KINGSMILL
INDUSTRIES (UK) LTD

ELECTRICIANS GUIDE TO THE SELECTION OF MAINS SURGE PROTECTION DEVICES ACCORDING TO THE 18TH WIRING REGULATIONS (BS 7671:2018) . . .

. . . AND MAINS SURGE PROTECTION DEVICES ACCORDING TO BS:EN 62305

Surge Protection requirements according to BS 7671:2018 18th Edition Wiring Regulations . . .

Previously, the 17th Edition Wiring Regulations stated that the need for surge protection was determined by risk assessment.

Since 1 January 2019, according to BS 7671:2018 section 443.3 *(reproduced in full on page 4)*, protection against transient overvoltages shall be provided where the consequence of damage caused by overvoltages meets certain criteria.

If these criteria are not met, a risk assessment must be carried out to determine if surge protection is required. If a risk assessment is not carried out, surge protection must be installed.

This publication provides:
- an overview of the requirements of the 18th Edition Wiring Regulations (BS 7671:2018),
- a guide to the causes and coupling methods of transient overvoltages (aka surges) *(page 3)*,
- risk assessment guidance *(page 4)*,
- Spacing requirements *(page 7)* **and installation good practice** *(page 11)*,
- Protector selection *(pages 8 and 9)*, **and**
- Surge Protection Devices *(pages 5 and 6)*

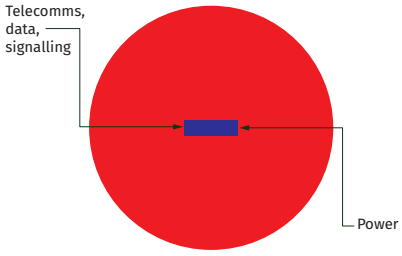
Further information can be found at www.kingsmillearthing.co.uk/surge-protection.

FACT Transient overvoltages (*surges*) are very short duration (*milliseconds*), high voltage (*up to 6kV*) 'spikes' caused by the secondary effects of lightning and electrical switching events.

"Surge Protection is designed to protect electronics from the effects of lightning and other transient overvoltages"

The probability of electronic systems being damaged by lightning is far greater than that of the building itself being struck, as lightning strikes up to 1km away from a building can damage electronics inside it. This is a far larger target area than the size of the building itself.

Damaging transient overvoltages are not only a result of lightning activity. Electrical switching, a common event, can also cause overvoltages which impair electrical components.



"The probability of electronic systems being damaged by lightning is far greater than that of the building itself being struck, as lightning strikes up to 1km away from a building can damage electronics inside it."

As per BS 7671:2018, there is now a requirement to consider protection from damage caused by transient overvoltages.

Even in domestic settings, the effects of overvoltages can cause costly damage to equipment and fittings. Because of this risk, surge protection is a recommended step in adequately protecting a building and its contents, as the potential cost of replacing damaged installations and equipment far outweighs the cost of installing surge protection.

Given that electronic systems are a vital part of everyday life and have become increasingly miniaturised over the past decades, protecting them from surges is more important than ever. If they were left unprotected and damaged by a transient overvoltage this could result in major inconvenience, lack of service and potentially life-threatening situations.

Problems caused by transients

Damage

This can range from burnt-out circuit boards to impaired operation of components.

Disruption

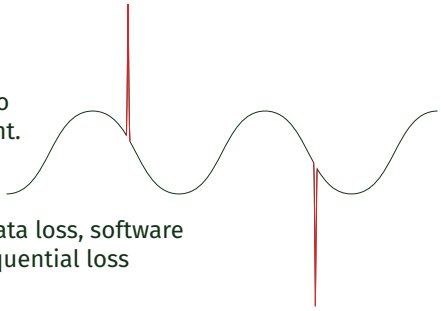
Disruption to the logic levels of the device rather than physical damage, resulting in data loss, software corruption and unexplained computer crashes.

Degradation

Long term exposure to transients can result in invisible degradation of electrical components.

Downtime

Resulting from inoperative systems.



A severe transient (15,400V according to IEC 60664) can result in serious damage to components and circuit boards. The damage can be obvious or difficult to pinpoint.

Long term exposure to transients (usually from switching) can result in degradation to electronic components, reducing system lifetime.

Transients can result in disruption to the electronic system, potentially causing data loss, software corruption and computer crashes. This can result in system downtime and consequential loss (equipment replacement, loss of service and revenue and labour costs).

Surge Protection Devices

Effective protection against the damaging effects of transient overvoltages/surges can be achieved through installing Surge Protection Devices (SPDs).

There are three types of SPDs, specified depending on their intended location and other factors:

Type 1		Type 2	Type 3
Lightning Current Arrester Install at MDBs to protect against lightning currents	*Kingsmill supply combined Type 1+2 protectors, instead of Type 1 protectors, to ensure that the voltage protection level is below the withstand voltage for electrical/electronic equipment*	**Surge Arrester** Install at MDBs and SDBs to protect against surge voltages and indirect lightning currents	**Fine Protection** Install less than 5m from critical, or high value, equipment for fine protection

For SPD selection, see pages 8 and 9. For SPD spacing guidance, see page 7. For Kingsmill SPD features, see page 5. For SPD installation guidance, see page 11.

Applying Surge Protection

In order to adequately protect an electrical installation, the incoming and outgoing circuits for the building must be protected. Mains power lines need to be protected from transient overvoltages at the points where they both enter and leave a building. The particular surge protection requirement depends on various factors, including the presence or absence of structural lightning protection, data or telephone lines, and sub-distribution boards.

To protect against lightning currents as well as transient overvoltages, where applicable and for ease of installation, we supply combined Type 1+2 devices.

FACT

"In order to adequately protect an electrical installation, the incoming and outgoing circuits for the building must be protected"

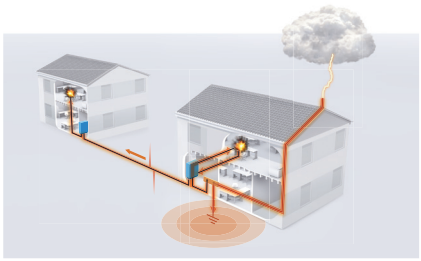
When a sub-distribution board is located more than 10m away from the mains SPD, additional SPDs are required. This is to protect systems from internally generated transients and transients magnified by oscillation. If the sub-distribution board also feeds outside the building (eg feeding CCTV, electric gates, lighting etc), a Type 1+2 device is required.

Before installing protection on other services such as telephone lines or data cables, contact the service provider. We are happy to assist in the decision process regarding the required SPDs. For more information about protecting other services and surge protection in buildings with structural lighting protection, contact us.

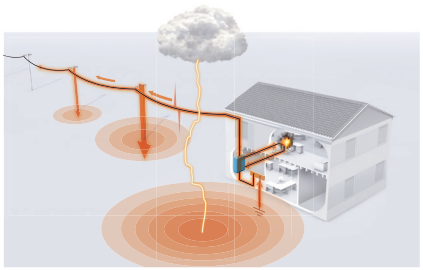
Coupling methods

Resistive Coupling

A lightning strike injects a current of up to 200,000A into the ground, which flows away from the point of entry into the ground via the path of least resistance. Current flows through earth terminations and electrical cables of nearby buildings since they are better conductors than the ground itself.



Striking a structure

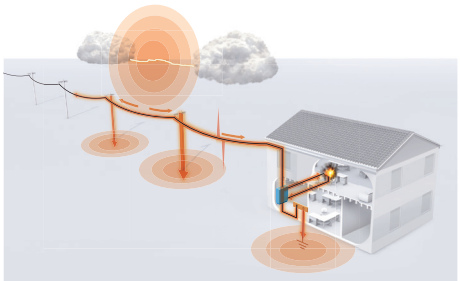


Striking the ground near a structure

Inductive (Magnetic) Coupling

Lightning strikes cause current to flow through lightning protection down conductors, resulting in an electromagnetic field which can induce transient overvoltages in the internal power cables of the building. Cloud to cloud lightning can induce transients in overhead cables.

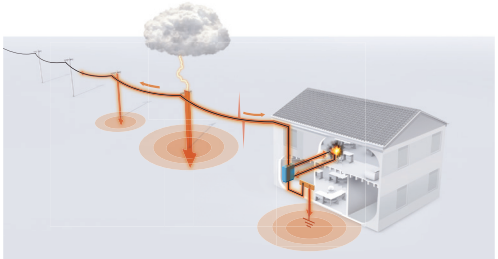
Inductive coupling - electro-magnetic field from a direct strike



Inductive Coupling - cloud to cloud lightning

Direct Strike

A lightning strike to an HV power line will cause a flashover to earth and line to line transients which can pass through supply transformers to reach electronic systems.



Direct strike to an overhead HV power line

Electrical Switching

Current flowing along a conductor induces a magnetic field, which discharges as a transient when the current is switched off.

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According to section 443.4 of the 18th edition UK wiring regulations (BS 7671:2018) . . .

"Protection against transient overvoltages shall be provided where the consequence caused by overvoltage could:

(i) result in serious injury to, or loss of, human life, or

(ii) result in interruption of public services and/or damage to cultural heritage, or

(iii) result in interruption of commercial or industrial activity, or

(iv) affect a large number of co-located individuals.

For all other cases, a risk assessment according to Regulation 443.5 shall be performed in order to determine if protection against transient overvoltages is required. If the risk assessment is not performed, the electrical installation shall be provided with protection against transient overvoltages, except for single dwelling units where the total value of the installation and equipment therein does not justify such protection.

Protection against switching overvoltages shall be considered in the case of equipment likely to produce switching overvoltages or disturbances exceeding the values according to the overvoltage category of the installation eg where an LV generator supplies the installation or where inductive or capacitive loads (eg motors, transformers, capacitor banks), storage units or high-current loads are installed."

Risk Assessment as detailed in BS 7671:2018

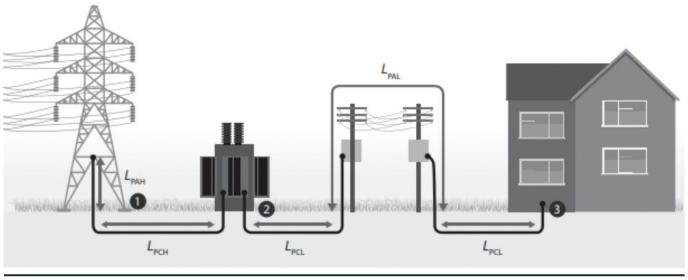
In order to understand whether surge protection is required in cases not fitting those outlined above, a risk assessment should be carried out to determine the calculated risk level. In the event a risk assessment is not undertaken, surge protection is required to be fitted.

The risk level is calculated using the formula outlined in section 443.5 of the wiring regulations (see below).

1. Environmental factors are given:

Environment	f_{env}
Rural and suburban	85
Urban	850

2. Calculate the power cable length (L_p) in km, as shown in figure 44.3 *(BS 7671:2018)* (if any lengths are unknown, assume that L_{PAL} completes the total length up to 1km)
3. Find the lightning flash density (N_g) from figure 44.2 in the wiring regulations (*see page 14*)
4. Put the above values into the formula: CRL = $f_{env}/(L_p x N_g)$ - If CRL < 1000, surge protection is required to be installed.



Calculate the power cable length (BS 7671:2018 figure 44.3)

For example:

Building in an rural environment
Ground flash density (N_g) = 1
Environmental factor (f_{env}) = 85
Power cable length (L_p) = $2L_{PAL} + L_{PCL} + 0.4L_{PAH} + 0.2L_{PCH}$
L_{PAL} = assumed 0.6km
L_{PCL} = 0.2km
L_{PAH} = 0.2km
L_{PCH} = unknown
= (2 x 0.6) + 0.2 + (0.4 x 0.2) = 1.48
CRL = $f_{env}/(L_p x N_g)$ = 85/(1.48 x 1) = 57.4
CRL < 1000, so surge protection shall be installed

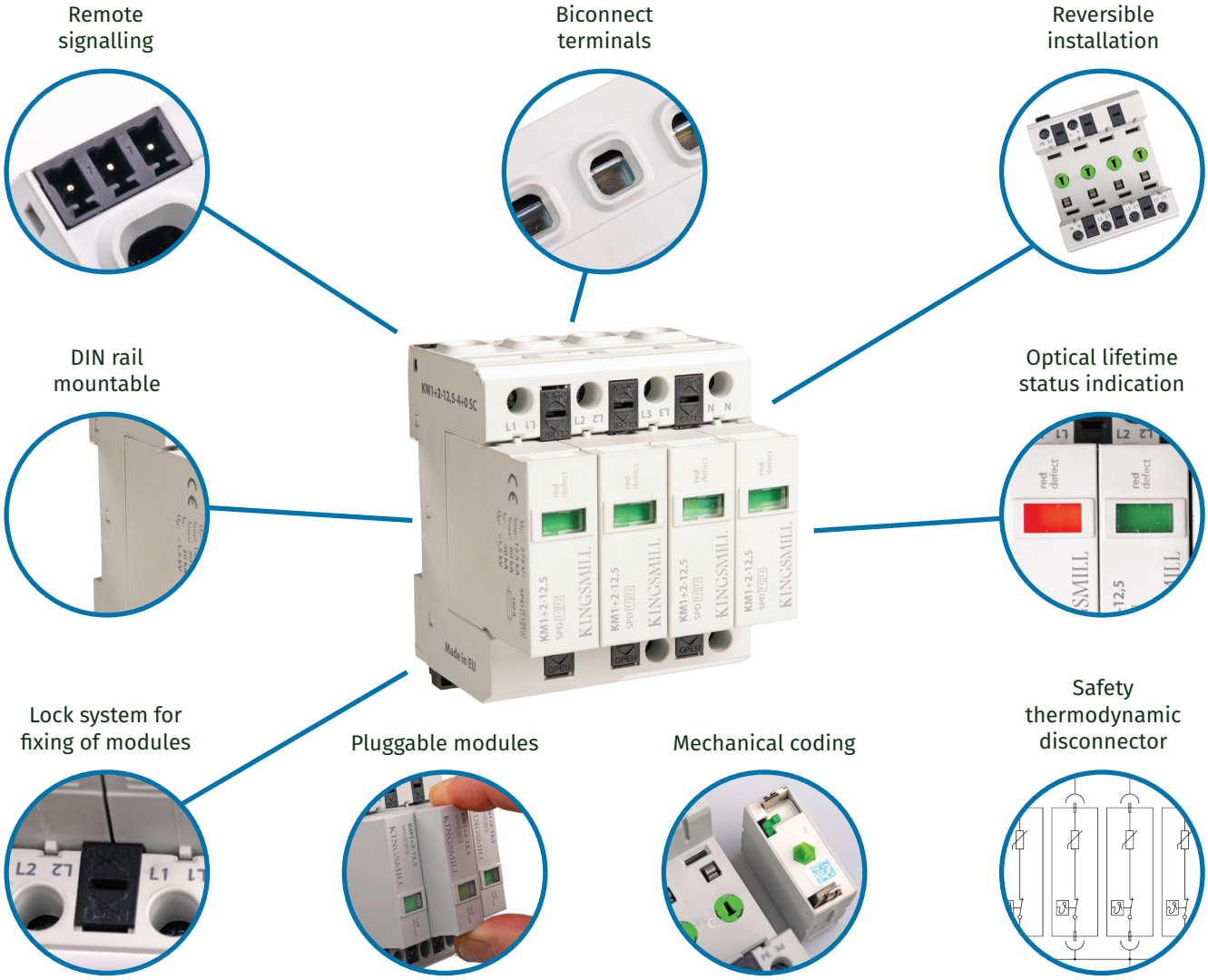
Building in an urban environment (supplied by overhead lines)
Ground flash density (N_g) = 1
Environmental factor (f_{env}) = 850
Power cable length (L_p) = $2L_{PAL} + L_{PCL} + 0.4L_{PAH} + 0.2L_{PCH}$
L_{PAL} = assumed 0.7km
L_{PCL} = unknown
L_{PAH} = 0.3km
L_{PCH} = unknown
= (2 x 0.7) + (0.4 x 0.3) = 1.52
CRL = $f_{env}/(L_p x N_g)$ = 850/(1.52 x 1) = 559.2
CRL < 1000, so surge protection shall be installed

Kingsmill Surge Protection Devices

Overleaf is a selection of Kingsmill Mains Surge Protection Devices that comply with the requirements of BS 7671:2018 and BS:EN 62305.

TURN OVER FOR SURGE PROTECTION SOLUTIONS . . .

Kingsmill Surge Protection Device features



Kingsmill SPD range overview

Kingsmill Surge Protection Devices are available for Type 1+2, Type 2 and Type 3 applications. The order codes identify the usage and rating, as follows . . .

[KM1+2] - [12.5] - 3+0 SC

Protector type:	*Ka rating (per pole):*	*Connection type:*
1+2, 2 or 3	25, 20, 12.5, 10	1+0, 2+0, 1+1, 3+0 etc

See page 2 for explanation of protector types . . .

Kingsmill Mains SPDs *(see pages 8 and 9 for specification guidance)*

BS 7671:2018 and BS:EN 62305 products

12.5kA combined Type 1 & 2 lightning current and surge arresters

Part number	Discharge current	Earthing system	Number of poles	Phase
KM1+2-12.5-4+0 SC	12.5kA	TNS / TN-C-S	4	Three
KM1+2-12.5-3+1 SC	12.5kA	TT	4	Three
KM1+2-12.5-3+0 SC	12.5kA	TN-C	3	Three
KM1+2-12.5-2+0 SC	12.5kA	TNS / TN-C-S	2	Single
KM1+2-12.5-1+1 SC	12.5kA	TT	2	Single
KM1+2-12.5-1+0 SC	12.5kA	TN-C	1	Single

20kA Type 2 surge arresters

Part number	Discharge current	Earthing system	Number of poles	Phase
KM2-20-4+0 SC	20kA	TNS / TN-C-S	4	Three
KM2-20-3+1 SC	20kA	TT	4	Three
KM2-20-3+0 SC	20kA	TN-C	3	Three
KM2-20-2+0 SC	20kA	TNS / TN-C-S	2	Single
KM2-20-1+1 SC	20kA	TT	2	Single
KM2-20-1+0 SC	20kA	TN-C	1	Single

10kA Type 3 surge arresters

Part number	Discharge current	Earthing system	Number of poles	Phase
KM3-10-3+1 SC	10kA	TN-C / TN-S / TN-C-S / TT	4	Three
KM3-10-1+1 SC	10kA	TN-C / TN-S / TN-C-S / TT	2	Single

2kA Type 3 surge protection module

Part number	Earthing system	Number of poles	Phase
KM3-275-A	TN-C / TN-S / TN-C-S / TT	N/A	Single

Enclosures (see page 13 for details)

Part number	Dimensions (mm)	Maximum product width (mm)
SPD-ENC	215 x 125 x 110	70
SPD-ENC-LARGE	210 x 215 x 100	160

BS:EN 62305 products

25kA combined Type 1 & 2 lightning current and surge arresters

Part number	Discharge current	Earthing system	Number of poles	Phase
KM1+2-25-4+0 SC	25kA	TNS (MDB) / TN-C-S (SDB)	4	Three
KM1+2-25-3+1 SC	25kA	TT	4	Three
KM1+2-25-3+0 SC	25kA	TN-C / TN-C-S	3	Three
KM1+2-25-2+0 SC	25kA	TNS (MDB) / TN-C-S (SDB)	2	Single
KM1+2-25-1+1 SC	25kA	TT	2	Single
KM1+2-25-1+0 SC	25kA	TN-C	1	Single

Surge Protection Device spacing

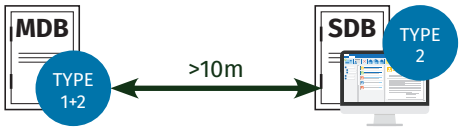
(in the event that the installer feels additional protection is required)

Spacing between Surge Protection Devices and the electronic equipment (eg computers/control systems/smart TVs etc) to be protected is crucial for achieving effective protection levels. The transient let-through voltage of the protector (the amount of voltage that leaves the SPD) can be magnified due to the effect of oscillation on cable lengths of over 10m. Below is a guide for the effective spacing of additional SPDs.

TYPE 1+2 DEVICES:

CABLE LENGTHS BETWEEN 10M AND 50M:

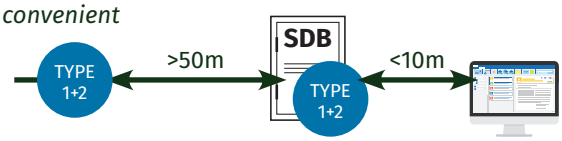
If the cable length between the Type 1+2 SPD and the SDB or electronic equipment being protected is >10m, a Type 2 SPD must be installed downstream of the Type 1+2 SPD.



CABLE LENGTHS OVER 50M:

If the cable length between the SPD and the SDB or electronic equipment being protected >50m, we recommend a Type 1+2 device with I_n= 30kA (8/20µs) is fitted. This will work as a strong Type 2 SPD protector, coping with transient overvoltages and different earth potentials (particularly if the equipotential bonding of earths is not continuous).

Install at the nearest convenient SDB or switched fuse supplying the equipment. This SPD must be located less than 10m away from the equipment being protected.

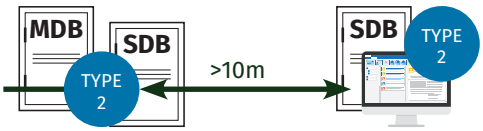


Cable lengths >50m and <100m = 12.5kA rated SPD
Cable lengths >100m = 25kA rated SPD

TYPE 2 DEVICES:

CABLE LENGTHS OVER 10M:

If the cable length between the Type 2 SPD and the next downstream SDB or the electronic equipment being protected is >10m, additional protection is required.



TYPE 3 DEVICES:

Type 3 SPDs offer a further level of protection, where sensitive or high value equipment is deemed to require an extra level of protection. Such devices, whether installed with a Type 1+2 SPD or a Type 2 SPD, would be installed within 10m of the Type 1+2/2 SPD and as close as possible to the equipment being protected. Type 3 SPDs must be installed no further than 5m away from such equipment.

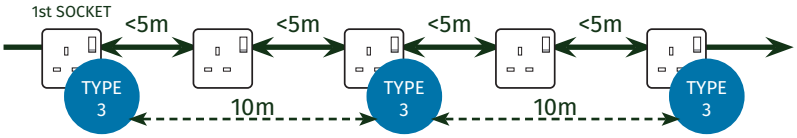
Two types of device are available: one which can be incorporated into an SDB or its own enclosure (KM3-10-3+1 SC and KM3-10-1+1 SC) and one which can be wired into the switch socket itself as a retrofit item (KM3-275-A).

TYPE 3 SPD LOCATION:

If fine protection is required, a Type 3 protector should be fitted as close as possible to the equipment being protected and no more than 5m of cable length away.

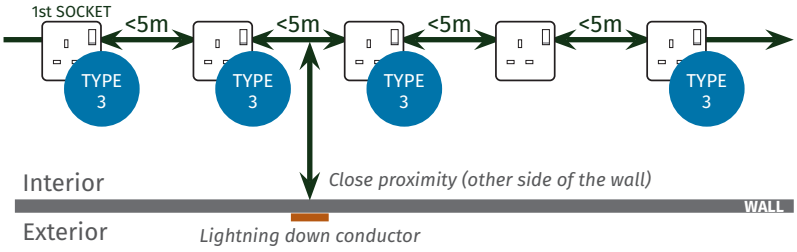
TYPE 3 SOCKET OUTLETS:

When using the Type 3 socket outlet protector (KM3-275-A), the protector should always be installed at the first socket outlet downstream of the distribution board supplying it and thereafter every 10m of circuit length.



SOCKET OUTLETS FITTED ADJACENT TO STRUCTURAL LIGHTNING PROTECTION:

However, if the socket outlet circuit is running on the inside of a wall that has a down conductor fitted to the outside, each socket outlet within 5m of the down conductor position should be protected individually with KM3-275-A protectors.



BS 7671:2018 Surge Protection Devices

Buildings WITHOUT structural Lightning Protection to BS:EN 62305

Does the building have overhead power or does the Main Distribution Board (MDB) feed appliances outside the building eg gates, CCTV, outside lighting or electric vehicle charging?

YES

Earthing System	Three Phase Systems	Single Phase Systems
TN-C	KM1+2-12.5-3+0 SC	KM1+2-12.5-1+0 SC
TN-S & TN-C-S	KM1+2-12.5-4+0 SC	KM1+2-12.5-2+0 SC
TT	KM1+2-12.5-3+1 SC	KM1+2-12.5-1+1 SC

MAIN DISTRIBUTION BOARD

NO

Earthing System	Three Phase Systems	Single Phase Systems
TN-C	KM2-20-3+0 SC	KM2-20-1+0 SC
TN-S & TN-C-S	KM2-20-4+0 SC	KM2-20-2+0 SC
TT	KM2-20-3+1 SC	KM2-20-1+1 SC

Is the Sub-Distribution Board (SDB) >50m from the MDB or does it feed appliances outside the building eg gates, CCTV, outside lighting or electric vehicle charging?

YES

Earthing System	Three Phase Systems	Single Phase Systems
TN-C	KM1+2-12.5-3+0 SC	KM1+2-12.5-1+0 SC
TN-S & TN-C-S	KM1+2-12.5-4+0 SC*	KM1+2-12.5-2+0 SC
TT	KM1+2-12.5-3+1 SC	KM1+2-12.5-1+1 SC

SUB DISTRIBUTION BOARD

NO

Earthing System	Three Phase Systems	Single Phase Systems
TN-C	KM2-20-3+0 SC	KM2-20-1+0 SC
TN-S & TN-C-S	KM2-20-4+0 SC*	KM2-20-2+0 SC
TT	KM2-20-3+1 SC	KM2-20-1+1 SC

*If the principle concern is internally generated switching transients, change the connection type to CT2 (or 3+1) instead of CT1 (or 4+0)

TYPE 3 FINE PROTECTION
(fit <5m from equipment)

Earthing System	Three Phase Systems	Single Phase Systems
TN-C/TN-S/TN-C-S	KM3-10-3+1 SC	KM3-10-1+1 SC / KM3-275-A
TT	KM3-10-3+1 SC	KM3-10-1+1 SC

PROTECTION ACHIEVED IN COMPLIANCE WITH BS 7671:2018

BS:EN 62305 Surge Protection Devices

Buildings WITH structural Lightning Protection to BS:EN 62305

If a building is fitted with a structural Lightning Protection system, the requirements of BS:EN 62305 take precedence over BS 7671:2018. If you are familiar with the requirements of BS:EN 62305, and know the Lightning Protection Level (LPL), select the appropriate Surge Protection Devices below. If in doubt, STOP NOW and contact us.

Three Phase Systems

Earthing System	Lightning Protection Level (LPL)	Main Distribution Board (MDB)	Sub-Distribution Board (SDB) (unless feeding outside circuits) *(figure given is cable length, not distance)*	Electronic Equipment *(<5m cable length)*
TN-C	I & II	**KM1+2-25-3+0 SC**	**KM2-20-3+0 SC** (>10m from MDB)	**KM3-10-3+1 SC**
			KM1+2-12.5-3+0 SC (>50m from MDB)	
			KM1+2-25-3+0 SC (>100m from MDB)	
TN-C	III & IV	**KM1+2-12.5-3+0 SC**	**KM2-20-3+0 SC** (>10m from MDB)	**KM3-10-3+1 SC**
			KM1+2-12.5-3+0 SC (>50m from MDB)	
TN-S	I & II	**KM1+2-25-4+0 SC**	**KM2-20-4+0 SC** (>10m from MDB)	**KM3-10-3+1 SC**
			KM1+2-12.5-4+0 SC (>50m from MDB)	
			KM1+2-25-4+0 SC (>100m from MDB)	
TN-S	III & IV	**KM1+2-12.5-4+0 SC**	**KM2-20-4+0 SC** (>10m from MDB)	**KM3-10-3+1 SC**
			KM1+2-12.5-4+0 SC (>50m from MDB)	
TN-C-S	I & II	**KM1+2-25-4+0 SC**	**KM2-20-4+0 SC** (>10m from MDB)	**KM3-10-3+1 SC**
			KM1+2-12.5-4+0 SC (>50m from MDB)	
			KM1+2-25-4+0 SC (>100m from MDB)	
TN-C-S	III & IV	**KM1+2-12.5-4+0 SC**	**KM2-20-4+0 SC** (>10m from MDB)	**KM3-10-3+1 SC**
			KM1+2-12.5-4+0 SC (>50m from MDB)	
TT	I & II	**KM1+2-25-3+1 SC**	**KM2-20-3+1 SC** (>10m from MDB)	**KM3-10-3+1 SC**
			KM1+2-12.5-3+1 SC (>50m from MDB)	
			KM1+2-25-3+1 SC (>100m from MDB)	
TT	III & IV	**KM1+2-12.5-3+1 SC**	**KM2-20-3+1 SC** (>10m from MDB)	**KM3-10-3+1 SC**
			KM1+2-12.5-3+1 SC (>50m from MDB)	

Single Phase Systems

Earthing System	Lightning Protection Level (LPL)	Main Distribution Board (MDB)	Sub-Distribution Board (SDB) (unless feeding outside circuits) *(figure given is cable length, not distance)*	Electronic Equipment *(<5m cable length)*
TN-C	I & II	**KM1+2-25-1+0 SC**	**KM2-20-1+0 SC** (>10m from MDB)	**KM3-10-1+1 SC KM3-275-A**
			KM1+2-12.5-1+0 SC (>50m from MDB)	
			KM1+2-25-1+0 SC (>100m from MDB)	
TN-C	III & IV	**KM1+2-12.5-1+0 SC**	**KM2-20-1+0 SC** (>10m from MDB)	**KM3-10-1+1 SC KM3-275-A**
			KM1+2-12.5-1+0 SC (>50m from MDB)	
TN-S	I & II	**KM1+2-25-2+0 SC**	**KM2-20-2+0 SC** (>10m from MDB)	**KM3-10-1+1 SC KM3-275-A**
			KM1+2-12.5-2+0 SC (>50m from MDB)	
			KM1+2-25-2+0 SC (>100m from MDB)	
TN-S	III & IV	**KM1+2-12.5-2+0 SC**	**KM2-20-2+0 SC** (>10m from MDB)	**KM3-10-1+1 SC KM3-275-A**
			KM1+2-12.5-2+0 SC (>50m from MDB)	
TN-C-S	I & II	**KM1+2-25-2+0 SC**	**KM2-20-2+0 SC** (>10m from MDB)	**KM3-10-1+1 SC KM3-275-A**
			KM1+2-12.5-2+0 SC (>50m from MDB)	
			KM1+2-25-2+0 SC (>100m from MDB)	
TN-C-S	III & IV	**KM1+2-12.5-2+0 SC**	**KM2-20-2+0 SC** (>10m from MDB)	**KM3-10-1+1 SC KM3-275-A**
			KM1+2-12.5-2+0 SC (>50m from MDB)	
TT	I & II	**KM1+2-25-1+1 SC**	**KM2-20-1+1 SC** (>10m from MDB)	**KM3-10-1+1 SC**
			KM1+2-12.5-1+1 SC (>50m from MDB)	
			KM1+2-25-1+1 SC (>100m from MDB)	
TT	III & IV	**KM1+2-12.5-1+1 SC**	**KM2-20-1+1 SC** (>10m from MDB)	**KM3-10-1+1 SC**
			KM1+2-12.5-1+1 SC (>50m from MDB)	

Identify your earthing system

Surge Protection Devices are available for specific earthing systems . . .

LPZ* refers to the Lightning Protection Zones concept described in BS 7671:2018 (18th Edition Wiring Regulations) section 534.1.

Illustration of TN-S, TN-C-S, TN-C and TT earthing systems

Installation guide

TN-C-S Neutralising Point

When installing SPDs to distribution boards with a TN-C-S earthing arrangement, it is important to establish where the neutralising point of the PEN is located. Typically, the neutralising point will be at the origin of the installation before the main supply fuse, therefore a **TN-S** type SPD is to be installed ***after*** the neutralising point.

However, if the device is to be installed ***before*** the neutralising point, a TN-C type device should be installed.

Installation

When installing SPDs, there are 3 main considerations:

1. Back up OCPD (Over Current Protection Device)
2. Conductor sizing
3. Conductor length & routeing

Back Up OCPD

When installing SPDs, the requirement for an OCPD depends on two main factors:

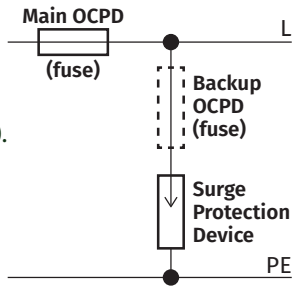
1. The main OCPD rating of the distribution board
2. The backup OCPD rating of the SPD

The typical maximum back up OCPD required for Kingsmill SPDs is 160A (250A for LPL I&II SPDs).

If main OCPD ≤ recommended maximum backup OCPD of the SPD, a supplementary OCPD for the SPD ***is not*** required.

If main OCPD rating > maximum backup OCPD rating of the SPD, a backup OCPD ***is*** required.

**If a backup OCPD is required, the recommended maximum backup OCPD should be installed.*



Conductor Sizing (as per BS 7671:2018, 534.4.10)

"Conductors between SPDs and the main earthing terminal or protective conductor shall have a cross-sectional area not less than:

- 16mm² copper or equivalent for Type 1 devices installed at or near the origin of the installation
- 6mm² copper or equivalent for Type 2 devices installed at or near the origin of the installation

Referring to Regulation 433.3.1(ii), conductors connecting SPDs and the OCPDs to live conductors should be rated to withstand the prospective short-circuit current to be expected and shall have a cross-sectional area not less than:

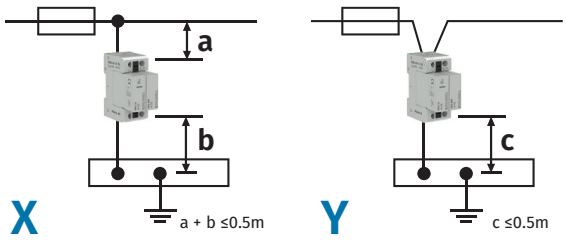
- 6mm² copper or equivalent for Type 1 devices installed at or near the origin of the installation
- 1.5mm² copper or equivalent for Type 2 devices installed at or near the origin of the installation"

Conductor Length & Routeing

For SPDs to efficiently discharge any overvoltages to earth, the connected conductors to the SPD should be as short and straight as possible.

Therefore, conductor lengths should be kept to a minimum and not exceed a total of 0.5m (**X**).

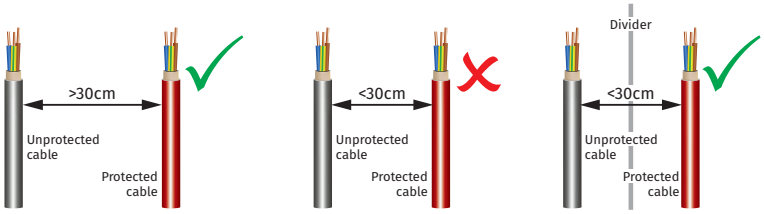
If this is not achievable, you can increase the PE conductor length to 0.5m by installing the device in a 'Y' connection (**Y**).



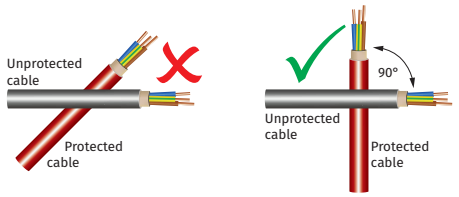
Wiring configurations

Conductors should be routed so as not to induce any overvoltages from unprotected (*dirty*) onto protected (*clean*) lines.

Care should be taken to keep conductors straight and to minimise conductor loops. The crossing of protected and unprotected conductors should also be avoided.



A separation distance of 30cm is recommended for protected and unprotected conductors. Otherwise, separate the conductors with a protective partition.



If conductors are crossed, they must do so at 90° to minimise induced overvoltages.

FAQs

1. What should I do if I have no information, or the risk assessment has not been completed?

   If there is little or no information available to guide you through the product selection process, or the risk assessment cannot be completed, surge protection must be installed as per BS 7671:2018 443.4.

   Kingsmill would recommend installing a Type 1+2 combined Surge Protection Device (SPD) with a minimum discharge current of 12.5kA per pole.

2. The building to be protected has a structural Lightning Protection System (LPS) but the Lightning Protection Level (LPL) is unknown. What do I have to do?

   If there is an LPS installed but the LPL is unknown, a Type 1+2 SPD is required to be installed at the main service entry (MDB) to the building. The device should have a minimum of 25kA discharge current per pole (see page 6 'BS EN 62305 Products').

3. What is a transient overvoltage?

   Also referred to as a spike, surge or transient, a transient overvoltage is a form of power disturbance. They are caused by the secondary effects of lightning and electrical switching events. They only last for microseconds but can reach 6,000 volts in magnitude.

4. In a single domestic dwelling, how would I determine if SPD installation is worthwhile?

   The main consideration here is the effects of a transient overvoltage and the possible damage to the electrical installation. For example, not only can appliances (TVs, computers etc) be damaged, but the internal wiring may also be damaged and require replacement. It is not uncommon for houses to undergo a full "re-wire" as a result of transient overvoltage damage, which can cost thousands of pounds. This is certainly more than the cost of SPD installation.

5. Do I need SPDs if I already have circuit breakers and/or fuses?

   SPDs and circuit breakers serve different purposes, protecting electronics from different events. Circuit breakers protect against overcurrents caused by a short circuit. SPDs protect against transient overvoltages. Circuit breakers and fuses do not provide protection against transient overvoltages.

6. Do I need to protect the SPD with a fuse?

   Overcurrent protection (OCPD) or fuse installation to protect the SPD specifically is only required if the mains supply fuse exceeds the recommended back up fuse of the SPD. Otherwise, the SPD is protected by the mains fuse/ overcurrent protection. Details are provided on page 11 and in the installation instructions supplied with each SPD.

7. Can I protect the SPD with an OCPD rated lower than the recommended?

   Kingsmill would always recommend the maximum back up OCPD for the SPD; installing a lower rated OCPD may lead to ineffective protection as the SPD may be disconnected by the OCPD before discharging the transient overvoltage safely to earth.

8. Do transient overvoltages only occur on mains power cables?

   No. Even though mains power cables are the most common coupling method associated with transient overvoltages, they can occur on generator or battery supplies, UPS outlets and data, signal and telephone lines.

9. How can I tell if an SPD has been damaged by transient overvoltages?

   Kingsmill SPD modules include lifetime status indication, clearly displaying if they have reached the end of their lifetimes, and hence need to be replaced to ensure continued protection. The modules can be easily and individually replaced.

10. How far away can my device be from an SPD and still be protected?

    Different types of SPD have different protective distances. SPDs should be installed at the service entrance and as close to the equipment to be protected as possible. A full explanation is provided on page 7 but, in general, a Type 1+2 device should be installed no further than 10m from the electronic equipment to be protected and a Type 3 device should be no further than 5m from sensitive equipment.

Enclosures

IP65 rated insulated distribution enclosures for use with Kingsmill Surge Protection Devices.

ABS enclosures with a polycarbonate window. Includes DIN rail. Complete with earth and neutral terminal blocks.

Fixings

Fixings for attaching the enclosure to the wall (not included) - 4 x stainless steel countersunk screws No.12 x 1.5" (A2RHSLT1.5-12) plus plastic plug (PP-12).

Modules for use with enclosures

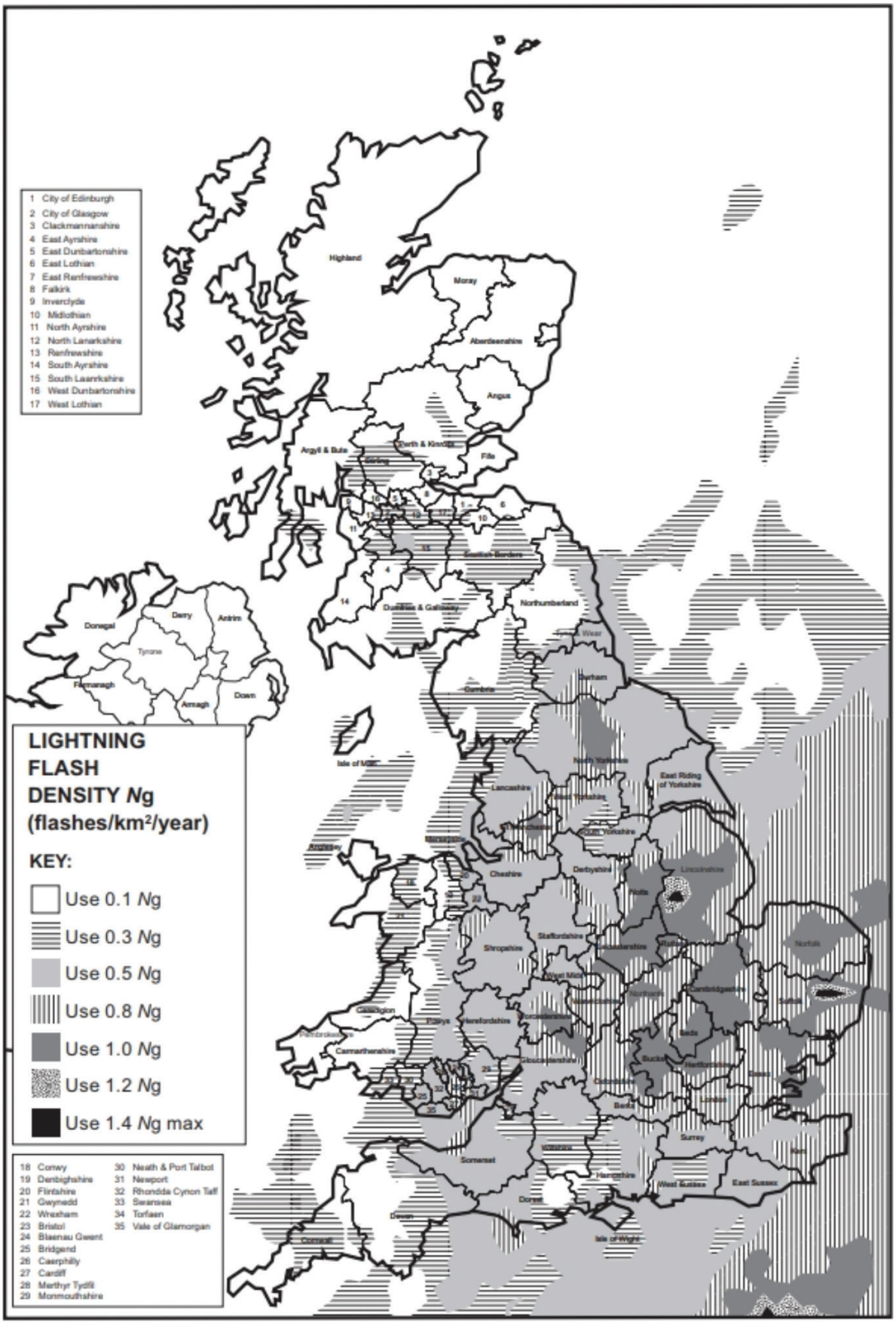
SPD-ENC		SPD-ENC-LARGE
25kA Type 1+2	**20kA Type 2**	**25kA Type 1+2**
KM1+2-25-1+0 SC	KM2-20-1+0 SC	KM1+2-25-3+0 SC
KM1+2-25-1+1 SC	KM2-20-1+1 SC	KM1+2-25-3+1 SC
KM1+2-25-2+0 SC	KM2-20-2+0 SC	KM1+2-25-4+0 SC
	KM2-20-3+0 SC	
12.5kA Type 1+2	KM2-20-3+1 SC	
KM1+2-12.5-1+0 SC	KM2-20-4+0 SC	
KM1+2-12.5-1+1 SC		
KM1+2-12.5-2+0 SC	**10kA Type 3**	
KM1+2-12.5-3+0 SC	KM3-10-1+1 SC	
KM1+2-12.5-3+1 SC	KM3-10-3+1 SC	
KM1+2-12.5-4+0 SC		

Metallic enclosures are available on request.

Specification

Order number	SPD-ENC	SPD-ENC-LARGE
DIN rail length (mm)	70	160
Useable window opening (mm)	70 x 45	160 x 45
Suitable for maximum product width (mm)	70	160
Height (mm)	215	210
Width (mm)	125	215
Maximum depth (to top of window) (mm)	110	100
Minimum depth (mm)	80	94
Cable knockouts (total all sides)	8	10
Fixing centres (mm)	145 x 52	145 x 143
Weight (kg)	0.51	0.69

Lightning Flash Density Map (BS 7671:2018 figure 44.2)



KINGSMILL
INDUSTRIES (UK) LTD

Kingsmill Industries (UK) Ltd is a leading manufacturer and distributor of Earthing and Lightning Protection products, including Surge Protection Devices (SPDs). We are pleased to introduce this guide to the 18th edition UK wiring regulations, BS 7671:2018, designed to simplify the decision making process with regards to the application of surge protection and SPDs.

Our wealth of knowledge gives us the ability to offer cutting edge product development and unparalleled technical support. We provide the highest standards of service and customer care without compromising quality or price.

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