	Din Rail, Panel Mount
ALPU	Outdoor	Both types	Panel Mount
Thunderbolt	Outdoor	Shielded	Bulkhead Mount



TSJ Series - Ethernet, Phone, Data Line SPD Protection

TSJ 10/100BT

10/100BaseT – Ethernet, T1/E1

Protects on all pins

RJ-45 Interface

TSJ-6A

Single Line POTS and Modem Protection

RJ-11 Interface

Control and Low Power DC SPD Protection

FSP Series

2-pair (4-Wire) Hardwire

12VDC to 325VDC , RS422/485

Pan/Tilt control lines, Propane Tank Monitoring, Generator Control Lines

IX Series

1 to 5-pair Hardwire Configurations

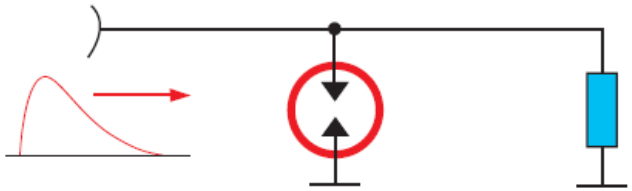
DC, Data, RS, POTS, Ethernet

Weatherized Enclosure

RF Suppression Technology Overview – Gas Tube

A gas-tube coaxial protector has DC continuity from surge-side connector center pin to equipment-side connector center pin. Since there is no DC-blocking mechanism, a high-voltage pulse would be applied directly to the equipment input before the gas tube turns on.

The gas tube might never see enough voltage to turn on until the equipment has been damaged since current flow must go through the coaxial cable jumper and equipment input before an inductive voltage drop across the gas tube could reach a potential high enough to ionize the gas.

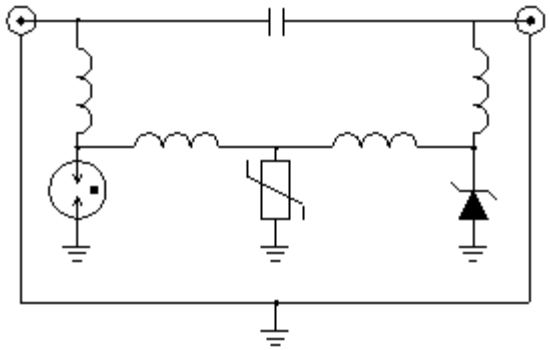


RF Suppression Technology Overview – Hybrid DC Pass

Our patented GX Series uses a dc blocking technique on the RF path while isolating and protecting the dc circuitry. The dc component is de-coupled from the RF path, passes through a dc protection circuit and is re-coupled to the coaxial conductor.

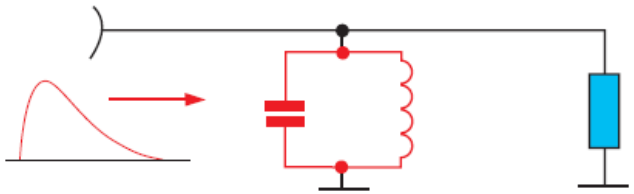
GX devices are broadband units covering multiple operating frequencies. The dc blocking mechanism ensures very high levels of surge suppression, and the dc protection modules cover a wide range of operating voltages of both positive and negative polarities.

The GX series devices are fully weather-proofed, enabling them to be used in tower mounted amplifiers, tower mounted electronics and global positioning systems.



RF Suppression Technology Overview – Quarter Wave Stub

The quarter wave stub is based on well-known Bandpass / band reject principles. By using a coaxial "T" fitting the length of a quarter wave coaxial section from the center conductor to the grounded base of the T, a bandpass filter can be formed at a given frequency. Since most of the energy in a lightning strike is from DC to 1 MHz, it would fall on the lower frequency reject side of the bandpass filter and be conducted to ground. However, if the equipment input is also DC shorted, the quarter wave stub will allow significant divided DC and low frequency energy to flow toward the equipment input. While the gas-tube protector could eventually "crowbar" to ground, the quarter wave stub will continue dividing energy between the protector's ground and the equipment input for the entire duration of the strike or series of strikes.

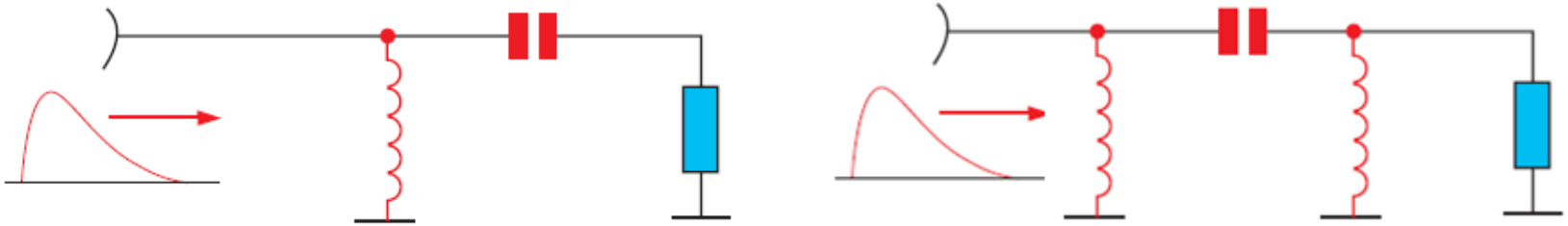


RF Suppression Technology Overview – LC Filter DC Block

Our patented SX series designs are characterized by their broadband performance over a wide spectrum of frequencies. The operating bandwidth of a single device covers >2GHz.

In contrast to the quarter wave stub's design, which capitalizes on a dc short principal, the SX series employs a dc blocking principal. Utilizing the dc blocking capacitive component in the center pin and inductive current discharge circuit to shield/ground ensures not only broadband RF performance, but also very good surge suppression characteristics.

This means that the dc blocking SX series lets less energy through than a quarter wave stub. Further, SX devices do not allow any dc components to be passed to the radio equipment.



Types of RF Protection

	Gas Tube (GT)	Hybrid Multi Stage (GX)	High Pass (SX)	Band Pass (QWS)
Time To React	Slow	Fast	Fast	Fast
DC Pass	Yes	Both	No	No
DC Blocked	No	Both	Yes	Yes
Insertion Loss	Average	Excellent	Excellent	Poor/Avg
Return Loss (VSWR)	Average	Excellent	Excellent	Poor/Avg
Maintenance	Yes	No	No	No
Frequency	Broadband	Broadband	Wideband	FQ Dependant
Throughput Energy	High	Low	Low	Medium
Multi Use	Yes	Yes	Yes	No
Cost	Low	High	Medium	Medium

Satellite Equipment Protection

MDS+24-F-F

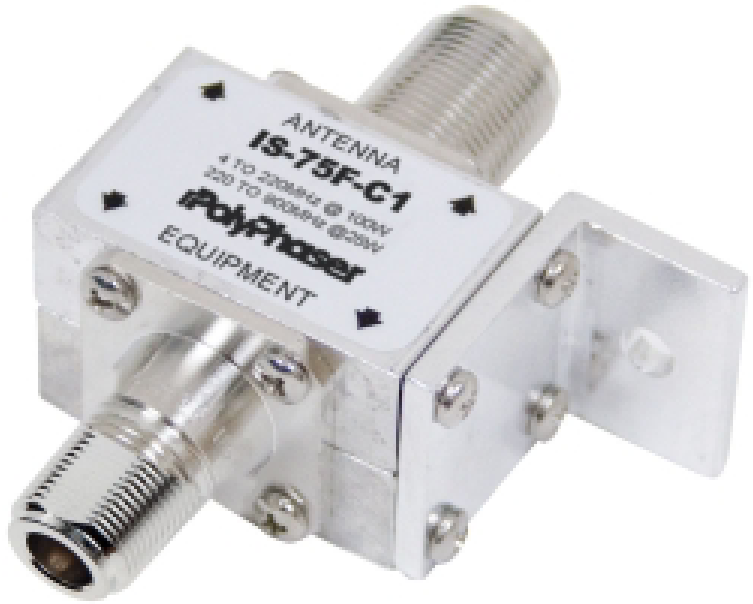
24VDC Pass

Frequency: 300 MHz to 2.5 GHz

75 OHM Coaxial SPD with F Style Connectors

Application: Satellite System Protection

Low Band 75 OHM RF Protection



IS-75F-C1

24VDC Pass

Frequency: 4 MHz to 900 MHz

75 OHM Coaxial SPD with F Style Connectors

Application: Channel 2 through 83 CATV/MATV protector

High Power AM/FM Protection

VUF50NHP-MA

For AM/FM Repeaters

DC Block

Frequency: 500 kHz to 1 GHZ

N Style Connectors

RF Power:
1000W

IS-50NX

IS-50NX-C0 and IS-50NX-C2

DC Block – Single Transmitter

Frequency:

-C0 = 1.5MHz to 700MHz

-C2 = 125MHz to 1GHz

N Style Connectors Flange Mount

IS-B50LN

IS-B50LN-C0 and IS-B50LN-C2

DC Block – Single Transmitter

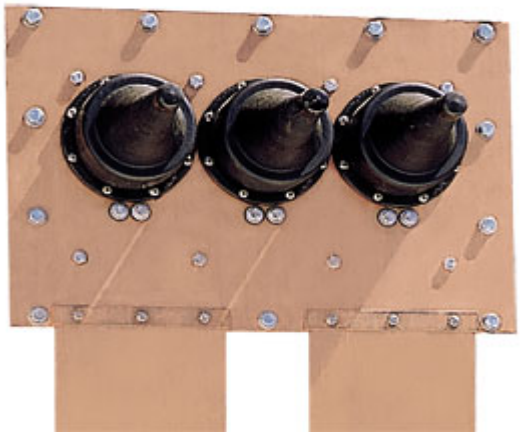
Frequency:

-C0 = 1.5MHz to 700MHz

-C2 = 125MHz to 1GHz

N Style Connectors Bulkhead Mount Bracket

Cable Entry Grounding Panels

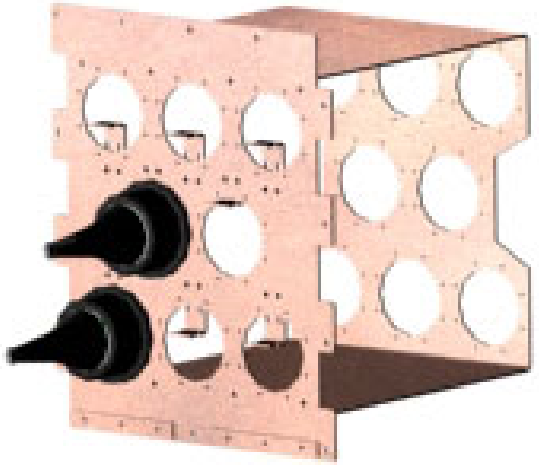


PEEP

3, 5, or 8 Cable Entry Port Versions

For walls up to 8” thick

Designed for establishing a single point ground reference for incoming RF Cables



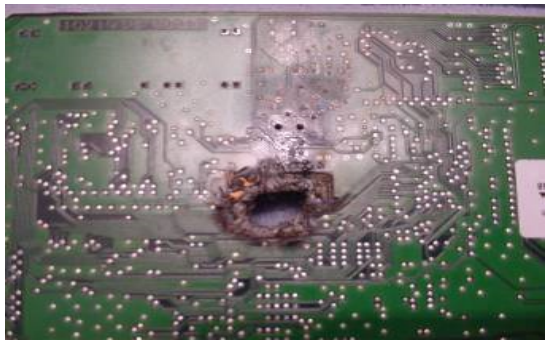
PB-M

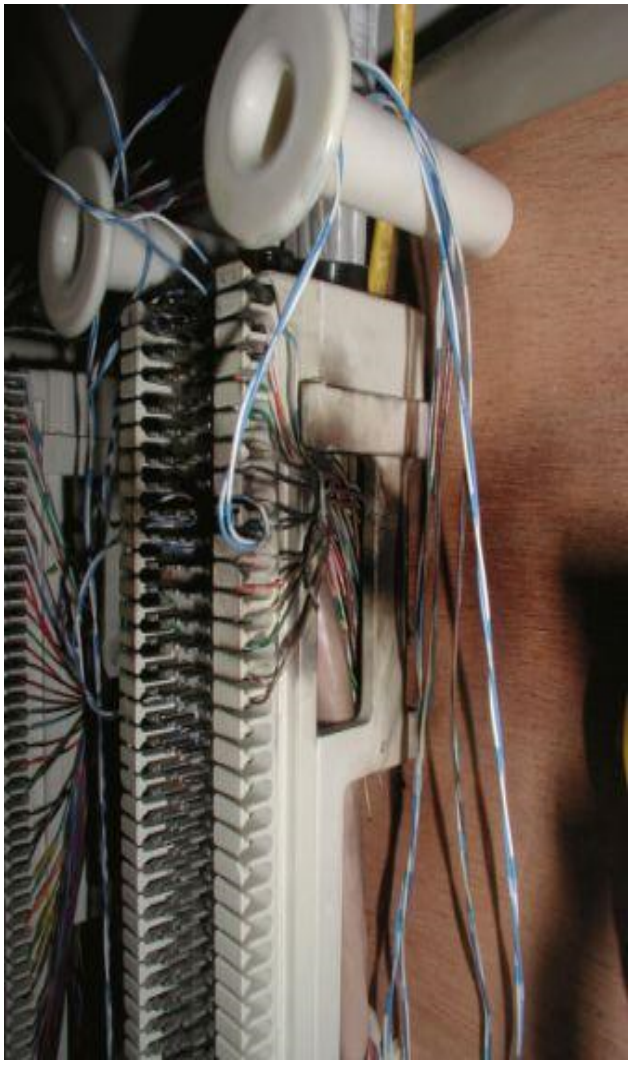
5 and 8 Cable Entry Port Versions

For walls over 8” thick

smiths

No Protection? Damaging Results…





Application Overview

Surge Protection Applications

PolyPhaser, LEA International and Transtector Systems

Thank you!!

Kevin Turner

Transtector/Polyphaser Northeast Regional Sales Manager

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