**Active Tracking**
A term used to describe the ability of a filter to reduce frequency disturbances at a constant level with respect to the entire sine wave. Similar to “Sine Wave Tracking”, “Active Tracking” is a marketing term that is usually associated with two-port SPD or filter designs.

**Attenuation**
It is the reduction of a transient or induced frequency. When speaking in terms of SPD’s, attenuation is used to describe the EMI/RFI filtering characteristics at a specific frequency and is usually expressed in decibels.

**Canadian Standards Association (CSA)**
CSA is an independent, not-for-profit, product-safety testing and standards agency. Accredited by OSHA as an NRTL, CSA serves business, industry, government and consumers in Canada as well as the global marketplace.

**Cascading**
The practice of installing surge protective devices at two or more points on the electrical power system. The upstream device should be designed to divert the majority of surge energy that comes from external sources (such as lightning induced transients), while secondary and tertiary devices serve to clamp the residual surge energy as well as any surge activity that originates within the facility. The use of a cascading SPD system can also protect against unexpected impulses entering a facility downstream of service entrance such as a lightning strike on a roof top air handler. Refer to IEEE 1100 for additional information about cascading.

**Category A, B, C**
Surge exposure location categories as defined in IEEE C62.41. Category C is outside and service entrance. Category B is distribution and short branch panel runs. Category A is Long Branch panel runs and electrical outlets/point-of-use equipment.

**CBEMA Curve**
See “ITIC Curve”

**Clamping Voltage**
The peak voltage level that an SPD will allow when tested with a specified surge waveform applied.

**Common Mode**
When relating to SPD’s, common mode refers to surge protection components provided between L-G and N-G modes.

**Common Mode Disturbance**
Refers to a noise or transient event that is propagated between two current carrying conductors and a common reference point. Usually between Line and Ground or Neutral and Ground.

**Cord-Connected SPD**
A Surge Protective Device that provides a plug for connection into an electrical outlet. Most commonly associated with strip protector types. See Type 3 SPD.

**Decibel (dB)**
A unit used to express relative difference in power or intensity, usually between two acoustic or electric signals, equal to ten times the common logarithm of the ratio of the two levels. Decibels may be positive or negative with the standard reference level as zero.

**Electromagnetic Interference (EMI)**
Sometimes referred to as “RFI”, EMI is a frequency voltage disturbance that affects sensitive electrical circuitry due to electromagnetic conduction or radiation that is emitted from an external source.

**Fault Current Rating**
See “Short Circuit Current Rating”
**Filter**
This is an electronic circuit or device that limits certain frequency bands while allowing others to pass. Filter designs that are integral to One-Port SPDs are of the band pass variety that attenuates a narrow spectrum of frequencies between line and ground. Filters that are integral to Two-Port SPD’s are typically of the low-pass variety that allows the 60Hz rms signal to continue to the loads while attenuating the higher interference frequencies.

**Follow Current**
This is electrical system current that continues to flow through an SPD following the passage of a surge event. For SPD’s utilizing components that exhibit follow current characteristics, the SPD must be designed in a fashion that will quickly interrupt the follow current before damage can occur to the SPD.

**Gas Tube**
A voltage switching or “crowbar” type component that has high initial impedance but changes rapidly to a low value when a surge has exceeded its turn on threshold. Gas Tubes are known for their ability to handle high energy transients, however they have slower response times and can remain conductive with relatively low follow currents after a surge discharge event.

**Hard-Wired SPD**
“See Permanently Connected SPD”

**Harmonics**
Harmonics are voltage and current distortions that result from non-linear loading of the electrical power system. They are multiples of the fundamental system frequency. For 60Hz systems, the second harmonic is 120Hz. 180Hz is the 3rd, 240Hz is 4th, etc. Surge Protective Devices do nothing to reduce the problematic effects of harmonic distortion.

**Hybrid SPD Design**
Hybrid SPD designs employ 2 or more suppression component technologies. Hybrid designs usually contain multiple protection circuits in an internally cascading or parallel configuration. When designed properly, hybrid SPDs can provide the best characteristics of each technology selected, but at the same time, can inherit some of the same undesirable characteristics of each technology as well. Attention should be paid to overall device performance characteristics when evaluating SPDs.

**IEEE 1100 (Emerald Book)**
IEEE Recommended Practice for the Powering and Grounding of Electrical Equipment

**IEEE C62.41.1**

**IEEE C62.41.2**
The IEEE Recommended Practice on the Characterization of Surges in Low-Voltage AC Power Circuits.

**IEEE C62.45**
The IEEE guide on Surge Testing of Equipment Connected to Low-Voltage AC Power Circuits.

**IEEE C62.62**

**IEEE C62.72**

**Institute of Electrical and Electronics Engineers (IEEE)**
The institute is an international engineering society of electrical and electronic engineers. The IEEE Standards Association has more than 8000 active members that develop standards for electro and information technologies/sciences for the benefit of humanity and the profession.

**ITIC Curve**
Replaces the former CBMA curve and provides a set of curves developed by the Information Technology Industry Council (ITIC) that represents the withstand capabilities of computers in terms of the magnitude and duration of the voltage disturbance.

**Joule Rating**
The amount of surge energy, measured in watt per second, that an SPD is capable of absorbing. Joule ratings should not be considered an indicator of SPD performance since the rating is based on current duration versus voltage formula. A high let thru voltage design, which is undesirable in a SPD, can also provide a higher joule rating than a more efficient, higher impulse current rated design. It is important to note that NEMA, ANSI, IEEE or IEC do not recognize joule ratings as a valid metric to benchmark SPD performance.
**kA Rating**
See “Maximum Single Impulse Surge Rating”

**Lightning Arrester**
See “Surge Arrester”

**Maximum Continuous Operating Voltage (MCOV)**
The maximum rms voltage that may be continuously applied between the connection terminals of the SPD. Per NEC 285, no SPD shall be installed on an electrical system where the MCOV rating of the SPD is less than the maximum continuous phase-to-ground power frequency voltage at the point of application.

**Maximum Single Impulse Surge Rating**
The maximum 8/20μs surge current pulse an SPD device is capable of surviving on a single-impulse basis without suffering either performance degradation or more than 10% deviation of clamping voltage at a specified surge current. The Maximum Single Impulse Surge Rating should be specified by mode since the number of components and ratings can vary by mode within any given SPD design.

**Metal Oxide Varistor (MOV)**
A MOV is a solid state, non-linear, voltage-limiting device. MOV’s are widely used in Commercial, Industrial and Residential SPD applications due their excellent energy handling capabilities and reliable performance.

**MIL-STD-220B**

**Modes of Protection**
Electrical paths where the SPD offers defense against transient surge voltages. Examples include, Line to Neutral (L-N), line to Ground (L-G), Line to Line (L-L) and Neutral to Ground (N-G).

**Nominal Discharge Current (In)**
The peak value of the current, selected by the manufacturer, impressed through the SPD having a current wave shape of 8/20μm where the SPD remains functional after 15 applied surges. Testing and assignment of (In) is carried out by an OSHA approved NRTL per the guidelines of UL 1449 3rd Edition Standard.

**Nominal Voltage**
The normal voltage level specified for a given electrical system. For grounded three phase WYE systems nominal voltages are typically 480/277 or 208/120 where the first number expresses the nominal phase to phase level and the second number is the phase to neutral voltage.

**Normal Mode**
When relating to SPD’s, normal mode refers to surge protection components provided between L-L and L-N modes.

**National Electrical Equipment Manufacturers Association (NEMA)**
NEMA is a standards body comprised of industry members with the objective to develop technical standard in the best interest of the electrical equipment industry and users, establish and advocate industry policies on legislative and regulatory matters and to collect, analyze and disseminate industry data.

**Nationally Recognized Test Laboratory (NRTL)**
An OSHA accredited Product Safety Testing Laboratory. Per NEMA LS1 and the NEC, all SPD devices must be listed by an NRTL.

NEMA LS1 is a written standard, established by a committee comprised of SPD technical subject matter experts. It is intended to serve as a minimum guideline on how SPD’s should be specified. All SPD suppliers should adhere to the basic outline provided by NEMA LS1. (Update: NEMA LS-1 has been rescinded by the NEMA 5VS technical committee. At the time of this release, there has been no NEMA document issued to supersede the LS1 Standard.)

**NFPA**
National Fire Protection Association

**Noise Filtering**
This is an optional SPD design feature that provides attenuation of EMI/RFI interference frequencies. See “Filter”

**Nominal Voltage**
The normal voltage level specified for a given electrical system. For grounded three phase WYE systems nominal voltages are typically 480/277 or 208/120 where the first number expresses the nominal phase to phase level and the second number is the phase to neutral voltage.

**Normal Mode**
When relating to SPD’s, normal mode refers to surge protection components provided between L-L and L-N modes.
Normal Mode Disturbance
Refers to a noise or transient event that is propagated between phase conductors without respect to ground.

One-Port SPD
A Surge Protective Device that connects parallel to the electrical system. Also referred to as a "shunt" configuration.

Overvoltage
This is an increase in the nominal phase voltage level, sometimes lasting for several seconds or minutes. The term can also apply to transients and surges. When applied as a sustained, multi-cycle variation it refers to a voltage with a value at least 10 percent above the nominal voltage for a period of time greater than 1 minute. Over voltage conditions where the voltage exceeds the SPD’s Maximum Continuous Operating Voltage (MCOV) level can result in immediate or premature failure of the SPD.

Parallel Connected SPD
Most common SPD type for facility protection. Parallel-connected devices are not restricted by electrical system load currents and can protect both upstream and downstream equipment. See “One-Port SPD”.

Peak
The maximum recorded measurement level of an electrical event.

Permanently Connected SPD
A SPD design type that is provided with field wiring cables or terminals to facilitate installation on the electrical panel or receptacle.

Phase Rating
This rating represents the performance characteristics of an SPD that are usually calculated by combining Line to Neutral + Line to Ground mode ratings.

Plug-In SPD
See “Cord Connected SPD”

Response Time
The time that is required for a SPD to react to a voltage that exceeds its threshold. It is important to understand, that while speed of response is a performance trait that is necessary to limit transient voltages, response ratings claims that are in published for SPD’s in the nanoseconds are based solely on the individual ratings of the suppression components and not represent the complete SPD assembly.

Secondary Surge Arrester
See “Type 1 SPD”

Selenium Cells
This is an SPD component that is compromised of selenium rectifier circuits. Generally recognized as an outdated technology due to the advent of Metal Oxide Varistors in the 1970’s.

Series Connected SPD
This SPD type is usually connected directly to a mission critical equipment load. Series connected SPD’s offer excellent surge protective characteristics against incoming transients, but are limited by the amount of load current they can support. The higher the operational current rating of the protected equipment, the larger and more costly a Series Connected SPD will be. Series SPD’s can only protect downstream equipment connected to same electrical conductor. See “Two-Port SPD”.

Short Circuit Current (SCC)
The maximum available current that an electrical system can produce under fault conditions.

Short Circuit Current Rating (SCCR) of an SPD
The suitability of an SPD for use on an AC power circuit that is capable of delivering not more than a declared rms symmetrical current at a declared voltage during a short circuit condition. The SCCR rating of an SPD is assigned by UL, based on abnormal overvoltage testing performed per UL 1449, and is required to be marked on the SPD per article 285 of the National Electrical Code.

Silicon Avalanche Diode (SAD)
Silicone Avalanche Diodes are semiconductor type SPD components that have fast, linear response characteristics, but are limited by their energy handling capabilities. SPD’s that are designed with SAD technology must utilize costly, high component count arrays to match the energy handling capability of an equivalent rated MOV based SPD design.
Sine Wave
The fundamental oscillatory RMS voltage and current waveform that is standard to 50/60Hz electrical power systems.

Sine Wave Tracking
A marketing term that is used to describe the EMI/RFI mitigation characteristics of an SPD with capacitive filtering circuitry. All SPDs with capacitive filtering exhibit sine wave tracking abilities.

Suppressed Voltage Rating (SVR)
No longer a valid rating for SPDs beginning with UL 1449 3rd Edition release, this was a per mode clamping voltage rating assigned by UL that was based on testing to a 6kV / 500A combination surge waveform. SVR ratings have now been superseded by UL 1449 VPR ratings. See "Voltage Protection Rating".

Surge
A transient wave of current, potential or power in an electric circuit. For the purposes of this SPD discussion, surges generally do not include overvoltages that consist of an increase in the power frequency voltage for several cycles.

Surge Arrester
Often referred to as Lightning Arrestors, Surge Arresters can be classified as a broad range of SPD's that are typically used on circuits above 1kV. Surge Arresters are covered under Article 280 of the National Electrical Code.

Surge Life Rating
The number of tested surge impulses that a SPD can be exposed to with less than 10% deviation from pre-test benchmark clamping levels.

Surge Life Test
This is a test used to determine the per-mode Surge Life Rating of an SPD based on the repetitive application of a specific surge current waveform across the terminals of the SPD. A commonly used and widely accepted surge life test waveform is IEEE C62.41 Category C3 applied to the SPD in 1-minute intervals.

Surge Protective Device (SPD)
A device composed of at least one non-linear component and intended for limiting surge voltages on equipment by diverting or limiting surge current and is capable of repeating these functions as specified. SPDs were previously known as Transient Voltage Surge Suppressors or secondary surge arresters.

Surge Rated Disconnect
A disconnect switch that has been tested and certified for use up to the maximum specified surge current level without failure.

Surge Rated Fusing
Fusing components that have been tested and certified for use up to the maximum specified surge current level without failure.

Temporary Overvoltage (TOV) Withstand Level
This is the maximum rms voltage limit and duration of a temporary over voltage event that the SPD can withstand without any changes in operational parameters or functionality.

Type 1 SPD
Devices previously known as Secondary Surge Arresters, Type 1 SPDs are permanently connected devices intended for installation between the secondary of the service transformer and the line side of the main service breaker, but are also suitable for installation on the load side as well. Type 1 SPDs are designed and rated to be installed without the requirement for an external overcurrent protective device.

Type 2 SPD
Devices previously known as Transient Voltage Surge Suppressors, Type 2 SPDs are permanently connected devices intended for installation on the load side of the main service breaker; including SPDs located at the branch panel.

Type 3 SPD
Point of utilization SPDs, installed at a minimum conductor length of 10 meters (30 feet) from the electrical service panel to the point of utilization, for example cord connected, direct plug-in, receptacle type and SPDs installed at the utilization equipment being protected.

Type 4 SPD
Component SPDs, including discrete suppression components as well as component assemblies.

Transient Impulse
This short duration, fast rising voltage event is induced onto the electrical system wiring. Remote lightning strikes, equipment switching and electrical motor starting operations commonly cause transients.

Transient Voltage Surge Suppressor (TVSS)
See "Type 2 SPD"
Two-port SPD
A Surge Protective Device with input and output terminals to serve the protected loads. Two-Port SPD's are highly effective in reducing damaging surge voltage levels, but they are limited by the amount of load current they can support.

UL 1283
UL Standard for Electromagnetic Interference Filters. UL 1283 details construction and product safety testing requirements for EMI/RFI type filters. UL 1283 does not establish performance guidelines, nor does it require test to determine the effectiveness of filter circuits for a given application.

UL 1449
UL Standard for Surge Protective Devices. UL 1449 details construction and product safety testing requirements for SPDs formerly called TVSS and Secondary Surge Arresters, as well as Suppression Components and cord-connected, point of use suppression devices. UL 1449 does not evaluate the adequacy of the VPR of the SPD to protect specific loads.

UL 96A
UL Standard for the installation requirements of Lightning Protection Systems.

Underwriters Laboratories (UL)
Underwriters Laboratories is an independent, not-for-profit product-safety testing and standards agency and is accredited by OSHA as an NRTL.

Voltage Protection Rating (VPR)
A rating selected from a list of preferred values from UL 1449 3rd Edition and assigned to each mode of protection. The value of VPR is determined as the nearest highest value (taken from Table 63.1 of UL 1449 Standard) to the measured limiting voltage determined during the transient-voltage surge suppression test using the combination wave generator at a setting of 6kV, 3kA.