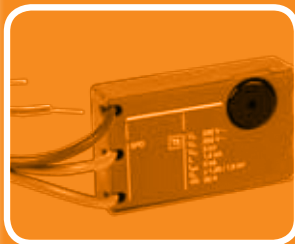


Surge Protection Devices



Selection of SPDs

3



Modular SPDs

8



SPDs in insulated enclosures

10



SPDs in metal clad enclosures

10



3ph Dis. Boards with integral SPD

11



Many UK businesses and households find out to their cost each year that voltage surges on the electrical supply have the potential to cause serious damage to electrical equipment.

Hence, the 17th Edition of the IET Wiring Regulations contains strong recommendations for the use of surge protection within the amended document introduced in January 2012, which require clear consideration of Overvoltage protection issues.

WHERE IS IT IN THE REGS?

Chapter 443 - Protection against overvoltages of atmospheric origin or due to switching.
+
Chapter 534 - Devices for protection against overvoltage



What are surges and how are they produced?

Surges are short-term high voltage impulses, other names being, transients, glitches and spikes, these show themselves for a very short duration of time, typically some micro seconds.

Remember, it doesn't need a direct lightning strike on an installation to cause damaging voltage surges – a ground strike in the near vicinity is quite sufficient. Also remember there are many other sources of voltage transients, such as the starting of large motors and the switching of large capacitive and inductive loads. Common examples of internal switching events are a lift motor in a hotel or fluorescent strip lights being turned on or off.

Every organisation has more than enough sensitive targets for these destructive transients, i.e. power supplies, telephone networks, field bus systems, fire and burglar alarm equipment etc.

About a third of transients affecting properties originate from outside the installation. These external transients usually take the form of single impulses with a peak amplitude often reaching up to 40kV. They are most often common mode impulses, occurring between live and earth and/or neutral and earth.

The remainder of transients are generated within the site. In an industrial environment, for example, around 100 internal transients per year of 1kV peak, plus another 20 to 40 per year of 2kV peak would be considered normal.

Safety can be achieved

Lightning and current surge arresters are used for the purpose of equipment protection, these devices basically conduct high energy impulses current safely to earth without damaging critical and sensitive electrical products.

Did you know

The blowing of a simple rewirable fuse can also cause transients. One of the pioneers of fuse technology stated: "It is noteworthy that, given sufficient inductance, the peak voltage with a 10inche (copper) fuse wire reached 6kV" (approximately 29times the circuit voltage)



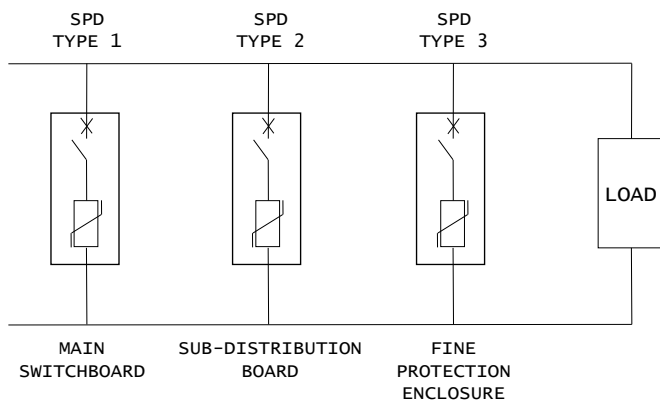
Typical distribution of SPDs within an installation

In practice, a three-stage arrangement is needed to achieve comprehensive protection.

Type 1 devices are intended for installation close to the point where the electricity supply enters the building for Industrial applications or specific installations e.g. TT systems. They can provide good protection for the main switchboard, however because of their point of installation and their mode of operation they do not provide effective protection against internal transients. Modules suitable for lightning protection generally use a 'spark gap' device to provide the necessary function. It is widely recognised that 'spark gap' technology has the highest energy handling capacity of SPD designs.

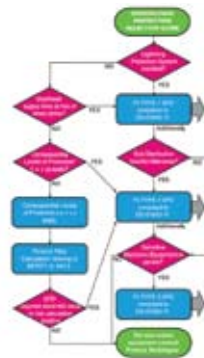
To deal with internal transients **Type 2** devices are used and are usually fitted in each of the installation's distribution boards. **Type 2** devices generally use a different technology – metal oxide varistor or MOV.

The **Type 3** devices are, in most respects, similar to **Type 2** devices. They use MOV technology, but they are designed to be installed as close as possible to the load, and to have even lower clamping voltages than their **Type 2** counterparts. Sometimes **Type 3** devices are offered in the form of plug-in socket strips with integrated surge protection. The type 3 design of din-rail mounted product has common and differential modes of protection.



Some applications can suffice with a single combination unit of Type 1 and Type 2. However, with the prevalence of delicate electronic equipment such as computers, photocopiers and telecommunications systems, it is now prudent to install Type 3 protection for selected loads. Additionally depending on the size of the electrical installation and the distance apart of downstream sub-distribution boards and final loads, designs may require additional **Type 2** and **Type 3** units suitably located / coordinated in series.

WHAT DEVICES WILL I NEED?

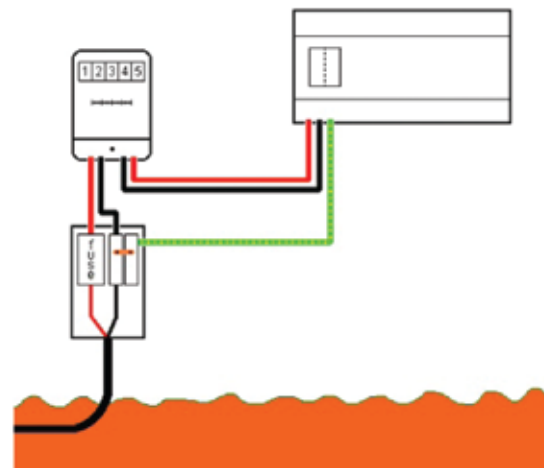


It is important to identify whether the installation earthing system is the more common TN-C-S type or if it is a TT system. Then work through the general guidance flow diagram to assist in deciding your requirements.

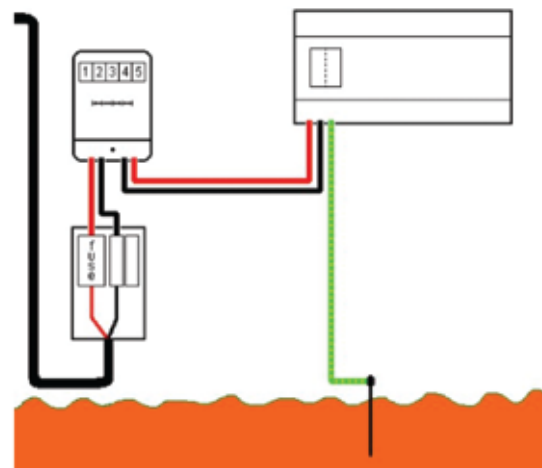
(See pg.6-7)

Earthing System reminder

A TN-C-S system has the neutral and earth COMBINED in the Electricity Boards supply cable, and SEPARATE with-in the installation, (this being the meter position and onwards).



A TT system has the neutral running in the supply cable as normal, and the earth from the installation is connected to an appropriate Earth Electrode inserted into the ground.



SECTION 443

Protection against overvoltages of atmospheric origin or due to switching

This section deals with protection of electrical installations against transient overvoltages of atmospheric origin (e.g. Lightning strikes), which are transmitted by the supply distribution system and against switching overvoltages generated by the equipment within the installation (e.g. reactive load operation like motors and certain lighting circuits).



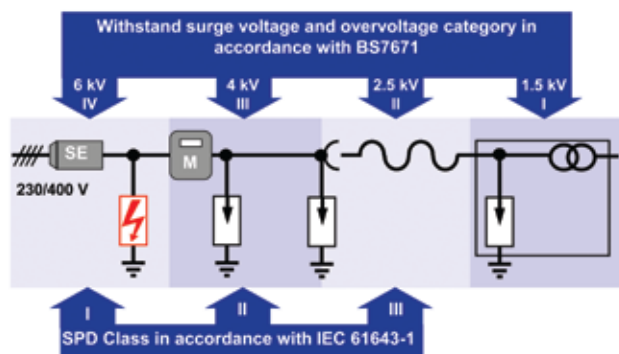
Determination of the necessary SPD requirement is based on a risk assessment criteria outlined in section 443.2.4.

In general assessment of installations covered by (i), (ii) and (iii) below always result in the requirement of SPDs, however certain conditions in (iv) and (v) are deemed low risk. See full details of formulae in BS7671:2008 Amd1:2011.

CONSEQUENTIAL LEVEL

- (i) Related to human life
- (ii) Related to public services
- (iii) Commercial or industrial activity
- (iv) Groups of individuals
- (v) Individuals

LOCATION OF SPD

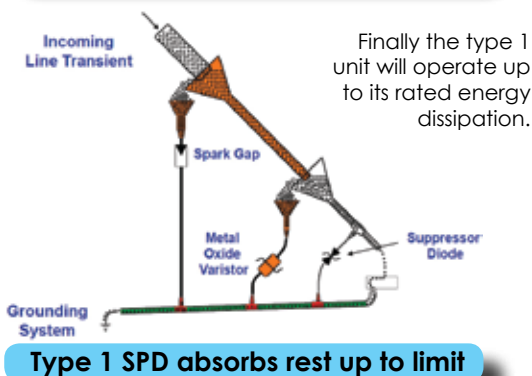
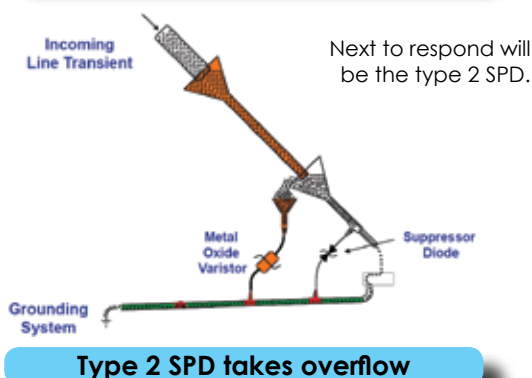
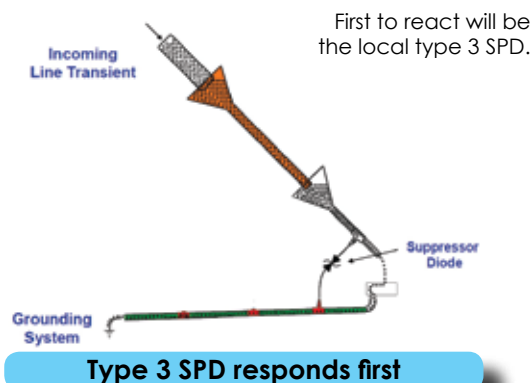


Type I devices are generally located at the Supply Entry point.
Type 2 devices will be found in the main distribution board and also at sub-distribution boards (if greater than 10m from the upstream SPD).
Type 3 devices are situated as close as practicable to the equipment being protected.

Section 534.2.3.6 Coordination of SPDs

SPDs shall be selected and erected such as to ensure coordination in operation.

To ensure discriminative function of in line SPDs, energy coordination of individual SPDs is essential. The basic principle of energy coordination is characterised by the fact that each protective stage must only discharge the amount of interference energy the SPD is designed for. If higher interference energies occur, the protective stage upstream of an SPD must take over e.g. SPD type 1 must take over from a type 2 downstream if necessary. This type of coordination must take into account all possible incidences of interferences such as switching surges, partial lightning current, etc. in accordance with BS EN 62305-4.



SPD MAIN FEATURES

SPDs are manufactured to exacting European/International standards - EN 61 643-1 1 / IEC 61 643-1.

Easy replacement of protection module without the need for tools.

Operating state/fault indication by flag indicator and/or volt free alarm contacts for optional remote signalling.

Busbar connectivity for Type 2 devices to enable trouble free retrofitting of devices into existing Consumer Units or 3phase Distribution Boards.



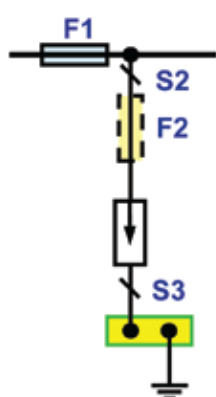
Appropriate selection of SCPD upstream of SPDs

Short Circuit Protective Devices (SCPDs) are an essential consideration when installing SPDs and can be implemented by a circuit breaker or fuse device situated upstream (supply side) of the SPD.

The SCPD should be coordinated with the SPD to ensure:

- continuity of services.
- withstand lightning current waves
- protect against overload following thermal runaway of varistor
- the SCPD must not trip upon 15 successive impulse currents at I_{imp} .

Connection of SCPDs can be either in series or parallel dependent on the type of SPD.

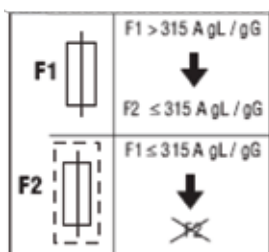


F1 = Main supply SCPD

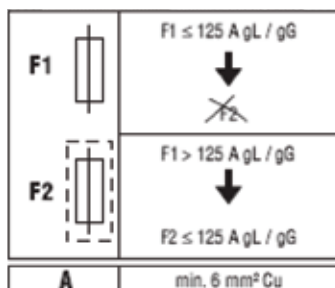
F2 = SCPD if required to protect SPD

Note: Generally SPDs don't need a fuse or MCB if the nominal supply current is less than 125A, however the fitting of an SCPD does allow isolation facility during testing. Essentially the SCPD is required to operate towards the 'end of the SPD's life and not blow during surge events themselves.

Type 1



Type 2



Ph-Ph Back-up protection		
Protection type	Fuse	MCB
Type 1 + 2	<315A gG max	n/a
Type 2	<125A gG max	n/a
Type 3	<25A gG	B25

Cross-sectional area of connecting conductors

Section 534.2.10 of BS7671 stipulates that SPDs shall either

- conductor size no less than 4mm² copper if the line conductor is 4mm² or greater.
- conductor size is not less than the line conductors, where the line conductors have a cross-sectional area less than 4mm²

Where there is a structural lightning protection system, the minimum cross-sectional area for Type 1 SPDs shall be 16mm² copper or equivalent.

WHAT IS THE RATING?

Key parameters are used to characterise surge protection devices.

Type 1 devices, the first of these is the Maximum Impulse Current

I_{imp}

Type 2/3 devices the first parameter is Maximum Discharge Current.

I_{max}

The remaining three parameters are the common to all types of devices.

The Nominal Discharge Current - the device must be able to withstand a current of this magnitude 15 times without damage.

I_n

The voltage protection level, is the voltage that will appear across the terminals of the device when it is carrying the nominal discharge current. Typical values are 1.0, 1.5 and 2.0kV.

U_p

The final parameter is the Maximum Continuous Operating Voltage. This is the maximum RMS or DC voltage that can be applied to the terminals of the device without causing excessive leakage current to flow.

U_c

SPD installation in conjunction with an RCD

Clause 534.2.6 of section 534 is concerned with SPDs and their installation with respect to RCDs. It is ideal to install SPDs on the supply side of the RCD as this prevents the RCD from tripping during a surge event.

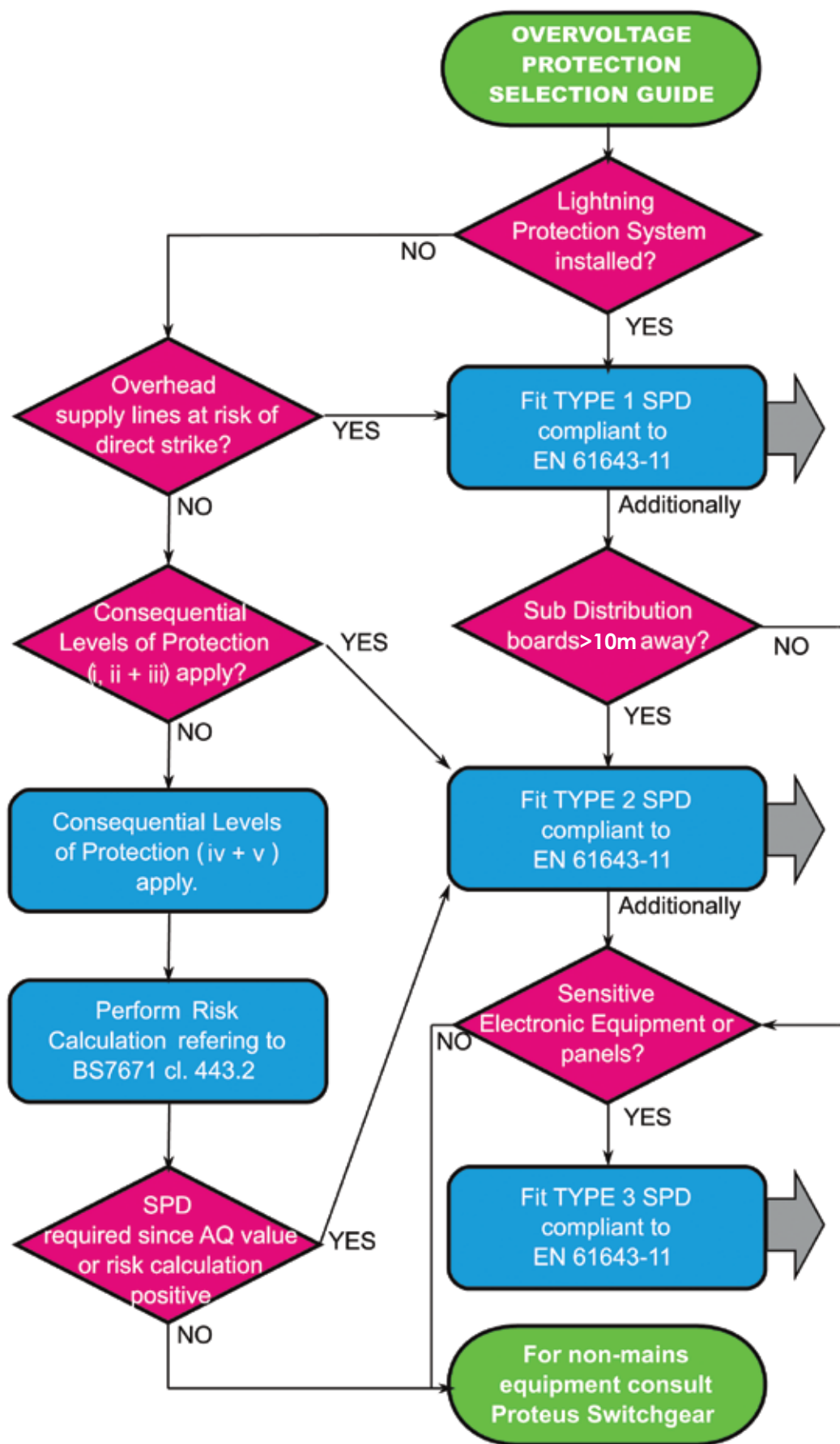
Where this is not possible and SPDs are installed on the load side of an RCD transients could therefore trip the RCD. In this type of situation, 534 recommends the use of RCDs which are highly resistant to surge currents of up to 3kA - consult manufacturer data for this information.

To comply with clause 534.2.5, fault protection shall also remain effective within the protected installation even in the event of an SPD failure.

In TN systems, automatic disconnection of supply shall be obtained by correct operation of the protective device on the supply side of the SPD.

In TT systems, installation of SPDs on either the supply or load side of an RCD must conform with the arrangements shown in Appendix 16 of BS7671.





Type 1

Type 2

Type 3

TT - Earthing

TN - Earthing

c/w Enclosure



Ref: SPD/T12/TT4P
SPD/T12/TT4PIF



Ref: SPD/T1/TT



Ref: SPD/T12/TNS4P
SPD/T12/TNS4PIF



Ref: SPD/T1/TN



Ref: SPD/T12/TNS4PES



Ref: SPD/T2/TT4P
SPD/T2/TT4PIF



Ref: SPD/T2/TT



Ref: SPD/T2/TNS4P
SPD/T2/TNS4PIF



Ref: SPD/T2/TN



Ref: SPD/T2/1P



Ref: SPD/T2/TNS4PE



Ref: SPD/T3/PC



Ref: SPD/T3/SC



Ref: SPD/T3/LPC



Ref: P408/FIL



Ref: PE581



Ref: SSP



Ref: SPD/T3/SCE



Ref: SPD/T12/TNS4P



Ref: SPD/T2/TT4P



Ref:SPD/T2/TN



Ref:SPD/T1/TT



Ref:SPD/T3/SC



Ref:SPD/T3/LPC

Type 1 SPDs are key to providing necessary protection of the installation against lightning strikes entering the building. Type 1 SPDs are designed to carry partial lightning currents and are defined as being tested with a high energy 10/350 μ s (I_{imp}) wave shape.

These Type 1 SPDs must be installed on incoming services (e.g. mains power and data) when an external Lightning Protection System (LPS) is installed on a building. Where partial lightning currents can also flow due to a direct lightning strike on overhead supplies or externally mounted equipment, Type 1 SPDs should also be used. Combined Type 1 + Type 2 SPDs are installed at the origin of the supply to the building, normally within the main switchboard. If the installation being protected is already fitted with an SCPD of 315A or less then the SPD can be connected direct to the busbar otherwise ensure the device is adequately protected.

In installations where it is not possible to fit a fuse or circuit breaker the 'IF' (Internal Fuse) version is available.

Type 2 SPDs in this modular form offer more general surge protection for equipment within the installation from sources of problematic electrical surges internal to the building (typically switching transients). If the installation being protected is already fitted with an SCPD of 125A or less then the SPD can be connected direct to the busbar otherwise ensure the device is adequately protected. In installations where it is not possible to fit a fuse or circuit breaker the 'IF' (Internal Fuse) version is available. Their protection is limited by distance with a general protection zone of <10m. Equipment further away necessitate the installation of additional Type 2 units in sub-distribution boards.

Type 2 and Type 3 SPDs are designed to discharge the induced surges created by lightning electromagnetic fields and also other transient surge events such as switching surges, supply faults etc. These devices are defined as being tested with a specific energy wave shape of 8/20 μ s (I_n) for Type 2 SPDs or a combination wave shapes for Type 3 SPDs. For many applications where the requirement is to provide surge protection only, Type 2 and Type 3 SPDs play a critical role in protecting electronic equipment.

Type 3 SPDs provide the primary 'fine protection' from surges, giving high sensitive equipment that added level of security. As a rule they should be installed as close as possible to the equipment being protected. This class of product is available in both din-rail mounting version or remote/local installation. For example the SPD/T3/LPC can be wired into the back of a plug socket feeding a certain piece of equipment. The SPD/T3/LPC has also the benefit of an audible alarm, for when the unit requires replacing

SPD Type	Earthing	Internal fuse	Cat. No.
1+2	TN-S , TN-C-S	N	SPD/T12/TNS4P
1+2	TN-S , TN-C-S	Y	SPD/T12/TNS4PIF
1+2	TT	N	SPD/T12/TT4P
1+2	TT	Y	SPD/T12/TT4PIF
2	TN-S , TN-C-S	N	SPD/T2/TNS4P
2	TN-S , TN-C-S	Y	SPD/T2/TNS4PIF
2	TT	N	SPD/T2/TT4P
2	TT	Y	SPD/T2/TT4PIF
1+2	TN-S , TN-C-S	N	SPD/T1/TN
1+2	TT	N	SPD/T1/TT
2 (1P+N)	TN-S , TN-C-S	N	SPD/T2/TN
2 (1P+N)	TT	N	SPD/T2/TT
2 (1P only)	-	N	SPD/T2/SP
3	-	N	SPD/T3/SC
3	-	N	SPD/T3/PC
3	-	N	SPD/T3/LPC

STAND-ALONE (NON-COORDINATED) SPD PRODUCTS



Ref: P408/FIL

Ref: P408/SRG



Ref: SSP



Ref: PE581

This small group of surge protection are ideal for simple Type 3 level protection, with surge suppression functionality in either the socket or the plug

Description	List No.
Surge & RFI Filtered Twin Switched Socket	P408/FIL
Surge Protected Twin Switched Socket	P408/SRG

This small group of surge protection products are ideal for simple Type 3 level coverage, offering surge suppression functionality in either the socket or the plug or via the flexible Easyclip modular unit.

Description	List No.
Surge Suppressor Plug	SSP

SURGE PROTECTION EASYCLIP MODULE

Description	List No.
Surge Protection Module	PE581

By incorporating a surge module with a fuse you can create a Surge Spur product



easyclip™

*Is your
PV system
protected*

A PV installation mounted on the roof of a building is yet another hazard with respect to potential for lightning strike energy entering the buildings electrical network.



*Bespoke
solutions for
fine protection*

Power Distribution Units (PDUs) can also be fitted with Surge modules or 'Filter Units' (just one of many example variants shown). For bespoke solutions and complete range contact RPP.



Ref: XAL4SF

RPP™

Tel: 01527 528024





Ref: SPD/T2/TNE



Ref: SPD/T2/TNS4PE



Ref: SPD/T12/TT4PE



Ref: SPD/T12/TNS4PEF



Ref: SPD/T2/TT4PES

TYPE 1 + 2, TYPE 2 and Type 3 SPDs WITHOUT INTEGRAL BACKUP PROTECTION FUSES IN IP RATED INSULATED ENCLOSURES

For a range of single and three phase application Proteus offer a selection of SPD units supplied with their own plastic enclosure (no integral fuses/SCPD).

SPD Type	IP rating	Earthing	H	W	D	Cat. No.
1+2	IP55	TN-S , TN-C-S	135	75	95	SPD/T1/TNE
1+2	IP55	TT	135	75	95	SPD/T1/TTE
2 (1P+N)	IP55	TN-S , TN-C-S	135	75	95	SPD/T2/TNE
2 (1P+N)	IP55	TT	135	75	95	SPD/T2/TTE
2 (1P only)	IP55	-	135	75	95	SPD/T2/SPE
3	IP55	-	135	75	95	SPD/T3/SCE
3	IP55	-	135	75	95	SPD/T3/PCE
1+2 (3P+N)	IP65	TN-S , TN-C-S	201	202	120	SPD/T12/TNS4PE
1+2 (3P+N)	IP65	TT	201	202	120	SPD/T12/TT4PE
2 (3P+N)	IP65	TN-S , TN-C-S	160	120	95	SPD/T2/TNS4PE
2 (3P+N)	IP65	TT	160	120	95	SPD/T2/TT4PE

TYPE 1 + 2 and TYPE 2 SPD WITH INTEGRAL BACKUP PROTECTION FUSES IN STEEL ENCLOSURES

Back up fuses are required when cabling to a system where the main incomer exceeds 315A in the case of Type 1 devices and 125A for Type 2 devices.

Proteus offer a packaged product housing the 3P+N SPD for either a TT or TNS/TN-C-S system manufactured in steel with an Ingress Protection rating of IP3X.

SPD Type	Earthing	H	W	D	Cat. No.
1 + 2	TN-S, TN-C-S	385	205	112	SPD/T12/TNS4PEF
1 + 2	TT	385	205	112	SPD/T12/TT4PEF
2	TN-S, TN-C-S	385	205	112	SPD/T2/TNS4PEF
2	TT	385	205	112	SPD/T2/TT4PEF

TYPE 1 + 2 and TYPE 2 SPD WITHOUT INTEGRAL FUSES IN STEEL ENCLOSURES

Proteus offer a selection of enclosed 3P+N SPDs for either TT or TNS/TN-C-S system manufactured in steel with an Ingress Protection rating of IP3X.

As long as the installation being protected is already fitted with a main SCPD of 315A (for Type 1) or 125A or less (for Type 2) then the SPD can be connected direct to the busbar.

SPD Type	Earthing	H	W	D	Cat. No.
1 + 2	TN-S, TN-C-S	385	205	112	SPD/T12/TNS4PES
1 + 2	TT	385	205	112	SPD/T12/TT4PES
2	TN-S, TN-C-S	385	205	112	SPD/T2/TNS4PES
2	TT	385	205	112	SPD/T2/TT4PES

BX



Ref: BX4S1TNS

RANGE OF THREE PHASE DISTRIBUTION BOARDS WITH FACTORY FITTED TYPE 2 SPDs AND INCOMERS UP TO 125A

A Type 2 SPD can be connected directly to the busbar (left hand side lower most outgoing way) within the Proteus range of BX and XL 3phase distribution boards.

The SPD units must be factory fitted due to their size and technical installation restrictions.

Suitable for use in TN-C-S/TN-S systems

No. of O/G ways	BX Board 100A Incomer	BX Board 125A Incomer	XL Board 100A Incomer	XL Board 125A Incomer
3	BX4S1TNS	BX4S125TNS	XL4S1TNS	XL4S125TNS
5	BX6S1TNS	BX6S125TNS	XL6S1TNS	XL6S125TNS
7	BX8S1TNS	BX8S125TNS	XL8S1TNS	XL8S125TNS
11	BX12S1TNS	BX12S125TNS	XL12S1TNS	XL12S125TNS
16	BX16S1TNS	BX16S125TNS	XL16S1TNS	XL16S125TNS
19	BX20S1TNS	BX20S125TNS	XL20S1TNS	XL20S125TNS
23	BX24S1TNS	BX24S125TNS	XL24S1TNS	XL24S125TNS

XL



Ref: XL4S1TT

Suitable for use in TT systems

No. of Out-going ways	BX Board 100A Incomer	BX Board 125A Incomer	XL Board 100A Incomer	XL Board 125A Incomer
3	BX4S1TT	BX4S125TT	XL4S1TT	XL4S125TT
5	BX6S1TT	BX6S125TT	XL6S1TT	XL6S125TT
7	BX8S1TT	BX8S125TT	XL8S1TT	XL8S125TT
11	BX12S1TT	BX12S125TT	XL12S1TT	XL12S125TT
15	BX16S1TT	BX16S125TT	XL16S1TT	XL16S125TT
19	BX20S1TT	BX20S125TT	XL20S1TT	XL20S125TT
23	BX24S1TT	BX24S125TT	XL24S1TT	XL24S125TT



Ref: BXS2TTK

THREE PHASE DISTRIBUTION BOARDS WITH INCOMER OF 200A RATING REQUIRE A CONVERSION KIT TO INTRODUCE TYPE 2 SPD PROTECTION

A Type 2 SPD can be connected in parallel with the installation using one of our conversion kit / enclosures which incorporate the necessary Type 2, 3P+N SPD with backup fuse units rated at 125A.

Type of 3ph board	TN-C-S TN-S	TT
	BXS2TNSK	BXS2TTK
	XLS2TNSK	XLS2TTK

Choosing the correct SPDs from Proteus will ensure compatibility with the requirements of BSEN62305 and also the 17th Edition. Additionally all SPDs comply with EN61643-11 and have the required CE approval.





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LV Switchgear & Distribution Boards

Also available from Proteus Switchgear are a comprehensive range of MCBs, RCBOs and associated Distribution Boards to meet most commercial / industrial applications.

For further details on these products contact us or visit our website.

Scan with
your smart
phone to
visit us on the
web...



www.proteusswitchgear.co.uk