GLOBAL LIGHTNING SOLUTIONS

PolyPhaser Corporation Product Catalog Vol. 4

PRODUCT CATALOG

ac Power Protectors

dc Power Protectors

Grounding Solutions

Protected Bias-T

dc Blocked Filters

Combiner Protectors

dc Blocked Single Transmitter

Twisted Pair Cable Protectors

We are the authority
on lightning and surge protection
ensuring uninterrupted communications
for a connected world.

PolyPhaser CORPORATION

Vol. 4

PolyPhaser CORPORATION

Table of Contents

To ensure immediate access of PolyPhaser's products and support, we have established a global distribution network with physical presence in over 50 countries. For a list of these distribution partners, contact PolyPhaser Customer Service at 800-325-7170 or visit our website at: www.polyphaser.com *and click on Partners.*

ISO 9001 & 14001 Certified

smiths

PolyPhaser: The authority on lightning and surge protection; ensuring uninterrupted communications for a connected world. We protect people, data, and equipment for global communications, transportation, defense, security, and industry.

With 125 years of combined technical expertise in RF path protection and over 3,000,000 units installed in 75 countries, PolyPhaser has become the benchmark in Telecommunications *global lightning solutions*®. Receiving our first of eight patents in 1982, we have expanded our lightning protection platforms to include board-level protection, power supplies, bias-T's and customized integrated solutions.

Resulting from the merger with Smiths Interconnect (SI) in 1997, PolyPhaser now has access to a global manufacturing network, allowing us to provide local service and support for an international customer base. Combining PolyPhaser's technical expertise and brand recognition with SI's Financial strength, we have opened a Sales and Manufacturing facility in Shanghai; Smiths Interconnect China (SIC), to provide product and customer services to the emerging Asian telecommunications markets.

**Smiths Interconnect China (SIC)
Mr. Stephen Phipson, Managing Director
of the Interconnect Division looks on
as employees manufacture PolyPhaser products
at our facility in Shanghai.**

Utilizing the most modern design and manufacturing capabilities, we have created a protection technology that virtually ensures an uninterrupted communications flow of data and information through global networks. We differentiate ourselves by providing a technologically advanced solution designed to overcome the inherent weaknesses associated with gas tube and quarter-wave technology. Our dc blocked, RF or Bias-T surge protectors have the lowest lightning surge let-through in the industry, thus ensuring the integrity of a global communications path.

Railroad Signal/Communications

Highway Infrastructure Systems

Telecommunication Sites

Worker Safety

GSM-R Highest Certification

E 911 Communication Systems

Utilities

Airborne Communications Networks

Industrial Automation

Flight Operations

PolyPhaser's Markets:

Transportation
Applications include railroad signal / communication line integrity, automated highway infrastructure systems, weather sensing devices and public safety. Based upon our successful history in the protection of mission-critical applications, GSM-R has awarded PolyPhaser the highest certification possible: PolyPhaser products are mandated to be installed on all applications where worker safety is threatened.

Security
Audio / Video surveillance, homeland security, remote monitoring / access systems, closed circuit audio / video systems, alarm systems, public facilities, TETRA, Police and Fire emergency communications systems, E911 location systems.

Defense
LAN Mobile, marine navigation / communications, mission control facilities, aerospace, flight operations, airborne communication networks, NEMP / EMP protection

Telecommunications
GSM / GPRS / TDS-CDMA / CDMA / CAT5-6 / WI-FI / WLAN / PoIP

Additional Markets
SCADA, Petro-Chemical, Telemetry, Process and Control, Utilities, Industrial Automation

Introduction
At PolyPhaser, our on-time delivery record and Quality Assurance programs are testimony to our commitment to total customer satisfaction. Our performance in these areas is measured via a series of Key Performance Measurements where zero defects and 100% on-time delivery are daily requirements. We are active members of the American Society for Quality and all products are qualified through a rigorous testing protocol derived from military and industry standards. Products are 100% tested prior to shipping and our P3 / ISO 9001 Quality System is continually monitored to ensure PolyPhaser's commitment to manufacturing excellence is met.

For 30 years, PolyPhaser's "focus-on-the-future" business philosophy has been the cornerstone of our success. Our global network of sales and support professionals ensure daily, technical involvement in the Wireless Communications Industry. Whether using our standard, patented lightning protection or a customized solution, PolyPhaser's name has become globally synonymous with high-quality and superior performance.

RF Suppression Technology Overview

Lightning damages communications sites all over the world every day. Most lightning strikes are to the tower. Although lightning is a dc pulse, the time from zero current to peak current can be very fast. The fast rise current pulse generates significant RF components up to frequencies greater than 1 GHz. Most of this RF energy is distributed between dc and 1 MHz. When lightning energy traverses a coaxial cable, there is high frequency roll-off and a slight propagation delay that occurs due to the unbalanced inductances of the shield and the center conductor, and the center conductor's capacitive relationship through the dielectric to the shield. The higher frequency shield energy will arrive at the equipment first, followed by the center conductor energy spread out over time. Since the pulse energy arrives at different times, a differential voltage occurs that must be equalized and prevented from reaching the equipment. The amount of energy reaching the equipment through the coaxial protector is known as "Throughput Energy."

The rated "Throughput Energy" specification indicates how much lightning energy can reach the equipment input during a standard waveform test. A very low throughput energy specification can be achieved with a "dc blocking mechanism" inside the protector (no dc continuity through the protector). This "mechanism" can be a capacitor or "strip line" coupling. Coaxial protectors utilizing gas tubes or inductors to ground can be combined with dc blocking to reduce the through-put energy to insignificant levels, and still maintain a low PIM (-dBc).

A gas tube type coaxial protector without dc blocking has dc continuity from surge side connector center pin to equipment side connector center pin. The fast rise time lightning pulse can achieve over 1,000 volts across the gas tube before the gas can ionize and become conductive. Since there is no dc blocking mechanism, this high voltage pulse is applied directly to the equipment input before the gas tube "turns on." If the equipment input is through a ferrite circulator / isolator, the incoming pulse is converted to current in the ferrite's resistive load, creating a magnetic field that can realign the critically adjusted field in the circulator, change the magnet's flux density, and damage or destroy the resistive load. If the incoming voltage pulse appears across a coupling loop (as in most filters & combiners), it sees a low resistance short and is almost entirely converted to current. A dc shorted equipment input loop directly shorts the gas tube. The gas tube might never see enough voltage to "turn on" until the equip-ment 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.

The "quarter wave stub" coaxial protector is based on well known band pass / band reject principles. By using a coaxial "T" fitting, and calculating the length of a quarter wave coaxial section from the horizontal center conductor to the grounded base of the "T", a band pass 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 band pass filter and be conducted to ground. However, if the equipment input is also dc shorted as in the above gas tube example, the quarter wave stub will allow significant divided dc and low frequency energy to flow towards the equipment input. While the above 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. The grounding conductor applied to either the straight through gas tube or quarter wave stub protector must be short and very low inductance, or the inductive voltage drop across the grounding conductor will be additive to the center conductor voltage applied to the equipment input.

A PolyPhaser dc blocked coaxial protector line has the lowest through-put specifications in the industry. dc blocked filter type protectors, when tested with the same pulse in the same test environment as the above protectors, will let through less than 500 millivolts peak. Attenuation at lightning frequencies is negative 98db or better.

For Applications Requiring dc to Power Tower Top Electronics:

A PolyPhaser coaxial protector dc blocks the RF path and also injects, passes through, or picks off a specified dc voltage on the coaxial cable center conductor for tower top electronics. The dc is decoupled from the RF, passes through a dc protection circuit, and can be recoupled to the coaxial cable center conductor. The RF protector can also be used as a dc injector or "bias-T" pick-off circuit. This combines the lightning protection for the RF and dc in one unit while eliminating separate devices for dc injection at the equipment or dc pick-off at tower-mounted amplifiers. An injector / pick-off combination eliminates a separate dc feed to the tower electronics, along with the dc conductor's lightning protection requirements.

Coaxial

For protection of equipment connected to coaxial cables. Technologies including the hybrid dc-pass and bias-T (for systems requiring dc) to the latest dc-blocked filter (for systems not requiring dc).

Coaxial Flowchart

Coaxial Protector Quick Search

Coaxial Lightning protectors can be classified into two major groups:

The most common group include those applications which do NOT require dc on the coaxial cable.
The second group include those applications which require dc to power up Tower Top Electronics,
Tower Mounted Amplifiers or active antennas (Global Positioning Systems).

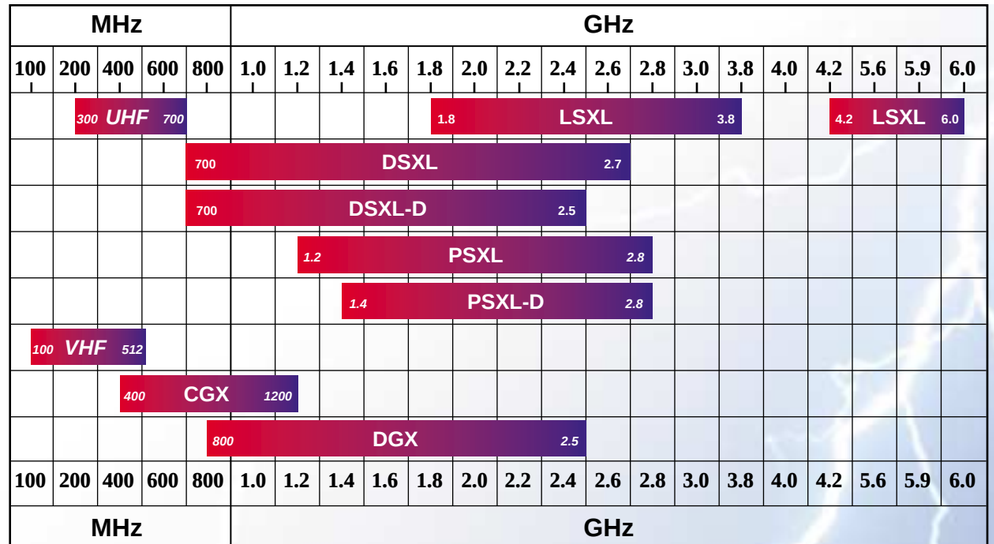
The below flow chart will guide you to the most common protectors for these applications.
Make your choice of dc versus no dc, then by frequency.

Applications **NOT** requiring dc on coaxial cable	< 800MHz	**B50** (Low/high power)	**Pg 16**
		HF (Combiner/high-power)	**Pg 18**
	> 800MHz	**B50** (Low/high power)	**Pg 16**
		SX (Wide band, medium power)	**Pg 12**
		CT (Narrow band, high-power)	**Pg 14**
Applications **requiring** dc on coaxial cable	< 400MHz	**BB** (data, video, HF receive)	**Pg 24**
	> 400MHz	**GX** (dc-Pass and Bias-T)	**Pg 20**

The product series listed above are our most popular, more choices are available by using the appropriate product matrix:

Single Transmitter: use for applications where there is no dc on the coaxial cable and the system utilizes a single transmitter
Combiner / High Power: use for applications where there is no dc on the coaxial cable and the system utilizes multiple transmitters also excellent single high power transmitter protectors
dc-Pass: use for applications where dc voltage is on the coaxial cable to power up Tower Top Electronics or active antennas
Bias-T: use to inject onto or pick-off dc voltage from coaxial cable to power up Tower Top Electronics or active antennas

Frequency Chart



The above matrix depicts our most popular products by frequency application. All units except for the CGX and DGX are used for systems not requiring dc.

For those applications not listed, please contact the factory. We will need as much of the information requested below to recommend the correct protector.

___ Frequency Range(s) or Center Frequency(ies) and Bandwidth(s) _____
___ Impedance (usually 50Ω; 75Ω for video) _____
___ Connectors _____
Most common for 50Ω systems: N, DIN and UHF. UHF are nominally 50Ω.
Most common for 75Ω systems: N, F and BNC.
___ Males required? _____ Antenna (MA) or Equipment (ME) side? _____
___ dc-Blocked. Normal status unless powering pre-amp, etc.
If not, maximum voltage (on coax): _____Vdc or (_____Vac @ _____Hz)
Maximum current: _____ Adc or (_____Aac)
___ _____ Bias-T _____ dc-Pass
___ Insertion Loss Required: _____
___ VSWR Required: _____
If transmit, need:
Worst case VSWR of system _____
___ Transmit (Tx) or Receive Only (RO) _____
If transmit, need:
___ Single or Multi-channel (@ Frequency) _____
___ If Multi-channel, how many channels and spacing between them? _____
___ Transmit Power (after combiner, if multi-channel) _____
Recommend obtaining Power / Channel
If value after combiner unknown, get transmitter power and dB loss through combiner
___ Modulation type (AM, FM, SSB, Pulse, Other [Specify]): _____
___ Duty Cycle: _____% On-Time per Day: _____
___ Special Handling Requirements: (Define) _____

PolyPhaser protects schools and institutions by providing lightning surge protection for the video surveillance systems and Police and Fire communication systems that make it a safer place.

We also provide uninterrupted telecommunications for WI-FI networks, WLAN and CAT5-6 data transmission.

PolyPhaser has designed a product portfolio to protect a myriad of mission-critical applications spanning a varied cross-section of vertical markets. Whether protecting key coaxial systems, twisted pair/data, dc or ac, matching the appropriate product for the specific needs of the application is paramount to ensure optimum protection.

dc Blocked Filter:
Use with passive (no pre-amp) antennas. These will NOT pass the dc (or low frequency ac power) voltage(s) diplexed onto the center conductor. They provide maintenance-free service and the industry's lowest throughput energy.

dc Blocked/Single Transmitter:
Use with passive (no pre-amp) antennas. These will NOT pass the dc (or low frequency ac power) voltage(s) diplexed onto the center conductor for feeding pre-amps, relays or sequencers. Use in single transmitter situations only. If combiners are used, a combiner protector should be specified.

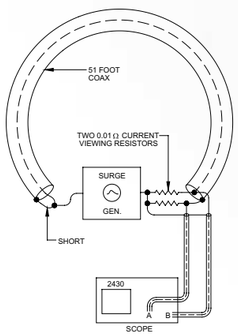
dc Injector/Bias-T:
Protects active antennas, pre-amps or other situations requiring dc (or ac) power on the center conductor. The dc and RF paths (RF is dc-blocked) are separated, individually protected, and recombined. Also bias-T models for injecting the dc (or ac) power onto the center conductor or picking off the dc (or ac) power to feed the powered device.

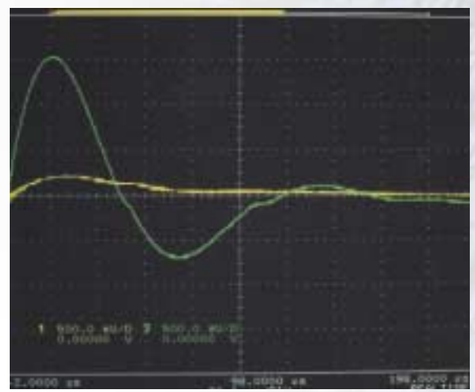
Combiner Protectors:
For multi-channel or multi-transmitter applications. Also excellent single transmitter protectors.

The Need for Coax Protection

Most lightning strikes are to the tower. Although lightning is a dc pulse, the rise time to peak current can be very fast. The fast rise current pulse generates significant RF components. Most of this RF energy is distributed between dc and 1 MHz. When lightning energy traverses a coaxial cable there is high frequency roll-off and a slight propagation delay that occurs due to the unbalanced inductances of the shield and the center conductor and the center conductor's capacitive relationship through the dielectric to the shield. The higher frequency shield energy will arrive at the equipment first, followed by the center conductor energy spread out over time. Since the pulse energy arrives at different times, a differential voltage occurs that must be equalized and prevented from reaching the equipment. The amount of energy reaching the equipment through the coaxial protector is known as "Throughput Energy."

A test was performed on 50 feet of LMR1200 (7/8") coaxial feeder. The center conductor and shield on the surge side were shorted to simulate a shunt-fed antenna. The current from the resulting voltage drop across two 0.001 Ohm current viewing resistors at the far end of the cable was viewed using an HP-54522C Oscilloscope. The coaxial feeder assembly was pulsed with a combinational waveform. The surge generator was set for a combinational waveform output of 1.2 x 50 us, 6kV open circuit voltage and 8 x 20 us 3kA short circuit current. The resulting peak currents on the shield were +1531/-688 Amperes. The currents on the center conductor were +234/-63 Amperes. A slight propagation delay was noted on the center conductor's peak current referenced to the shield peak current.





The above pulse was applied to a 50' long, 7/8" coax feeder. One end was shorted to simulate a shunt-fed antenna, while the other end went to separate 0.001 Ohm current viewing resistors.

PolyPhaser protects mission control facilities by providing lightning protection for closed circuit security audio/video surveillance systems and provides flight operations with uninterrupted telecommunications.

Our ability to provide consistent quality and compliance with ISO9001 and Mil Certifications has made PolyPhaser the industry leader.

COAX PROTECTION
To determine the proper protector, the following properties should be taken into consideration.

IMPEDANCE
PolyPhaser products are either 50 or 75 Ω impedance devices. All of our products have constant impedance throughout their entire frequency range.

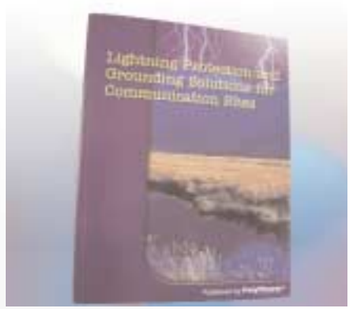
TURN-ON SPEED
Our continuously enabled filters are band pass / band reject protectors that have effectively zero turn-on time.

FREQUENCY RANGE
PolyPhaser has a wide range of products that cover a diverse range of applications and frequency ranges up to 10GHz. We manufacture hybrid protectors for HF; UHF; and VHF frequencies from 50-1000 MHz. DC blocked cavity filters and DC-pass bias-tee are manufactured to cover GSM, CDMA, and UMTS applications from 450-2700 MHz, as well as, microwave frequencies 2.4 GHz and higher used in LAN and MAN applications such as IEEE 802.11 and 802.16.

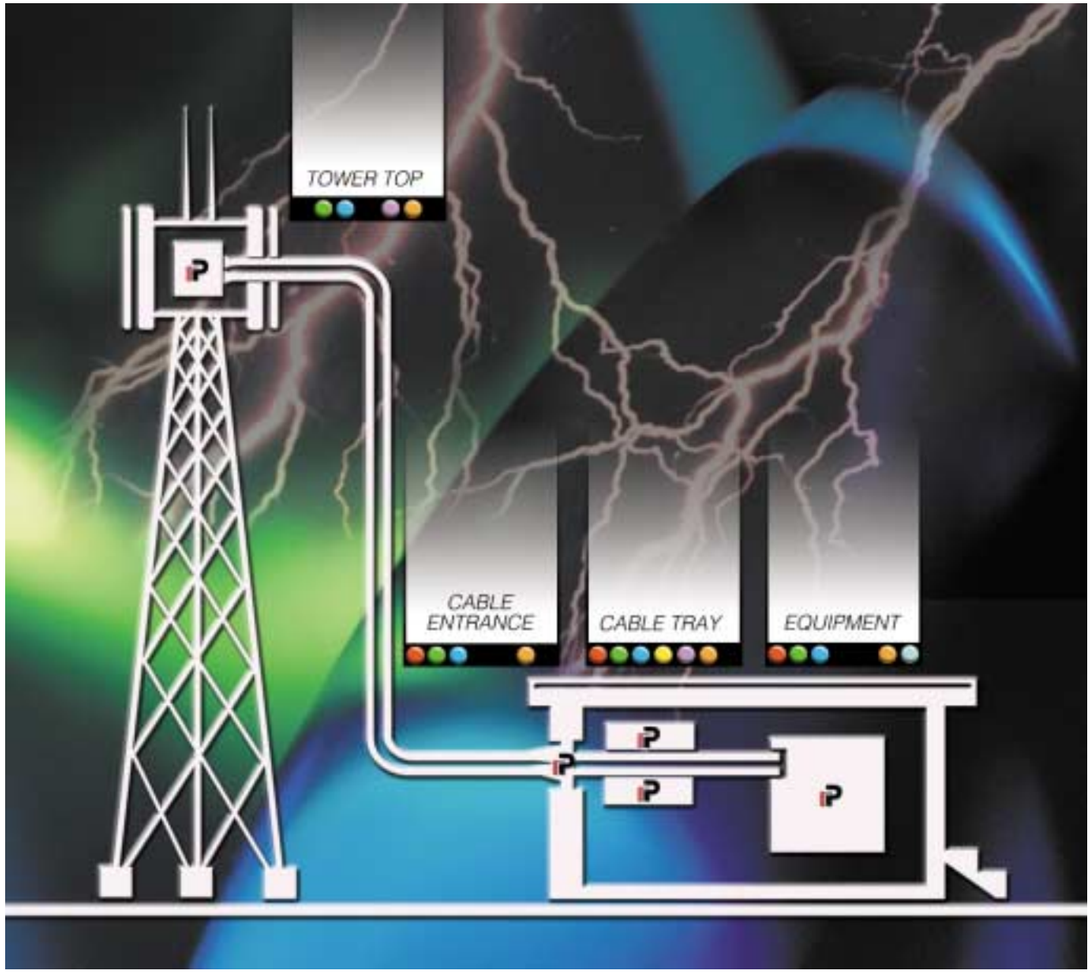
TRANSMIT, TRANSCEIVE, OR RECEIVE ONLY
If multiple transmitters are combined, the number of transmit signals is important. Gas tube protectors are voltage sensitive and multi-transmitter signals are voltage additive. Two 100-Watt transmission signals combine for 200 Watts of power, but the additive voltages have peaks of 200V, which equates to a single 400 Watt signal. Therefore, multi-channel simultaneous transmit systems must have a higher turn-on voltage and be designed to handle the higher peak instantaneous RF currents. This peak turn-on voltage calculation is not required for our filter type protectors.

PRES.ENCE OF AC/DC ALONG WITH THE RF SIGNAL
If dc is required on the center pin of the coax cable to power tower top electronics a dc pass protector should be used. PolyPhaser makes a protected bias-tee that capitalizes on dc blocking for superior surge protection. These low resistance protected bias-T's come in a variety of user voltages.

MOUNTING
Bulkhead panels are the recommended mounting method. Flange style
protectors may be mounted on a bus bar or a single-point ground panel. A ground strap or large ground conductor should be used to connect to a low impedance ground system. For more on grounding, see Grounding Overview section and PPC's own publication Lightning Protection and Grounding Solutions for Communication Sites (LPGS).



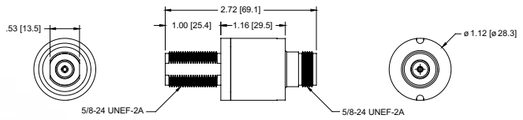
CONNECTOR AND GENDER
Type N and 7/16 Din connectors are standard, yet TNC, BNC, SMA, and F connectors, as well as, reverse pin models are also available. The connector gender can be chosen for male and / or female combinations. Since most of our protectors are directional for surge (bi-directional for RF,) care must be taken to properly orient the protector.



The highlighted areas in the above cell site identify general locations for the installation PolyPhaser's patented lightning protection.

Each highlighted area contains colored dots that reference a specific PolyPhaser product set identified in the table on this page and throughout the catalog.

- *B50, 50NX series.* dc Blocked Single Channel Coaxial Protectors (gas tube)
- *SXL series.* dc Blocked Combiner / High Power Coaxial Protectors (filter)
- *CT/PT series.* dc Blocked Combiner Coaxial Protectors (gas tube)
- *GX series.* dc-Pass / Bias-T Coaxial Protector (hybrid: separate RF and dc paths)
- *75BB series.* Security Camera System Protectors (dc-pass, baseband)
- *IX series.* Data Protection
- *VDC series.* DC Power Protectors



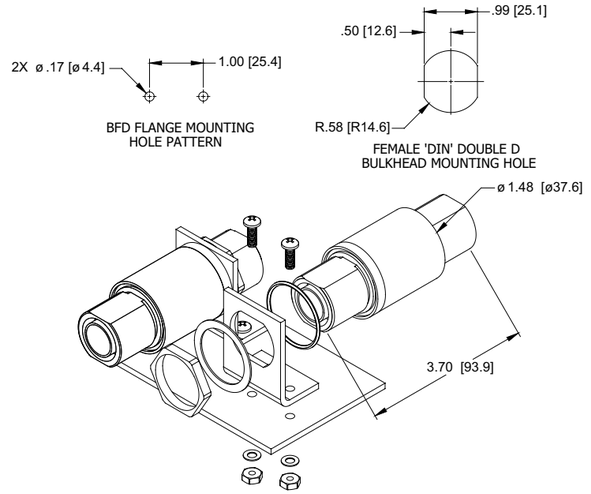
PolyPhaser's best in-line equipment protector
High surge current capability
Low let-through voltage and throughput energy
dc-Shorted filter design, no dc continuity between center pins
Use for applications where dc is NOT required on coaxial cable.
Weatherized body, normal connector weatherization required

Let-through voltage: < 3 Volts (6kV/3kA 8/20usec waveform)
Throughput energy: < 0.5µJ (6kV/3kA 8/20usec waveform)

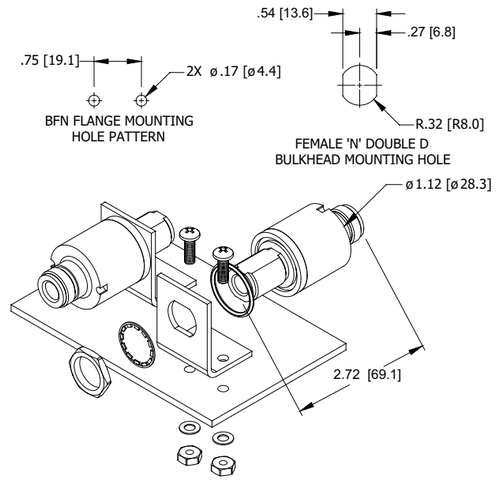
Part Number	Connector	Frequency Range	RF Power	VSWR	Insertion Loss
DSXL	N	800 to 2500MHz	300	1.1 to 1	0.1
DSXL-D	DIN	800 to 2300MHz	500	1.1 to 1	0.1
DSXL-DN	DIN to N	800 to 2300MHz	500	1.1 to 1	0.1
DSXL-T	TNC	800 to 2300MHz	500	1.1 to 1	0.1
DSXL-NS	N to SMA	800 to 2300MHz	300	1.1 to 1	0.1
PSXL	N	1.5 to 2.8GHz	300	1.1 to 1	0.1
LSXL	N	1.8 to 3.8 & 4.2 to 6.0GHz	10	1.3 to 1	0.2
For less exposed subscriber systems:					
AL-LSXM	N	2.0 to 6.0GHz	10	1.3 to 1	0.2
AL-LSXM-RT-ME	TNC (RP)*	2.0 to 6.0GHz	10	1.3 to 1	0.2

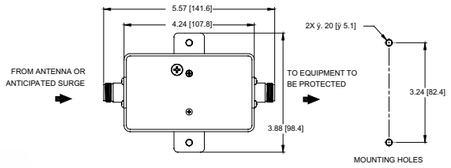
add: -MA for Male Surge (Antenna) Connector
-ME for Male Protected (Equipment) Connector
** RP = Reverse Polarity*

Drawing Number: B003



Drawing Number: B004





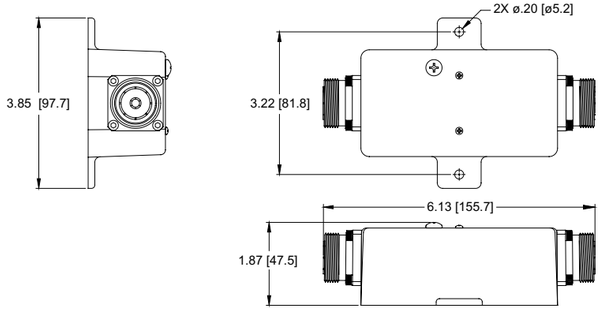
PolyPhaser's best narrow band high power system protector
Narrow band for Cellular (800 to 900MHz) and Paging (860 to 980MHz)
High power gas tube design, no dc continuity between center pins
Use for applications where dc is NOT required
Use indoors; if to be installed outdoors, weatherize using WK-1

RF Power: 750W single channel
VSWR: 1.1 to 1 over frequency range
Insertion loss: 0.1dB
Turn-on: 1200Vdc
*To calculate Vp : 1.414 * x * (√Pch*50)*
Vt = Vp1 + Vp2 …+ Vpn, Vt shall be ≤ 1800V
Turn-on Time: 7ns for 2kV/nsec

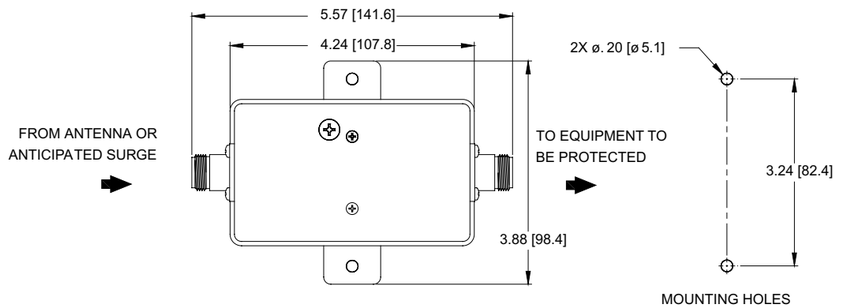
Part Number	Mounting	Connector	Frequency Range	Let-through Voltage	Through-put Energy	Note
IS-CS50HN-B	Bulkhead	N	800 to 900MHz	24	6.5nJ	Sampler Port
IS-CS50HD-B	Bulkhead	DIN	800 to 900MHz	24	6.5nJ	Sampler Port
IS-CT50HN-B	Bulkhead	N	800 to 900MHz	24	15nJ	
IS-CT50HD-B	Bulkhead	DIN	800 to 900MHz	24	15nJ	
IS-CS50HN	Flange	N	800 to 900MHz	24	6.5nJ	Sampler Port
IS-CS50HD	Flange	DIN	800 to 900MHz	24	6.5nJ	Sampler Port
IS-CT50HN	Flange	N	800 to 900MHz	24	15nJ	
IS-CT50HD	Flange	DIN	800 to 900MHz	24	15nJ	
IS-PS50HN-B	Bulkhead	N	860 to 980MHz	14	6.5nJ	Sampler Port
IS-PS50HD-B	Bulkhead	DIN	860 to 980MHz	14	6.5nJ	Sampler Port
IS-PT50HN-B	Bulkhead	N	860 to 980MHz	24	15nJ	
IS-PT50HD-B	Bulkhead	DIN	860 to 980MHz	24	15nJ	
IS-PS50HN	Flange	N	860 to 980MHz	14	6.5nJ	Sampler Port
IS-PS50HD	Flange	DIN	860 to 980MHz	14	6.5nJ	Sampler Port
IS-PT50HN	Flange	N	860 to 980MHz	24	15nJ	
IS-PT50HD	Flange	DIN	860 to 980MHz	24	15nJ	

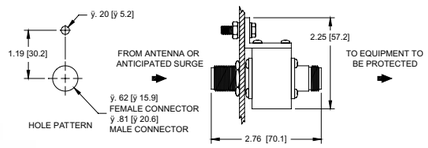
add: -MA for Male Surge (Antenna) Connector
-ME for Male Protected (Equipment) Connector

Drawing Number: B001



Drawing Number: B002





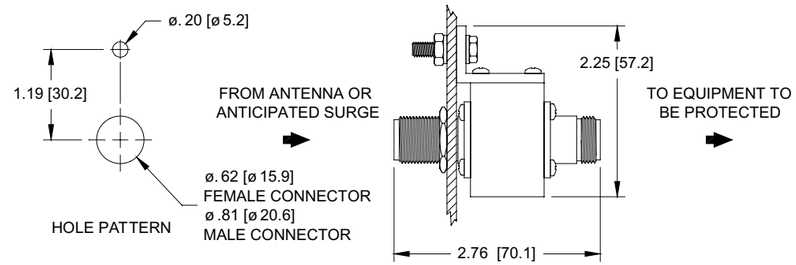
PolyPhaser's broadband protectors for general radio use
Bulkhead or surface mountable
dc-Blocked gas tube design, no dc continuity between center pins
Use indoors, if to be installed outdoors weatherize using WK-1

Insertion Loss: 0.1dB
Turn-on: 600Vdc L models, 1200Vdc H models
Turn-on time: 2.5ns L models, 7ns H models

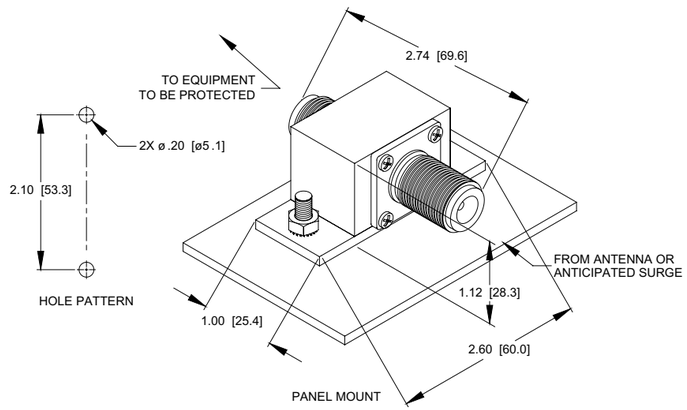
Mounting	Part Number	Connector	Frequency Range	RF Power	VSWR	Let-through Voltage	Throughput Energy
Bulkhead	**IS-B50LU-C0**	UHF	1.5 to 400MHz	HF: 2kW, VHF: 375W, UHF: 125W	1.2 to 1	900	10mJ
	IS-B50HU-C0	UHF	1.5 to 400MHz	HF: 3kW, VHF: 500W, UHF: 250W	1.2 to 1	1200	20mJ
	IS-B50LU-C1	UHF	50 to 700MHz	VHF: 375W, UHF: 125W	1.2 to 1	750	600µJ
	IS-B50HU-C1	UHF	50 to 700MHz	VHF: 500W, UHF: 250W	1.2 to 1	800	1mJ
	IS-B50LN-C0	N	1.5 to 400MHz	HF: 2kW, VHF: 375W, UHF: 125W	1.2 to 1 (1.5 to 2MHz), 1.1 to 1 (2 to 400MHz)	900	10mJ
	IS-B50HN-C0	N	1.5 to 400MHz	HF: 3kW, VHF: 500W, UHF: 250W	1.2 to 1 (1.5 to 2MHz), 1.1 to 1 (2 to 400MHz)	1200	20mJ
	IS-B50LN-C1	N	50 to 700MHz	VHF: 375W, UHF: 125W	1.2 to 1 (50 to 60MHz), 1.1 to 1 (60 to 700MHz)	750	600µJ
	IS-B50HN-C1	N	50 to 700MHz	VHF: 500W, UHF: 250W	1.2 to 1 (50 to 60MHz), 1.1 to 1 (60 to 700MHz)	800	1mJ
	IS-B50LN-C2	N	125 to 1000MHz	VHF: 375W, UHF(low): 125W, 800 to 1000MHz: 50W	1.1 to 1	700	220µJ
	IS-B50HN-C2	N	125 to 1000MHz	VHF: 500W, UHF(low): 250W, 800 to 1000MHz: 125W	1.1 to 1	800	800µJ
Flange	**IS-50UX-C0**	UHF	1.5 to 400MHz	HF: 2kW, VHF: 375W, UHF: 125W	1.2 to 1	1100	10mJ
	IS-50UX-C1	UHF	50 to 700MHz	VHF: 375W, UHF: 125W	1.2 to 1	650	600µJ
	IS-50NX-C0	N	1.5 to 400MHz	HF: 2kW, VHF: 375W, UHF: 125W	1.2 to 1 (1.5 to 2MHz), 1.1 to 1 (2 to 400MHz)	1100	10mJ
	IS-50NX-C1	N	50 to 700MHz	VHF: 375W, UHF: 125W	1.2 to 1 (50 to 60MHz), 1.1 to 1 (60 to 700MHz)	650	600µJ
	IS-50NX-C2	N	125 to 1000MHz	VHF: 375W, UHF(low): 125W, 800 to 1000MHz: 50W	1.1 to 1	750	220µJ
	IS-75F-C1	F	4 to 900MHz	HF: 100W, VHF: 100W, UHF: 25W	1.2 to 1	720	1mJ

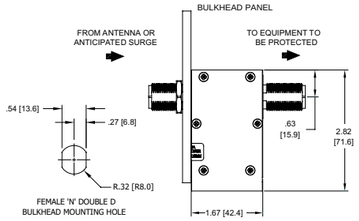
add: -MA for Male Surge (Antenna) Connector
-ME for Male Protected (Equipment) Connector

Drawing Number: A001



Drawing Number: A002





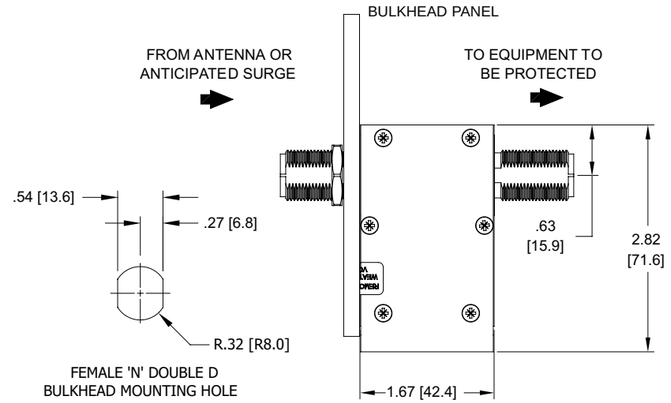
PolyPhaser's best in-line equipment protector
High surge current capability
Low let-through voltage and throughput energy
dc-Shorted filter design, no dc continuity between center pins
Use for applications where dc is NOT required on coaxial cable
Weatherized body, normal connector weatherization required

RF Power: 750 W
VSWR: 1.1 to 1 over frequency range
Insertion loss: 0.1 dB
Let-through Voltage: 12V
Through-put energy: 0.5nJ

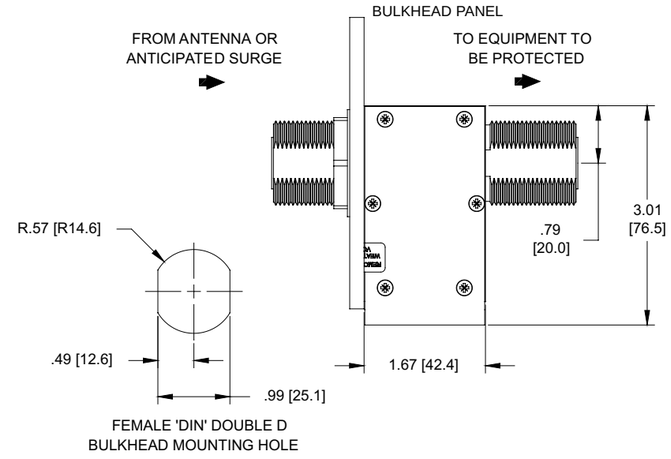
Part Number	Connector	Frequency Range
VHF50HN	N	100 to 512MHz
VHF50HD	DIN	100 to 512MHz
UHF50HN	N	300 to 700MHz
UHF50HD	DIN	300 to 700MHz

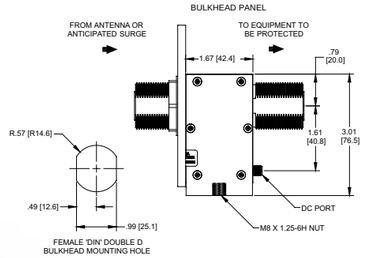
add: -MA for Male Surge (Antenna) Connector
-ME for Male Protected (Equipment) Connector

Drawing Number: B005



Drawing Number: B006





D	GX	J	+	06	D	M	D	F	-	A
Frequency Band	Series	Type	Polarity	Voltage	Surge Side Connector	Surge Side Connector Gender	Protected Side Connector	Protected Side Connector Gender		Lid Configuration

Frequency Band: C = 400 to 1200MHz, D = 800 to 2500MHz
Type: Z = dc-pass, J = Bias-T
Polarity: + positive voltage, - negative voltage
Voltage: System operating voltage; to pass through protector
Surge side connector & gender; type N, 7/16 DIN, TNC
Protected side connector & gender; type N, 7/16 DIN, TNC
Lid configuration: -A = standard
(contact factory or visit website for alternates)

1st Four	Frequency Range	Type
CGXZ	400 to 1200MHz	dc-pass
CGXJ	400 to 1200MHz	Bias-T
DGXZ	800 to 2500MHz	dc-pass
DGXJ	800 to 2500MHz	Bias-T

GXZ dc-Pass

Max current: 4Adc
Weatherized body, normal connector weatherization required
VSWR: ≤1.1 to 1 over frequency range
Insertion Loss: ≤0.1dB
Turn-on time: 4ns for 2kV/ns

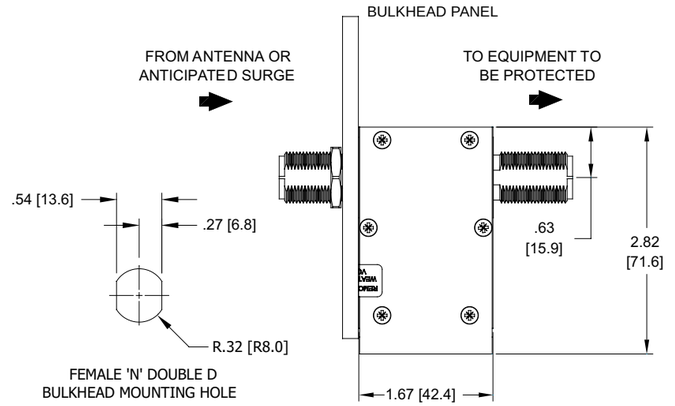
Operating Voltage	Max RF Power	Let-through Voltage	Through-put Energy	Turn-on Voltage
6	0.25	11	175uJ	7
15	2.25	25	500uJ	16.5
24	6.25	45	1mJ	28.5
36	15	60	1.5mJ	40
48	40	80	2.0mJ	55
60	40	80	2.5mJ	66.5

GXJ Bias-T

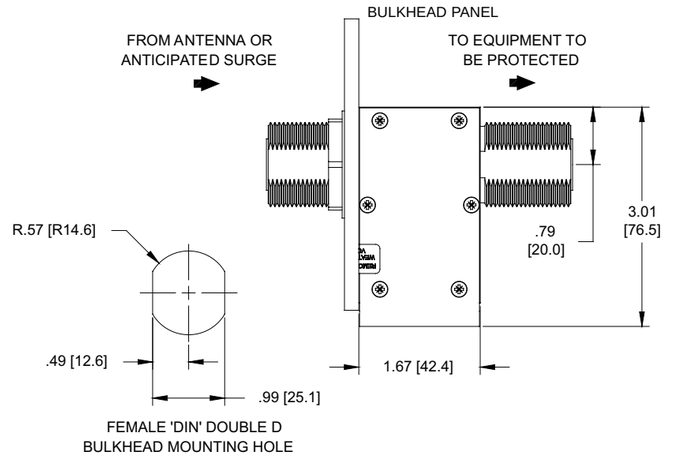
Weatherized body, normal connector weatherization required
Max current: 4Adc
VSWR: ≤1.1 to 1 over frequency range
Insertion Loss: ≤0.1dB
Turn-on time: 4ns for 2kV/ns
SMA connector as dc injector/pick-off port

Operating Voltage	Max RF Power	Let-through Voltage	Through-put Energy RF	Through-put energy dc	Turn-on Voltage
6	300	11	5nJ	175uJ	7
15	300	25	5nJ	500uJ	16.5
24	300	45	10nJ	1000uJ	28.5
36	300	60	15nJ	1500uJ	40
48	300	80	20nJ	2000uJ	53
60	300	80	25nJ	2500uJ	66

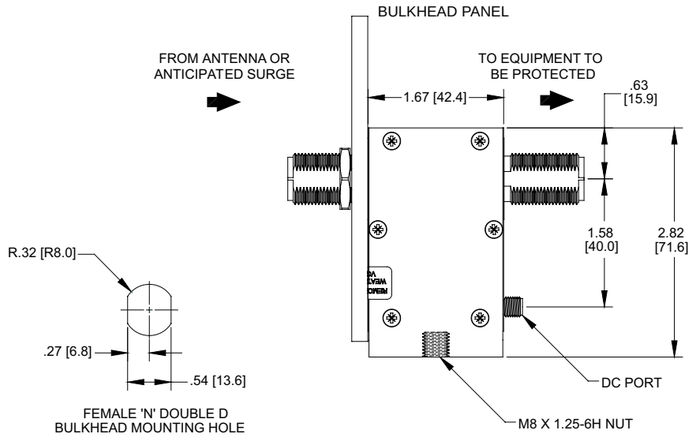
Drawing Number: C002



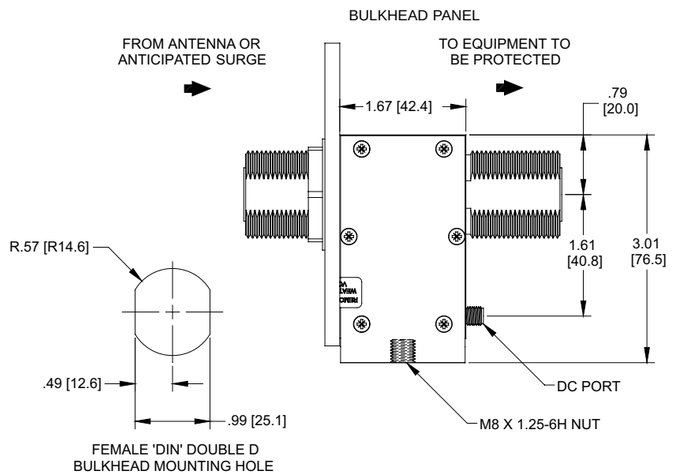
Drawing Number: C003



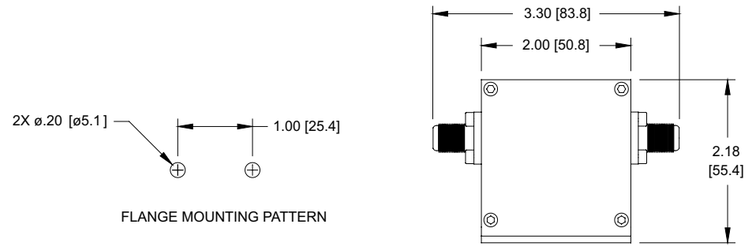
Drawing Number: C006 (dc Port)



Drawing Number: C007 (dc Port)



Drawing Number: C004



Surge Capabilities: IEC 1000-4-5, 8/20µs @ 3kA, IEC 1000-4-5, 10/350µs @3kA

Frequency Range: Telemetry (10 kHz to 150 kHz, 10 MHz to 100 MHz)
Rx/Tx (300 MHz to 2500 MHz)

Return Loss: Telemetry (>10.0 dB)
Rx/Tx (>15.0dB nominal)

Insertion Loss: Telemetry (2.0dB max)
Rx/Tx (1.0dB max)

Rx/Tx Group Delay Variation: 100ps max

Impedance: 75 Ohms

RF power: 50 Watts max

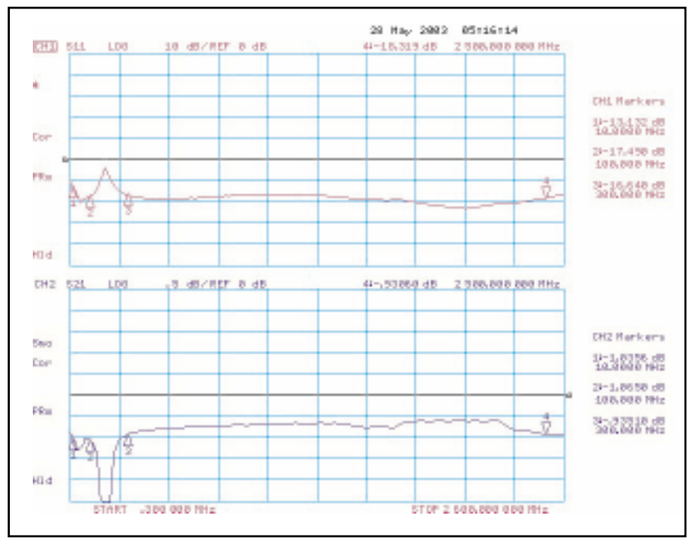
User Voltage: 24Vdc

Operating Temperature: - 50° C to + 85° C, Storage Temperature: - 50° C to + 95° C

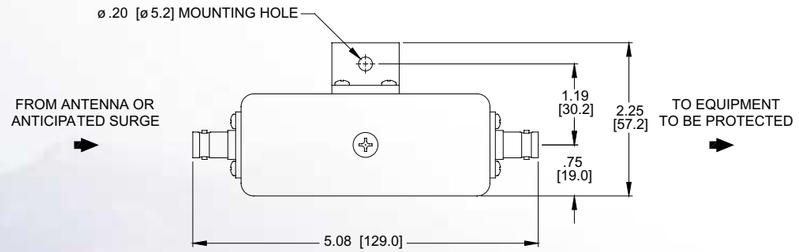
Relative Humidity: 0 to 100% condensing

Surge Throughput Energy: 1mJ typical (6kV/3kA 8/20µs)

Peak Let-through Voltage: 2 x operating voltage max



Drawing Number: C005



PolyPhaser's baseband protectors
Use for applications which may require dc on the coaxial cable
VLF/HF receive only, LAN, closed circuit television
Use indoors; if to be installed outdoors, weatherize using WK-1

Typical Applications: 75Ω (1.5V) video, 50Ω (6V) VLF/HF Receive Only, 50Ω (18V) LAN 10Mbps max.
Frequency Range: 50 Ohm, dc to 50 MHz, 75 Ohm, dc to 30MHz (DS-3 up to 200MHz)
Receive only
Max current: 2Adc
VSWR: 1.1 to 1 over frequency range
Insertion Loss: 0.3dB
Turn-on time: 4ns for 2kV/ns
Operating (Turn-on Voltage): 1.5 (2.3V), 6 (7V) and 18 (19V)

Impedance	Part Number	Connector	Operating Voltage	Let-through Voltage	Throughput Energy
50 Ω	IS-50UB/1.5	UHF	1.5	37.0	103µJ
	IS-50UB/6	UHF	6	38.0	153µJ
	IS-50UB/18	UHF	18	54.0	386µJ
	IS-50BB/1.5	BNC	1.5	37.0	103µJ
	IS-50BB/6	BNC	6	38.0	153µJ
	IS-50BB/18	BNC	18	54.0	386µJ
	IS-50NB/1.5	N	1.5	37.0	103µJ
	IS-50NB/6	N	6	38.0	153µJ
	IS-50NB/18	N	18	54.0	386µJ
	IS-50TB/1.5	TNC	1.5	37.0	103µJ
	IS-50TB/6	TNC	6	38.0	153µJ
	IS-50TB/18	TNC	18	54.0	386µJ
75 Ω	IS-75UB/1.5	UHF	1.5	37.0	103µJ
	IS-75UB/6	UHF	6	38.0	153µJ
	IS-75UB/18	UHF	18	54.0	386µJ
	IS-75BB/1.5	BNC	1.5	37.0	103µJ
	IS-75BB/6	BNC	6	38.0	153µJ
	IS-75BB/18	BNC	18	54.0	386µJ
	IS-75FB/1.5	F	1.5	37.0	103µJ
	IS-75FB/6	F	6	38.0	153µJ
	IS-75FB/18	F	18	54.0	386µJ
	IS-75NB/1.5	N	1.5	37.0	103µJ
	IS-75NB/6	N	6	38.0	153µJ
	IS-75NB/18	N	18	54.0	386µJ
DS-3 data	IS-75BB-DS-3	BNC	2	174.0	3.05mJ

Coaxial Protector Selection

1. Determine Application:
- **Single Transmitter:** dc-blocked, use for applications where there is no dc on the coax and the system utilizes a single transmitter
- **Combiner / High Power:** dc-blocked, use for applications where there is no dc on the coax and the system utilizes multiple transmitters also excellent single high power transmitter protector
- **dc-Pass:** Use for applications where dc voltage is on the coax to power up Tower Top Electronics or active antennas
- **Bias-T:** Use to inject or pick-off dc voltage to power up Tower Top Electronics

2. Determine Mounting and Impedance Option:
- **Bulkhead:** Designed to go through bulkhead, groundbar or enclosure wall
- **Flange:** Designed to be mounted on plate or ground bar
- **Bulkhead / Flange:** May be mounted either bulkhead or flange

3. Determine Connector Type:
Select desired connector type, units listed are female gender both sides, add -MA for male antenna (surge) or -ME for male equipment (protected) GX series, see below part number configurator

4. Determine Frequency Range:
Select desired frequency (or range) between low and high frequencies listed

5. Determine RF Power Requirements:
Select desired RF power requirement, RO = receive only

6. Determine Weatherization Requirement:
- **Y:** Outdoor applications, connector weatherization requirements apply
- **N:** Indoor or bulkhead applications, connector weatherization requirements apply

7. Part Number:
Units listed have female gender connectors both sides, add -MA for male antenna (surge) or -ME for male equipment (protected) GX series, part number configurator

8. VSWR (Voltage Standing Wave Ratio):
VSWR listed for entire frequency range listed, degradation occurs if used outside this range

9. Insertion Loss (dB):
Insertion Loss listed for entire frequency range listed, degradation occurs if used outside this range

10. Let-through Voltage:
Maximum voltage let-through the protector (typical)

11. Throughput Energy:
Total energy that will be let-through to the equipment (typical)

12. Turn-on Voltage:
Turn-on voltage at with a ramp of 100V/µs typical, N/A for filter units

13. Turn-on Time:
Time to 50% of peak voltage during turn-on process, N/A for filter units

14. Notes:
- **Filter:** Utilizes filter technology, dc-blocked RF path, dc-shorted on surge side
- **Reverse Bulkhead:** Designed to be mounted outside screen room penetration panel
- **Sampler Port:** Built-in BNC connector sampler port (20dB attenuation)
- **Isolated Equipment:** Equipment to be protected must be isolated from ground

15. Drawing Number:
Refers to dimensional and installation drawing

PolyPhaser

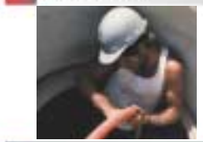
Single Transmitter Matrix

Part Number	Connector	Frequency Range	Max Power	Weatherized	VSWR	Insertion Loss dB	Let-through Voltage (dc)	Throughput Energy	Turn-on Voltage (dc)	Turn-on Time ns for 2kV / ns	Notes	Drawing Number	Drawing Page	Part Number
Bulkhead 50Ω					**Bulkhead 50Ω**									
IS-B50LU-C0	UHF	1.5 to 400MHz	HF: 2kW, VHF: 375W, UHF: 125W	N	1.2 to 1	0.1	900	10mJ	600	2.5		A001	17	**IS-B50LU-C0**
IS-B50HU-C0	UHF	1.5 to 400MHz	HF: 3kW, VHF: 500W, UHF: 250W	N	1.2 to 1	0.1	1200	20mJ	1200	7		A001	17	**IS-B50HU-C0**
IS-B50LU-C1	UHF	50 to 700MHz	VHF: 375W, UHF: 125W	N	1.2 to 1	0.1	750	600µJ	600	2.5		A001	17	**IS-B50LU-C1**
IS-B50HU-C1	UHF	50 to 700MHz	VHF: 500W, UHF: 250W	N	1.2 to 1	0.1	800	1mJ	1200	7		A001	17	**IS-B50HU-C1**
IS-B50LN-C0	N	1.5 to 400MHz	HF: 2kW, VHF: 375W, UHF: 125W	N	1.2 to 1 (1.5 to 2MHz), 1.1 to 1 (2 to 400MHz)	0.1	900	10mJ	600	2.5		A001	17	**IS-B50LN-C0**
IS-B50HN-C0	N	1.5 to 400MHz	HF: 3kW, VHF: 500W, UHF: 250W	N	1.2 to 1 (1.5 to 2MHz), 1.1 to 1 (2 to 400MHz)	0.1	1200	20mJ	1200	7		A001	17	**IS-B50HN-C0**
IS-B50LN-C1	N	50 to 700MHz	VHF: 375W, UHF: 125W	N	1.2 to 1 (50 to 60MHz), 1.1 to 1 (60 to 700MHz)	0.1	750	600µJ	600	2.5		A001	17	**IS-B50LN-C1**
IS-B50HN-C1	N	50 to 700MHz	VHF: 500W, UHF: 250W	N	1.2 to 1 (50 to 60MHz), 1.1 to 1 (60 to 700MHz)	0.1	800	1mJ	1200	7		A001	17	**IS-B50HN-C1**
IS-B50LN-C2	N	125 to 1000MHz	VHF: 375W, UHF(low): 125W, 800 TO 1000MHz: 50W	N	1.1 to 1	0.1	700	220µJ	600	2.5		A001	17	**IS-B50LN-C2**
IS-B50HN-C2	N	125 to 1000MHz	VHF: 500W, UHF(low): 250W, 800 TO 1000MHz: 125W	N	1.1 to 1	0.1	800	800µJ	1200	7		A001	17	**IS-B50HN-C2**
IS-NEMP-C0	N	1.5 to 400MHz	HF: 500W, VHF: 200W, UHF: 100W	N	1.2 to 1 (1.5 to 2MHz), 1.1 to 1 (2 to 400MHz)	0.1	600	1.10mJ	330	1.5	Reverse Bulkhead	A001	17	**IS-NEMP-C0**
IS-NEMP-C1	N	50 to 700MHz	VHF: 200W, UHF: 100W	N	1.2 to 1 (50 to 60MHz), 1.1 to 1 (60 to 700MHz)	0.1	400	313µJ	330	1.5	Reverse Bulkhead	A001	17	**IS-NEMP-C1**
IS-NEMP-C2	N	125 to 1000MHz	VHF: 200W, UHF(low): 100W, 800 TO 1000MHz: 50W	N	1.1 to 1	0.1	415	250mJ	330	1.5	Reverse Bulkhead	A001	17	**IS-NEMP-C2**
IS-GF50LN	N	80 to 900MHz	HF: 10W, VHF: 5W	N	1.1 to 1	0.2	400	33µJ	90	4		A004	36	**IS-GF50LN**
Flange 50Ω					**Flange 50Ω**									
IS-50UX-C0	UHF	1.5 to 400MHz	HF: 2kW, VHF: 375W, UHF: 125W	N	1.2 to 1	0.1	1100	10mJ	600	2.5		A002	17	**IS-50UX-C0**
IS-50UX-C1	UHF	50 to 700MHz	VHF: 375W, UHF: 125W	N	1.2 to 1	0.1	650	600µJ	600	2.5		A002	17	**IS-50UX-C1**
IS-50NX-C0	N	1.5 to 400MHz	HF: 2kW, VHF: 375W, UHF: 125W	N	1.2 to 1 (1.5 to 2MHz), 1.1 to 1 (2 to 400MHz)	0.1	1100	10mJ	600	2.5		A002	17	**IS-50NX-C0**
IS-50NX-C1	N	50 to 700MHz	VHF: 375W, UHF: 125W	N	1.2 to 1 (50 to 60MHz), 1.1 to 1 (60 to 700MHz)	0.1	650	600µJ	600	2.5		A002	17	**IS-50NX-C1**
IS-50NX-C2	N	125 to 1000MHz	VHF: 375W, UHF(low): 125W, 800 TO 1000MHz: 50W	N	1.1 to 1	0.1	750	220µJ	600	2.5		A002	17	**IS-50NX-C2**
AL-LSXM	N	2.0 to 6.0GHz	10W	Y	1.3 to 1	0.2	3	0.5µJ	N/A	N/A	Filter	Consult factory for print		**AL-LSXM**
AL-LSXM-RT-ME	TNC (RP)	2.0 to 6.0GHz	10W	Y	1.3 to 1	0.2	3	0.5µJ	N/A	N/A	Filter	Consult factory for print		**AL-LSXM-RT-ME**
Flange 75Ω					**Flange 75Ω**									
IS-75F-C1	F	4 to 900MHz	HF: 100W, VHF: 100W, UHF: 25W	N	1.2 to 1	0.1	720	1mJ	600	2.5				**IS-75F-C1**

Note: *Add -MA for male antenna (surge)*
-ME for male equipment (protected)

NOTE:
Discontinued Products:
For a complete reference of discontinued product number and associated replacement products refer to the PolyPhaser website @ http://www.polyphaser.com/products/obsolete.aspx

PolyPhaser



Combiner/High-power Matrix

Part Number	Connector	Frequency Range	Max Power (single channel)	Weatherized	Max VSWR	Max Insertion Loss dB	Let-through Voltage (dc)	Throughput Energy	Turn-on Voltage (dc)	Turn-on Time ns for 2kV/ns	Notes	Drawing Number	Drawing Page	Part Number
Bulkhead 50Ω					**Bulkhead 50Ω**									
IS-VU50HN	N	50 to 550MHz	750	N	1.1 to 1	0.1	1200	2.23mJ	1800	15		B002	15	**IS-VU50HN**
IS-CU50HN	N	450 to 900MHz	250	N	1.1 to 1	0.1	1350	2.23mJ	1200	7		B002	15	**IS-CU50HN**
IS-CS50HN-B	N	800 to 900MHz	750	N	1.1 to 1	0.1	24	6.5nJ	1200	7	Sampler Port	B002	15	**IS-CS50HN-B**
IS-CS50HD-B	DIN	800 to 900MHz	750	N	1.1 to 1	0.1	24	6.5nJ	1200	7	Sampler Port	B001	15	**IS-CS50HD-B**
IS-PS50HN-B	N	860 to 980MHz	750	N	1.1 to 1	0.1	14	6.5nJ	1200	7	Sampler Port	B002	15	**IS-PS50HN-B**
IS-PS50HD-B	DIN	860 to 980MHz	750	N	1.1 to 1	0.1	14	6.5nJ	1200	7	Sampler Port	B001	15	**IS-PS50HD-B**
IS-CT50HN-B	N	800 to 900MHz	750	N	1.1 to 1	0.1	24	15nJ	1200	7		B002	15	**IS-CT50HN-B**
IS-CT50HD-B	DIN	800 to 900MHz	750	N	1.1 to 1	0.1	24	15nJ	1200	7		B001	15	**IS-CT50HD-B**
IS-PT50HN-B	N	860 to 980MHz	750	N	1.1 to 1	0.1	24	15nJ	1200	7		B002	15	**IS-PT50HN-B**
IS-PT50HD-B	DIN	860 to 980MHz	750	N	1.1 to 1	0.1	24	15nJ	1200	7		B001	15	**IS-PT50HD-B**
DSXL	N	800 to 2500MHz	300	Y	1.1 to 1	0.1	3	0.5µJ	N/A	N/A	Filter	B004	13	**DSXL**
DSXL-D	DIN	800 to 2300MHz	500	Y	1.1 to 1	0.1	3	0.5µJ	N/A	N/A	Filter	B003	13	**DSXL-D**
DSXL-DN	DIN to N	800 to 2300MHz	500	Y	1.1 to 1	0.1	3	0.5µJ	N/A	N/A	Filter	Consult factory for print		**DSXL-DN**
DSXL-T	TNC	800 to 2300MHz	500	Y	1.1 to 1	0.1	3	0.5µJ	N/A	N/A	Filter	Consult factory for print		**DSXL-T**
DSXL-NS	N to SMA	800 to 2300MHz	300	Y	1.1 to 1	0.1	3	0.5µJ	N/A	N/A	Filter	Consult factory for print		**DSXL-NS**
PSXL	N	1.2 to 2.8GHz	300	Y	1.1 to 1	0.1	3	0.5µJ	N/A	N/A	Filter	B004	13	**PSXL**
LSXL	N	1.8 to 3.8GHz	10	Y	1.3 to 1	0.2	3	0.5µJ	N/A	N/A	Filter	B004	13	**LSXL**
Flange 50Ω					**Flange 50Ω**									
IS-CS50HN	N	800 to 900MHz	750	N	1.1 to 1	0.1	24	6.5nJ	1200	7	Sampler Port	B002	15	**IS-CS50HN**
IS-CS50HD	DIN	800 to 900MHz	750	N	1.1 to 1	0.1	24	6.5nJ	1200	7	Sampler Port	B001	15	**IS-CS50HD**
IS-PS50HN	N	860 to 980MHz	750	N	1.1 to 1	0.1	14	6.5nJ	1200	7	Sampler Port	B002	15	**IS-PS50HN**
IS-PS50HD	DIN	860 to 980MHz	750	N	1.1 to 1	0.1	14	6.5nJ	1200	7	Sampler Port	B001	15	**IS-PS50HD**
IS-CT50HN	N	800 to 900MHz	750	N	1.1 to 1	0.1	24	15nJ	1200	7		B002	15	**IS-CT50HN**
IS-CT50HD	DIN	800 to 900MHz	750	N	1.1 to 1	0.1	24	15nJ	1200	7		B001	15	**IS-CT50HD**
IS-PT50HN	N	860 to 980MHz	750	N	1.1 to 1	0.1	24	15nJ	1200	7		B002	15	**IS-PT50HN**
IS-PT50HD	DIN	860 to 980MHz	750	N	1.1 to 1	0.1	24	15nJ	1200	7		B001	15	**IS-PT50HD**
Bulkhead / Flange 50Ω					**Bulkhead / Flange 50Ω**									
VHF50HN	N	100 to 512MHz	750	Y	1.1 to 1	0.1	12	0.5nJ	N/A	N/A	Filter	B005	19	**VHF50HN**
VHF50HD	DIN	100 to 512MHz	750	Y	1.1 to 1	0.1	12	0.5nJ	N/A	N/A	Filter	B006	19	**VHF50HD**
UHF50HN	N	300 to 700MHz	750	Y	1.1 to 1	0.1	12	0.5nJ	N/A	N/A	Filter	B005	19	**UHF50HN**
UHF50HD	DIN	300 to 700MHz	750	Y	1.1 to 1	0.1	12	0.5nJ	N/A	N/A	Filter	B006	19	**UHF50HD**

Note: *Add -MA for male antenna (surge)*
-ME for male equipment (protected)

NOTE:
Discontinued Products:
For a complete reference of discontinued product number and associated replacement products refer to the PolyPhaser website @ http://www.polyphaser.com/products/obsolete.aspx

Part Number	Connector	Frequency Range	Operating Voltage (Vdc)	Max dc Current (Adc)	Max Power (watts)	Weatherized	VSWR	Insertion Loss dB	Let-through Voltage (dc)	Throughput Energy	Turn-on Voltage (dc)	Turn-on Time ns for 2kV / ns	Drawing Number	Drawing Page	Part Number
Bulkhead / Flange 50Ω							**Bulkhead / Flange 50Ω**								
CGXZ+15NFNF-A	N	400 to 1200MHz	+15	4	2.25	Y	1.1 to 1	0.1	25.0	500µJ	16.5	4	C002	21	**CGXZ+15NFNF-A**
CGXZ+24NFNF-A	N	400 to 1200MHz	+24	4	6.25	Y	1.1 to 1	0.1	45.0	1mJ	28.5	4	C002	21	**CGXZ+24NFNF-A**
CGXZ+36NFNF-A	N	400 to 1200MHz	+36	4	15	Y	1.1 to 1	0.1	60.0	1.5mJ	40	4	C002	21	**CGXZ+36NFNF-A**
CGXZ+48NFNF-A	N	400 to 1200MHz	+48	4	40	Y	1.1 to 1	0.1	80.0	2.0mJ	55	4	C002	21	**CGXZ+48NFNF-A**
CGXZ-15NFNF-A	N	400 to 1200MHz	-15	4	2.25	Y	1.1 to 1	0.1	25.0	500µJ	16.5	4	C002	21	**CGXZ-15NFNF-A**
CGXZ-24NFNF-A	N	400 to 1200MHz	-24	4	6.25	Y	1.1 to 1	0.1	45.0	1mJ	28.5	4	C002	21	**CGXZ-24NFNF-A**
CGXZ-36NFNF-A	N	400 to 1200MHz	-36	4	15	Y	1.1 to 1	0.1	60.0	1.5mJ	40	4	C002	21	**CGXZ-36NFNF-A**
CGXZ-48NFNF-A	N	400 to 1200MHz	-48	4	40	Y	1.1 to 1	0.1	80.0	2.0mJ	55	4	C002	21	**CGXZ-48NFNF-A**
CGXZ+06DFDF-A	DIN	400 to 1200MHz	+06	4	0.25	Y	1.1 to 1	0.1	11.0	175µJ	7	4	C003	21	**CGXZ+06DFDF-A**
CGXZ+15DFDF-A	DIN	400 to 1200MHz	+15	4	2.25	Y	1.1 to 1	0.1	25.0	500µJ	16.5	4	C003	21	**CGXZ+15DFDF-A**
CGXZ+24DFDF-A	DIN	400 to 1200MHz	+24	4	6.25	Y	1.1 to 1	0.1	45.0	1mJ	28.5	4	C003	21	**CGXZ+24DFDF-A**
CGXZ+36DFDF-A	DIN	400 to 1200MHz	+36	4	15	Y	1.1 to 1	0.1	60.0	1.5mJ	40	4	C003	21	**CGXZ+36DFDF-A**
CGXZ+48DFDF-A	DIN	400 to 1200MHz	+48	4	40	Y	1.1 to 1	0.1	80.0	2.0mJ	55	4	C003	21	**CGXZ+48DFDF-A**
CGXZ-15DFDF-A	DIN	400 to 1200MHz	-15	4	2.25	Y	1.1 to 1	0.1	25.0	500µJ	16.5	4	C003	21	**CGXZ-15DFDF-A**
CGXZ-24DFDF-A	DIN	400 to 1200MHz	-24	4	6.25	Y	1.1 to 1	0.1	45.0	1mJ	28.5	4	C003	21	**CGXZ-24DFDF-A**
CGXZ-36DFDF-A	DIN	400 to 1200MHz	-36	4	15	Y	1.1 to 1	0.1	60.0	1.5mJ	40	4	C003	21	**CGXZ-36DFDF-A**
CGXZ-48DFDF-A	DIN	400 to 1200MHz	-48	4	40	Y	1.1 to 1	0.1	80.0	2.0mJ	55	4	C003	21	**CGXZ-48DFDF-A**
DGXZ+06NFNF-A	N	800 to 2500MHz	+06	4	0.25	Y	1.1 to 1	0.1	11.0	175µJ	7	4	C002	21	**DGXZ+06NFNF-A**
DGXZ+15NFNF-A	N	800 to 2500MHz	+15	4	2.25	Y	1.1 to 1	0.1	25.0	500µJ	16.5	4	C002	21	**DGXZ+15NFNF-A**
DGXZ+15TFTF-A	TNC	800 to 2500MHz	+15	4	2.25	Y	1.1 to 1	0.1	25.0	500µJ	16.5	4	C002	21	**DGXZ+15TFTF-A**
DGXZ+24NFNF-A	N	800 to 2500MHz	+24	4	6.25	Y	1.1 to 1	0.1	45.0	1mJ	28.5	4	C002	21	**DGXZ+24NFNF-A**
DGXZ+36NFNF-A	N	800 to 2500MHz	+36	4	15	Y	1.1 to 1	0.1	60.0	1.5mJ	40	4	C002	21	**DGXZ+36NFNF-A**
DGXZ+48NFNF-A	N	800 to 2500MHz	+48	4	40	Y	1.1 to 1	0.1	80.0	2.0mJ	55	4	C002	21	**DGXZ+48NFNF-A**
DGXZ+60NFNF-A	N	800 to 2500MHz	+60	4	40	Y	1.1 to 1	0.1	80.0	2.5mJ	66.5	4	C002	21	**DGXZ+60NFNF-A**
DGXZ-15NFNF-A	N	800 to 2500MHz	-15	4	2.25	Y	1.1 to 1	0.1	25.0	500µJ	16.5	4	C002	21	**DGXZ-15NFNF-A**
DGXZ-24NFNF-A	N	800 to 2500MHz	-24	4	6.25	Y	1.1 to 1	0.1	45.0	1mJ	28.5	4	C002	21	**DGXZ-24NFNF-A**
DGXZ-36NFNF-A	N	800 to 2500MHz	-36	4	15	Y	1.1 to 1	0.1	60.0	1.5mJ	40	4	C002	21	**DGXZ-36NFNF-A**
DGXZ-48NFNF-A	N	800 to 2500MHz	-48	4	40	Y	1.1 to 1	0.1	80.0	2.0mJ	55	4	C002	21	**DGXZ-48NFNF-A**
DGXZ-60NFNF-A	N	800 to 2500MHz	-72	4	40	Y	1.1 to 1	0.1	80.0	2.5mJ	66.5	4	C002	21	**DGXZ-60NFNF-A**
DGXZ+06DFDF-A	DIN	800 to 2500MHz	+06	4	0.25	Y	1.1 to 1	0.1	11.0	175µJ	7	4	C003	21	**DGXZ+06DFDF-A**
DGXZ+15DFDF-A	DIN	800 to 2500MHz	+15	4	2.25	Y	1.1 to 1	0.1	25.0	500µJ	16.5	4	C003	21	**DGXZ+15DFDF-A**
DGXZ+24DFDF-A	DIN	800 to 2500MHz	+24	4	6.25	Y	1.1 to 1	0.1	45.0	1mJ	28.5	4	C003	21	**DGXZ+24DFDF-A**
DGXZ+36DFDF-A	DIN	800 to 2500MHz	+36	4	15	Y	1.1 to 1	0.1	60.0	1.5mJ	40	4	C003	21	**DGXZ+36DFDF-A**
DGXZ+48DFDF-A	DIN	800 to 2500MHz	+48	4	40	Y	1.1 to 1	0.1	80.0	2.0mJ	55	4	C003	21	**DGXZ+48DFDF-A**
DGXZ+60DFDF-A	DIN	800 to 2500MHz	+60	4	40	Y	1.1 to 1	0.1	80.0	2.5mJ	66.5	4	C003	21	**DGXZ+60DFDF-A**
DGXZ-15DFDF-A	DIN	800 to 2500MHz	-15	4	2.25	Y	1.1 to 1	0.1	25.0	500µJ	16.5	4	C003	21	**DGXZ-15DFDF-A**
DGXZ-24DFDF-A	DIN	800 to 2500MHz	-24	4	6.25	Y	1.1 to 1	0.1	45.0	1mJ	28.5	4	C003	21	**DGXZ-24DFDF-A**
DGXZ-36DFDF-A	DIN	800 to 2500MHz	-36	4	15	Y	1.1 to 1	0.1	60.0	1.5mJ	40	4	C003	21	**DGXZ-36DFDF-A**
DGXZ-48DFDF-A	DIN	800 to 2500MHz	-48	4	40	Y	1.1 to 1	0.1	80.0	2.0mJ	55	4	C003	21	**DGXZ-48DFDF-A**
DGXZ-60DFDF-A	DIN	800 to 2500MHz	-72	4	40	Y	1.1 to 1	0.1	80.0	2.5mJ	66.5	4	C003	21	**DGXZ-60DFDF-A**

NOTE:

Discontinued Products:

For a complete reference of discontinued product number and associated replacement products refer to the PolyPhaser website @ http://www.polyphaser.com/products/obsolete.aspx

Refer to page 20 for GX Part Number Congfigurator

Part Number	Connector	Frequency Range	Operating Voltage (Vdc)	Max dc Current (Adc)	Max Power (watts)	Weatherized	VSWR	Insertion Loss dB	Let-through Voltage (dc)	Throughput Energy	Turn-on Voltage (dc)	Turn-on Time ns for 2kV / ns	Drawing Number	Drawing Page	Part Number
Bulkhead 50Ω							**Bulkhead 50Ω**								
IS-MD50LNZ	N	dc to 0.5 / 50 to 500MHz	- 48	2	RO	N	1.2 to 1	0.3	52.0	313µJ	- 66, +2	4	A004	36	**IS-MD50LNZ**
DC50LNZ+15	N	400 to 960MHz	+15	2	RO	N	1.2 to 1	0.3	34.0	294µJ	17	4	A004	36	**DC50LNZ+15**
DC50LNZ+20	N	400 to 960MHz	+20	2	RO	N	1.2 to 1	0.3	36.0	255µJ	23	4	A004	36	**DC50LNZ+20**
DC50LNZ+26	N	400 to 960MHz	+26	2	RO	N	1.2 to 1	0.3	51.0	644µJ	30	4	A004	36	**DC50LNZ+26**
DC50LNZ+30	N	400 to 960MHz	+30	2	RO	N	1.2 to 1	0.3	56.0	498µJ	34.5	4	A004	36	**DC50LNZ+30**
DC50LNZ+36	N	400 to 960MHz	+36	2	RO	N	1.2 to 1	0.3	76.0	900µJ	42	4	A004	36	**DC50LNZ+36**
IS-MR50LNZ+6	N	1.2 to 2.0GHz	+ 6	2	RO	N	1.1 to 1	0.1	12.5	58µJ	+ 7, -1	4	A004	36	**IS-MR50LNZ+6**
MR50LNZ+15	N	1.2 to 2.0GHz	+15	2	RO	N	1.1 to 1	0.1	19.5	58µJ	+17, -1	4	A004	36	**MR50LNZ+15**
Bulkhead 75Ω							**Bulkhead 75Ω**								
IS-MR75LBZ+6	BNC	1.2 to 1.7GHz	+ 6	2	RO	N	1.1 to 1	0.25	12.5	58µJ	+ 7, -1	4			**IS-MR75LBZ+6**
Flange 50Ω							**Flange 50Ω**								
IS-50UB / 1.5	UHF	dc to 50MHz	1.5	2	RO	N	1.1 to 1	0.3	37.0	103µJ	2.3	4	C005	24	**IS-50UB / 1.5**
IS-50UB / 6	UHF	dc to 50MHz	6	2	RO	N	1.1 to 1	0.3	38.0	153µJ	7	4	C005	24	**IS-50UB / 6**
IS-50UB / 18	UHF	dc to 50MHz	18	2	RO	N	1.1 to 1	0.3	54.0	386µJ	19	4	C005	24	**IS-50UB / 18**
IS-50BB / 1.5	BNC	dc to 50MHz	1.5	2	RO	N	1.1 to 1	0.3	37.0	103µJ	2.3	4	C005	24	**IS-50BB / 1.5**
IS-50BB / 6	BNC	dc to 50MHz	6	2	RO	N	1.1 to 1	0.3	38.0	153µJ	7	4	C005	24	**IS-50BB / 6**
IS-50BB / 18	BNC	dc to 50MHz	18	2	RO	N	1.1 to 1	0.3	54.0	386µJ	19	4	C005	24	**IS-50BB / 18**
IS-50NB / 1.5	N	dc to 50MHz	1.5	2	RO	N	1.1 to 1	0.3	37.0	103µJ	2.3	4	C005	24	**IS-50NB / 1.5**
IS-50NB / 6	N	dc to 50MHz	6	2	RO	N	1.1 to 1	0.3	38.0	153µJ	7	4	C005	24	**IS-50NB / 6**
IS-50NB / 18	N	dc to 50MHz	18	2	RO	N	1.1 to 1	0.3	54.0	386µJ	19	4	C005	24	**IS-50NB / 18**
IS-50TB / 1.5	TNC	dc to 50MHz	1.5	2	RO	N	1.1 to 1	0.3	37.0	103µJ	2.3	4	C005	24	**IS-50TB / 1.5**
IS-50TB / 6	TNC	dc to 50MHz	6	2	RO	N	1.1 to 1	0.3	38.0	153µJ	7	4	C005	24	**IS-50TB / 6**
IS-50TB / 18	TNC	dc to 50MHz	18	2	RO	N	1.1 to 1	0.3	54.0	386µJ	19	4	C005	24	**IS-50TB / 18**
Flange 75Ω							**Flange 75Ω**								
IS-75UB / 1.5	UHF	dc to 30MHz	1.5	2	RO	N	1.1 to 1	0.3	37.0	103µJ	2.3	4	C005	24	**IS-75UB / 1.5**
IS-75UB / 6	UHF	dc to 30MHz	6	2	RO	N	1.1 to 1	0.3	38.0	153µJ	7	4	C005	24	**IS-75UB / 6**
IS-75UB / 18	UHF	dc to 30MHz	18	2	RO	N	1.1 to 1	0.3	54.0	386µJ	19	4	C005	24	**IS-75UB / 18**
IS-75BB / 1.5	BNC	dc to 30MHz	1.5	2	RO	N	1.1 to 1	0.3	37.0	103µJ	2.3	4	C005	24	**IS-75BB / 1.5**
IS-75BB / 6	BNC	dc to 30MHz	6	2	RO	N	1.1 to 1	0.3	38.0	153µJ	7	4	C005	24	**IS-75BB / 6**
IS-75BB / 18	BNC	dc to 30MHz	18	2	RO	N	1.1 to 1	0.3	54.0	386µJ	19	4	C005	24	**IS-75BB / 18**
IS-75BB-DS-3	BNC	dc to 200MHz	2	2	RO	N	1.1 to 1	0.3	174.0	3.05mJ	3	4	C005	24	**IS-75BB-DS-3**
IS-75FB / 1.5	F	dc to 30MHz	1.5	2	RO	N	1.1 to 1	0.3	37.0	103µJ	2.3	4	C005	24	**IS-75FB / 1.5**
IS-75FB / 6	F	dc to 30MHz	6	2	RO	N	1.1 to 1	0.3	38.0	153µJ	7	4	C005	24	**IS-75FB / 6**
IS-75FB / 18	F	dc to 30MHz	18	2	RO	N	1.1 to 1	0.3	54.0	386µJ	19	4	C005	24	**IS-75FB / 18**
IS-75NB / 1.5	N	dc to 30MHz	1.5	2	RO	N	1.1 to 1	0.3	37.0	103µJ	2.3	4	C005	24	**IS-75NB / 1.5**
IS-75NB / 6	N	dc to 30MHz	6	2	RO	N	1.1 to 1	0.3	38.0	153µJ	7	4	C005	24	**IS-75NB / 6**
IS-75NB / 18	N	dc to 30MHz	18	2	RO	N	1.1 to 1	0.3	54.0	386µJ	19	4	C005	24	**IS-75NB / 18**
IS-SB75F	F (single LNB)	450 to 1450MHz	+24	2	RO	N	1.5 to 1	0.3	64.0	580µJ	+26, -1	6	C004	23	**IS-SB75F**
IS-DB75F	F (dual LNB)	450 to 1450MHz	+24	2	RO	N	1.5 to 1	0.3	64.0	580µJ	+26, -1	6	C004	23	**IS-DB75F**
MDS+24-F-F	F	10kHz to 150kHz / 10MHz to 100MHz / 300MHz to 2500MHz	24	3	50	Y	1.9 to 1 Tel, 1.42 to 1 Rx/Tx2.0 Tel, 1.0 Rx/Tx		48.0	1mJ	33	4	C004	23	**MDS+24-F-F**

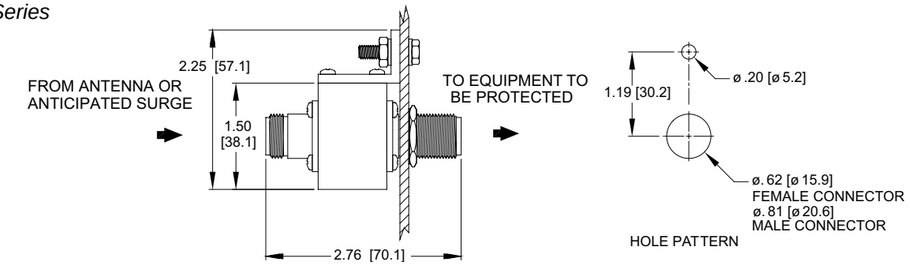
NOTE:
Discontinued Products:
For a complete reference of discontinued product number and associated replacement products refer to the PolyPhaser website @ http://www.polyphaser.com/products/obsolete.aspx

Note: *Add -MA for male antenna (surge)*
-ME for male equipment (protected)

Part Number	Connector	Frequency Range	Type	Operating Voltage (dc)	Max dc Current (Adc)	Max Power	Weatherized	Max VSWR	Max Insertion Loss dB	Let-through Voltage (dc)	Throughput Energy (RF)	Throughput Energy (dc)	Turn-on Voltage (Vdc)	Turn-on Time ns for 2kV / ns	Drawing Number	Drawing Page	Part Number
Bulkhead 50Ω								**Bulkhead 50Ω**									
DC50LN+15 (GC50LN+15)	N	400 to 960MHz	Injector (Pickoff)	+15	2	RO	N	1.2 to 1	0.3	30.0	49nJ (5.50µJ)	730µJ (20µJ)	17	4	A004	36	**DC50LN+15 (GC50LN+15)**
DC50LN+20 (GC50LN+20)	N	400 to 960MHz	Injector (Pickoff)	+20	2	RO	N	1.2 to 1	0.3	39.0	1.76µJ (19.5µJ)	348µJ (900µJ)	23	4	A004	36	**DC50LN+20 (GC50LN+20)**
DC50LN+26 (GC50LN+26)	N	400 to 960MHz	Injector (Pickoff)	+26	2	RO	N	1.2 to 1	0.3	45.0	1.95µJ (4.0µJ)	1.42mJ (576µJ)	30	4	A004	36	**DC50LN+26 (GC50LN+26)**
DC50LN+30 (GC50LN+30)	N	400 to 960MHz	Injector (Pickoff)	+30	2	RO	N	1.2 to 1	0.3	55.0	1.60µJ (1.60µJ)	509µJ (460µJ)	34.5	4	A004	36	**DC50LN+30 (GC50LN+30)**
DC50LN+36 (GC50LN+36)	N	400 to 960MHz	Injector (Pickoff)	+36	2	RO	N	1.2 to 1	0.3	60.0	0.94µJ (0.78µJ	762µJ (2.14mJ)	42	4	A004	36	**DC50LN+36 (GC50LN+36)**
														Note: *Add -MA for male antenna (surge) -ME for male equipment (protected)*			
Bulkhead / Flange 50Ω								**Bulkhead / Flange 50Ω**									
CGXJ+15NFNF-A	N	400 to 1200MHz	Bias-T	+15	4	300	N	1.1 to 1	0.1	25.0	5nJ	500µJ	16.5	4	C006	22	**CGXJ+15NFNF-A**
CGXJ+24NFNF-A	N	400 to 1200MHz	Bias-T	+24	4	300	N	1.1 to 1	0.1	45.0	10nJ	1000µJ	28.5	4	C006	22	**CGXJ+24NFNF-A**
CGXJ+36NFNF-A	N	400 to 1200MHz	Bias-T	+36	4	300	N	1.1 to 1	0.1	60.0	15nJ	1500µJ	40	4	C006	22	**CGXJ+36NFNF-A**
CGXJ+48NFNF-A	N	400 to 1200MHz	Bias-T	+48	4	300	N	1.1 to 1	0.1	80.0	20nJ	2000µJ	53	4	C006	22	**CGXJ+48NFNF-A**
CGXJ-15NFNF-A	N	400 to 1200MHz	Bias-T	-15	4	300	N	1.1 to 1	0.1	25.0	5nJ	500µJ	16.5	4	C006	22	**CGXJ-15NFNF-A**
CGXJ-24NFNF-A	N	400 to 1200MHz	Bias-T	-24	4	300	N	1.1 to 1	0.1	45.0	10nJ	1000µJ	28.5	4	C006	22	**CGXJ-24NFNF-A**
CGXJ-36NFNF-A	N	400 to 1200MHz	Bias-T	-36	4	300	N	1.1 to 1	0.1	60..0	15nJ	1500µJ	40	4	C006	22	**CGXJ-36NFNF-A**
CGXJ-48NFNF-A	N	400 to 1200MHz	Bias-T	-48	4	300	N	1.1 to 1	0.1	80.0	20nJ	2000µJ	53	4	C006	22	**CGXJ-48NFNF-A**
CGXJ+06DFDF-A	DIN	400 to 1200MHz	Bias-T	+06	4	300	N	1.1 to 1	0.1	11.0	5nJ	175µJ	7	4	C007	22	**CGXJ+06DFDF-A**
CGXJ+15DFDF-A	DIN	400 to 1200MHz	Bias-T	+15	4	300	N	1.1 to 1	0.1	25.0	5nJ	500µJ	16.5	4	C007	22	**CGXJ+15DFDF-A**
CGXJ+24DFDF-A	DIN	400 to 1200MHz	Bias-T	+24	4	300	N	1.1 to 1	0.1	45.0	10nJ	1000µJ	28.5	4	C007	22	**CGXJ+24DFDF-A**
CGXJ+36DFDF-A	DIN	400 to 1200MHz	Bias-T	+36	4	300	N	1.1 to 1	0.1	60.0	15nJ	1500µJ	40	4	C007	22	**CGXJ+36DFDF-A**
CGXJ+48DFDF-A	DIN	400 to 1200MHz	Bias-T	+48	4	300	N	1.1 to 1	0.1	80.0	20nJ	2000µJ	53	4	C007	22	**CGXJ+48DFDF-A**
CGXJ-15DFDF-A	DIN	400 to 1200MHz	Bias-T	-15	4	300	N	1.1 to 1	0.1	25.0	5nJ	500µJ	16.5	4	C007	22	**CGXJ-15DFDF-A**
CGXJ-24DFDF-A	DIN	400 to 1200MHz	Bias-T	-24	4	300	N	1.1 to 1	0.1	45.0	10nJ	1000µJ	28.5	4	C007	22	**CGXJ-24DFDF-A**
CGXJ-36DFDF-A	DIN	400 to 1200MHz	Bias-T	-36	4	300	N	1.1 to 1	0.1	60.0	15nJ	1500µJ	40	4	C007	22	**CGXJ-36DFDF-A**
CGXJ-48DFDF-A	DIN	400 to 1200MHz	Bias-T	-48	4	300	N	1.1 to 1	0.1	80.0	2.0nJ	2000µJ	53	4	C007	22	**CGXJ-48DFDF-A**
DGXJ+06NFNF-A	N	800 to 2500MHz	Bias-T	+06	4	300	N	1.1 to 1	0.1	11.0	5nJ	175µJ	7	4	C006	22	**DGXJ+06NFNF-A**
DGXJ+15NFNF-A	N	800 to 2500MHz	Bias-T	+15	4	300	N	1.1 to 1	0.1	25.0	5nJ	500µJ	16.5	4	C006	22	**DGXJ+15NFNF-A**
DGXJ+24NFNF-A	N	800 to 2500MHz	Bias-T	+24	4	300	N	1.1 to 1	0.1	45.0	10nJ	1000µJ	28.5	4	C006	22	**DGXJ+24NFNF-A**
DGXJ+36NFNF-A	N	800 to 2500MHz	Bias-T	+36	4	300	N	1.1 to 1	0.1	60.0	15nJ	1500µJ	40	4	C006	22	**DGXJ+36NFNF-A**
DGXJ+48NFNF-A	N	800 to 2500MHz	Bias-T	+48	4	300	N	1.1 to 1	0.1	80.0	20nJ	2000µJ	53	4	C006	22	**DGXJ+48NFNF-A**
DGXJ+60NFNF-A	N	800 to 2500MHz	Bias-T	+60	4	300	N	1.1 to 1	0.1	80.0	25nJ	2500µJ	66	4	C006	22	**DGXJ+60NFNF-A**
DGXJ-15NFNF-A	N	800 to 2500MHz	Bias-T	-15	4	300	N	1.1 to 1	0.1	25.0	5nJ	500µJ	16.5	4	C006	22	**DGXJ-15NFNF-A**
DGXJ-24NFNF-A	N	800 to 2500MHz	Bias-T	-24	4	300	N	1.1 to 1	0.1	45.0	10nJ	1000µJ	28.5	4	C006	22	**DGXJ-24NFNF-A**
DGXJ-36NFNF-A	N	800 to 2500MHz	Bias-T	-36	4	300	N	1.1 to 1	0.1	60.0	15nJ	1500µJ	40	4	C006	22	**DGXJ-36NFNF-A**
DGXJ-48NFNF-A	N	800 to 2500MHz	Bias-T	-48	4	300	N	1.1 to 1	0.1	80.0	20nJ	2000µJ	53	4	C006	22	**DGXJ-48NFNF-A**
DGXJ-60NFNF-A	N	800 to 2500MHz	Bias-T	-60	4	300	N	1.1 to 1	0.1	80.0	25nJ	2500µJ	66	4	C006	22	**DGXJ-60NFNF-A**
DGXJ+06DFDF-A	DIN	800 to 2500MHz	Bias-T	+06	4	300	N	1.1 to 1	0.1	11.0	5nJ	175µJ	7	4	C007	22	**DGXJ+06DFDF-A**
DGXJ+15DFDF-A	DIN	800 to 2500MHz	Bias-T	+15	4	300	N	1.1 to 1	0.1	25.0	5nJ	500µJ	16.5	4	C007	22	**DGXJ+15DFDF-A**
DGXJ+24DFDF-A	DIN	800 to 2500MHz	Bias-T	+24	4	300	N	1.1 to 1	0.1	45.0	10nJ	1000µJ	28.5	4	C007	22	**DGXJ+24DFDF-A**
DGXJ+36DFDF-A	DIN	800 to 2500MHz	Bias-T	+36	4	300	N	1.1 to 1	0.1	60.0	15nJ	1500µJ	40	4	C007	22	**DGXJ+36DFDF-A**
DGXJ+48DFDF-A	DIN	800 to 2500MHz	Bias-T	+48	4	300	N	1.1 to 1	0.1	80.0	20nJ	2000µJ	53	4	C007	22	**DGXJ+48DFDF-A**
DGXJ+60DFDF-A	DIN	800 to 2500MHz	Bias-T	+60	4	300	N	1.1 to 1	0.1	80.0	25nJ	2500µJ	66	4	C007	22	**DGXJ+60DFDF-A**
DGXJ-15DFDF-A	DIN	800 to 2500MHz	Bias-T	-15	4	300	N	1.1 to 1	0.1	25.0	5nJ	500µJ	16.5	4	C007	22	**DGXJ-15DFDF-A**
DGXJ-24DFDF-A	DIN	800 to 2500MHz	Bias-T	-24	4	300	N	1.1 to 1	0.1	45.0	10nJ	1000µJ	28.5	4	C007	22	**DGXJ-24DFDF-A**
DGXJ-36DFDF-A	DIN	800 to 2500MHz	Bias-T	-36	4	300	N	1.1 to 1	0.1	60.0	15nJ	1500µJ	40	4	C007	22	**DGXJ-36DFDF-A**
DGXJ-48DFDF-A	DIN	800 to 2500MHz	Bias-T	-48	4	300	N	1.1 to 1	0.1	80.0	20nJ	2000µJ	53	4	C007	22	**DGXJ-48DFDF-A**
DGXJ-60DFDF-A	DIN	800 to 2500MHz	Bias-T	-60	4	300	N	1.1 to 1	0.1	80.0	25nJ	2500µJ	66	4	C007	22	**DGXJ-60DFDF-A**

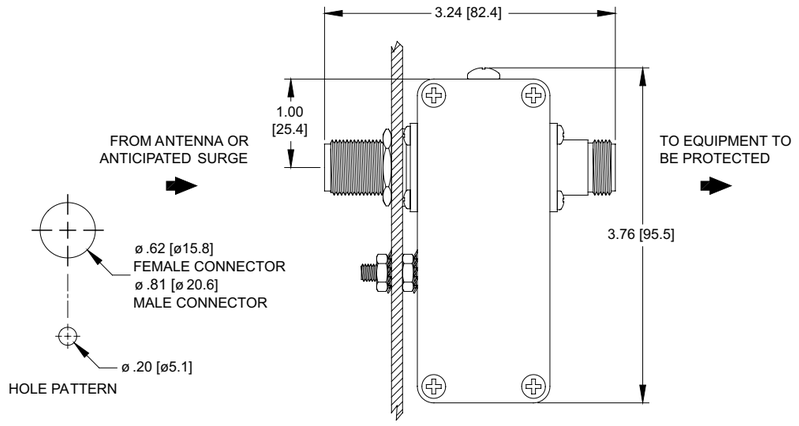
Drawing Number: A003

NEMP Series



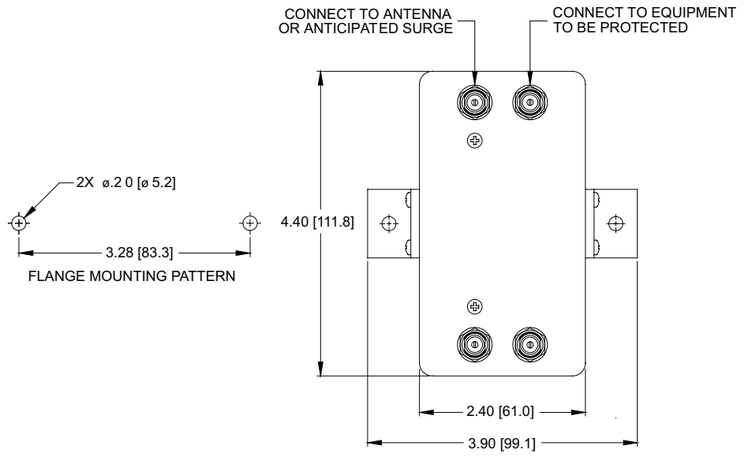
Drawing Number: A004

MR50 Series



Drawing Number: C001

IS-DB75F



Data

A complete series of high quality data and telephone line protectors for data rates up to 100Mbps and voltage levels to 200Vdc.

Data/Phone Line Protection
Telephone central offices and computer rooms have many things in common. Both have computers connected to data or phone lines, local area networks (LAN), and phone channel banks (T-carrier). All are interconnected to the "outside world" with twisted pair, coaxial cable, or fiber optic interfaces.

Telephone line protectors supplied by the phone company are a first line of defense, but are not always connected to a high current capacity, fast transient response ground system. PolyPhaser offers a series of data and Telco protectors when a higher level of protection is required.

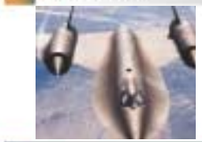
LAN and T-carriers require protectors that have wide bandwidths for high frequency data with tightly controlled surge energy specifications. If our catalog products do not match your requirement, PolyPhaser can supply a custom-designed product for your application.

Other special protectors are available for Telco span line and repeater current loop lines. Please visit PolyPhaser's web site or contact our customer service for more information.

Wireless Ethernet/Internet Data Line Protection
Surge protection for wireless power over Ethernet equipment used for point to multipoint communications, data backhaul, wireless internet hot spots and many other wireless services that need lightning surge protection for tower or pole mounted outdoor base station or hub equipment as well as protection for indoor located computer, communications, and other equipment connected to these systems.

PolyPhaser's IX Protection Platform can be configured with standard modules to provide the highest level of data line and supply power protection for your equipment. The IX products are UL listed and meet BELCORE 1089 requirements for 100Amp 10/1000 uSec waveform in a weather-tight housing. Please visit PolyPhaser's web site or contact our customer service for more information.

PolyPhaser's Data Protection Platform, IX series, is available for many applications



Configurable to your application Data only or Power over Ethernet

Connections:	*# 16 - 28 AWG*
Temperature:	*-40˚ to +65˚ C storage* *-40˚ to +50˚ C operating*
Vibration:	*1 G @ 5 Hz to 100 Hz*
Environmental:	*(Outdoor unit)* *BELLCORE #TA-NWT-000487, Procedure 4.11* *Wind Driven (70 MPH) Rain Intrusion Test*
Surge:	*BELLCORE 1089, 10/1000 uSec @ 100 A*
Agency Approval:	*UL497B - Listed*
Accessory:	*Pole Mount (sold separately)*

Part Number Matrix:

IX-	#	Data	#	DC	dc voltage	Weatherization
	1 to 5*	L, M, or H	1 to 5*		24 or 48	W - yes

** ≤ 5 total per standard enclosure*

Examples:

IX-	2	H	2	DC	48	W
IX-	3	M	1	DC	24	
IX-	4	L				W
IX-			5	DC	24	

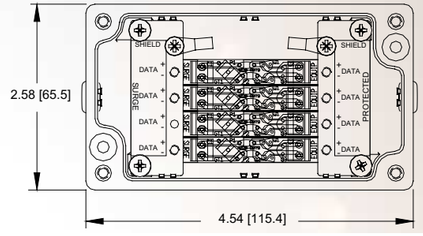
IX-H
Application: *(up to 100Mbps) CAT5 Compatible, UTP, STP*
Turn On: *+ 8 Vdc, Common and Differential Mode*
Series Resistance: *1 Ohm Typical*
Capacitance *(Common Mode) 15 pF Typical*
Capacitance *(Differential Mode) 30 pF Typical*

IX-L
Application: *(up to 25Mbps) T1/E1, RS422, RS485*
Turn On: *+/- 12 Vdc*
Series Resistance: *1 Ohm Typical*
Capacitance *(Common Mode) 100 pF Typical*
Capacitance *(Differential Mode) 100 pF Typical*

IX-M
Application: *(up to 25Mbps) RS 232*
Turn On: *+/- 30 Vdc*
Series Resistance: *1 Ohm Typical*
Capacitance *(Common Mode) 100 pF Typical*
Capacitance *(Differential Mode) 100 pF Typical*

IX-DC24 or IX-DC48
Application: *(24 or 48Vdc) Power Supply, dc voltage*
Turn On: *+/- 32, +/- 53 Vdc*
Series Resistance: *< 0.02 Ohms*
Current: *2.0 Adc*

Drawing Number: D005



How to use the Matrix

Data Protector selection

Data Protector Selection

1. Determine Application:	Select from typical application
2. Determine Turn-on Voltage:	Turn-on voltage must be above maximum system operating voltage
3. Determine Number of Wires to be Protected:	One pair equals two wires
4. Part Number IX Series:	Part number configuration: # of data boards, type data board, # dc boards, dc voltage (W-weatherized)
5. Max dc Current:	Maximum user current capability of protector, N/A for shunt
6. Capacitance:	Capacitance line to ground or line to line
7. Series Resistance:	Amount of resistance added in series by protector
8. Let-through Vp:	Maximum voltage let-through the protector
9. -3dB (600 Ohm) Bandwidth:	Frequency at which the input signal is at half power
10. Drawing Number:	Refers to dimensional and installation drawing

IX Matrix

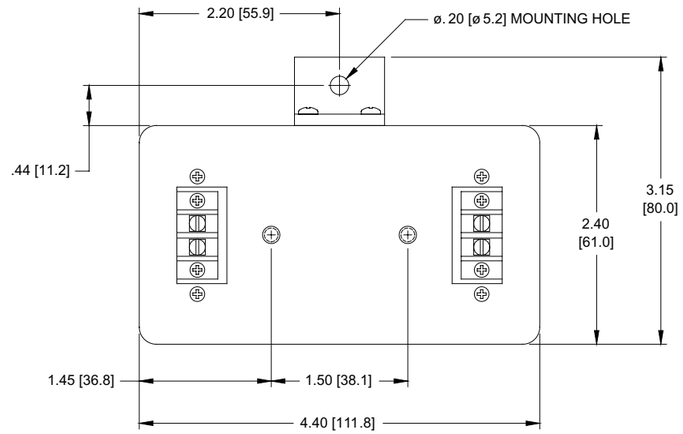
Part Number	Data Application	# of Wires	dc Application	# of Wires	Weatherized	Drawing Number	Drawing Page
IX- 1H/W	CAT5 (up to 100Mbps)	2			Y	D005	39
IX- 1H1DC48/W	CAT5 (up to 100Mbps)	2	48	2	Y	D005	39
IX- 2H	CAT5 (up to 100Mbps)	4				D005	39
IX- 2H1DC24/W	CAT5 (up to 100Mbps)	4	24	2	Y	D005	39
IX- 2H1DC48	CAT5 (up to 100Mbps)	4	48	2		D005	39
IX- 2H1DC48/W	CAT5 (up to 100Mbps)	4	48	2	Y	D005	39
IX- 2H2DC24/W	CAT5 (up to 100Mbps)	4	24	4	Y	D005	39
IX- 2H2DC48/W	CAT5 (up to 100Mbps)	4	48	4	Y	D005	39
IX- 4H	CAT5 (up to 100Mbps)	8				D005	39
IX- 4H/W	CAT5 (up to 100Mbps)	8			Y	D005	39
IX- 4H1DC24/W	CAT5 (up to 100Mbps)	8	24	2	Y	D005	39
IX- 1M	RS232	2				D005	39
IX- 1M1DC24/W	RS232	2	24	2	Y	D005	39
IX- 2M2DC48	RS232	4	48	4		D005	39
IX- 3M1DC24/W	RS232	6	24	2	Y	D005	39
IX- 4M	RS232	8				D005	39
IX- 4M1DC24/W	RS232	8	24	2	Y	D005	39
IX- 2L	T1/E1, RS422, RS485	4				D005	39
IX- 2L1DC48	T1/E1, RS422, RS485	4	48	2		D005	39
IX- 2L1DC48/W	T1/E1, RS422, RS485	4	48	2	Y	D005	39
IX- 3L	T1/E1, RS422, RS485	6				D005	39
IX- 3L1DC24/W	T1/E1, RS422, RS485	6	24	2	Y	D005	39
IX- 3L1DC48/W	T1/E1, RS422, RS485	6	48	2	Y	D005	39
IX- 3L2DC24/W	T1/E1, RS422, RS485	6	24	4	Y	D005	39
IX- 4L	T1/E1, RS422, RS485	8				D005	39
IX- 4L/W	T1/E1, RS422, RS485	8			Y	D005	39
IX- 5L	T1/E1, RS422, RS485	10				D005	39
IX- 1DC48/W			48	2	Y	D005	39
IX- 2DC48/W			48	4	Y	D005	39
IX- 4DC24			24	8		D005	39

Data Matrix

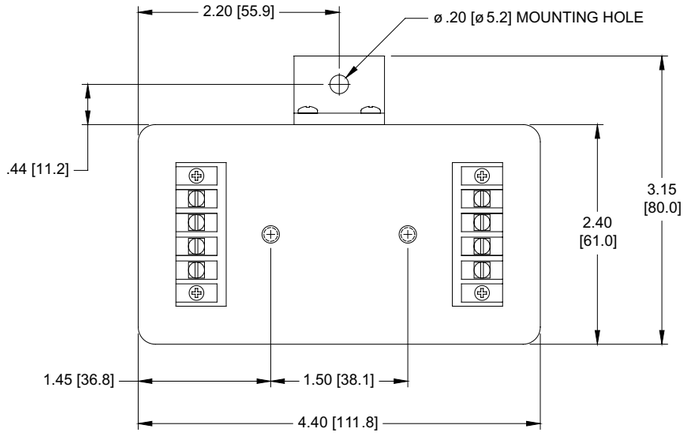
Part Number	Series	Typical Application	Turn-on Vdc	# of Wires	Max dc Current (Adc)	C Data	Series R (Ω)	Let-through Vp	-3dB (600Ω) BW	Drawing Number	Drawing Page
	(Twisted Pair Series)										
IS-T1		RS422/T1 Data	7	4	2	30pF	1	17	120MHz	D001	43
IS-3T1		RS422/T1 Data	7	12	2	30pF	1	17	120MHz	D003	44
IS-SPDDL		RS232/562	20	2	2	30pF	1	24	120MHz	D001	43
IS-DPDDL		RS232/562	20	4	2	30pF	1	24	120MHz	D002	43
IS-6PDDL		RS232/562	20	12	2	30pF	1	24	120MHz	D003	44
IS-SPHSD		RS423/485 Data	+2.8 / -0.6	2	2	30pF	1	+10 / -1	95MHz	D001	43
IS-DPHSD		RS423/485 Data	+2.8 / -0.6	4	2	30pF	1	+10 / -1	95MHz	D002	43
IS-6PHSD		RS423/485 Data	+2.8 / -0.6	12	2	30pF	1	+10 / -1	95MHz	D003	44
IS-CLSP		Current Loops	27	2	2	30nF	0.1	35	65kHz	D001	43
IS-CLDP		Current Loops	27	4	2	30nF	0.1	35	65kHz	D002	43
IS-CL6P		Current Loops	27	12	2	30nF	0.1	35	65kHz	D003	44
IS-SPXL		Extension Lines	75	2	2	11nF	20	100	30kHz	D001	43
IS-DPXL		Extension Lines	75	4	2	11nF	20	100	30kHz	D002	43
IS-6PXL		Extension Lines	75	12	2	11nF	20	100	30kHz	D003	44
IS-SPTL		Telco Trunks	200	2	2	2.4nF	20	300	250kHz	D002	43
IS-DPTL		Telco Trunks	200	4	2	2.4nF	20	300	250kHz	D003	44
IS-6PTL		Telco Trunks	200	12	2	2.4nF	20	300	250kHz	D003	44
	(Data Shunt for 66 Block)		(Operating Vdc)								
IS-MPT-17			17	2	N/A	27nF	N/A	80	N/A	D004	44
IS-MPT-24			24	2	N/A	27nF	N/A	100	N/A	D004	44
IS-MPT-75		Extension lines	75	2	N/A	5nF	N/A	185	N/A	D004	44
IS-MPT-200		Telco Trunks	200	2	N/A	1.6nF	N/A	400	N/A	D004	44
25P10GB		Ground bus 25 pairs								D004	44

Data Drawings

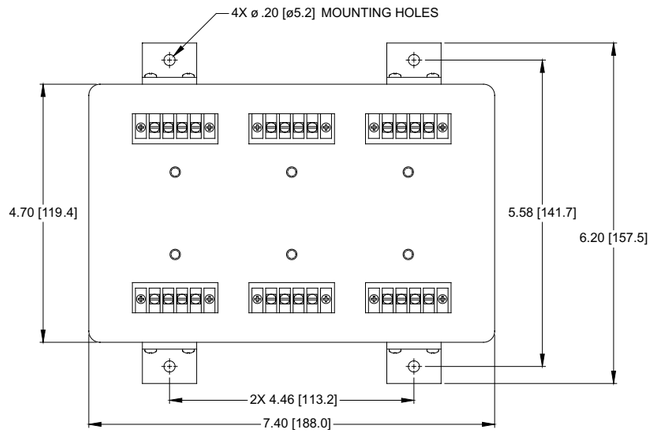
Drawing Number: D001



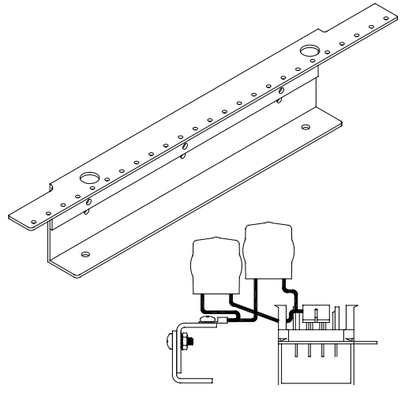
Drawing Number: D002



Drawing Number: D003



Drawing Number: D004



Available in shunt or in-line configurations, this series of ac/dc protectors provide total protection for mission critical, sensitive ac and dc electronic based systems.

POWER MAINS INFORMATION

There are several ways in which your equipment can be damaged via the power line. One is a strike elsewhere on the power line, inducing a surge that travels to your equipment. However, a strike to your tower or a coupled surge to the phone lines can also damage equipment since the power line can provide an alternate path to ground. To ensure survival, all inputs and outputs (I/Os) must not only be protected but must be bonded in common via a common low inductance conductor to an earth ground. All grounds should be bonded in the earth to form a single earth system.

Power mains protectors are to be placed at the entrance panels, transfer switches or distribution panels. They should have a low inductance path to the earth system and be installed with the minimal lead inductance (short with gradual bends). For best protection, have an additional in-line power protector at or very near the sensitive equipment. This should not be a protector that uses only the wall outlet safety ground. It should be a protector that can be mounted/grounded (like the PLDO or MSRP) to your main earth system.

TYPES OF POWER MAINS CONFIGURATIONS

Power mains come in several different configurations. The three basic ones are single, bi-phase and three phase. Three phase is sometimes called polyphase and has further divisional classes using the letters "Y" (written "Wye") and "Δ" (the Greek letter Delta).

SINGLE PHASE
(One hot, neutral and ground)

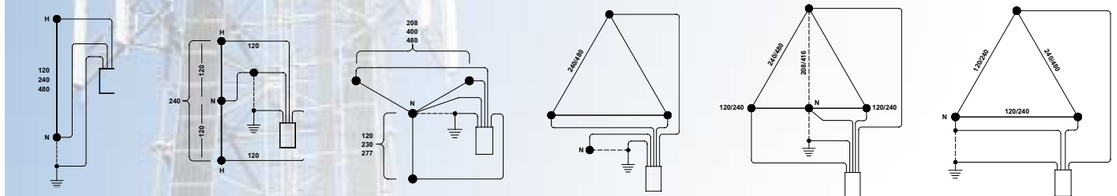
This is the simplest. It has one live or hot feed, a return called a neutral and a safety ground. This is commonly used for secondary wiring for a normal outlet.
It may be any worldwide standard voltage. For the U.S.A., it is 120Vac (see drawing).

BI-PHASE
(Two hot, neutral and ground)

This is a common feed configuration. It may be obtained by either a single transformer, center tapped or by grounding one phase of a three phase delta. The former is often called single phase in the U.S.A. since it often uses a single, center tapped transformer fed from one of three high line phases. These phases are 180 degrees from each other so 120Vac is available as well as 240Vac. This is typical for most 240Vac applications in the U.S.A. (see drawing).

THREE PHASE
(Three hot, neutral and grounded neutral)

This is the feed for large facilities. The phases are 120 degrees apart. The Wye configuration normally has a neutral/return which is grounded. The true delta (or closed delta) normally does not have a ground. The open delta has a high leg (red lead) with a higher voltage to ground than the rest. A grounded delta has one leg grounded (see drawings).



SINGLE PHASE (SP)
120, 240 OR 480VAC

BI-PHASE
(North American Only)

120/208 230/400
277/480 WYE (Y)

240 or 480
DELTA (D)

240 or 480
OPEN DELTA (O)

240 or 480
GROUNDED DELTA

Part Number	ac Series	Application	Max ac Current (Aac)	Turn-On Vdc	Pk Vdc	Drawing Number	Drawing Page
IS-SPTV		24	5	39	215	D001	43
	ac Shunt						
IS-PM120-SP		120	N/A	205	400	E001	48
IS-PM208-3Y		120 / 208	N/A	205	400	E001	48
IS-PM240-BP		120 / 240	N/A	205	400	E001	48
IS-PM240-SP		240	N/A	360	700	E001	48
IS-PM480-3Y		277 / 480	N/A	425	850	E001	48
IS-PSP-24		24	N/A	39	80	E002	48
PSP-120		120	15	400	800	E002	48
PSP-240		120 / 240	15	400	800	E002	48
	ac Plug-in						
PLDO-120US15A		120	15	200	400	E003	48
PLDO-120US20A		120	20	200	400	E003	48
PLDO-240US15A		120 / 240	15	200	400	E003	48
	ac Plug-in Rack Mount						
MSRP-120US15A		120	15	200	400	E004	49
MSRP-120US20A		120	20	200	400	E004	49
MSRP-240US15A		120 / 240	15	200	400	E004	49

Part Number	dc Series	Application	Max ac Current (Aac)	Turn-On Vdc	Pk Vdc	Drawing Number	Drawing Page
IS-12VDC-30A-FG, -NG, -PG	connections:	12	30	18	60	E005	49
IS-12VDC-50A-FG, -NG, -PG	30A: 14 to 1/0AWG,	12	50	18	60	E006	50
IS-17VDC-30A-FG, -NG	compression lug	17	30	27	70	E005	49
IS-17VDC-50A-FG, -NG	50A: 3/8-24 SS Studs	17	50	27	70	E006	50
IS-24VDC-30A-FG, -NG, -PG		24	30	35	97	E005	49
IS-24VDC-50A-FG, -NG, -PG		24	50	35	97	E006	50
IS-35VDC-30A-FG, -NG		35	30	53	95	E005	49
IS-35VDC-50A-FG, -NG		35	50	53	95	E006	50
IS-48VDC-30A-FG, -NG, -PG		48	30	80	130	E005	49
IS-48VDC-50A-FG, -NG, -PG		48	50	80	130	E006	50
	dc Shunt (Rotor Control)						
IS-RCT	up to 8 lines	60	N/A	82	230	E007	50

ac/dc Protector Selection

1. Determine Application:
- **ac Series:** CCTV Power Protector
- **ac Shunt:** Power mains shunt type protector, use plug-in protector at sensitive equipment
- **ac Plug-in:** Protects at the sensitive equipment
- **ac Plug-in Rack Mount:** Plug-in type protector for 19" rack mount
- **dc Series:** In-line battery, charge or other dc circuit protector
- **dc Shunt:** Shunt rotor control or other dc circuit protector

2. Determine Maximum Voltage:
- **24:** Single phase (One hot, neutral and ground)
- **120:** Single phase (One hot, neutral and ground)
- **120/240:** Bi-phase (two hot, neutral and ground)
- **240:** Single phase (One hot, neutral and ground)
- **120/208:** Three-phase (three hot, neutral and ground)
- **277/480:** Three-phase (three hot, neutral and ground)
- **dc Series:** Allow for maximum initial charger voltage

3. Determine Maximum Current:
- **Series:** Select unit above maximum operating current
- **Shunt:** Are not affected by operating current

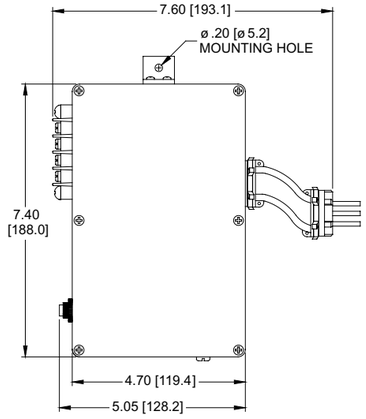
4. Part Number:
- **dc Series:** -NG: Negative ground, Positive Voltage
  -PG: Positive ground, Negative Voltage
  -FG: Floating Ground, Positive or Negative Voltage

5. Turn-on: Turn-on voltage at 1mAdc with a ramp of 100V/ms typical

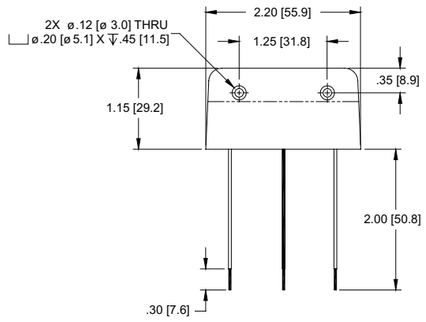
6. Peak Vdc: Maximum voltage let-through the protector

7. Drawing Number: Refers to dimensional and installation drawing

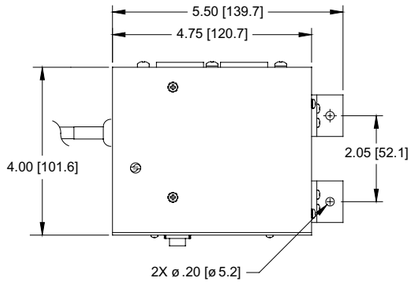
Drawing Number: E001



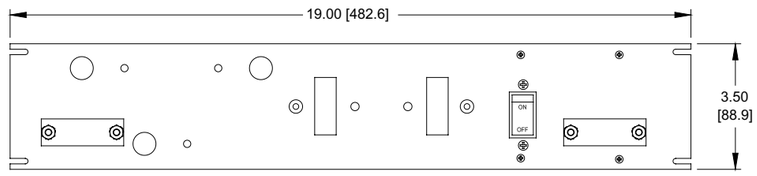
Drawing Number: E002



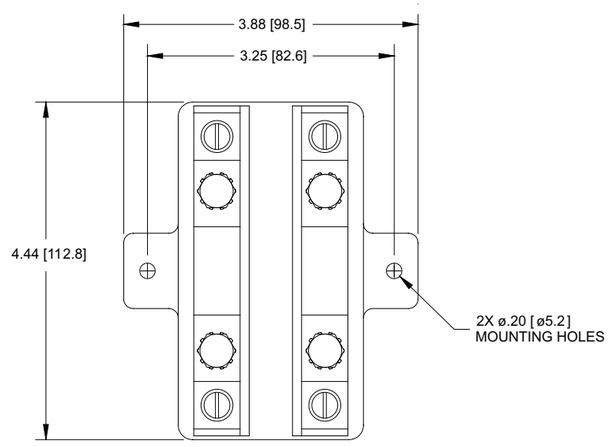
Drawing Number: E003



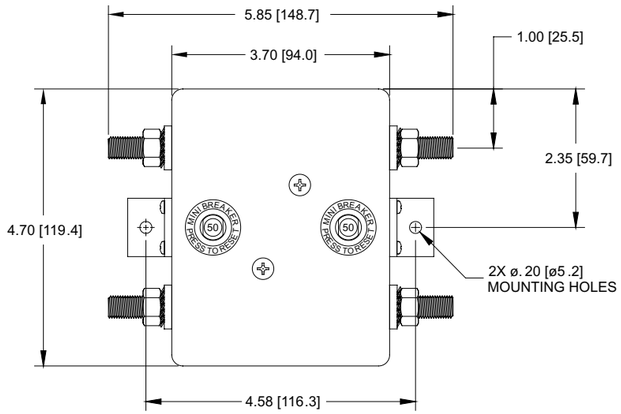
Drawing Number: E004



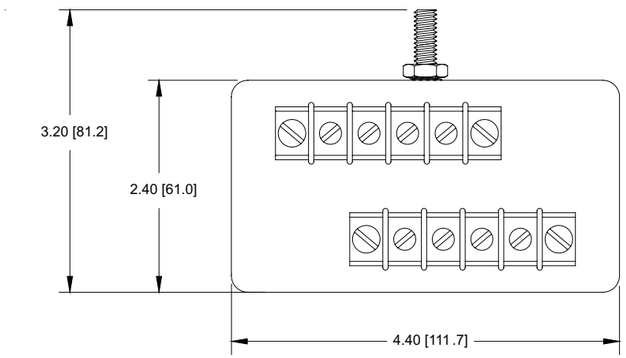
Drawing Number: E005



Drawing Number: E006



Drawing Number: E007



Accessories

An industry-leading portfolio of grounding essentials and protection installation components provide everything required for total lightning protection installations.

Lightning Protection Information

The severity of a lightning strike is a statistically predictable event. An economically designed protection / grounding (P / G) system should take into account a typical-to-large strike. The P / G system should be maintained on a monthly or at least yearly basis. This should include testing protectors, measuring the ground system, pulling on ground rods, and cleaning / inspecting connections for corrosion and tightness. It should also involve a re-evaluation of the overall system design every time new equipment is installed, moved, or modified.

A lightning strike starts with a local breakdown of the atmosphere (step leader) and steps about 150 feet in 1µs time increments every 50µs. During each of the 49µs dormant stages, an imaginary hemisphere of 150-foot radius can be used to determine the next jumping distance. Any object which penetrates this hemisphere can be chosen as the point of attachment for the return stroke (lightning strike). Since this is a hemisphere, the geometry of a horizontal strike to a tower can occur anywhere above the 150-foot point over average terrain (side mounted antennas above this height are vulnerable). This has led to the 150-foot radius rolling ball concept, where an imaginary ball is rolled along the ground in all directions. Each touch point of the ball with any ground-mounted object is subject to an attachment point (hit). Coax grounding kits should be installed every 75 feet above the 150-foot point. Install additional kits below 150-feet at the middle, bottom, and prior to the building entry bulkhead.

Lightning will take the path of least impedance which is both resistance and inductance. The larger the conductive surface, the lower the inductance. Bends add inductance — a coil is the continuous bending of a wire. Ground wires should be large and run straight for minimum inductance and voltage drop. They also should be separated from all other conductors by 6 to 8 inches and should not run inside or through a conductor unless they are bonded to it. In conduit, ground wires should be bonded at both the entrance and the exit. When working with a metal wall, bond the ground wires to both sides. Do not go through the wall.

Your tower will be the point of impact like a pebble going into a still pond. The rings will be equipotential waves as they diffuse into the surrounding soil. The ground wires in the soil still have inductance. This inductance, shunted by the soil resistance, sets up a time constant or velocity of propagation (since capacitance is present also). The "ripples" will propagate faster with larger surface area wire and better conductive soil. The doping of soil with MgSO4 salts can help increase soil conductivity and retain water.

It is not necessary to run interconnecting rings around a tower. Self-support towers will equalize the surge current to each leg (the coax leg may have slightly more current). Guyed towers should not have rings, even if the rings are to act as a collector for the radials. If each radial is interconnected directly to the tower base or leg, the inductance would be less than having only one or two connections going to a ground ring. Rings further out would be connecting radial ground rods that will have the same potential at the same point in time, thus little current will flow as compared to taking the same material and effort and running another radial from the tower base.

Guy anchors should be grounded with no dissimilar metals. In poor soil conditions, radials can be used together with ground rods to ground the anchors. A ground system can be obtained in many ways, but the most economical is with radials and ground rods. Radials of less than 100' will disperse the tower base or guy wire energy outward, while the ground rods can help take it to lower, more conductive soil layers. If the surge is not leaked or launched into the soil in the radial section(s), the ground rods, if lower soil conductivity can't be found, will develop high E fields and can arc in the soil to spread the charge outward. (This arcing is less likely in soils with higher conductivity.)

Arcing can cause glassification around the rod, starting at the tip and working upward. The hot plasma fuses the silica sand into glass which is a good insulator since water is boiled out in the process and can no longer re-penetrate the hardened glass. This is why, as a routine maintenance, a tug on the rod which produces easy movement, is a possible indication of glassification.

The whole practice of lightning protection is to control the discharge path and not have it randomly disperse in any direction.

In normally conductive soil, two ground rods should be spaced the sum of their lengths. One long deep rod or well casing will not be as effective as an array of radials and ground rods. Even if the one deep rod measures a low resistance, the inductance is usually much greater. In conductive upper layer soil conditions, saturation can occur which can cause eddy currents and additional inductance.

Unlike the radials, ground rod diameter size will have little effect on impedance unless the rod is very long. It is not always imperative to reach the water table, since this may be too far for the rod to be effective. It may be easier to salt dope the rod or use a chemical ground rod that collects precipitation. In poor soil conditions, the spacing of ground rods should be closer. Poor ground conductivity will not shunt the radials' inductance, thus more ground rods will help by either reaching more conductive soil or arcing to relieve the voltage potential. If not quickly dispersed, the voltage will build up at the tower and attempt to go another, perhaps unwanted, path.

All radials should be run away from the equipment building. The more radials there are, the more the current is divided. A perimeter ground system (ring) around the building will help form an equipotential plane. If this ring is approximately equal (in length) to each radial and if eight radials are used, each will have 1 / 9 the total surge energy. This will leave only 1 / 9 the strike energy to the equipment building perimeter ground. The perimeter should only have one interconnection to the tower base and should be just below the coax cable runs. For mountaintops, where no conductive soil exists and only radials can be used, wide copper strap, 1-1 / 2" to 3" wide, should be used to minimize inductance.

The rebar in the concrete tower base should be used to augment the grounding system. Concrete is conductive because of retained moisture and alkalinity. Tower J bolts or anchor bolts embedded in a conductive concrete tower base will couple strike energy to the concrete. The surface area interface between bolt and concrete will conduct high current levels during a strike. If the ground system is not adequate, the current density could be high enough to cause arcing at the bolt / concrete interface. When the rebar is interconnected with the bolts, there is additional surface area interface with the concrete, reducing current density. With more surface area and less current density, arcing in the concrete is less likely to occur. If the ground system is not adequate, the current density will be high enough to cause arcing at the bolts. By interconnecting the rebar, the current density will be reduced and arcing will be less likely to occur. To learn more on designing with the rebar, consult our book, Lightning Protection and Grounding Solutions for Communication Sites (LPGS).

It is not necessary to route a single copper ground wire up a large galvanized steel tower. The difference in resistance between copper and galvanized steel is lost when compared to the inductive voltage drop due to surface area (skin effect). Placing a lightning rod at the tower top and using the copper cable and tying it to ground is ineffective. The inductive voltage drop of the wire (>100kV) will cause it to jump (arc) to the tower, unless it is at least 24" from the tower. In fact, the use of bare copper cable can cause a corrosion problem to the tower and should not be used unless covered. Copper should never come in contact with galvanized steel. Tinned copper wire should not be used in the ground together with copper ground rods, since the tinning will be leached into the soil very quickly.

Increasing the distance between the tower and the coax cable entry provides additional propagational time for the tower ground to absorb the strike energy. At the building entry bulkhead panel, coax protectors should be used in addition to another set of coax grounding kits. This bulkhead panel should have ground connectors connecting it to the perimeter ground with the same circumferences as the combined circumferences of the coax cables. Tower lighting protectors should also be included and grounded at this same point.

In a P / G system design, one should also think of system noise reduction and EMI / RFI (Tempest) shielding. This can be accomplished with a single point grounding system. Sometimes the use of a single ground bus (called the Principal Ground Window or PGW) can act as your single point. All your equipment chassis should be grounded to this bus. It should be a large surface area connection to the ground system such as a PolyPhaser Bulkhead Panel, PEEP or PEP.

Typically, the plasma column of the lightning strike (return stroke) can have a voltage rise time of 20-50 nanoseconds. If it hits a tower, the tower will handle the majority of the current pulse to ground.
The tower will also radiate the RF energy of the strike. The near field (high magnetic or H field) will penetrate equipment interconnecting wires and induce surge energy. A Faraday cage can reduce this energy. A halo ground system with multiple down conductors to the outside perimeter ground loop can act as a quasi-Faraday cage and give some low frequency shielding. Properly bonded metal building panels can act as a more effective cage. Double-walled screen rooms offer the greatest isolation.

Tower flasher lines, both strobe and conventional, should have protectors to prevent surge entry into the building on the power lines as well as nuisance damage to strobe PC boards.

To ensure survival of the building equipment, all Inputs/Outputs (I/Os) must have protection and they should all be ideally located at the principal ground window or bulkhead panel. If these I/Os (power, telco, etc.) enter elsewhere, protect them first at the entry point (ground protector to perimeter) next run to Perimeter Ground Window (PGW) then protect it again before distribution by the cable trays.(Note: All trays should be grounded to the PGW or bulkhead panel.)

TYPES OF PROTECTORS

The best type of protector is an in-line type. It can better clamp and protect, while preventing the sharing of surge voltage and current with equipment. For telco lines, the best protector is needed when just a few lines are used. Every ground system will momentarily saturate or elevate with respect to the surrounding area until the surge can propagate and dissipate into the soil. The evaluated site ground system can force "on" protectors (power and telco) and dump surge energy onto outbound lines. The greater the number of telco lines, the more the surge is divided as it is distributed over these pairs. The single pair needs the world's best protector to ensure equipment survivability from over-voltage stress, as larger surge energy is diverted to this single outbound pair.

LOCAL AREA NETWORKS

When coax or twisted pairs are used in LAN or WAN systems, a problem between different local grounds can occur. This can cause protectors, which protect in differential mode (wire to wire) as well as common mode (wire to ground), to see a voltage over the turn-on threshold between wires and grounds and clip, induce a hum, or not allow the system to operate. This is not the fault of the protector, but the system design. Grounds should be in common, or on an isolated ground adapter.

POWER LINE

Lightning and surge protectors are no substitute for an Uninterruptible Power Supply (UPS). However, many UPS units do not have adequate surge protection. In-line protectors can offer filtering of the line; however, many protectors use ferrite core material which will saturate on major surges and be useless. Air core type indicators may not offer as low a cutoff frequency or as much filter attenuation and are physically larger, but they will not change with surge current or become less effective due to ferrite core magnetic orientation. (PolyPhaser uses only air core inductors.) If your equipment is sensitive and critical, it should be on a UPS, which will buffer any line noise from your system since the ac power is regenerated. (Filters do not absorb or dissipate energy, but merely shunt or reflect it back to its source.) Power line protectors that cover the wall outlet when they plug in are only good for stand-alone equipment with no other I/Os. This is because other I/Os can input a surge to the equipment. A power line protector, which is far away on the end of an inductive cord, will not limit the over voltage due to the inductance of the cord's safety ground wire. Protectors should be in common with (by a short interconnection) the chassis of the equipment that is to be protected and not at the end of a long equipment power cord. This may be hard or impossible to do with consumer type protectors in plastic enclosures, but not with PolyPhaser's conductive aluminum case.

Semiconductors, whether silicon based or Metal Oxide Varistors (MOV), will fail in a shorted mode when they are at the end of life, or when overpowered beyond their designed capabilities. However, if subjected to power levels in excess of the fusing levels of the wire leads, the unit may fuse open.

Gas tubes normally fail in a shorted mode. Once shorted, another large strike can explode the gas tube, creating an open circuit. Lab test levels show that our IS-NEMP, IS-B50 and IS-50 series models will vent the gas tubes at 89kA and above using the IEEE 8/20µs waveform.

This is just an overview of proper grounding and protector installation. For a more in-depth study, please consult our 100+ page book, Lightning Protection and Grounding Solutions for Communication Sites (LPGS). Or visit our website at www.polyphaser.com

Grounding Solutions:

Everything for grounding applications except the ground rods. PEPs, PEEP-Ms and PB-Ms come with everything necessary for a complete installation: boots, copper straps, hardware, etc. Use PEPs and PEEP-Ms for "thin wall" buildings and PB-Ms for "thick wall" (cinderblock and concrete) structures. The -M suffix means 'modular'; panels can be installed side-by-side to increase the number of ports. GSIE grounding bars can be used to provide proper grounding and expansion of existing sites.

Grounding Components:

- **Rack Isolation Kit:**

Isolates the rack from conductive floors (concrete). The isolation kit will eliminate a current path through sensitive equipment.

- **Bulkhead to Flange Adapter:**

Adapts most PolyPhaser bulkhead-mounted protectors to mount on a single point grounding panel or similar flat surface. The connector on the antenna (surge) side must be female; i.e. will not work with the -MA versions.

- **Low Inductance Copper Grounding Strap:**

To achieve a low inductance ground system. Copper strap has a larger surface area and lower inductance per foot than equivalent cross section circular wire.

- **Copper Strap Bonding Clamps:**

To bond copper strap without building up the joint for an exothermic weld. Use for connecting the copper strap radial to the ground rod; to transition from copper strap to wire [sizes: #6 to #4/0 AWG]; and bonding different widths of copper strap to each other.

- **Copper to Tower Leg Corrosion-Free Grounding Clamps:**

Use for attaching copper strap to a galvanized tower leg. Maximizes the contact surface area and prevents corrosion due to dissimilar metals. These clamps eliminate the need for exothermic welding to the tower.

- **Wire/Copper Rod Transition Clamps:**

Bonds the copper strap radial to the (copper-plated) ground rod without building up the joint for an exothermic weld.

- **Copper Cleaning Kit:**

For best results, the copper should be brought down to "white metal" before bonding and weather sealing.

- **Weatherproofing Kit:**

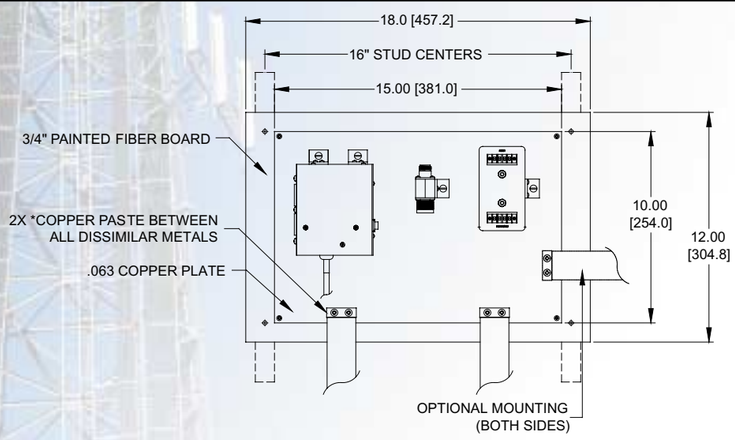
When a PolyPhaser model designed for inside use must be mounted outdoors and unprotected, use the weatherproofing kit to prevent moisture ingress. The kit can easily handle extreme temperatures, and is unaffected by the sun's ultraviolet (UV) rays.

Accessories Matrix

Part Number					Drawing Number	Drawing Page
	Installation kits	**Application**				
CU-SPGP		Grounding plate 16" on center		Board Dimen: 12" x 18", CU plate: 10" x 15"	F001	56
RACK-ISO-KIT-19		19" Rack Isolation kit				
	Bonding clamps		**Wire Size**			
10C-112S		copper strap clamp	1/0 to 6/0 AWG	C110 half hard copper	F006	59
1C-112S		copper strap clamp	6 to 1 AWG	C110 half hard copper	F006	59
58R-112S		copper strap clamp	5/8" Rod	C110 half hard copper	F006	59
			Strap Size			
MSC-3		copper strap clamp multi	1-1/2" or 3"		F006	59
			Rod diameter			
J-1		wire/copper rod transition clamp	1/2 to 1-1/3"	bronze, wire sizes: # 2 stranded to # 10 solid		
J-2		wire/copper rod transition clamp	1-1/2' to 2-1/4"	bronze, wire sizes: # 2 stranded to # 10 solid		
			Tower leg diameter			
TK-1		strap to tower leg ground clamp	5/8" to 1-1/4"	SS 300 transition material		
TK-2		strap to tower leg ground clamp	1-1/4" to 2-1/4"	SS 300 transition material		
TK-3		strap to tower leg ground clamp	2-1/4" to 3-3/4"	SS 300 transition material		
TK-4		strap to tower leg ground clamp	3-1/2" to 5"	SS 300 transition material		
	Copper Strap	**Width inches**	**Length feet***	**Inductance per 8 feet**		
CS112-25	(26 AWG = 0.0159")	1-1/2	25	2.58µH		
CS112-50		1-1/2	50	2.58µH		
CS112-100		1-1/2	100	2.58µH		
CS3-25		3	25	2.22µH		
CS3-50		3	50	2.22µH		
CS3-100		3	100	2.22µH		
CS6-25		6	25	1.9µH		
CS6-50		6	50	1.9µH		
CS6-100		6	100	1.9µH		

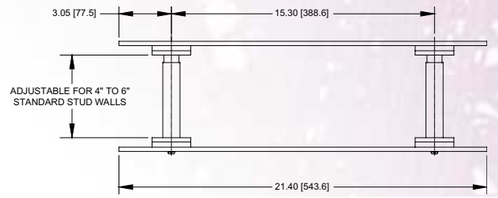
**Longer lengths available, contact factory for details*

Drawing Number: F001

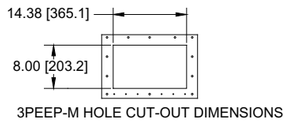


Part Number					Drawing Number	Drawing Page
	Coax Install accessories			**Connector**		
BFN		Flange bracket SX series		N		
BFD		Flange bracket SX series		DIN		
GSA-KIT-N		Ground strap adapter SX series		N		
GSA-KIT-D		Ground strap adapter SX series		DIN		
BF-ADAPTER		Bulkhead to Flange adapter		N		
FB-ADAPTER		Flange to Bulkhead adapter				
IGA-90V		Isolated Ground Adapter (90Vdc)				
BF/IGA-ADAPTER		BF-adapter to IGA-90V adapter		N		
WK-1		Weatherproofing Kit				
T-1		B50 Tower mount kit				
	Coax Shield Ground kits	**Shield diameter**		**Shield Material**	**Grounding to**	
UNI-KIT-2CC		1/4" to 2-1/8"		Copper or Brass	Copper or Brass	
UNI-KIT-2CT		1/4" to 2-1/8"		Copper or Brass	Aluminum, Tin or Galvanized	
UNI-KIT-2TC		1/4" to 2-1/8"		Aluminum, Tin or Galvanized	Copper or Brass	
UNI-KIT-2TT		1/4" to 2-1/8"		Aluminum, Tin or Galvanized	Aluminum, Tin or Galvanized	
UNI-KIT-4CC		2-1/8" to 4"		Copper or Brass	Copper or Brass	
UNI-KIT-4CT		2-1/8" to 4"		Copper or Brass	Aluminum, Tin or Galvanized	
UNI-KIT-4TC		2-1/8" to 4"		Aluminum, Tin or Galvanized	Copper or Brass	
UNI-KIT-4TT		2-1/8" to 4"		Aluminum, Tin or Galvanized	Aluminum, Tin or Galvanized	
	Entrance panels	**Number of ports**	**Diameter of cable**	**Wall thickness**		
3PEEP		3	up to 3-1/8"	8" plus	F003	58
5PB-M		5	up to 3-1/8"	up to 8"	F004	58
5PEEP-M		5	up to 3-1/8"	8" plus	F003	58
8PB-M		8	up to 3-1/8"	up to 8"	F004	58
8PEEP-M		8	up to 3-1/8"	8" plus	F003	58
8PEP		8	up to 1"	8" plus	F005	59
	GSIE kits	**Number of Cables**	**Wall thickness**			
GSIE-8		8	4" to 6"		F002	57
GSIE-12		12	4" to 6"			
	GSIE accessories					
GSIE-KIT-1		Attaches Strap to groundbar	Attaches Kit-2 or UNI-KIT			
GSIE-KIT-2		Strap to protector kit	Use Kit-1 to attach to bar			
	Misc					
GROUNDING VIDEO-NTSC		Video, grounding				
LSC-12		Strike counter	Weatherized			
LSC-13		Strike counter, remote monitoring	Dry contact relay			
CCK		(Copper Cleaning Kit)				

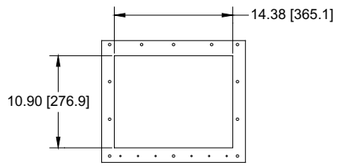
Drawing Number: F002



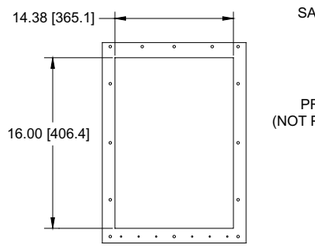
Drawing Number: F003



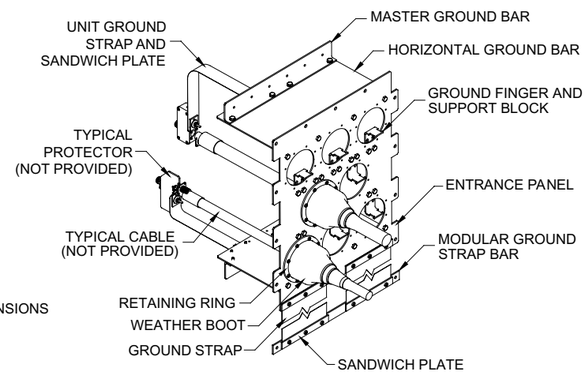
3PEEP-M HOLE CUT-OUT DIMENSIONS



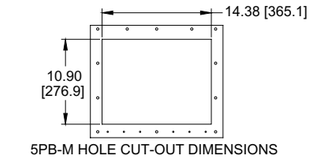
5PEEP-M HOLE CUT-OUT DIMENSIONS



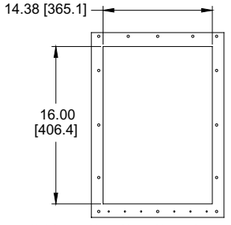
8PEEP-M HOLE CUT-OUT DIMENSIONS



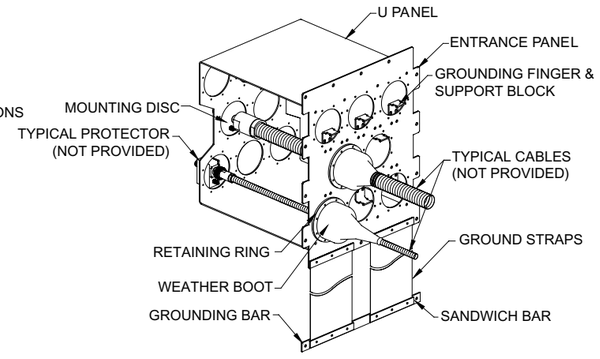
Drawing Number: F004



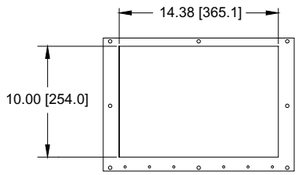
5PB-M HOLE CUT-OUT DIMENSIONS



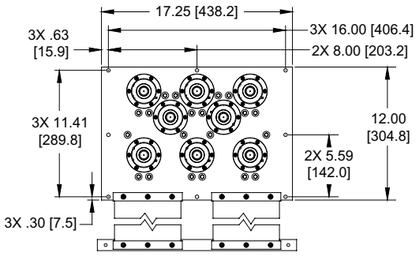
8PB-M HOLE CUT-OUT DIMENSIONS

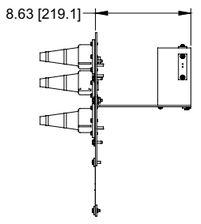


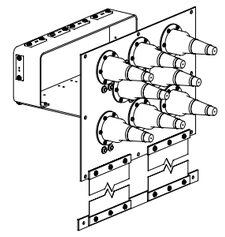
Drawing Number: F005



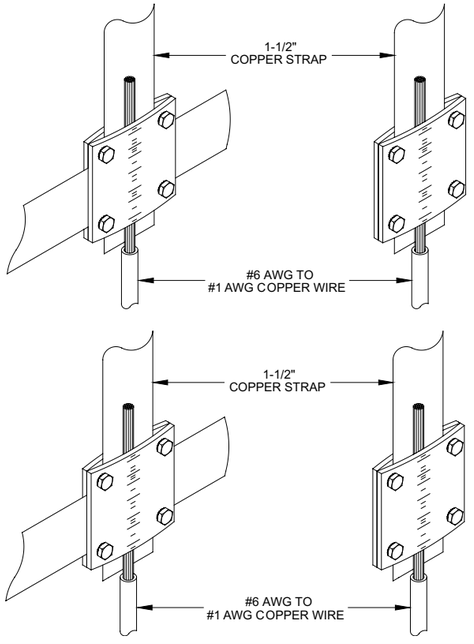
HOLE CUT OUT DIMENSIONS

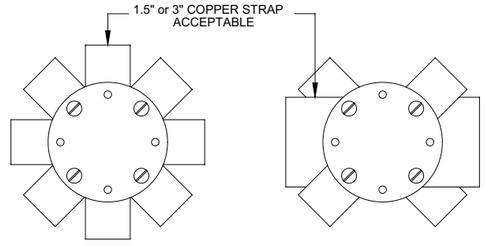






Drawing Number: F006





AMPERE
(N): The base unit of electrical current. An ampere (current) is a (coulomb/second).

BANDWIDTH
(N): Difference in frequency between the upper and lower 3dB down response frequencies.
(A): A measure of the amount of voice, data or video that is sent through a connection, usually measured in bps = bits per second. A full page of English text is about 16,000 bits. A fast modem can move about 56,000 bits in one second. Full-motion, full-screen video would require roughly 10 Mb/s, depending on compression.

BI-PHASE
Found as a power feed to most U.S. homes. Derived from a center tapped transformer; it contains two hot phases (180°) with a center tap neutral return. Normally supplied as two 120 volt single phases with 240 volts available across both phases. The neutral return is usually earth grounded.

CAPACITANCE
(N): A measure of the ability of a circuit to resist changes in voltage magnitude. Circuits placed close together generate another type of additional capacitance called mutual capacitance. Capacitance allows a ground system to store ampere seconds, measured at 1.0KHz unless otherwise stated.

CLAMP
Voltage clamp or clip. To hold turn-on voltage as current is increased. Turn-on voltage is the same, or nearly the same, as "on-state" voltage drop.

CLAMPING RATIO
The ratio of voltage drop at a given current to the turn-on voltage for TVSS devices (gas tube, MOV, SAD).

CLAMPING SPEED
Measured with full lead length using a 1kV/ns waveform in a 50 Ω system, with ≥300MHz or larger bandwidth of TVSS devices.

COMBINER
(N): Used to combine correlated signals.
(A): The summation of multiple transmitters into one transmission line. The peak voltage from each signal will be additive and will be higher than the sum of the power would indicate.

COMMON-MODE
Pertaining to signals or signal components referenced to ground.

COULOMB
(N): SI unit of electric charge, equal to the charge found on 6.25 x 10E18 electrons; amount of charge that crosses surface in one second when current of one ampere flows across it. Measurement of charge often used to indicate the amount of transferred charge through a gas tube to determine gas tube life. "Q" abbreviation. A coulomb is (current x time).

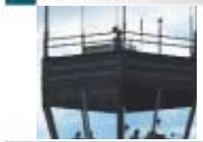
CROWBAR
As pertains to gas tube devices: To turn-on and clamp close to ground level. Having a high turn-on trigger voltage and a low "on" voltage.

DIFFERENTIAL MODE COUPLING
(a tutorial): (1) Non common-mode radiation from a wire pair or coaxial line or (2) Radiation into a wire pair or coax which develops a differential-mode voltage.

DIPLEXER
(N): A three-port frequency-dependent device that may be used as a separator or a combiner of signals. A diplexer is also a multi-coupler that permits the connection and the simultaneous use of several devices, such as transmitters or receivers, to a common or single device, such as an antenna. It does not allow simultaneous transmission and reception, but allows the simultaneous transmission of two or more signals using the same circuit, such as an antenna feed and a transmitting antenna, without EMI. A diplexer allows the simultaneous reception of two or more signals using the same circuit, such as an antenna lead, without EMI.

DUPLEXER
Simultaneous receive and transmit on one transmission line. Where a T connector splits/combines the signals to two groups of filters. The receiver filter passes the receive frequency while rejecting (band stop) the transmitter's frequency. The transmitter filter passes its frequency while attenuating the Class C transmit noise at the receive frequency.

EMC
Electromagnetic Compatibility: Operations of equipment and systems in their installed environments which cause no unfavorable response to, or by, other equipment and systems in the same environment.



EMI/RFI
Electromagnetic interference: When an electrical disturbance from a natural phenomena (e.g., lightning or ESD) or an electrical/electronic device or system causes an undesired conducted or radiated response in a system. Radio Frequency Interference (RFI): Exists when either the transmitter or receiver is carrier operated (has an antenna), causing undesired responses to, or from, other electronic equipment or systems. Sometimes, RFI and EMI are used interchangeably. This is not correct. RFI requires that at least one antenna be involved and is part of the EMI umbrella.

EMP
Electromagnetic pulse: The radiation coming from a thermonuclear explosion. One upper atmospheric EMP default value is a 50 kV/m E-field pulse having a rise time of 5 nsec and pulse duration of 150 nsec at the 50% amplitude) which can be captured by antennas and long unshielded lines. Sometimes referred to as NEMP, HEMP, etc. Lightning can also generate an EMP near the event, referred to as LEMP.

EMP RATED
Rated as having a fast enough turn-on time or filtering to protect against the effects of an EMP event.

FARADAY SHIELD
An electrostatic (E field) shield made up of a conductive or partially conductive material or grid. A Faraday cage or screen room is effective for protecting inside equipment from outside radiated RF energies.

FILTERING (EMI/RFI)
Filters designed for power line and/or signal line applications to pass a defined band and reject emissions above the cutoff frequency. Almost all EMI filters are of the low-pass type and are designed to provide some minimum attenuation in the stop band, provided they are bulkhead mounted in accordance with the manufacturers' specifications. EMI filters are measured in a 50-ohm system pursuant to MIL-STD-220A. Above about 20KHz, this causes little problem, but substantial insertion-loss errors can result at low frequency for power lines.

FREQUENCY RANGE
The bandwidth over which both the listed maximum VSWR and Insertion Loss specifications are valid.

GROUND IMPEDANCE
The ground resistance and the inductance/capacitance value of the grounding system, also called dynamic surge ground impedance.

GROUND LOOP
"Ground loops" are produced when a circuit is grounded at more than one point, with noise voltage (common mode) existing between the points. Solutions include single-point grounding, diversion of ground-noise currents from signal circuits (via common mode capacitors or isolation transformers), and loop-impedance modification (with isolation transformers, opto-isolators, fiber optics, or filters).

GROUND RESISTANCE
The resistance value of a grounding system or given ground rod as measured, usually by a fall of potential (3 stake) method.

HF
High Frequency – normally from 3 to 30MHz; however in this catalog it covers from 1.5 to 30MHz.

HOUSED USE ONLY
For indoor use, or must be further enclosed or weatherproofed for outdoor usage.

IMPEDANCE
Nominal impedance of a device or system. The variation of this impedance with frequency is measured as VSWR or return loss.

IN-LINE
Power or signal passes through unit. In series with line, usually a multi-stage protector. Best protection method.

IL
Insertion Loss - The attenuation vs. frequency of a device placed into a circuit, cable, connector, network, etc. IL is usually expressed as the logarithm of the ratio of a voltage, VB, before vs. after, VA, the device is inserted. IL = 20 log10(VB/VA).

JOULE
A unit of energy measured in watt seconds. One watt for one second is equal to one joule.

LEAKAGE CURRENT
The 50/60 Hz current returned from (flowing through) a filter capacitor(s) back to the safety-ground wire. The National Electrical Code and other regulations limit the amount of allowable leakage current for portable apparatus as a safety consideration in case the ground terminal should accidentally break. Where ground-fault interrupters are used, they usually are set to trip when the leakage current exceeds about 5 mA.

LIGHTNING
(N): A transient high-current electric discharge whose path length is generally measured in kilometers. Lightning occurs when some region of the atmosphere becomes sufficiently electrically charged, allowing the electric fields associated with the charge to cause electrical breakdown of the air. The most common producer of lightning is the cumulonimbus thundercloud; however, lightning also occurs in snowstorms, sandstorms, and in clouds over erupting volcanoes.

LOOP RESISTANCE
Total resistance as measured across the input with the output shorted.

MAXIMUM PEAK LET-THROUGH VOLTAGE
Measured at a given surge current using a given waveform, and using ≥300MHz bandwidth across a load impedance (typically 50Ω). (Note: this impedance may be dc blocked [large bandwidth compared to the surge frequencies present] and resistive load [termination]).

MAXIMUM POWER
Maximum Continuous Wave (CW) RMS transmit power, without unit degradation.

MAXIMUM SURGE
The maximum single surge current and specified waveform that can be handled by a device without failure during the conduction of that wave-form and which ends the life of the device for conducting successive waveforms, but does not allow any generation of outward projectiles.

MULTI-STRIKE CAPABILITY
Capability of surge protection to take multiple lightning strikes and continue to provide equipment protection.

PIM:
PASSIVE INTER MODULATION
The generation of new RF signals from the interaction of two or more RF carriers with non-linear junctions in a conductive path (eg. $IM_3 = 2 *F_1-F_2$).

POWER
Measured in Watts, one Watt = one Amp X one Volt. Continuous Power is an RMS value, while Peak Power is the product of the voltage and current values.

RECEIVER MULTICOUPLER
(N): A device that:
- permits the connection and the simultaneous use of several devices, such as transmitters or receivers, to a common or single device, such as an antenna,
- does not allow simultaneous transmission and reception,
- allows the simultaneous transmission of two or more signals using the same circuit, such as an antenna feed and a transmitting antenna, without EMI, and
- allows the simultaneous reception of two or more signals using the same circuit, such as an antenna lead, without EMI.

RADIO FREQUENCIES
RF: In the ANSI/IEEE Standard 100-1984, the term is commonly used to cover the frequency range from 10KHz to 1,000GHz.

SAFETY GROUND
The local earth ground. The earth ground which bonds the neutral return. The wire may be green or bare and can be through a metal conduit. It may be earth grounded as many times as needed. (Neutral must only be grounded once at the entry location.)

SUPER HIGH FREQUENCY
SHF: Frequency ranging from 3GHz to 30GHz. This includes C, X, Ku and K-bands.

SHUNT PROTECTOR
Line-to-ground. No power or signal passage through unit. Not in-series with line.

SINGLE PHASE
A true single phase supply. Usually a two-wire system with one hot phase and a neutral return. A safety earth ground is also present.

SKIN EFFECT
At RF, current flows on the surface or skin of metal due to the increased inductance in the interior. 1-1/e or 63% of the current flows in the first skin depth. The gradient conduction and propagation of RF or RF components of a surge on the outer surfaces of conductors.

TEMPERATURE LIMITS
The extremes of operating or storage that the unit or unit parts have been tested to under MIL-STD-202 for thermal shock.

THREE PHASE
It consists of sinusoids 120° apart on at least three wires (Delta) and often four wires (Wye). The fourth wire is a grounded neutral return. In a Delta system there is no reference to ground and thus it is more susceptible to lightning problems.

THROUGHPUT ENERGY
The total energy, expressed in Joules, that will be let through a device using the indicated surge waveform.

TOTAL SURGE ENERGY
Total sum of surge energy for all lines of a protector unit. Measured in Joules. The minimum total energy which results in the failure of the unit.

TRANSFER IMPEDANCE
Referring to coax, is the impedance to transfer into or outside the coax at various frequencies usually below 1MHz. Due to loss of skin effect attenuation or shielding at these low frequencies, coax can be susceptible to interference and noise, as well as the radiation of such signals.

TURN-ON TIME – GAS TUBE
The amount of time that exists in the period that occurs when the ramp voltage barely exceeds the turn-on voltage of the device, and the point at which 50% of the peak voltage is achieved during the turn-on (crowbar) process. Measured in a 50 Ω system with ≥300MHz bandwidth

TURN-ON Vac
The maximum ac sine wave voltage that can be passed with the peaks just at the turn-on Vdc level.

TURN-ON Vdc
Turn-on voltage at 1mA dc with a ramp of 100V/ms typical.

UHF
Ultra-High Frequency – normally from 300 to 3000MHz, however in this catalog we breakout 800 to 1000MHz separately even though it is within this category.

VHF
Very High Frequency - Frequencies ranging from 30MHz to 300MHz. This includes FM broadcast, VHF TV channels, VHF communications, P-band radar and some walkie talkie radios.

VLF
Very Low Frequency – Frequencies ranging from 3KHz to 30KHz.

VOLT
(N): The difference in potential between two points of a conducting wire carrying a constant current of one ampere when the power dissipated between these two points equals one watt. A volt of charge is a (joule/coulomb).

VSWR
Voltage Standing Wave Ratio - A measure of the degree to which a load is impedance matched to its transmission line. A perfect match has a VSWR = 1.0 and poorer matches have correspondingly greater VSWRs. VSWR = (Vincident+Vreflected)/Vincident-Vreflected).

VT MAX
The max peak voltage of all combined waveforms. Vtotal is used for multi-coupled or combined transmit signals.

Terms and Conditions of Sale

1. ORDERING GOODS. All orders for goods must be made or confirmed in writing. PolyPhaser's acceptance of any order shall occur only after receipt of Purchaser's written order or confirmation and delivery of PolyPhaser's written confirmation to Purchaser.

2. PRICES. Unless otherwise quoted in a firm offer, all prices shall be as described in PolyPhaser's price list last published before PolyPhaser's receipt of Purchaser's written order or confirmation. PolyPhaser shall provide firm quotes only in writing. Unless otherwise specified, all firm quotes shall expire thirty (30) days from date of issuance. Prices are subject to change at any time without notice. Prices do not include federal, state or local taxes, freight or insurance.

3. TERMS. Sales on account are Net thirty (30) days upon previously approved credit only. All other sales shall be Cash, Discover, MasterCard, Visa, Prepaid (before shipping) and Cash on Delivery (COD), OR payment guaranteed by Irrevocable Letter of Credit, all bank charges paid by Purchaser. Purchaser may purchase goods on account or credit only after written approval by PolyPhaser's Credit Department.

4. DELIVERY AND SHIPPING. Unless otherwise requested in writing before shipment:
(1) All domestic orders shall be shipped (a) prepaid and added to invoice, insured to destination, UPS Ground Service; or (b) COD or on Collect account, from PolyPhaser's factory in Minden, Nevada; and (2) All international orders shall be shipped insured air delivery via carriers serving Reno/Tahoe International Airport. All freight and insurance charges shall be payable by Purchaser (in addition to the purchase price for the goods) in accordance with Section 3 TERMS above. Except goods shipped freight paid by factory, Purchaser bears the risk of all loss or damage to goods in transit, and must make any claim for damage or loss during shipment directly with the carrier. Identification of goods shall occur when PolyPhaser places the goods in the custody of carrier for shipment.

5. INSPECTION AND ACCEPTANCE. All claims for damages, errors, shortages or nonconformance of goods must be made to PolyPhaser in writing within thirty (30) days of Purchaser's receipt of the goods. Purchaser's failure to make such claim within the time permitted shall constitute Purchaser's irrevocable acceptance of the goods.

6. MODIFICATIONS. PolyPhaser reserves the right to modify and change specifications with respect to any goods without notice, and to substitute such modified goods to the extent that they meet or exceed the performance specifications of the goods ordered by Purchaser.

7. RETURNS AND ALLOWANCES. Goods rejected by Purchaser for damage (other than during shipping) or nonconformance must be returned to PolyPhaser within thirty (30) days of Purchaser's timely rejection thereof. All other returns, whether for warranty or otherwise, may be returned only after written notice given by Purchaser to PolyPhaser and written authorization and acceptance by PolyPhaser. Purchaser shall ship all returned goods insured freight collect by carrier designated by PolyPhaser. Credit or adjustment for returned goods shall be subject to inspection and acceptance by PolyPhaser at PolyPhaser's factory in Minden, Nevada. Non-standard catalog items and items specially manufactured for Purchaser are non-cancelable, non-returnable and non-refundable except as to warranty defects and nonconformance to manufacturing specifications.

8. LIMITED WARRANTY. POLYPHASER WARRANTS THAT AT THE TIME OF SHIPMENT THE GOODS SHALL MEET OR EXCEED ALL OF POLYPHASER'S PUBLISHED SPECIFICATIONS FOR SUCH GOODS AND SHALL BE AND REMAIN FREE OF DEFECTS IN WORKMANSHIP AND MATERIALS FOR A PERIOD OF UP TO TEN (10) YEARS AFTER THE DATE OF SHIPMENT OF THE GOODS TO PURCHASER. PURCHASER AGREES THAT THE GOODS ARE DESIGNED ACCORDING TO SPECIFICATIONS SUITABLE FOR PURCHASER'S PURPOSES, AND THAT, EXCEPT AS SET FORTH IN THIS LIMITED WARRANTY, POLYPHASER DISCLAIMS ANY WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTY AS TO THE DESIGN, FITNESS, CONDITION, MERCHANTABILITY OR DESCRIPTION OF OR AS TO THE QUALITY OF THE MATERIAL OR WORKMANSHIP IN THE GOODS, OR AS TO THEIR FITNESS FOR ANY PARTICULAR PURPOSE FOR ANY TRADE OR BUSINESS, OR ANY OTHER REPRESENTATION OR WARRANTY WHATSOEVER. Also excluded from this limited warranty are goods covered by other written manufacturer or supplier warranties, damage resulting from ordinary wear and tear, abusive use or lack of proper maintenance, work not done by PolyPhaser or PolyPhaser's contractor or agents, or loss or injury caused by the elements or during shipment to or from Purchaser. Purchaser agrees to notify PolyPhaser in writing within thirty (30) days of Purchaser's discovery of any problem with any goods subject to this limited warranty. Goods determined to be defective in materials or workmanship within the time described in this Limited Warranty shall be repaired, replaced, or price fully refunded at PolyPhaser's sole discretion, and only after Purchaser's full compliance with the terms of RETURNS AND ALLOWANCES above, PolyPhaser's written approval for return, and examination by PolyPhaser at PolyPhaser's factory. PolyPhaser shall notify Purchaser of its decision to repair, replace, refund the purchase price, or to deny liability under this Limited Warranty within sixty (60) days of PolyPhaser's receipt of the returned goods. The warranties contained in this Limited Warranty are personal to Purchaser and are not assignable by Purchaser to any transferee of the goods.

9. LIMITATION OF LIABILITY. PolyPhaser shall not under any circumstances (a) be liable to Purchaser for any warranty claim relating to the goods or components that Purchaser asserts more than ten (10) years after the date of shipment of the goods to Purchaser; (b) be liable to Purchaser for any damages in excess of the amount actually paid by Purchaser to PolyPhaser for the goods as to which Purchaser makes a warranty claim or the cost of repair or replacement, whichever is the smaller amount; (3) be liable to Purchaser for any loss of use or profits or other special or consequential damages; or (4) be responsible for any personal injury, or property damage alleged to arise as a result of Purchaser's or any third party's use of the goods. Purchaser expressly assumes the risk of and the responsibility for any and all damages for personal injury, property damage, loss of use or profits or other special or consequential damages relating in any way to the goods or use thereof. The above limitation shall apply even though it may be alleged that PolyPhaser or its agents have been actively or passively negligent.

10. VENUE AND JURISDICTION. The sole and exclusive forum for the resolution of any disputes arising between Purchaser and PolyPhaser shall be the Ninth Judicial District Court in the State of Nevada, in and for Douglas County, or, upon proper legal basis, the United States District Court for the District of Nevada, Northern Nevada Division, and Purchaser and PolyPhaser each confers jurisdiction over the resolution of such disputes upon these courts.

PolyPhaser CORPORATION

P.O. Box 9000, 2225 Park Place,

Minden NV 89423 USA

www.polyphaser.com

Tel: +1.775.782.2511

Fax: +1.775.782.4476

E-mail: info@polyphaser.com

Shanghai Representative Office:

Suite 601, Novel Plaza,

128 Nanijing Road West,

Shanghai 200003, PR China

Tel: +86.21.6350.1735

Fax: +86.21.6350.1398