SALTEK®

Overvoltage controlled. ANYWHERE.

PRACTICAL GUIDE

Low-voltage power systems

Surge protection

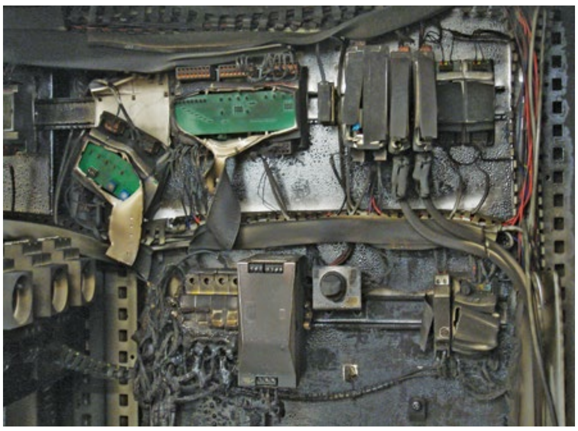
Introduction

Since the 1960s, the purely technical term EMC (electromagnetic compatibility) has become a term comprising not only safety for appliances and components, but in particular, for their users. Apart from others, it refers to the resistance of devices and equipment to all forms of electromagnetic disturbance, including impulse overvoltage and high frequency disturbance. It is thus the suppliers who must increase the resistance of systems today. A correctly designed and installed system of surge protective devices and SALTEK® filters can satisfy even the most demanding requirements for the safety of equipment in terms of electromagnetic compatibility.

The current standard of technology offers good protection for electronic and electrical equipment against the effects of dangerous impulse overvoltage, i.e., surge arresters. Equipment can be protected not only against the effects of a destructive impulse that features great energy, but also against the effects of high frequency disturbances. Unprotected electrical wiring, computer and data networks always pose a huge risk for their users. Installing overvoltage protection devices therefore prevents possible damage. The price of surge arresters is only a tiny part of the cost expended on protected equipment and a negligible amount compared to the potential damage resulting from a failure or destruction of the technological equipment followed by financial losses.

SALTEK surge arresters comply to Czech and international standards.

Electronic components damaged by overvoltage



Overvoltage

Overvoltage types

Basically, overvoltage can be classed according to its duration.

Transient overvoltage – short-term changes in voltage:

overvoltage that lasts a short time not exceeding several thousandths of a second, oscillating or non-oscillating, usually highly damped, in hundreds of microseconds *(see Fig. 1a)* – such overvoltage **can be successfully eliminated** using an SPD (Surge Protective Device).

Temporary overvoltage – long-term changes in voltage:

overvoltage with industrial frequency of oscillation and a relatively long duration

- in milliseconds or less *(see Fig. 1b)*
- such overvoltage **cannot be eliminated** by means of an SPD.

Fig. 1a

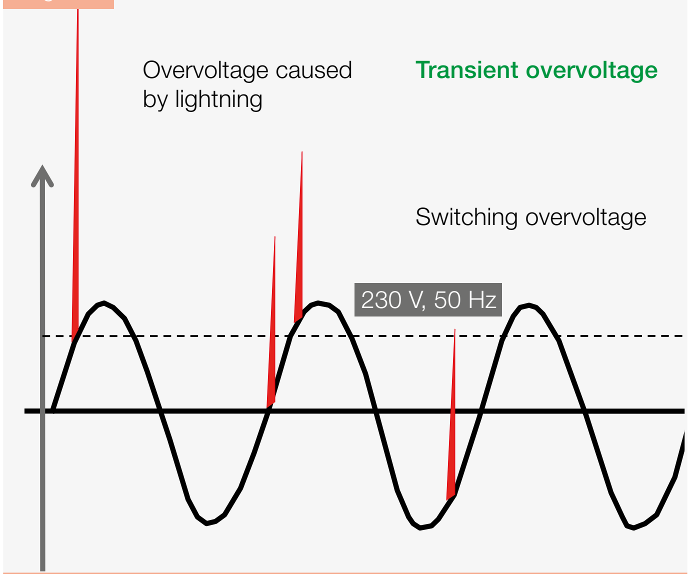
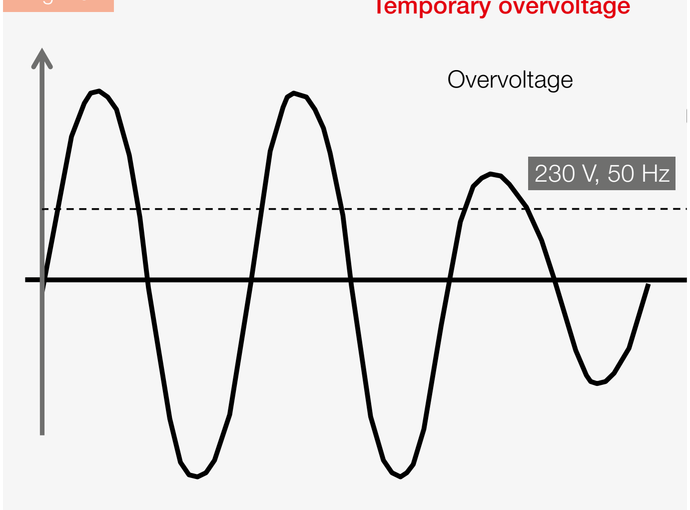


Fig. 1b



Short-term changes in voltage, i.e. transient overvoltage can be classed in several groups according to the origin:

- **differential mode of overvoltage:** overvoltage between live conductors (L1-L2, L-N with LV supply, a-b with telecommunications…), such overvoltage occurs as a result of technological events – e.g. switching of non-linear loads (motors, refrigerators,...). These are particularly dangerous for electronic equipment, sensitive hardware-like control systems, computers and their software utilities, etc. *(see Fig. 2)*
- **common-mode of overvoltage:** overvoltage between the neutral conductor and earthing conductor (L-PE, N-PE in LV, a/b-PE in telecommunications…) that results from atmospheric events – a lightning strike. Such overvoltages are particularly dangerous for technological equipment, the frame of which is earthed (insulation breakdown). *(see Fig. 3)*

An SPD in the supply network will be selected according to the type of respective overvoltage.

Fig. 2

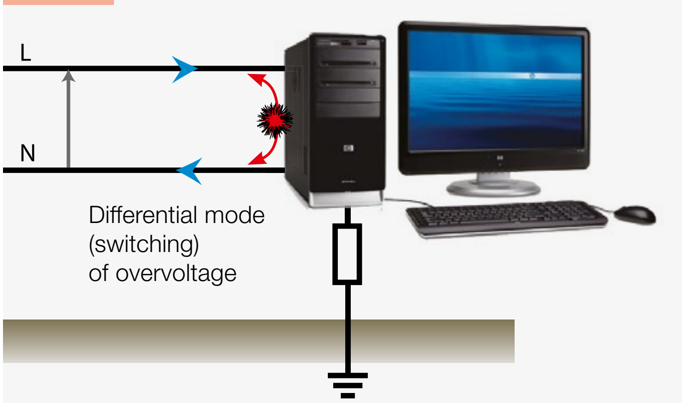
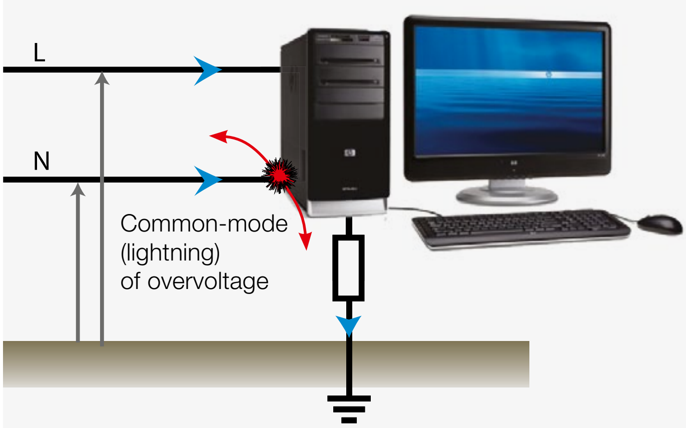
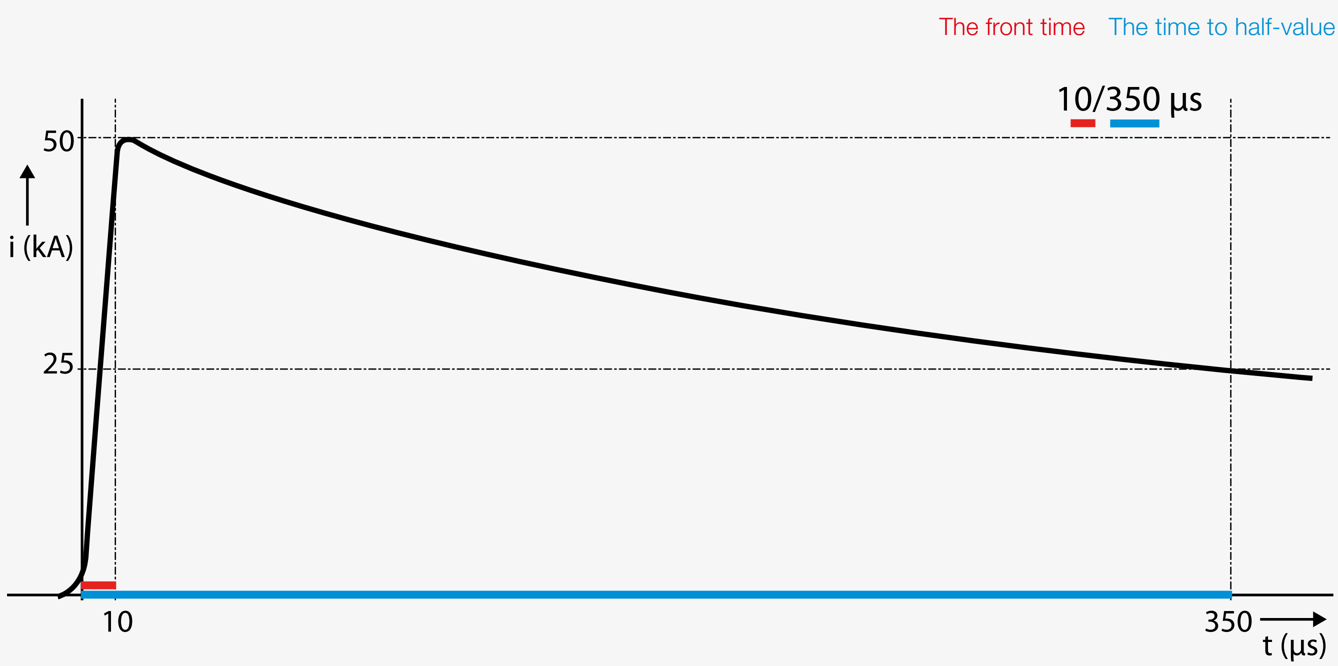


Fig. 3



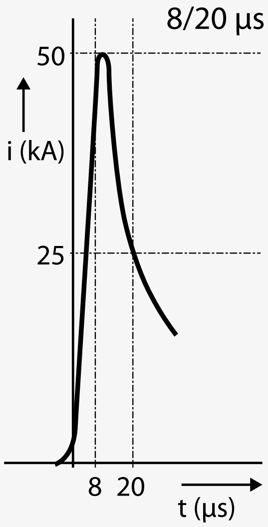
Parameters of (current) impulse

Fig. 4



Test impulse 10/350 µs simulates a lightning strike and SPD Type 1 and SPD Type 1+2 are tested according to it

Fig. 5



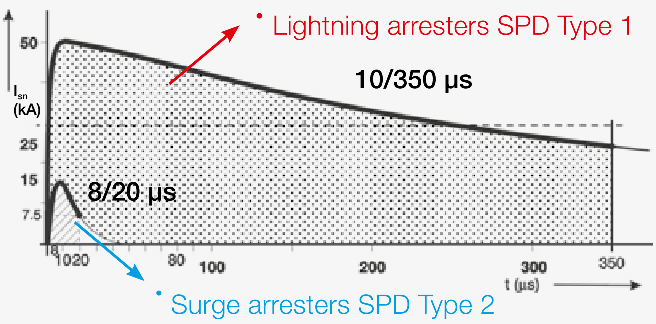
8/20 µs current impulse simulates surge from switching overvoltage or inductive coupling. This impulse is used for the classification of the SPD for class II test (SPD Type 2)

Protection of technological equipment against overvoltage

The principle of surge protective devices is based on equipotential bonding. This is conditioned by the effective equalising potential in the whole building. It is only possible if the whole building is thoroughly provided with equipotential bonding and it should be connected to the earthing electrode.

If a building features external lightning protection (LPS), both the down conductor as well as the protective conductor of the supply network should be connected to the earthing conductor. This is shown in the following chapter.

Fig. 6



Comparison of the energy of 10/350 µs and 8/20 µs testing impulses

Supply networks – SPD connection principles on how to connect SPDs

An SPD in power supply networks should be connected in two connection modes – mode x+0 (CT1) and mode x+1 (CT2).

The x+0 (CT1) connection mode is designated 3+0 (TN-C) or 4+0 (TN-S) for three-phase power supply and 1+0 (TN-C) or 2+0 (TN-S) for single-phase power supply. Such mode is beneficial in eliminating common mode of overvoltage.

The x+1 (CT2) connection mode is designated 3+1 for three-phase power supply and 1+1 for single-phase power supply. It cannot be used in the TN-C supply network. It is advantageous to use it to eliminate the differential mode of overvoltage.

TN-S system

An SPD Type 1 or SPD Type 1 and 2 should be located at the incoming supply side to the building (mostly in the main distribution board). These SPDs are mainly intended to restrict lightning electromagnetic impulses (lightning strikes) and therefore are connected in the x+0 pattern, i.e. with all (L1, L2, L3 and N) conductors in live condition against the ground (PE).

An SPD Type 2 should be located in a subsidiary distribution board. In such supply networks, the SPD Type 2 can either be connected in the x + 0 mode (to eliminate longitudinal – lightning electromagnetic impulse) or in the x + 1 mode (to restrict overvoltage in the equipment).

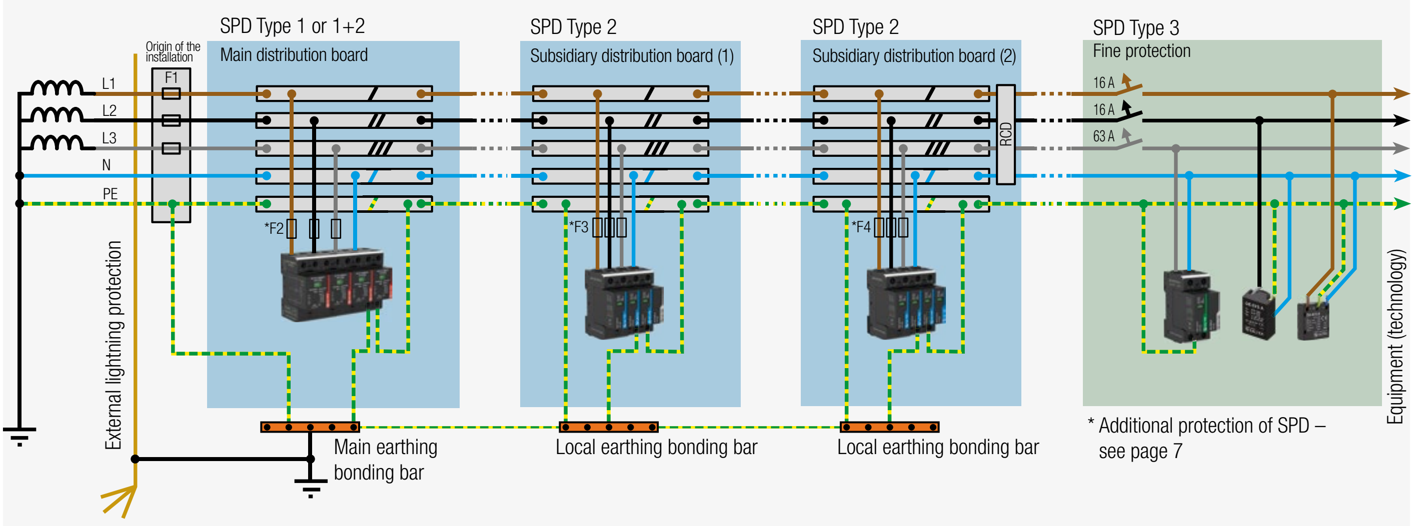
In a TN-S supply network, connection of a Type 2 SPD must follow the type of overvoltage that will prevail in the supply network. Consequently, in industrial operations, where a great number of switching overvoltage occurs, it is more advantageous to connect the SPD Type 2 in the x+1 (CT2) mode, while in administrative and residential buildings it is better to connect the SPD Type 2 in the x+0 (CT1) mode.

An SPD Type 3 is always mounted close to the equipment to be protected.

TN-C-S system

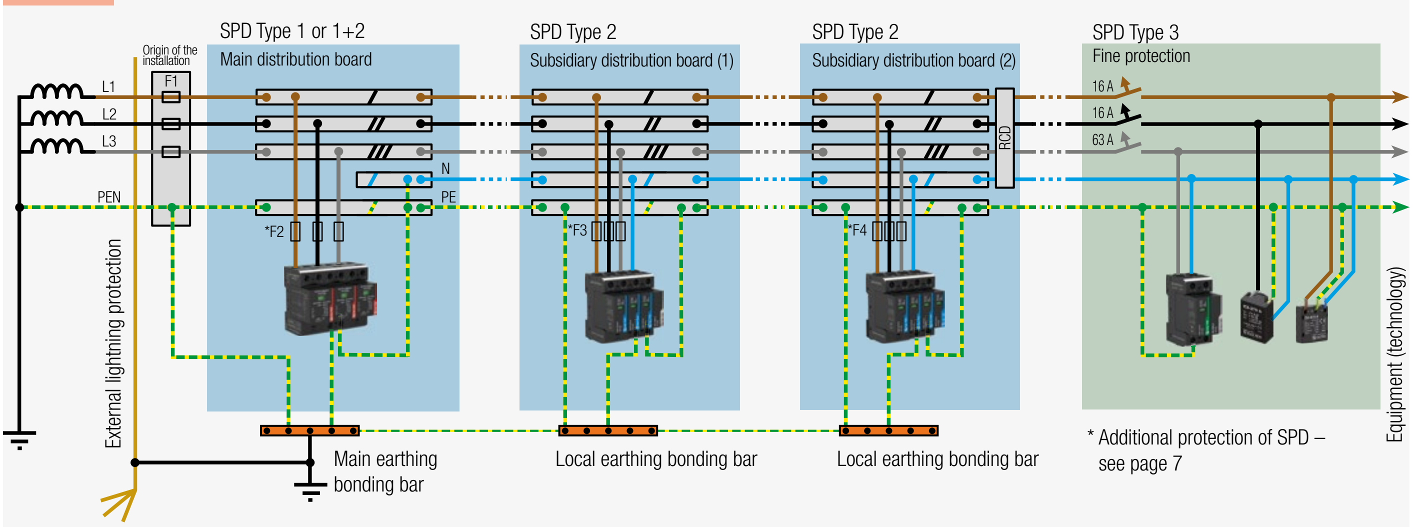
In a TN-C-S supply network, the SPD located before the point from which the PEN conductor separates to the N and PE conductors should always be connected in the x+0 mode. Behind the point of separation, the SPD Type 2 can be connected in both the x+1 mode or x+0, with the same principle to be followed as in a TN-S network, i.e., such type of connection should be chosen to better suit the respective situation.

Fig. 7



TN-S system

Fig. 8



TN-C-S system

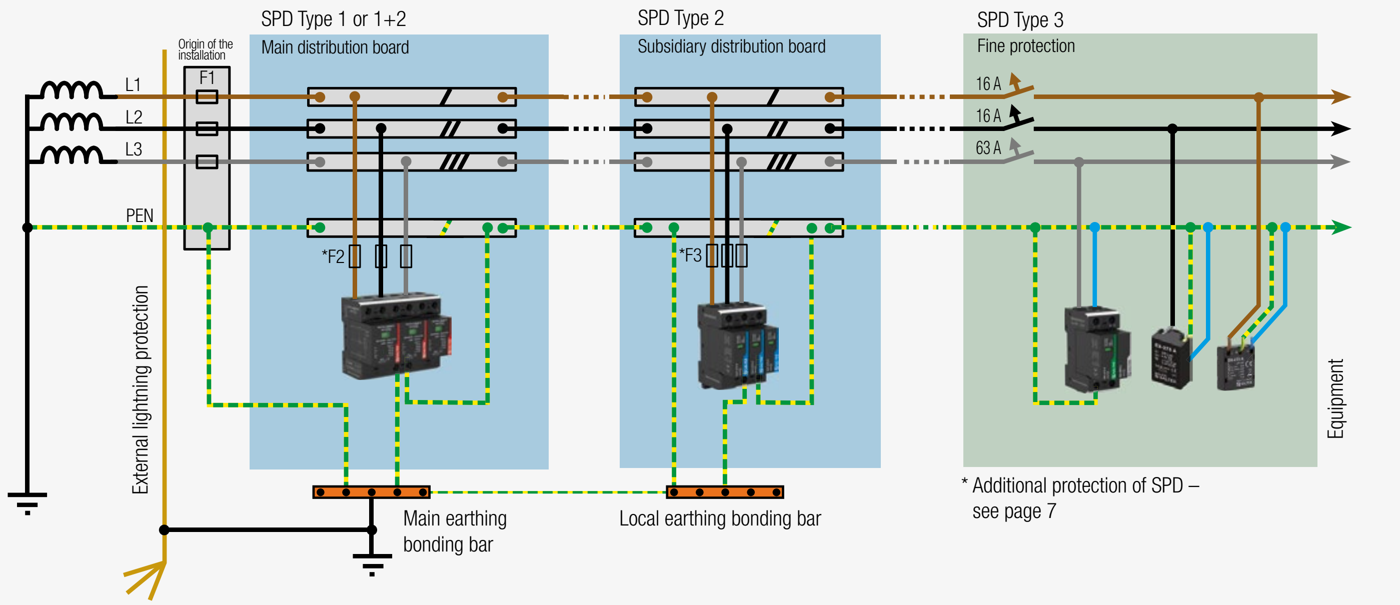
TN-C system

In a TN-C supply network, an SPD can only be connected in the x+0 (CT1) mode. Concerning the SPD Type 3, wired in the x+1 (CT2) connection mode, the N conductor (blue) as well as the PE conductor (yellow-green) should always be connected to the PEN conductor.

TT system

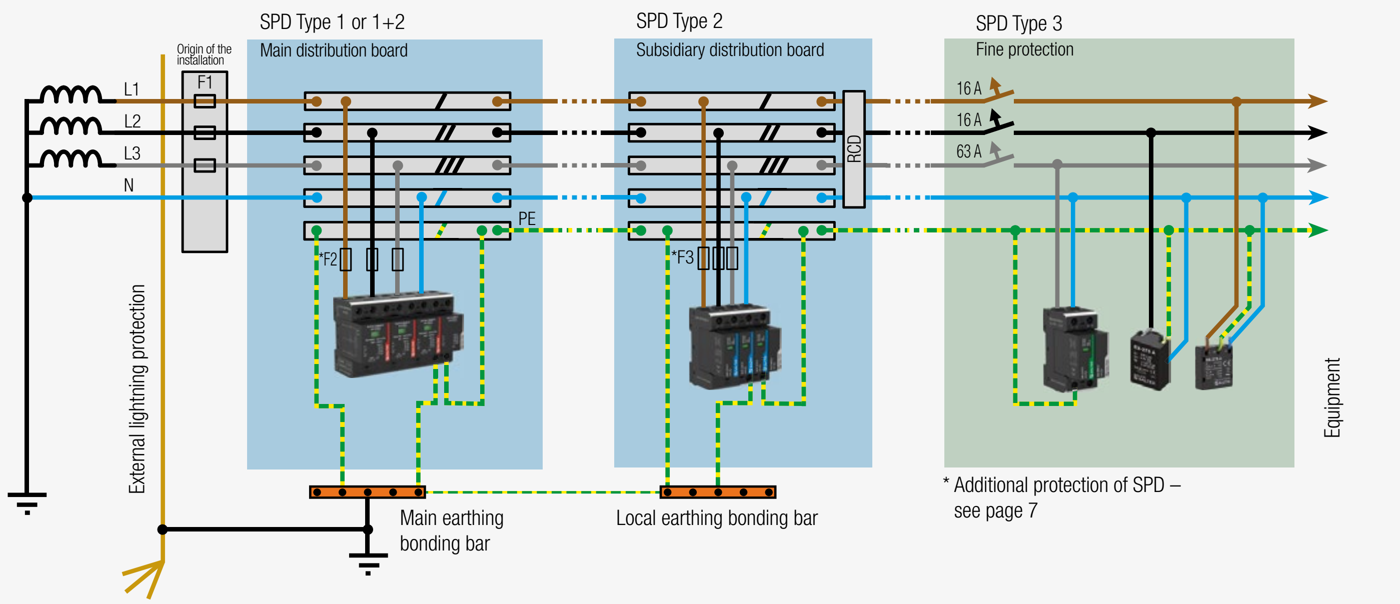
For a TT supply network, in which only neutral conductors L1, L2, L3 are routed from the power source, all levels of SPD should always be connected in the x+1 (CT2) mode.

Fig. 9



TN-C system

Fig. 10



TT system

Principle of overcurrent protection using SPD

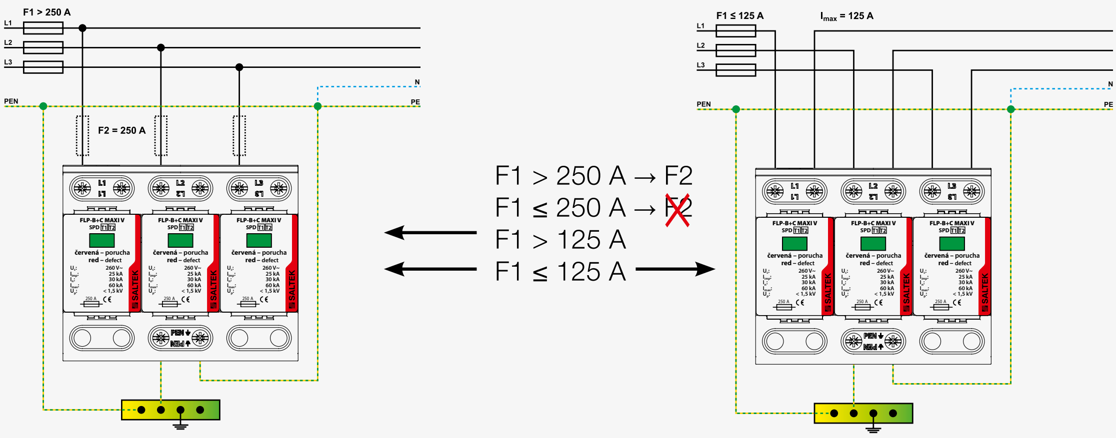
For overcurrent protection using SPD it is important to consider whether we should follow the protection priority principle, which is used in most installations, or the power supply priority principle.

In case of the protection priority principle the SPD is pre-protection only if the line protection value (fuse F1) is higher than of SPD in the catalogue (fuse F2), and the overcurrent protection of SPD has always the value specified in the manufacturer's catalogue (parameter – maximum overcurrent protection).

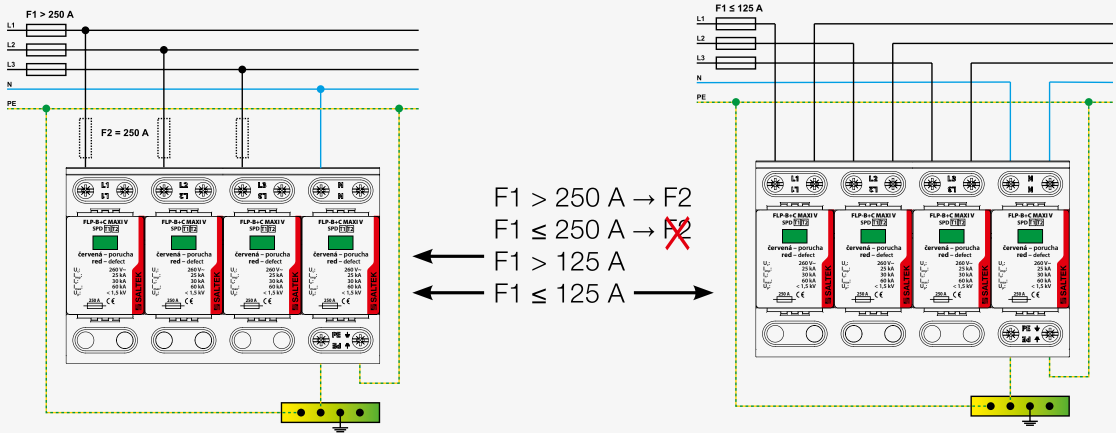
An example of back-up fuse for SPD – FLP-B+C MAXI V – in different supply networks.
The catalogue value of maximum back-up fuse for FLP-B+C MAXI V is 250 A, and 125 A for the "V" connection.

Parallel connection | **"V" (series) connection**

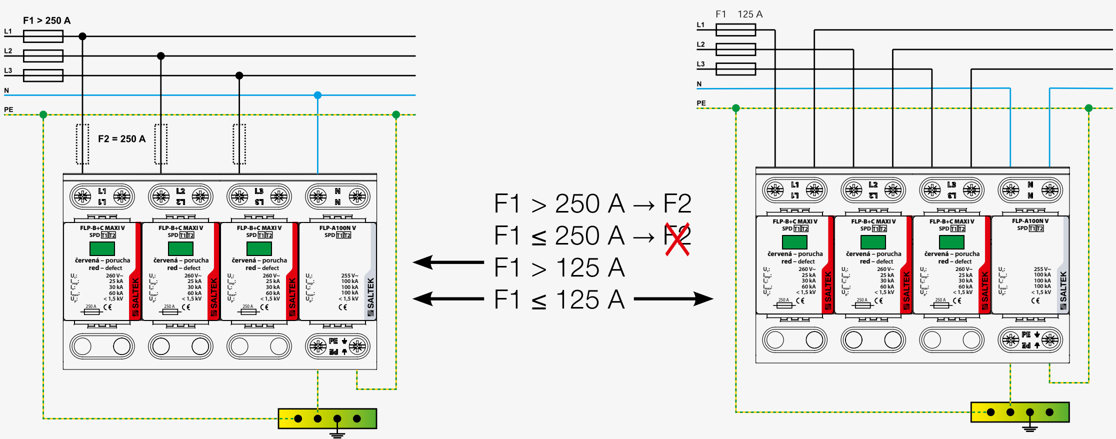
1 TN-C and also TN-C-S



2 TN-S

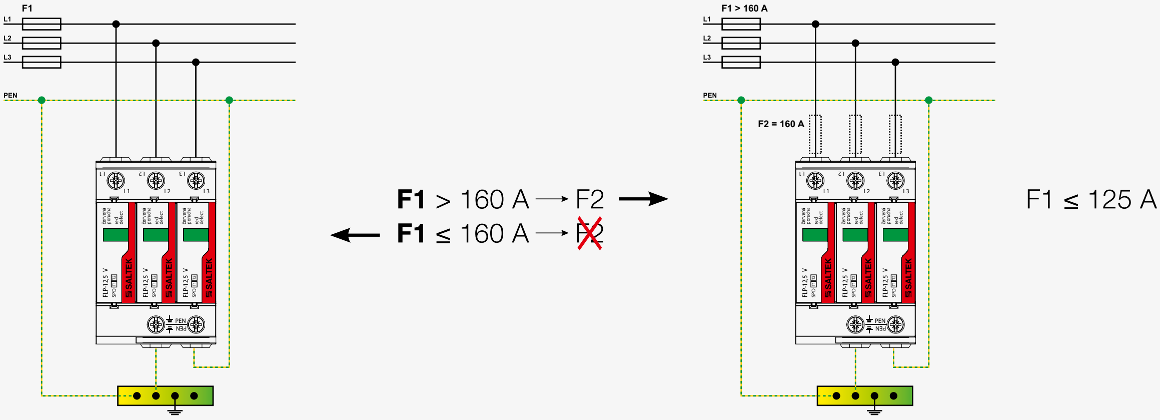


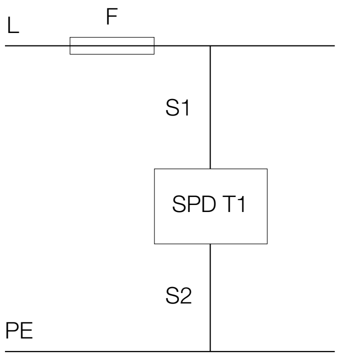
3 TT



An example of back-up fuse for SPD – FLP-12,5 V or SLP-275 V TN-C system ofsupply networks
The catalogue value of maximum back-up fuse for FLP-12,5 V or SLP-275 V is 160 A.

1 TN-C



	F ≤ 250 A S1 ≥ 6 mm² S2 ≥ 16 mm²	FLP-25-T1-V… FLP-B+C-MAXI-V… 
	F > 250 A S1, S2 ≥ 25 mm²	FLP-25-T1-VSF/… FLP-B+C-MAXI-VSF/… 

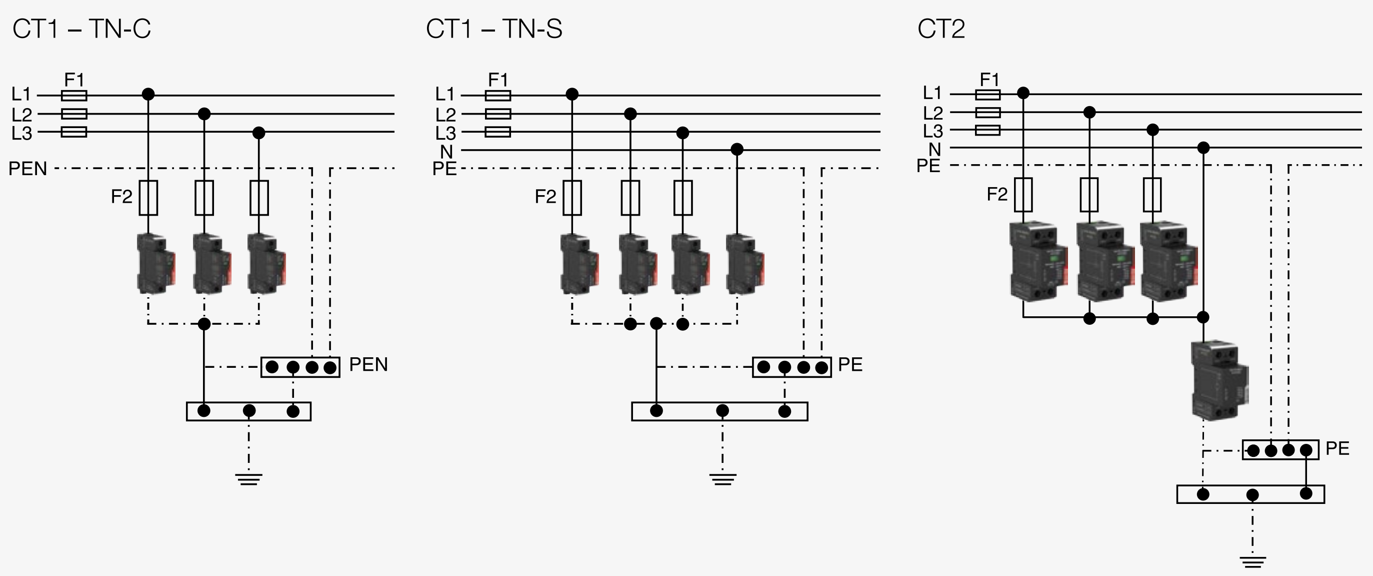
SPD dimensioning

Only the SPD Type 1 should be dimensioned. Dimensioning of the SPD Type 1 should be based on the calculation of the lightning protection level (LPL) for the lightning protection system (LPS). The table below shows minimum values of the discharge lightning strike current to the pole considering the lightning protection (LPL) class of the building for the SPD Type 1.

If the LPL value is not known, the worse scenario is anticipated			Low voltage networks									
LPL	Maximum current corresponding to LPL	Number of conductors (n)	TT			TN-C	TN-S			IT without neutral conductor	IT with neutral conductor	
			Connection mode				Connection mode			Connection mode		
			CT1	CT2			CT1	CT2		CT1	CT2	
			L-PE N-PE	L-N	N-PE	L-PEN	L-PE N-PE	L-N	N-PE	L-PE	L-N	N-PE
I or unknown	200 kA		I_{imp} (kA)									
		5	N/A	N/A	N/A	N/A	20.0	20.0	80.0	N/A	N/A	N/A
		4	25.0	25.0	100.0	25.0	N/A	N/A	N/A	N/A	25.0	100.0
		3	N/A	N/A	N/A	N/A	33.3	33.3	66.7	33.3	N/A	N/A
		2	50.0	50.0	100.0	50.0	N/A	N/A	N/A	N/A	50.0	100.0
II	150 kA		I_{imp} (kA)									
		5	N/A	N/A	N/A	N/A	15.0	15.0	60.0	N/A	N/A	N/A
		4	18.8	18.8	75.0	18.8	N/A	N/A	N/A	N/A	18.8	75.0
		3	N/A	N/A	N/A	N/A	25.0	25.0	50.0	25.0	N/A	N/A
		2	37.5	37.5	75.0	37.5	N/A	N/A	N/A	N/A	37.5	75.0
III or IV	100 kA		I_{imp} (kA)									
		5	N/A	N/A	N/A	N/A	10.0	10.0	40.0	N/A	N/A	N/A
		4	12.5	12.5	50.0	12.5	N/A	N/A	N/A	N/A	12.5	50.0
		3	N/A	N/A	N/A	N/A	16.7	16.7	33.3	16.7	N/A	N/A
		2	25.0	25.0	50.0	25.0	N/A	N/A	N/A	N/A	25.0	50.0

Table 1

Note: CT1 – SPD connected in the x+0 mode; CT2 – SPD connected in the x+1 mode



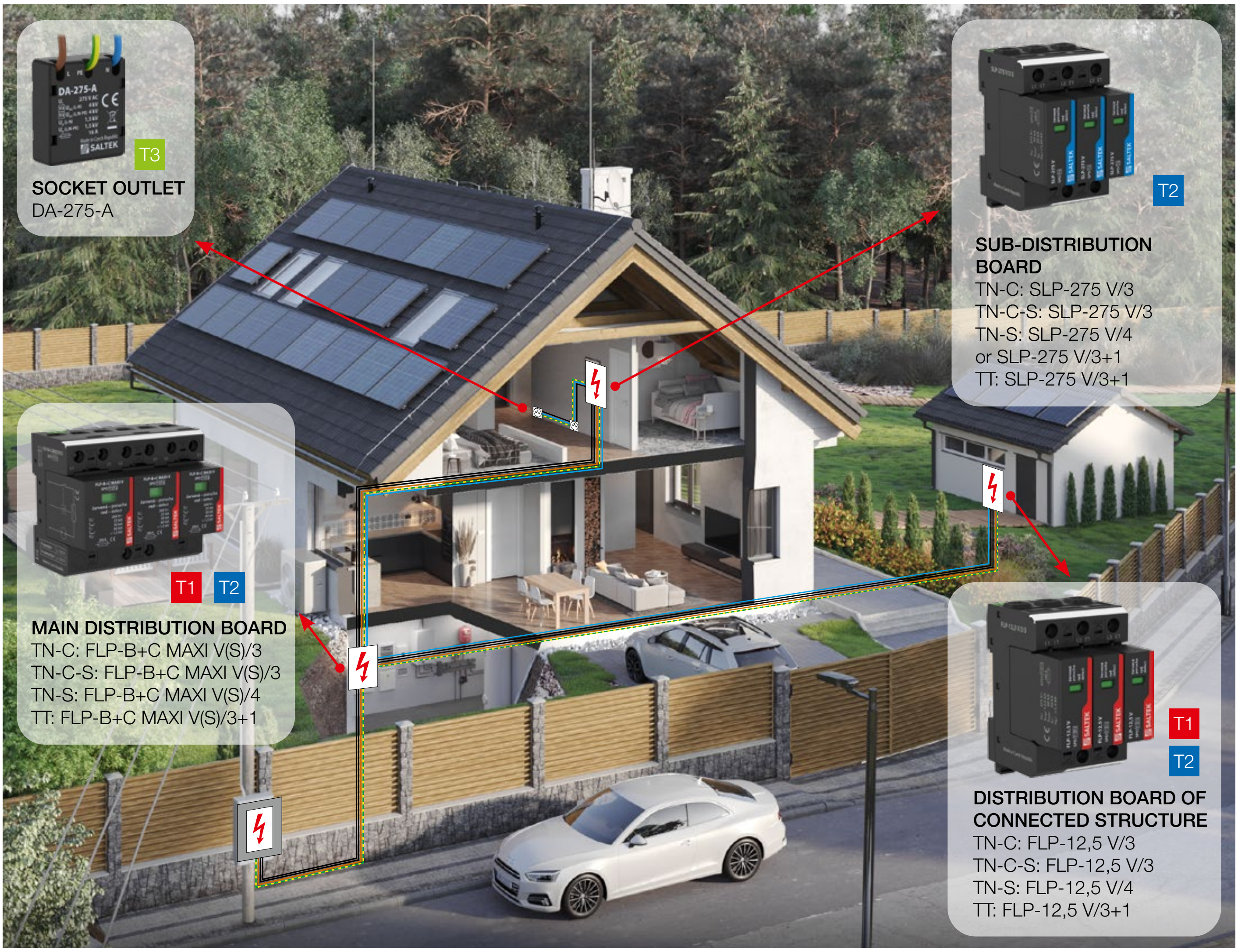
Selection of SPD at the incoming supply side to the building

For selection of the SPD Type 1 at the incoming supply to the building we use the table for SPD Type 1 dimensioning (see table 1). At the same time, it is necessary to consider the specific situation. Even if the calculation made according to the previous table shows that the Impulse current of SPD Type 1 may be, for example, 12.5 kA in a 10/350 μs wave and the building is fed by external cabling, then the probability of a lightning strike into the outdoor line is high and the SPD Type 1 would be under-dimensioned.

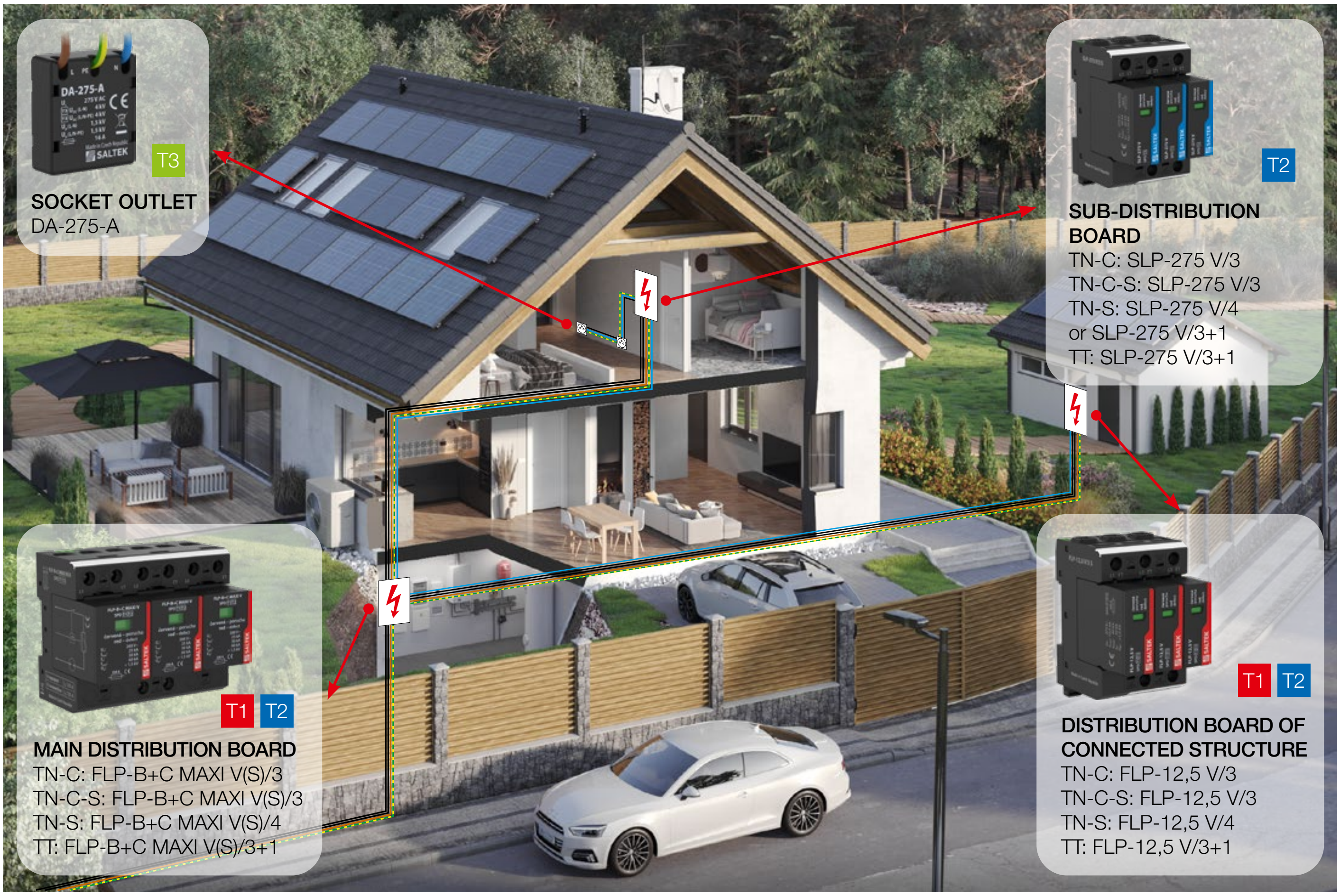
Variants of SPD applications are shown in the following examples:

Situation at the entrance of structure	Solution
A house with LPS, earthed antenna, or metallic roof, etc.	SPD Type 1 ✔ SPD Type 2 ✘
A house with an overhead line	SPD Type 1 ✔ SPD Type 2 ✘
A house with earthed metallic parts or LPS nearby	SPD Type 1 ✔ SPD Type 2 ✘

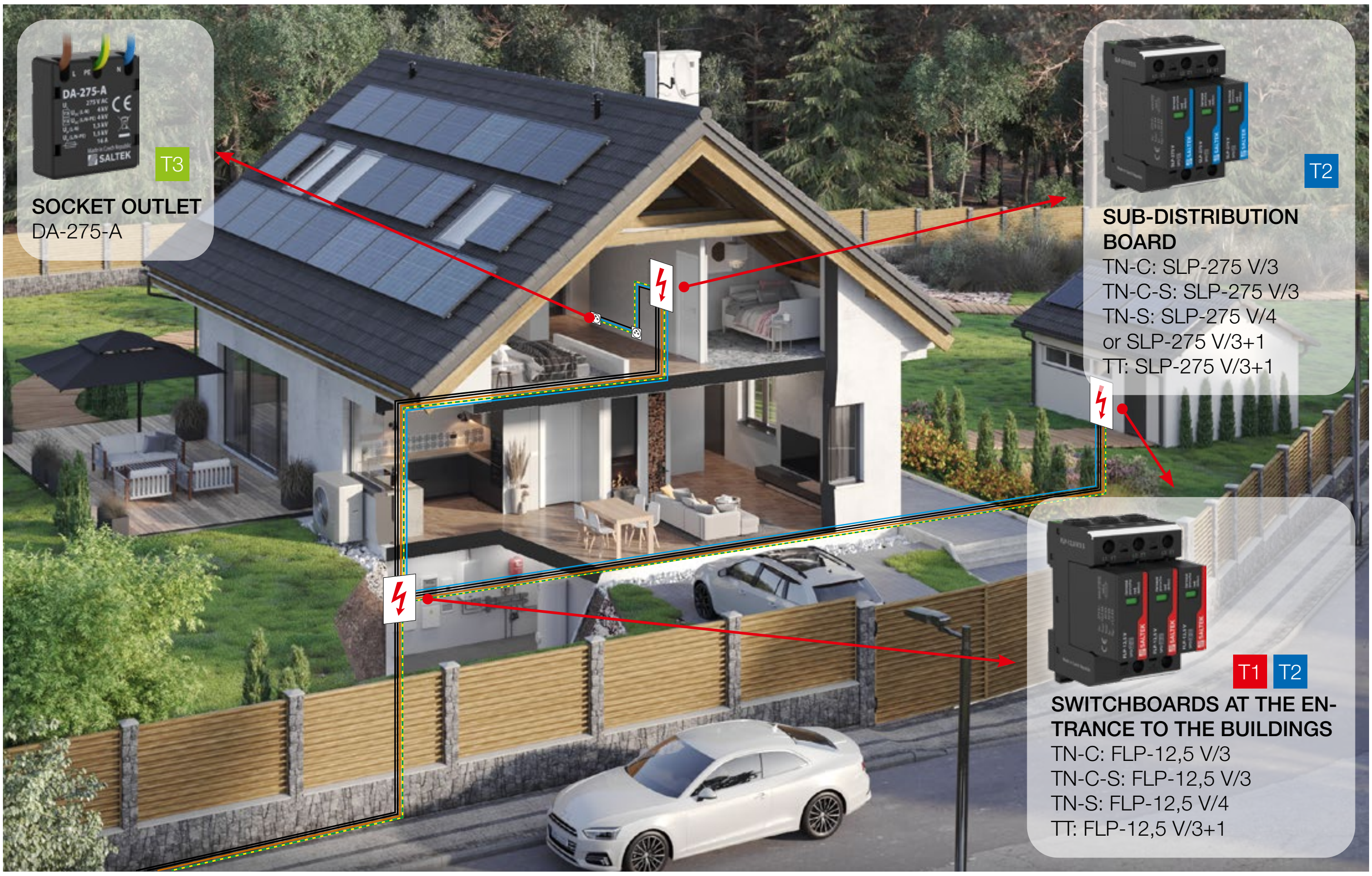
1 A family house in a built-up area or a detached structure with or without LPS and overhead line



2 A detached family house with or without LPS, with an underground cable connection



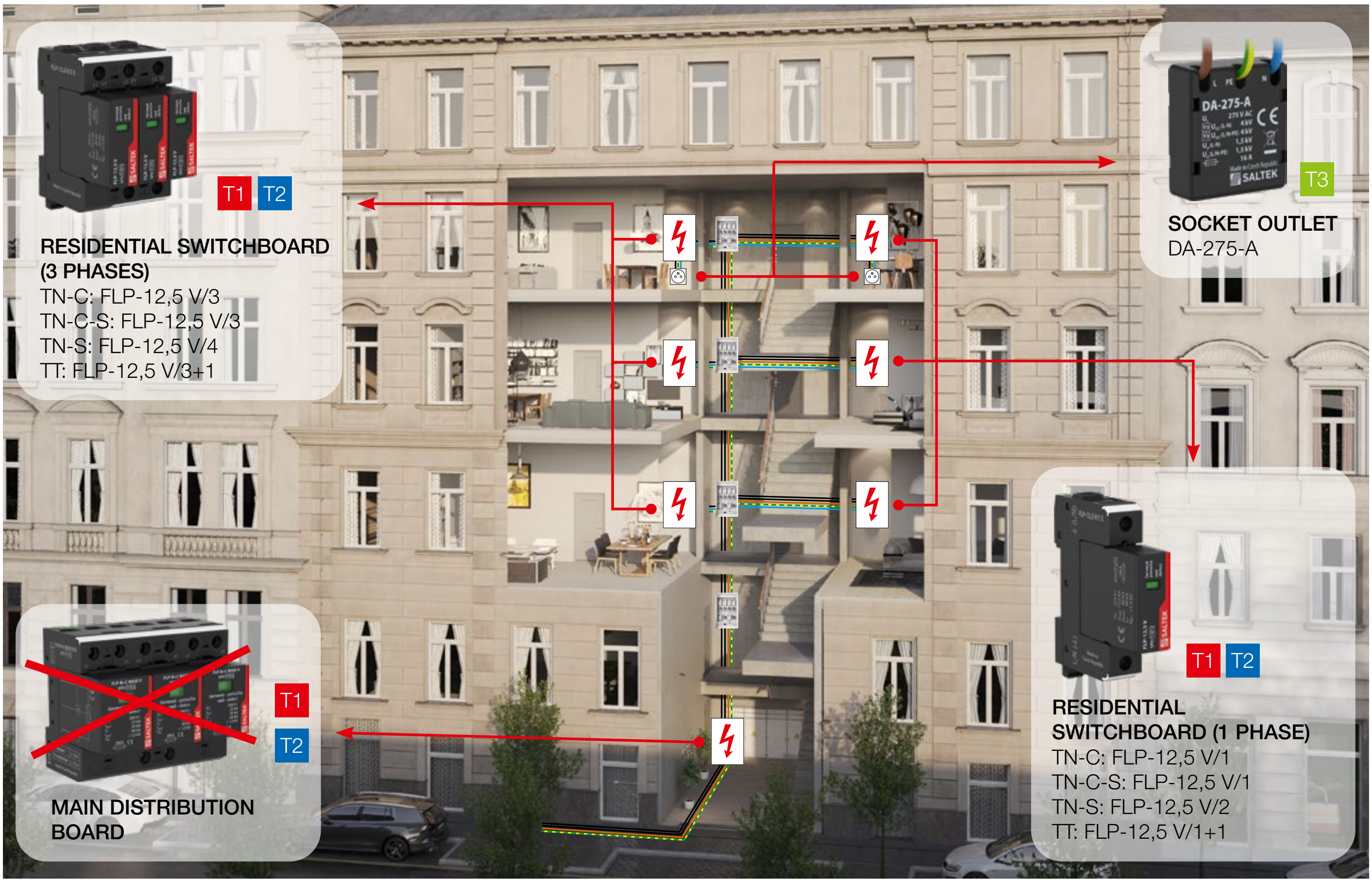
3 A family house in a built-up area without LPS and with an underground cable connection



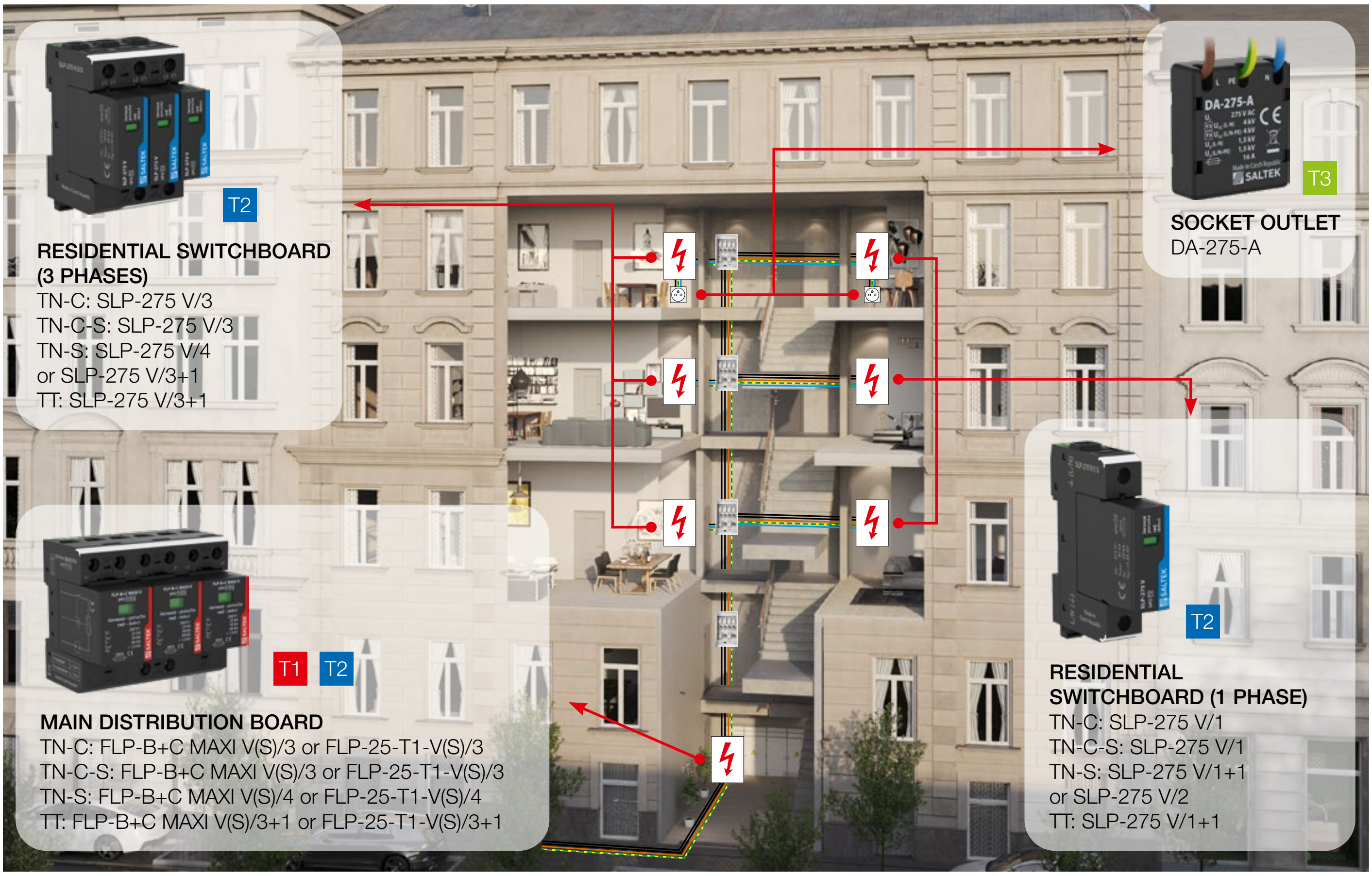
4 Terrace houses with a common LPS and overhead line

5 Terrace houses with a common LPS and an underground cable connection

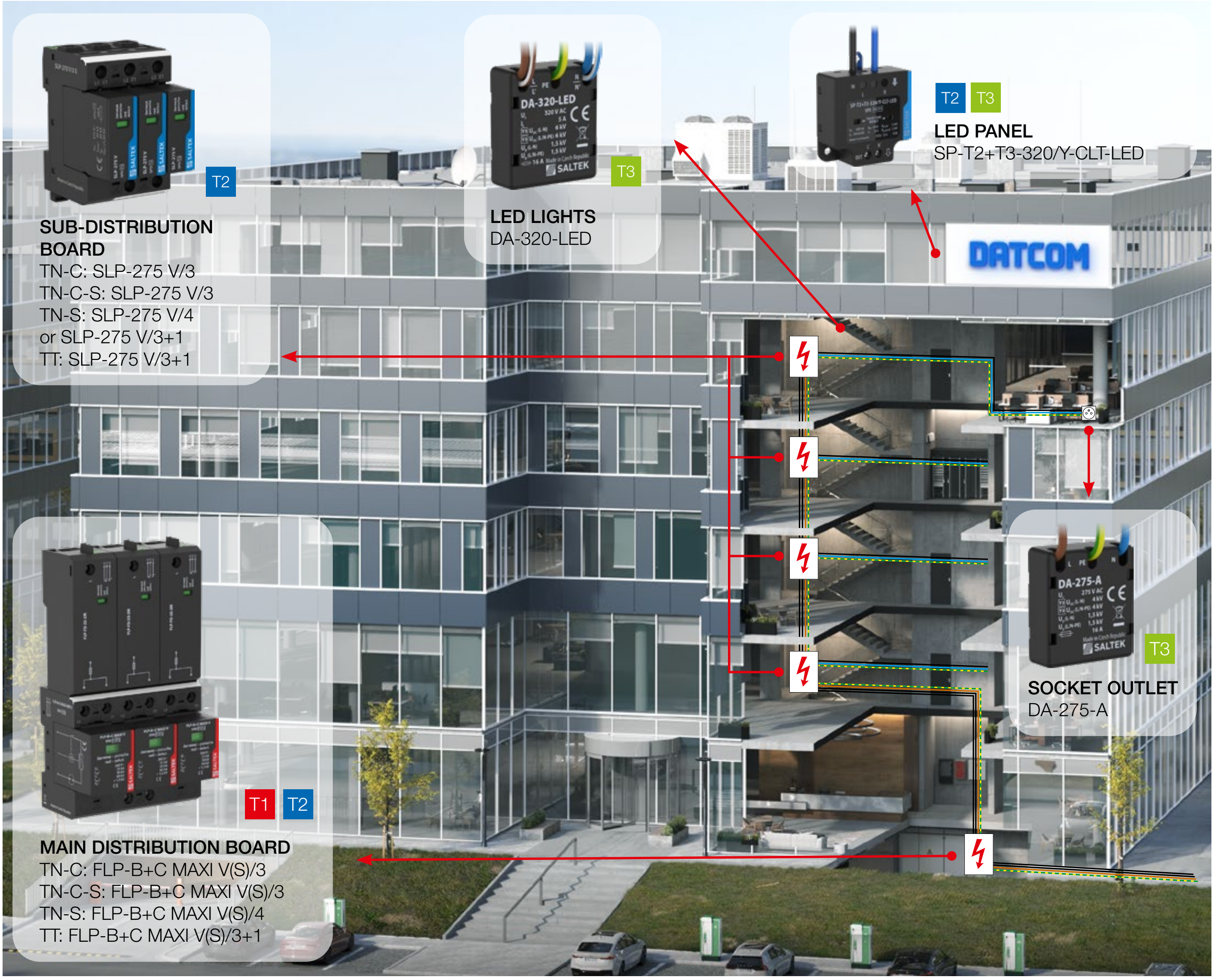
6 **Block of flats; underground cable connection; upstream of power meter SPD T1 installation impossible.**
Note: for situation where is not possible to install Type 1 SPD upstream of power meter



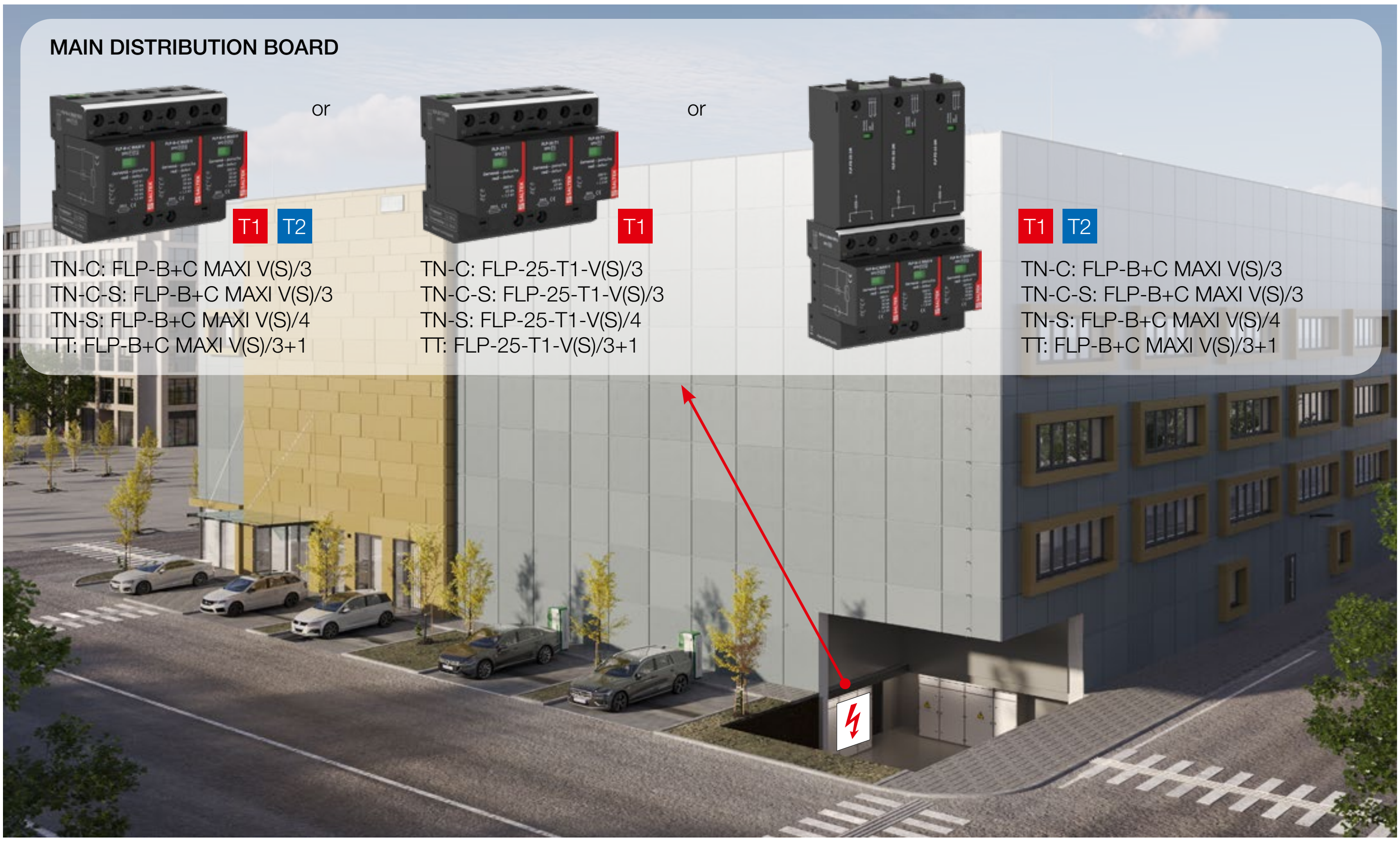
7 **Block of flats; underground cable connection; upstream of power meter SPD T1 installation.**



8 Administration building

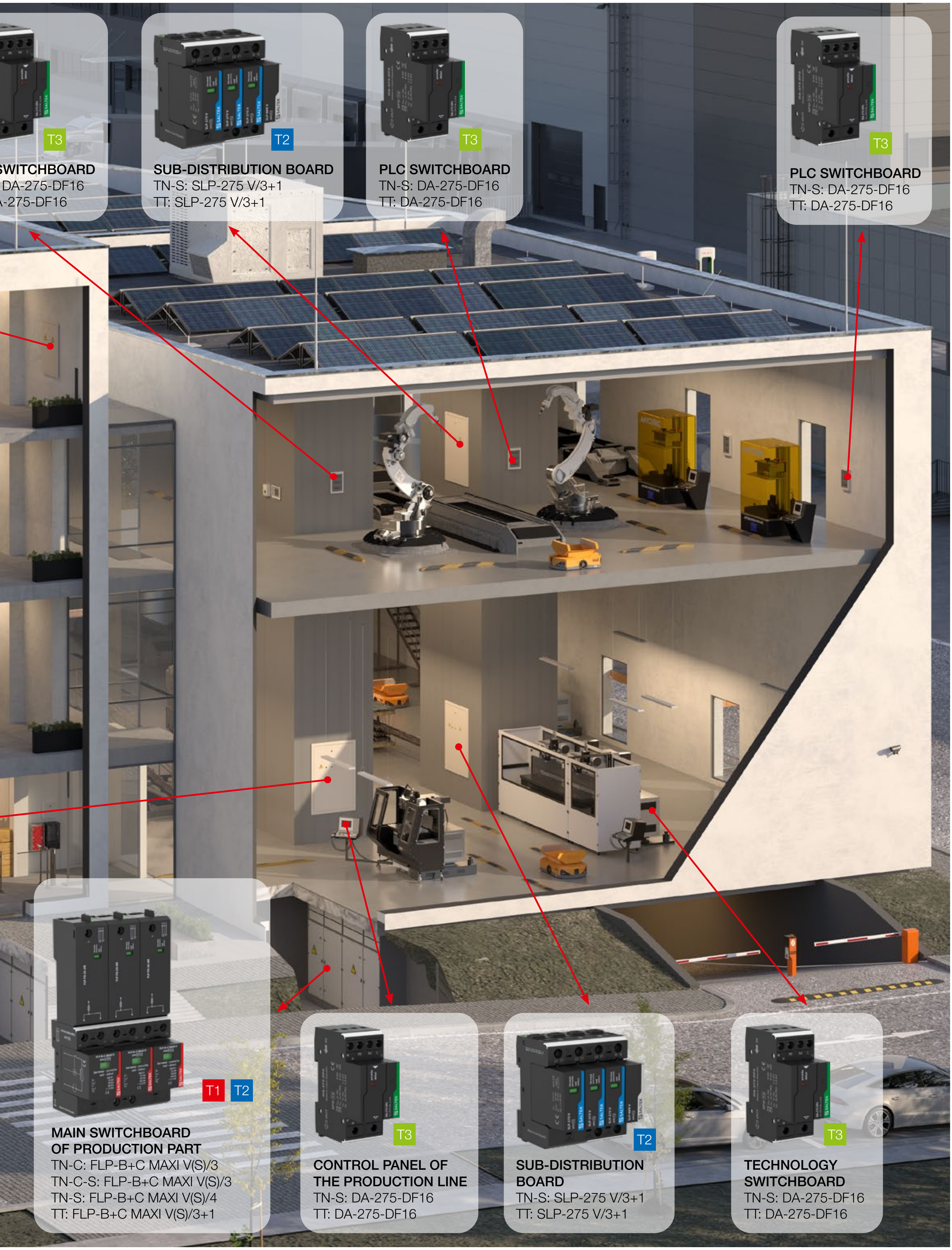


9 Commercial building

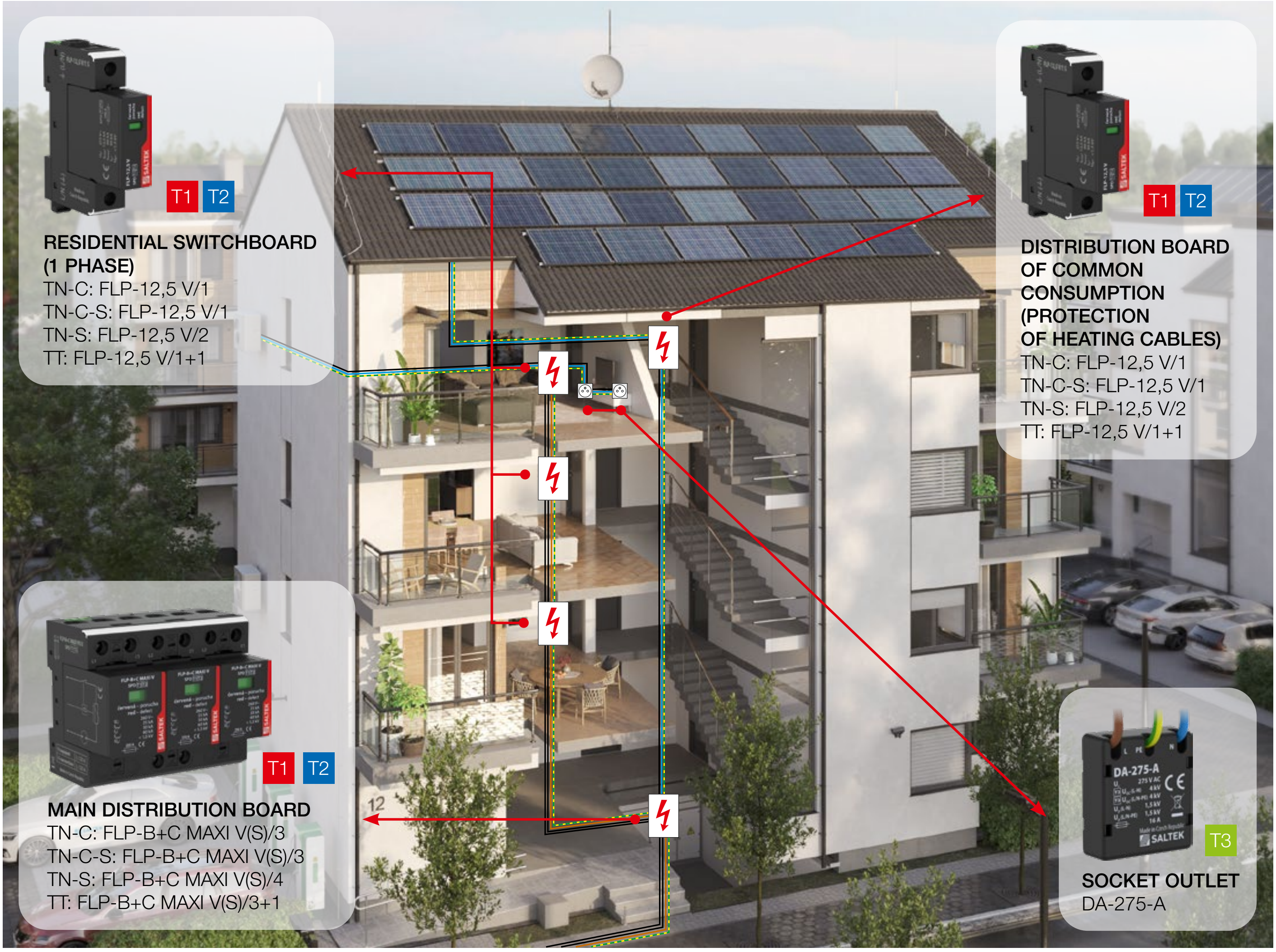


10 Commercial building of special importance

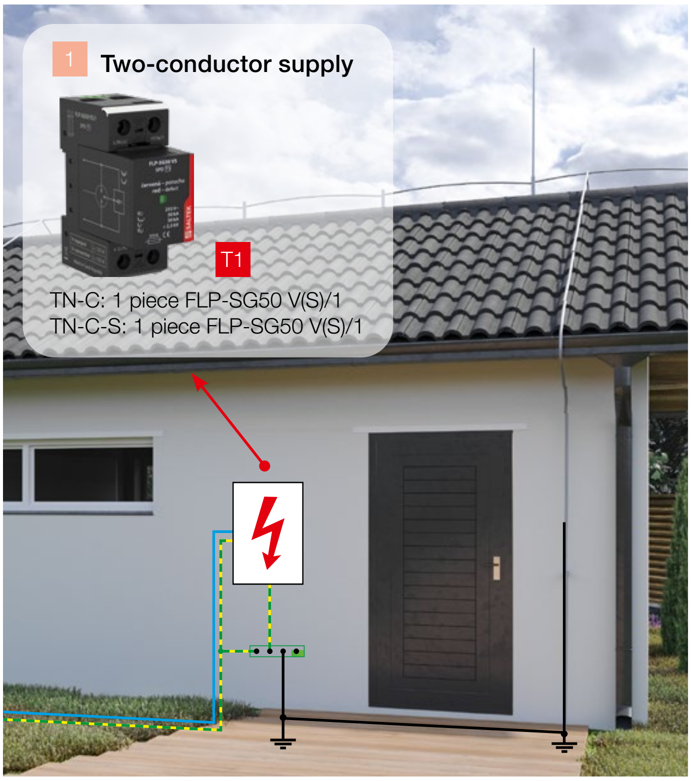
Administrative and commercial premises

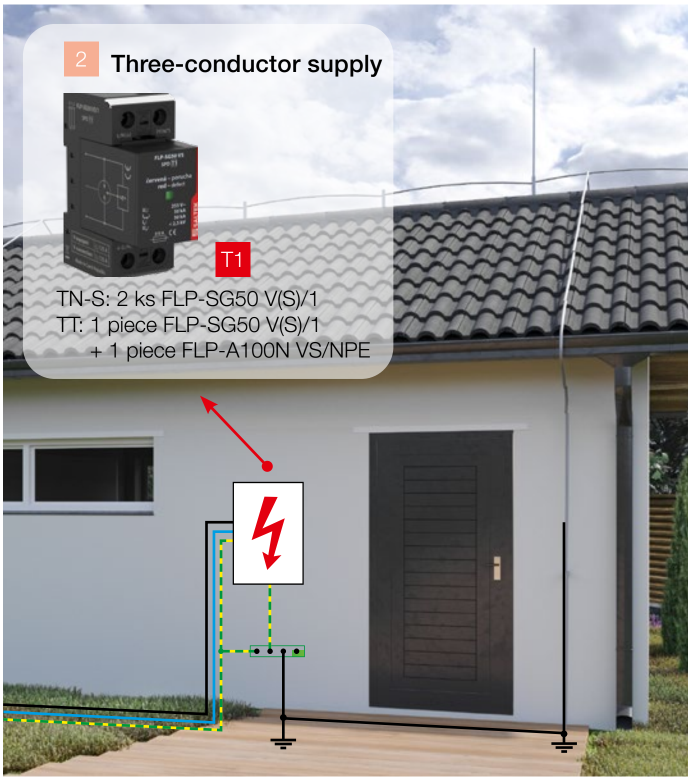

T3
SWITCHBOARD
DA-275-DF16
A-275-DF16
T2
SUB-DISTRIBUTION BOARD
TN-S: SLP-275 V/3+1
TT: SLP-275 V/3+1
T3
PLC SWITCHBOARD
TN-S: DA-275-DF16
TT: DA-275-DF16
T3
PLC SWITCHBOARD
TN-S: DA-275-DF16
TT: DA-275-DF16
T1 T2
MAIN SWITCHBOARD
OF PRODUCTION PART
TN-C: FLP-B+C MAXI V(S)/3
TN-C-S: FLP-B+C MAXI V(S)/3
TN-S: FLP-B+C MAXI V(S)/4
TT: FLP-B+C MAXI V(S)/3+1
T3
CONTROL PANEL OF
THE PRODUCTION LINE
TN-S: DA-275-DF16
TT: DA-275-DF16
T2
SUB-DISTRIBUTION
BOARD
TN-S: SLP-275 V/3+1
TT: SLP-275 V/3+1
T3
TECHNOLOGY
SWITCHBOARD
TN-S: DA-275-DF16
TT: DA-275-DF16

12 Building with LPS and air conditioner or heating cables in gutters



13 House with a single-phase power supply and LPS (LPL I)

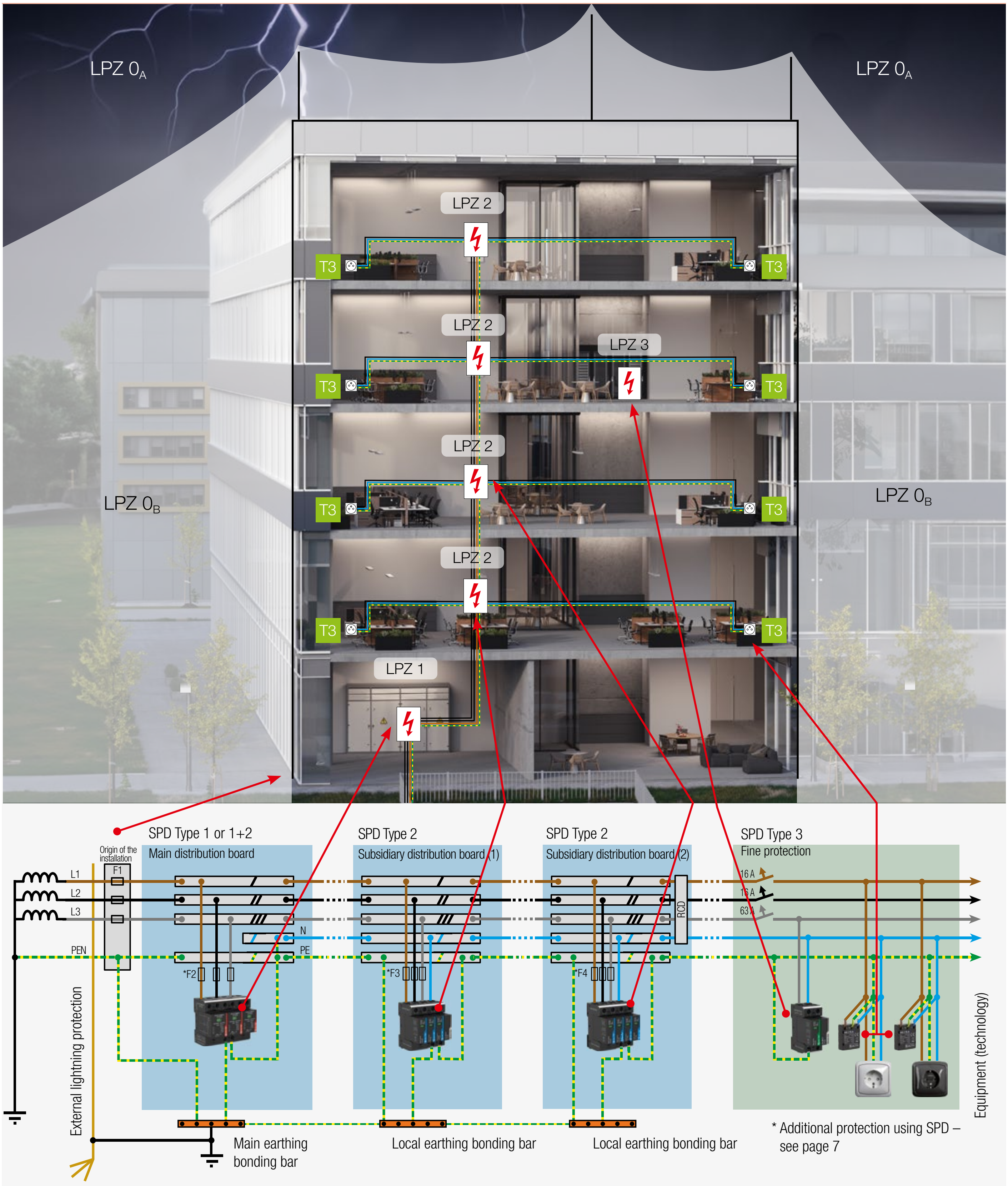




Reduction of overvoltage in LPZ zones

The principle of voltage reduction using zones lies in progressive reduction of the overvoltage level to a safe value that will not damage the specific equipment or technology.

To obtain a safe overvoltage value, the whole structure is divided into individual zones and the SPD is installed at the boundary between the zones.



SPD mounting – principles

Principle 1 – length of connecting conductors

If you want to protect equipment, there are several things to remember when installing an SPD, i.e., apart from its diverting ability, it is the maximum value of voltage protective level to be withheld by the equipment at its terminals considering the installation method. Protection level U_p and the drop in voltage at the supply conductors ΔU must not exceed the withstand voltage at the terminals of the equipment.

Fig. 11 clearly shows that the aggregate protection level is given by adding partial reductions in voltage, while such a sum must not exceed 80% of the withstand voltage U_w at the terminals of the equipment.

$$U_w > U_p + \Delta U_1 + \Delta U_2$$

where U_w … withstand voltage
U_p … voltage protection level
ΔU_1, ΔU_2 … reduction in voltage at the supply conductor.

The impedance of supply conductors for high frequency currents is approximately 1 µH per 1 m of conductor length.

The voltage drop in this conductor is given by the formula:

$$\Delta U = L \times di/dt$$

So with a steepness of the pulse rise time of 1 kA/µs, there is a reduction of 1,000 V per 1 m of length, which is added to the protection voltage level of the SPD itself. With the total length of supply conductors being 0.5 m, 500 V will be added to the protection voltage level U. Consequently, the length of the supply conductors must be as short as possible and should not exceed an aggregate length of 0.5 m, as shown in the following figures *(Fig. 12 and Fig. 13)*, depicting the connection options.

Fig. 11

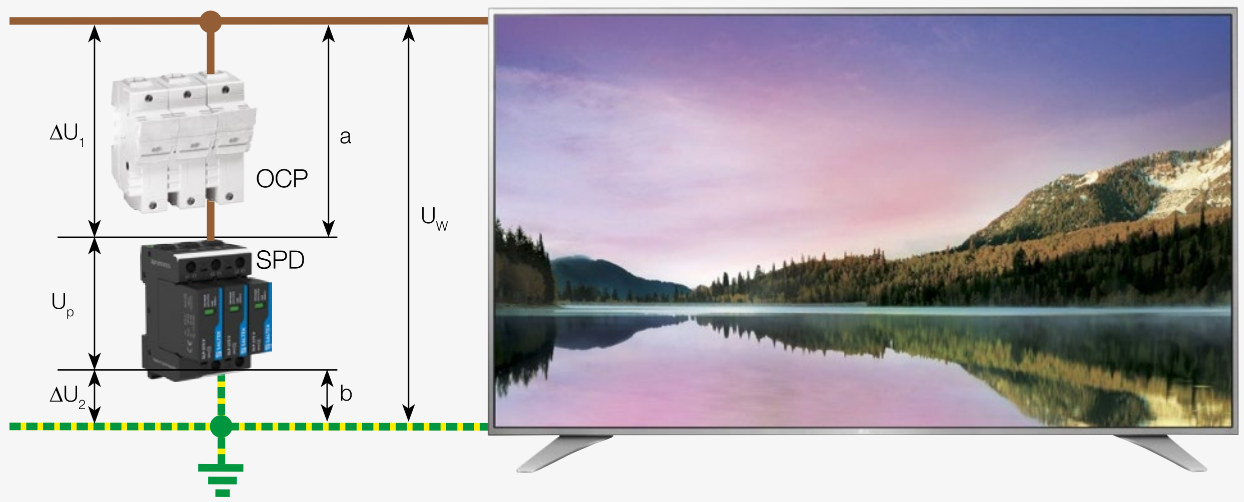


Fig. 12

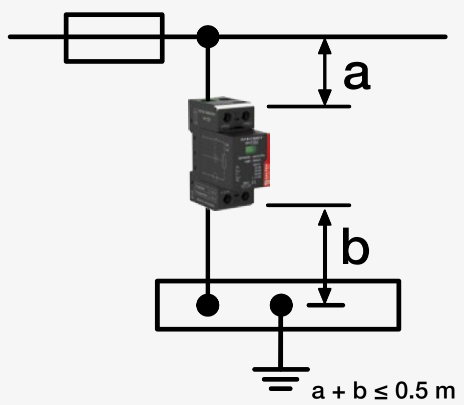
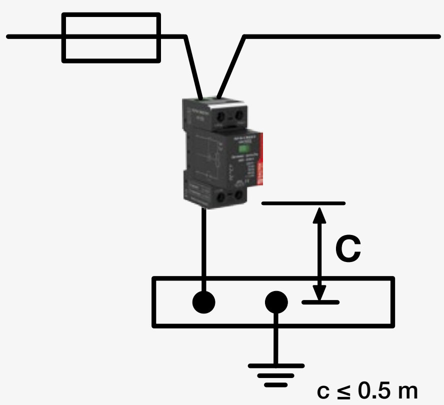
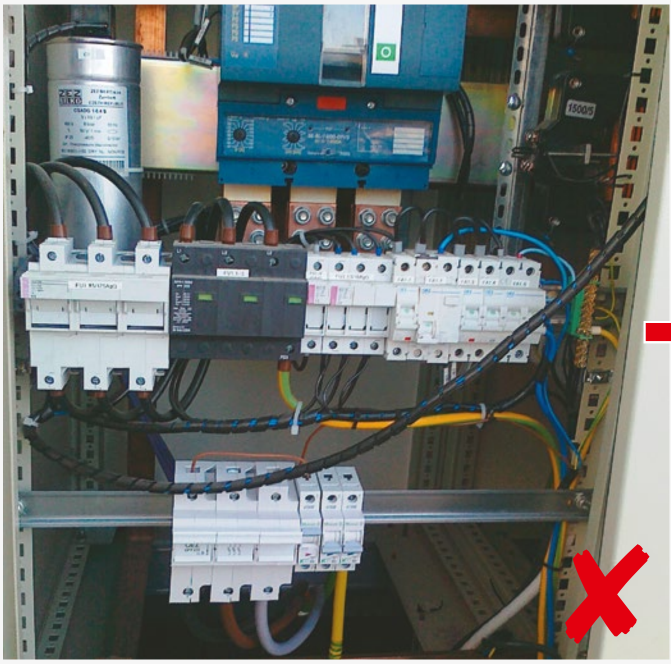


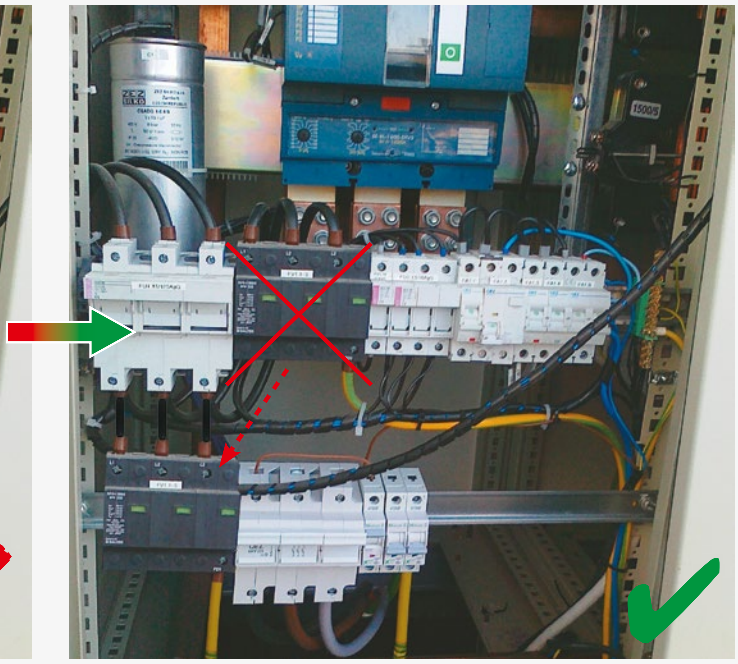
Fig. 13



The two pictures below illustrate how the stipulated conductor length of ≤ 0.5 m to connect the SPD can be met in practice.

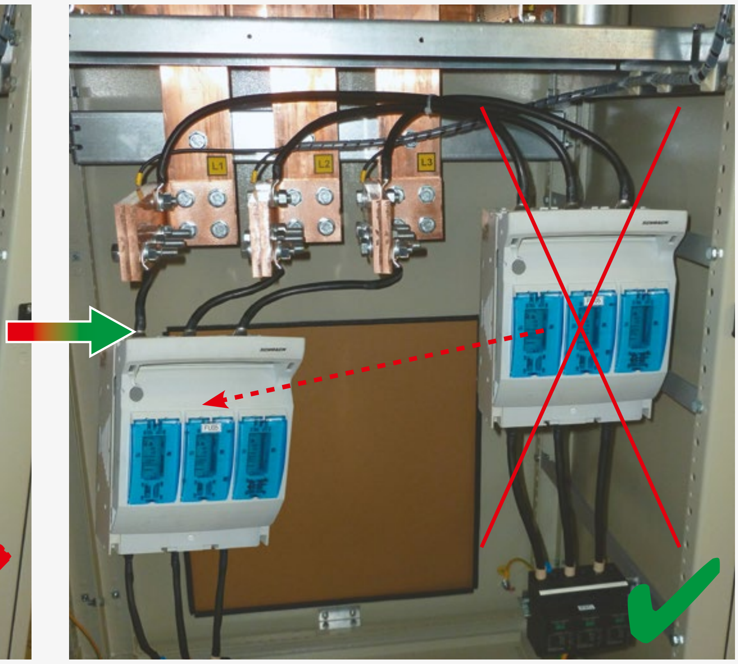


Before the intervention: The SPD installation fails to meet the condition as regards the length of supply conductors for the SPD



After the intervention: By relocating the SPD the condition above will be satisfied.

Before the intervention: The SPD installation fails to meet the condition as regards the length of supply conductors

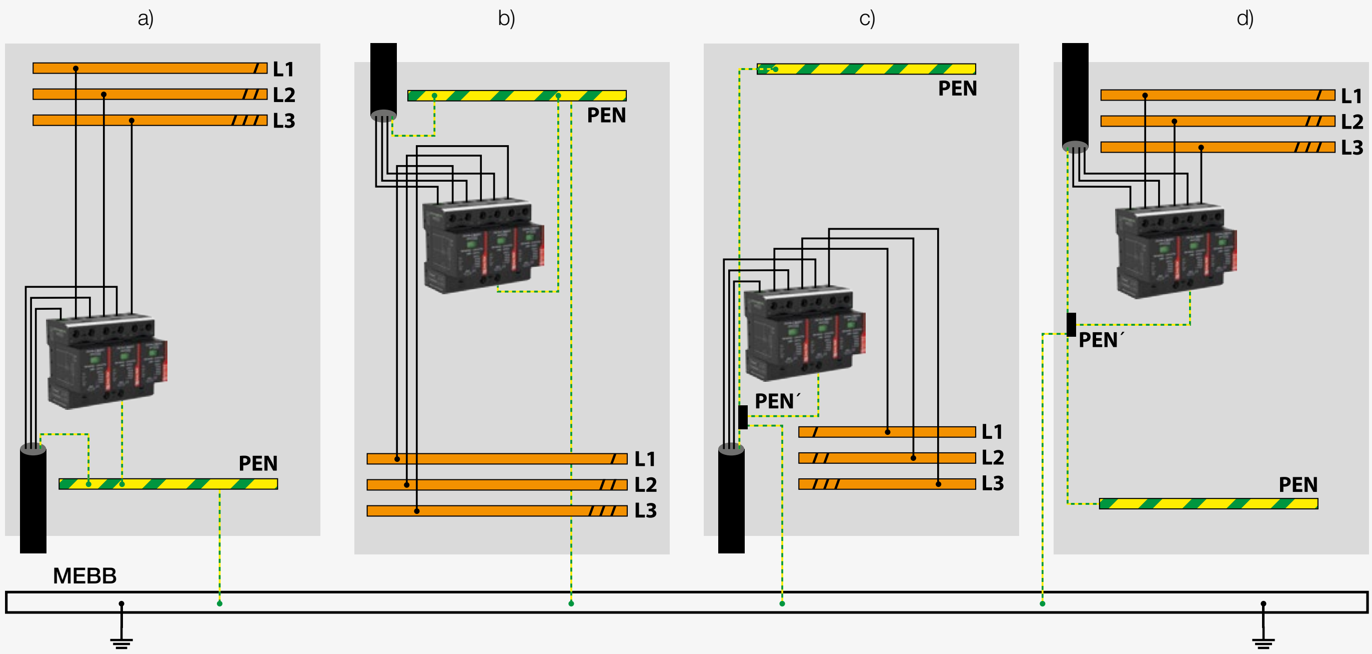


After the intervention: By relocating the SPD the condition will be satisfied

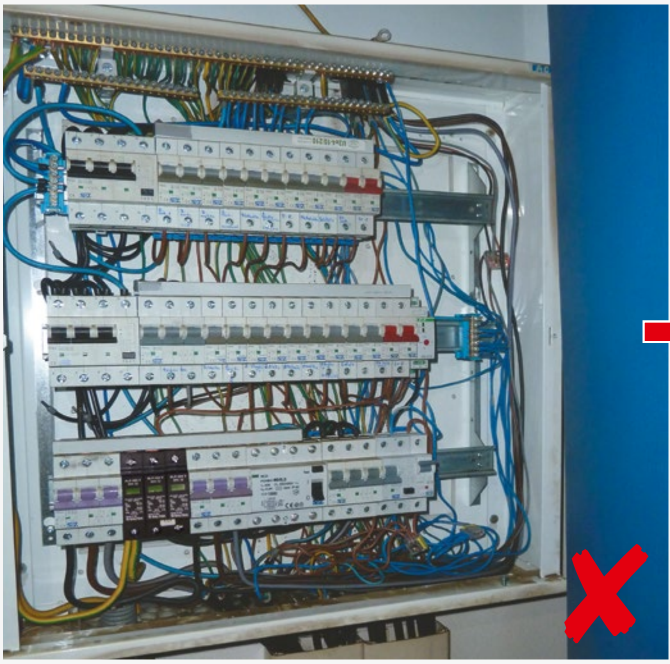
Principle 2 – Locating the SPD in the distribution board

An SPD in the distribution board is located at the entry of the customer´s structure, to eliminate as early as possible any surges entering the supply line, and to prevent their effects on appliances installed in the distribution board. It makes sure the unprotected conductors (affected by overvoltage) are kept as short as possible and the overvoltage that could be induced in conductors protected by the SPD is minimized. Basic options are shown in *Fig. 14*.

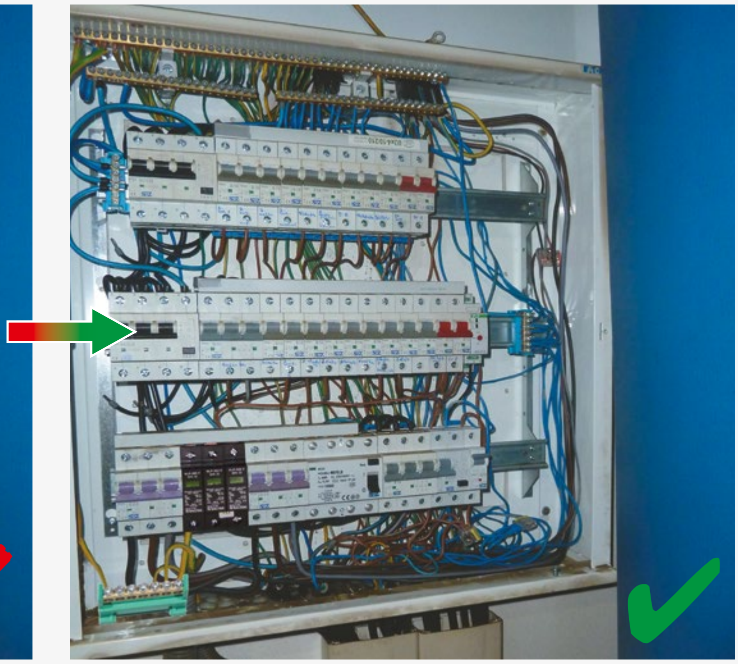
Fig. 14



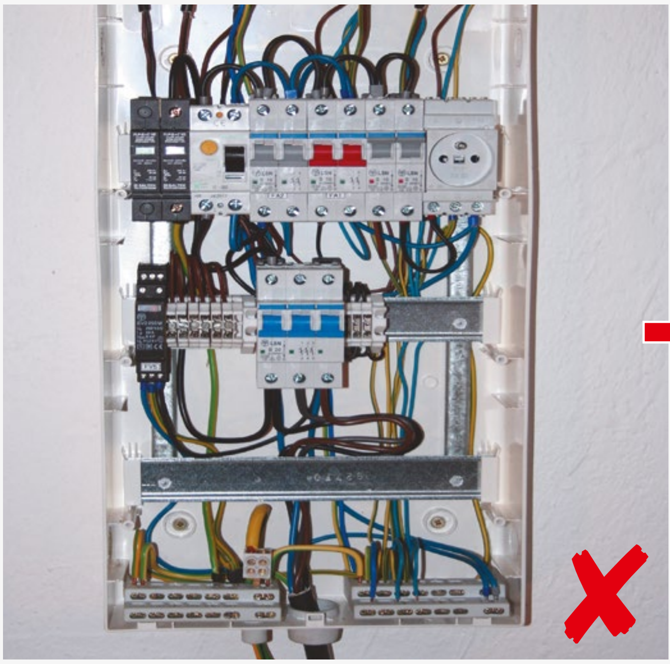
The next figure shows the practical implementation of the c) option displayed in *Fig. 14*.



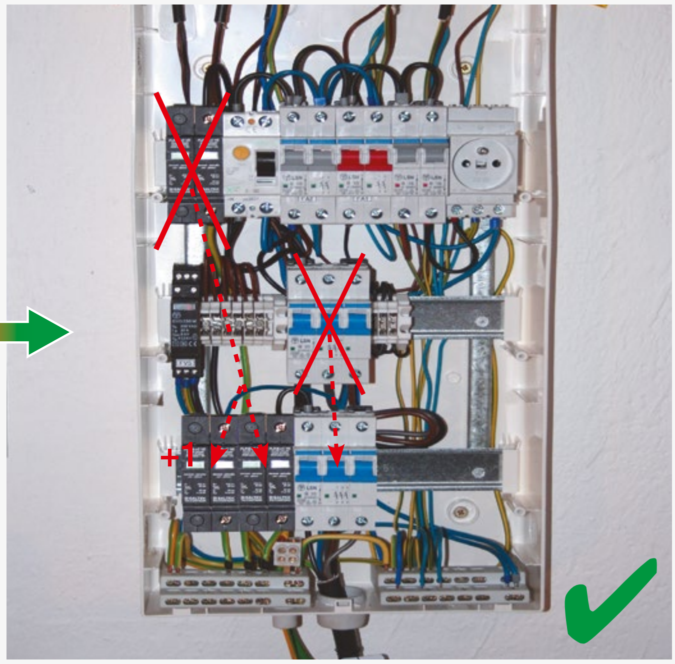
Before the intervention: The SPD installation fails to meet the condition as regards the length of supply conductors for the SPD



After the intervention: By adding a terminal block and connecting a PEN conductor, these conditions will be satisfied



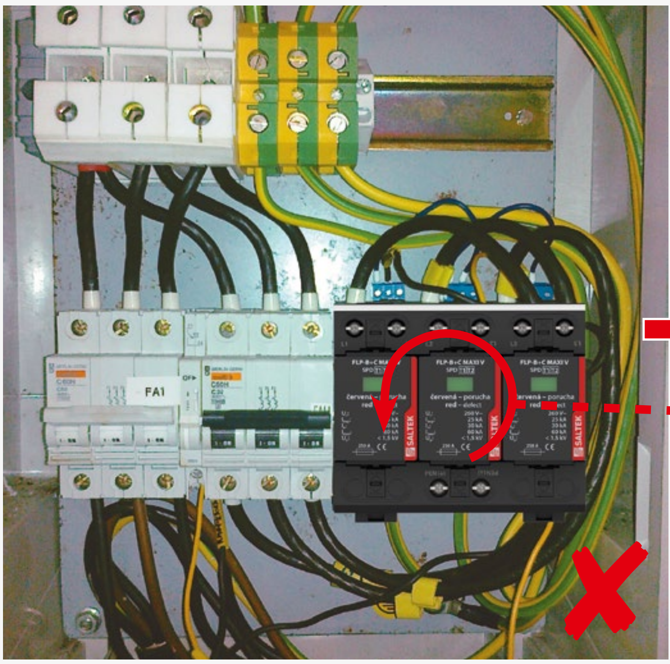
Before the intervention: The SPD installation fails to meet the condition as regards the length of supply conductors for the SPD and also the SPD connection for the TN-S system



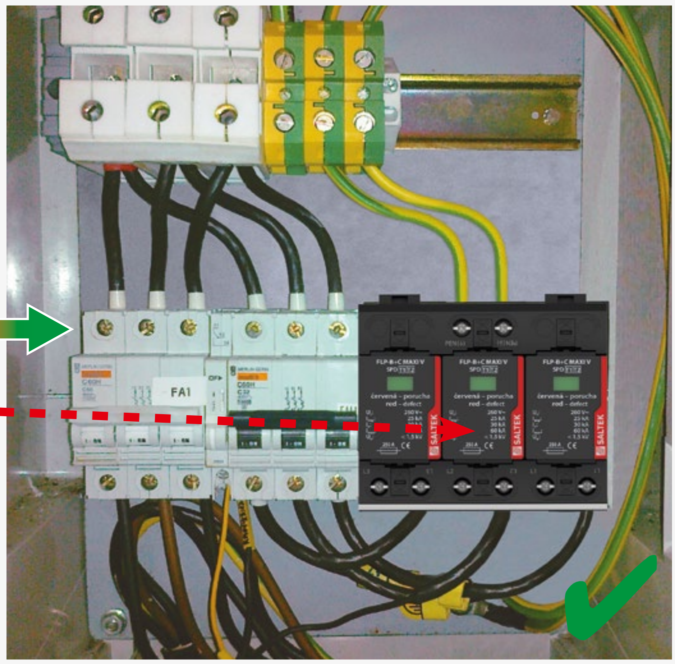
After the intervention: By relocating the circuit breaker and the SPD, the conditions will be satisfied; and by adding one more SPD the N conductor will also be protected.

Principle 3 – loops

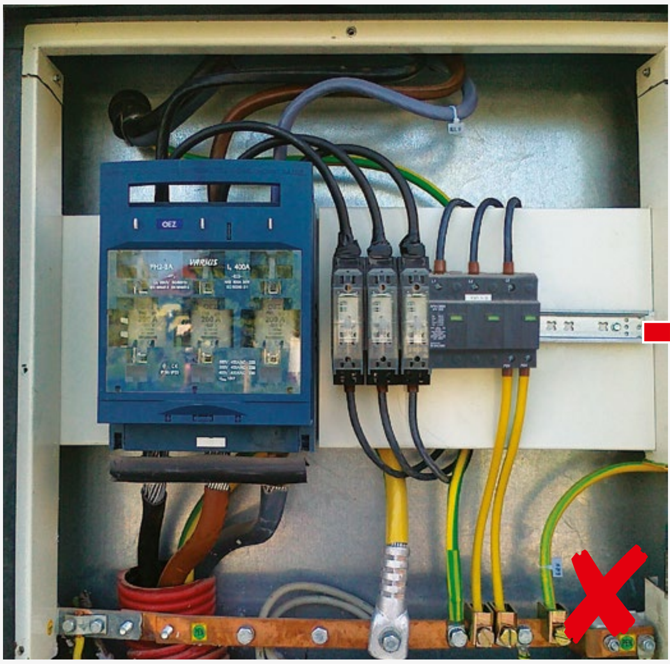
To minimize the overvoltage induced in a loop and to considerably reduce the effects of such overvoltages on other equipment connected in the distribution board, the surface of the loop consisting of the L, N and PE conductors must be kept as small as possible. The principle of minimizing the loop is shown in *Fig. 14* and the following examples.



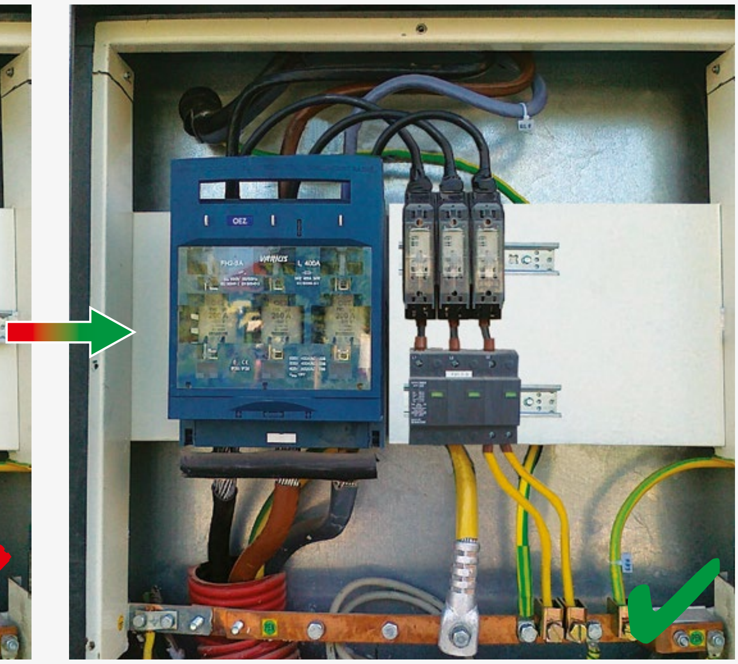
Before the intervention



After the intervention: By turning the SPD, the hardwiring in the distribution board will be better arranged and, at the same time, the condition from IEC 61643-12/2008 (CLC/TS 61643-12/2009) concerning loops will be satisfied



Before the intervention



After the intervention: By relocating the SPD, the hardwiring in the distribution board will be better arranged, the condition concerning loops specified in IEC 61643-12/2008 (CLC/TS 61643-12/2009) will be satisfied and, at the same time, the condition stipulating the length of supply conductors for the SPD will be met as well

Principle 4 – conductor routing in the distribution board

When routing the conductors in the distribution board it is always necessary to separate protected („clean“) from unprotected („dirty“) conductors. To minimise the bonding between the different types of conductors („clean“ and „dirty“), it is essential to keep the distance between them as great as possible (over 30 cm). If such a distance is impossible to observe, a protective partition should be placed between them, see *Fig. 15*.

If you cannot avoid crossing of protected and unprotected conductors, the crossing should be made at a right angle to prevent induction of interference pulses in the protected conductors, as shown in *Fig. 16.*

Fig. 15

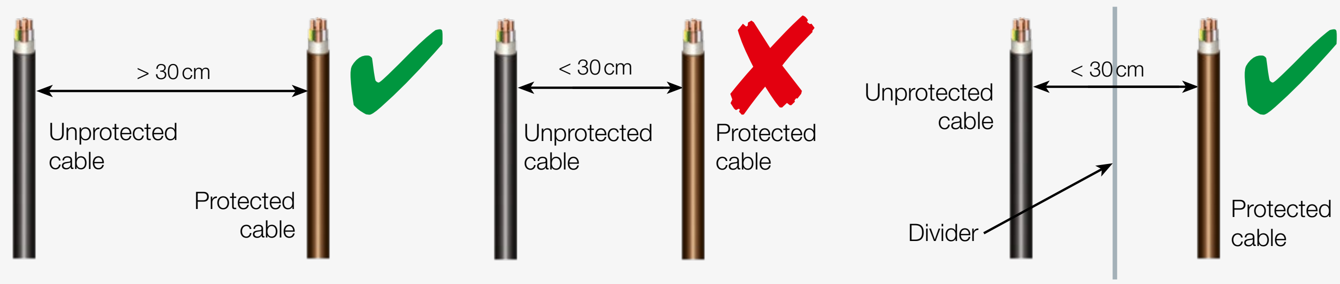
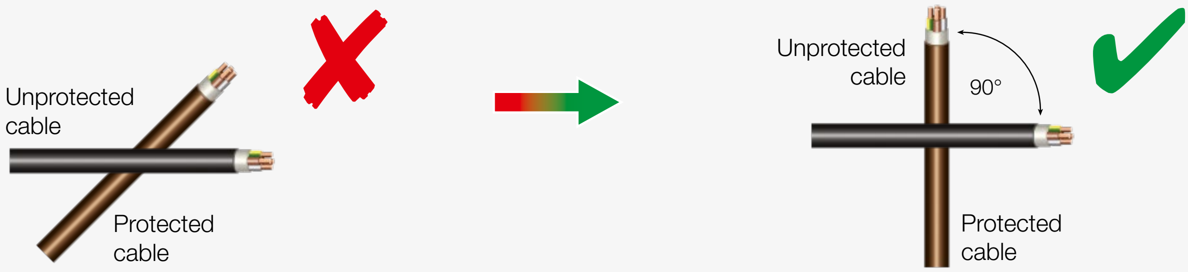


Fig. 16



Coordination of SALTEK SPDs Rules

To achieve correct operation of individual SPD protection levels, specific distances should be observed between them. A general solution is shown in *Fig. 17* and *Fig. 19. Fig. 18* shows incorrect coordination between the individual SPDs.

Should it be impossible to observe the coordination distances between the specific protection levels, the distance can be extended using coordination RTO impedances. These coordination impedances must be sized to the current flowing through the line. This can be established from the value of the circuit protection.

Since the usage of RTOs appears rather problematic for higher currents of long duration when the distances between the respective stages are not adhered to, it is the reason why coordinated SPDs of Type 1 with the corresponding SPD Type 2 are used.

Fig. 17

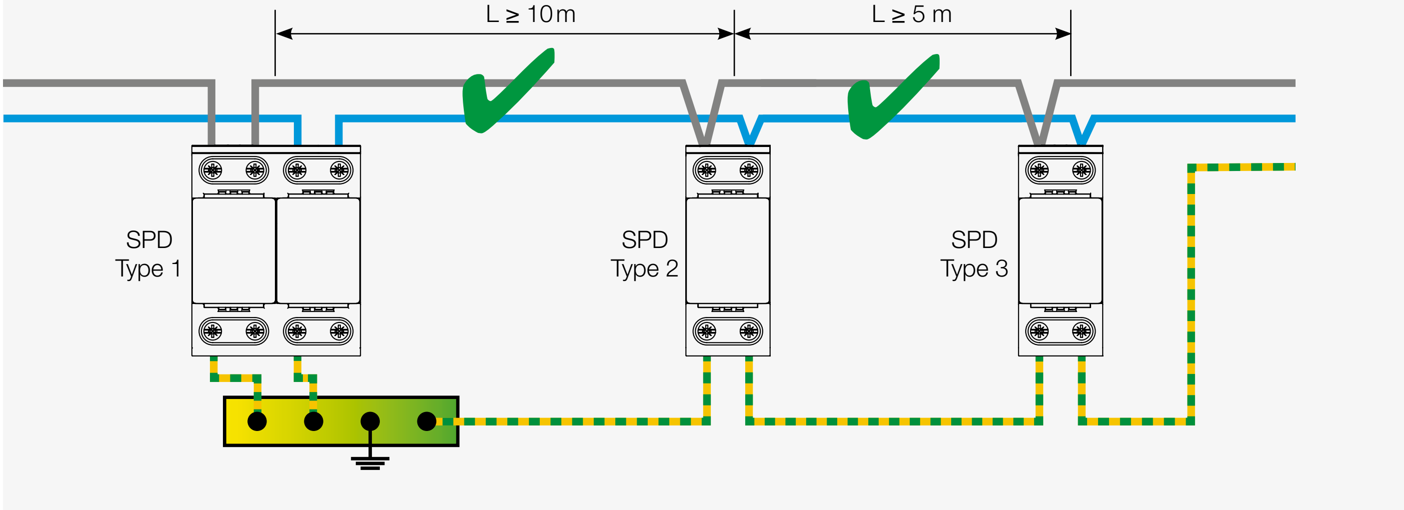
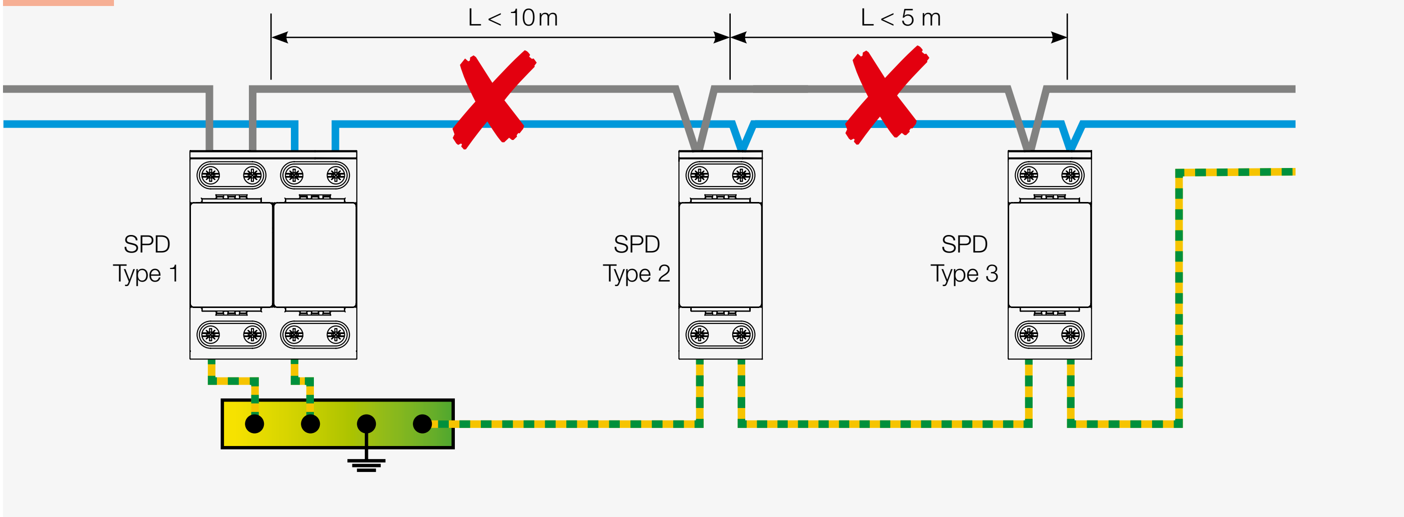


Fig. 18



See following figures for coordination of specific SPD Type 1 and SPD Type 2 by Saltek. If lightning arrester FLP-SG50 V/1 is used as an SPD Type 1 and SLP-275 V is used as an SPD Type 2, it will not be necessary to keep the distance between them in excess of 10 m since they are mutually coordinated and can be mounted next to each other *(see Fig. 20)*. The same conditions apply to FLP-B+C MAXI V and FLP-25-T1-V.

Also for correct operation of the stages of the SPD Type 2 and SPD Type 3, minimum distances need to be adhered to. Again, a general design is shown in *Fig. 17* and *Fig. 19*, and wrong coordination is shown in *Fig. 18*. Should no co-ordination distance can be maintained between SPD Type 2 and SPD Type 3, the distance can be again increased using the RTO coordination impedances, see *Fig. 19*. The co-ordination impedances need to be rated to the line current.

Fig. 19

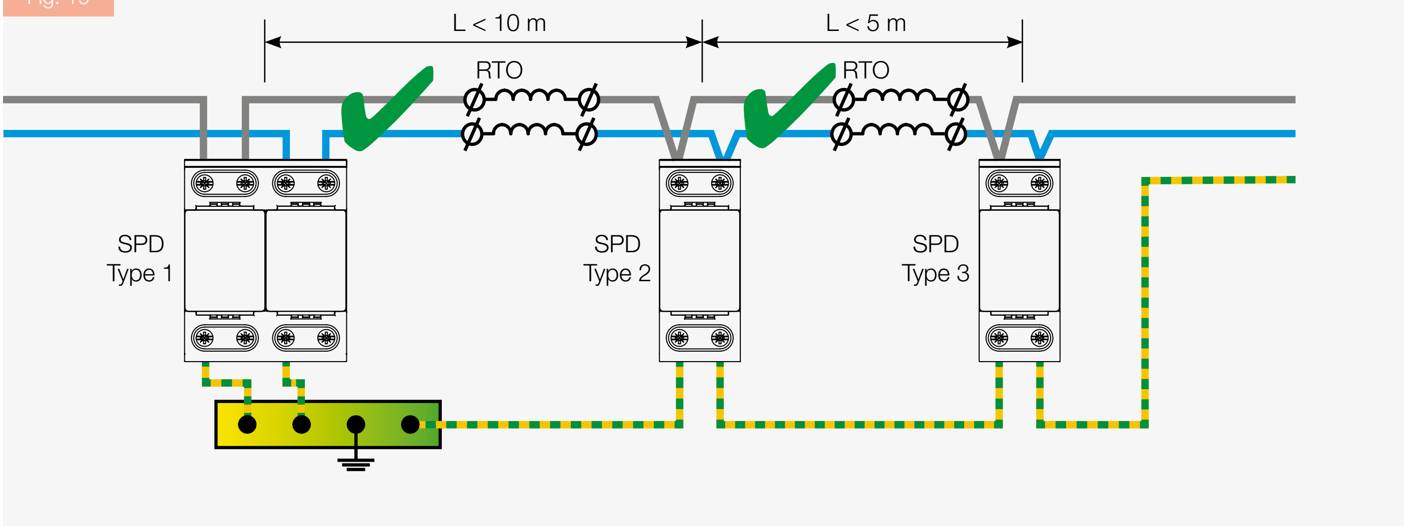
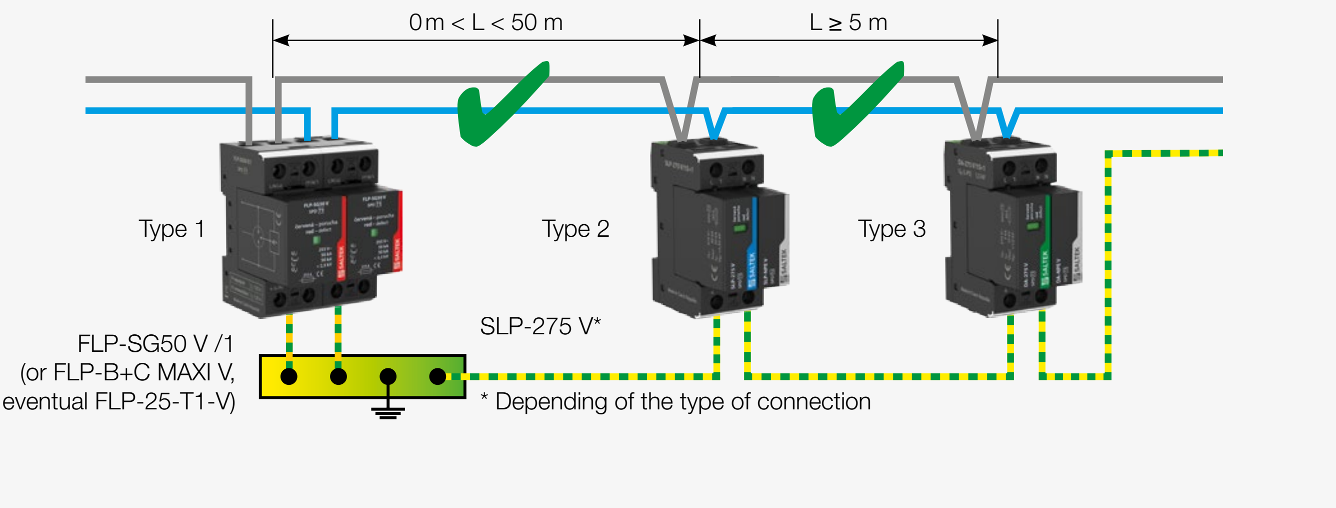


Fig. 20



Relation between distance and selection of SPD

Since there are situations in practice where the equipment to be protected is connected directly from the main distribution board and the technology distribution board finds itself usually at a distance of tens of meters, it is advisable to install an SPD in the technology distribution board to cope with overvoltage as well as different earth potentials that might occur there, particularly if the earthing (equipotential bonding) is not completely all the way through. Consequently, an SPD Type 1+2, featuring a diverting ability of I_n = 30 kA (8/20 μs), should be installed in the position of the SPD Type 2, whose diverting ability is I_n = 20 kA (8/20 μs), to work I_n this case as a strong SPD Type 2 *(see Fig. 21–22 and Fig. 23–24)*. For more information see the table "SALTEK SPD applications in LV distribution systems", pages 31–32.

Fig. 21

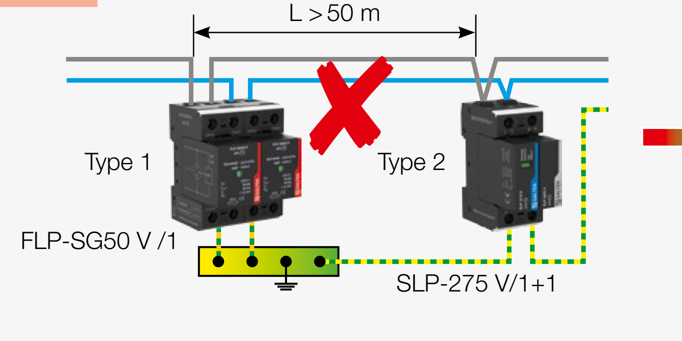


Fig. 22

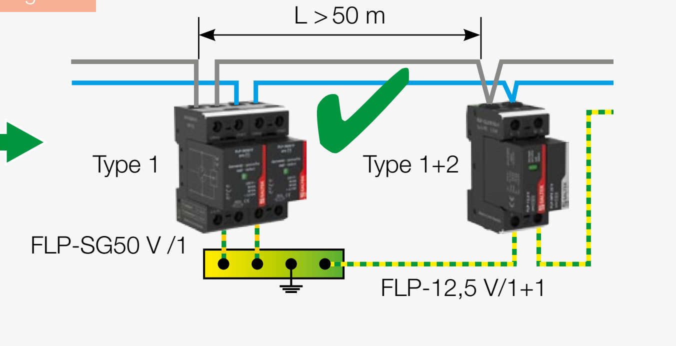


Fig. 23

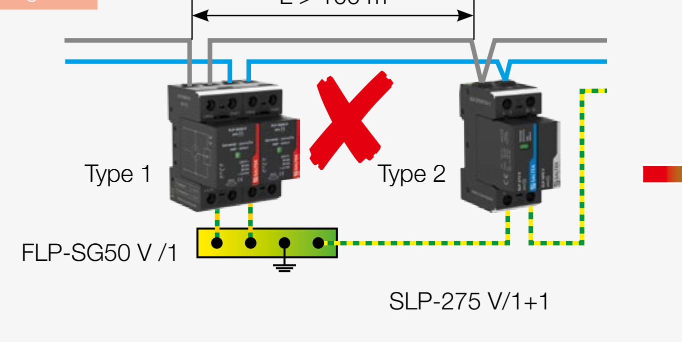
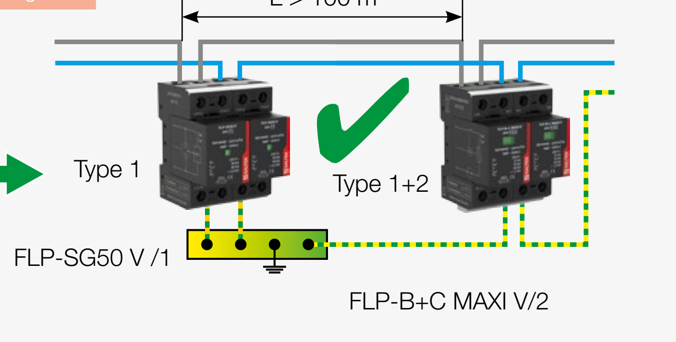


Fig. 24



Protective distance

To protect specific equipment, an SPD should be installed as close as possible to the protected equipment. If the distances between the SPDs or that between the SPD and the protected equipment are too long, voltages cause by oscillation phenomena may appear on the line which can destroy either the connected equipment or cause the breakdown of power line insulation. These oscillations can even double the U_p protection voltage level. The doubling effect occurs if the equipment is disconnected inside or its input impedance is high. If the distance between the SPD and the protected equipment is L ≤ 10 m, the oscillations disturbing signals need not be taken into consideration. If the distance is great (L >> 10 m), remember to install an additional SPD *(see Fig. 25–26 and Fig. 27–28)*.

Fig. 25

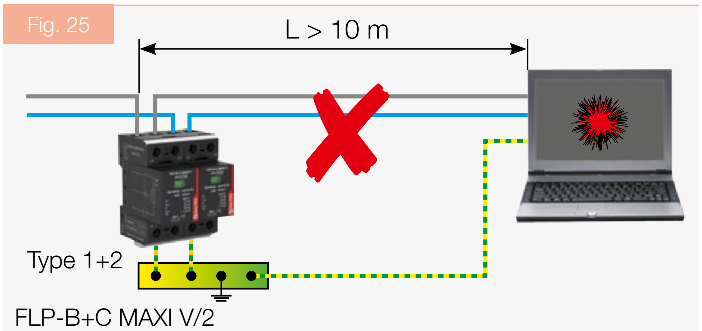


Fig. 26

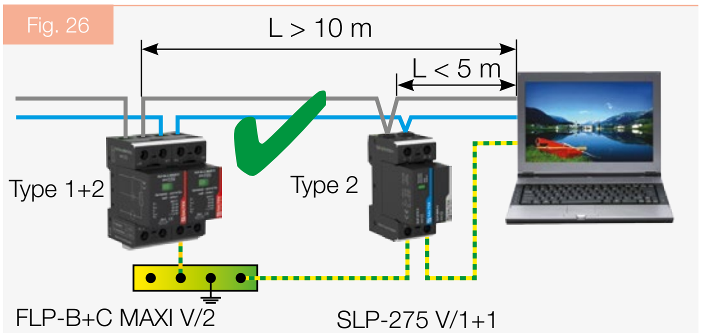


Fig. 27

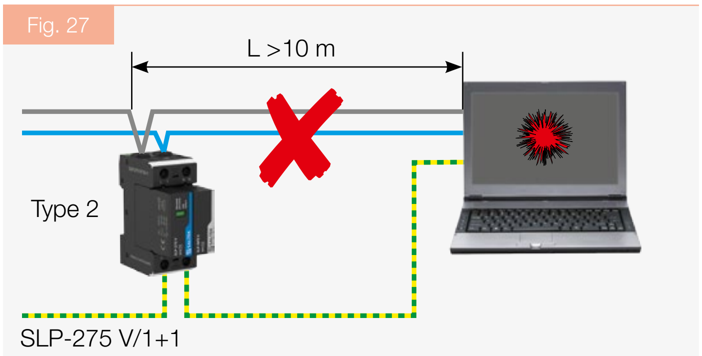
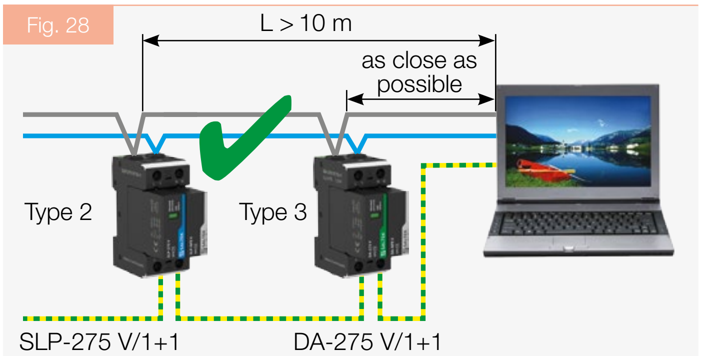


Fig. 28



In the practice, the protective distance of the SPD always decreases due to voltages induced by lightning currents or the switching of burdens connected in the loop circuit. This is why the distance between an SPD and the technology should never exceed 5 m.

This is of particular importance in protecting highly sensitive equipment, such as electronic security systems, electronic fire signalling systems, PLC and other processor-controlled technology that is also prone to induced switching overvoltage. Such overvoltage with a very short duration (in μs) and a small pulse amplitude (hundreds of volts) would pass up to the equipment, which maybe will not destroy it but may cause the processor to freeze or damage or erase memory chips or impair the functionality of the equipment. Hence, an SPD Type 3 with a RFi filter, able to cope with this problem, should be installed in these cases. An example of the connection of an SPD Type 3 with a RFi filter is shown in *Fig. 29* and *Fig. 30*.

Fig. 29

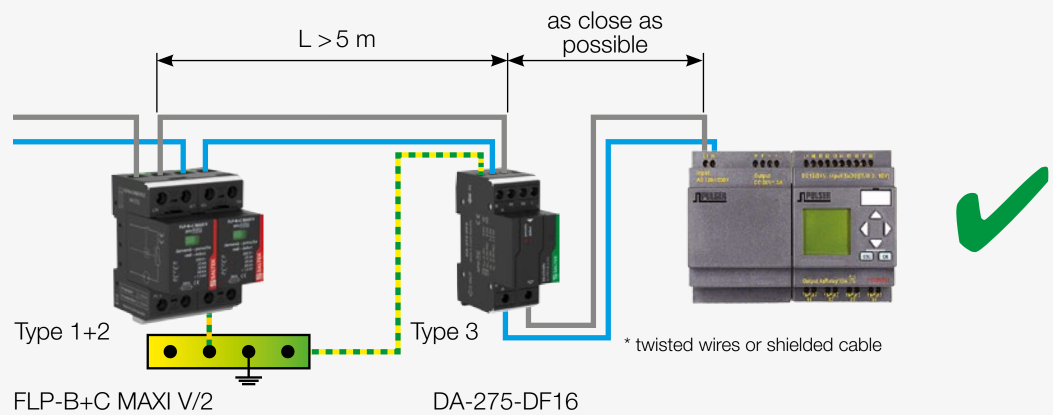
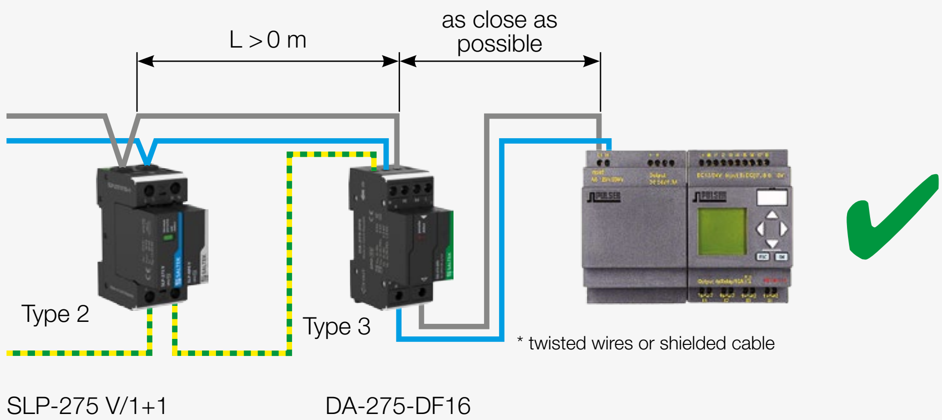


Fig. 30



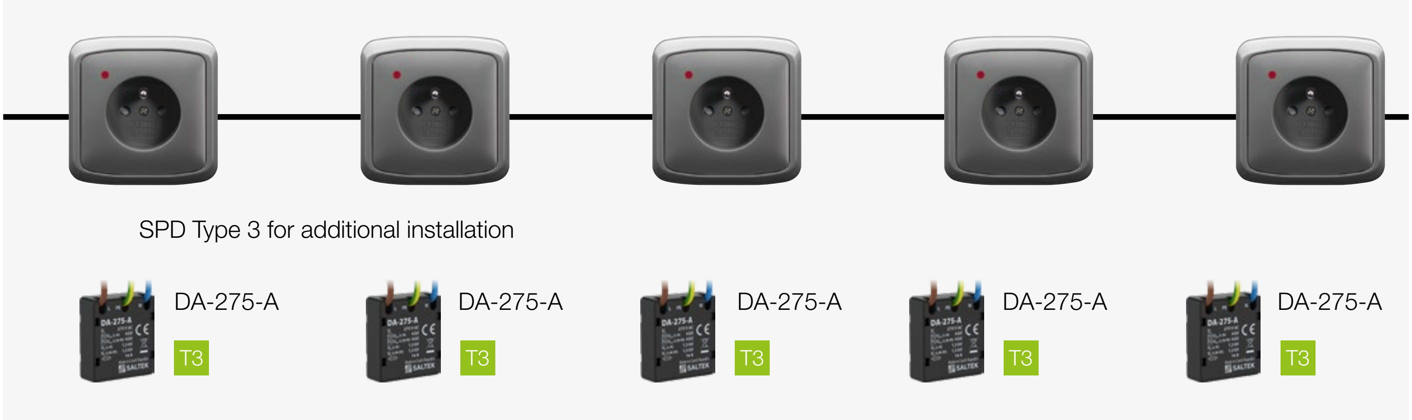
Socket circuits with SPD Type 3

Consideration should be taken regarding socket circuits, which are usually very long and are used in different situations. The protective distance of an SPD Type 3 in cabled socket circuits amounts to 5 m, at maximum, as shown in *Fig. 32*.

To ensure correct functioning of an SPD Type 3, both protection levels – SPD Type 1 and SPD Type 2 – should be mounted upstream.

Socket circuitry featuring all sockets either with integrated SPD Type 3 protection or available with SPD Type 3 protection for additional installation *(see Fig. 31)*, is always used in heavily disturbed environments, or places with a larger number of electrical appliances installed. Laboratories are a typical example of such environment.

Fig. 31 A socket with integrated SPD Type 3



In order to reduce the number of SPD Type 3 in the socket circuitry, protective distances between the SPDs Type 3 of less than 5 m are used as standard. In these cases it is not necessary to equip all sockets with SPD Type 3 protection. The basic principle to follow in this method of installing an SPD Type 3 is that the SPD must always be installed at the first socket in the socket circuit; the protective distance principle for SPD Type 3, as shown in *Fig. 32*, can be applied only after that. *Fig. 33* shows an example of incorrect application of the protective distance. The principle of protective distance cannot be applied to situations where one side of the wall features a socket circuit with, for example, a down conductor bar or an unprotected ascending LV line situated on the other side of the wall. All sockets installed at this place should be provided with an SPD Type 3, as shown in *Fig. 34* and *Fig. 35*.

Fig. 32

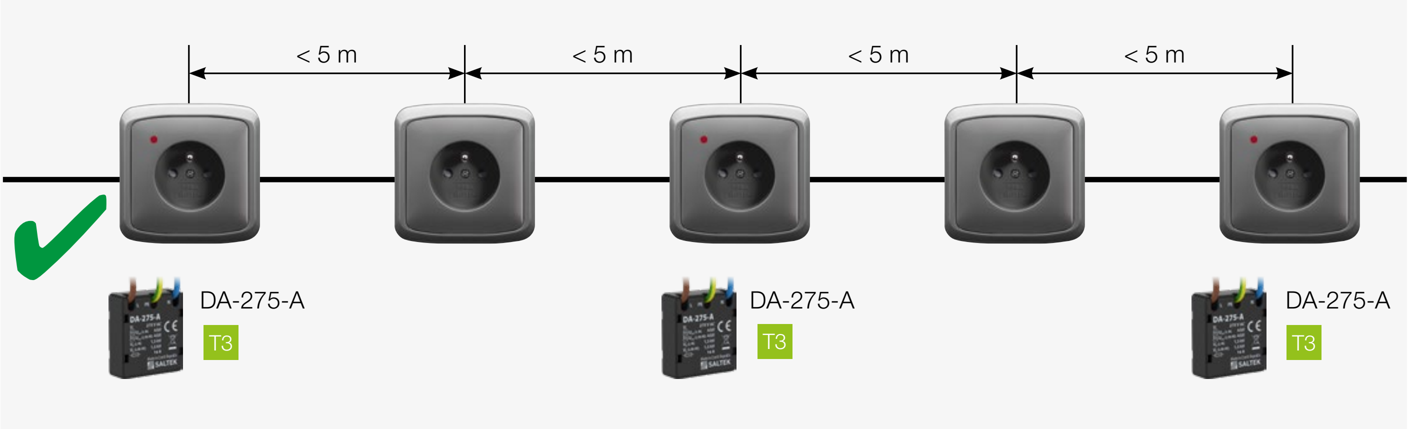
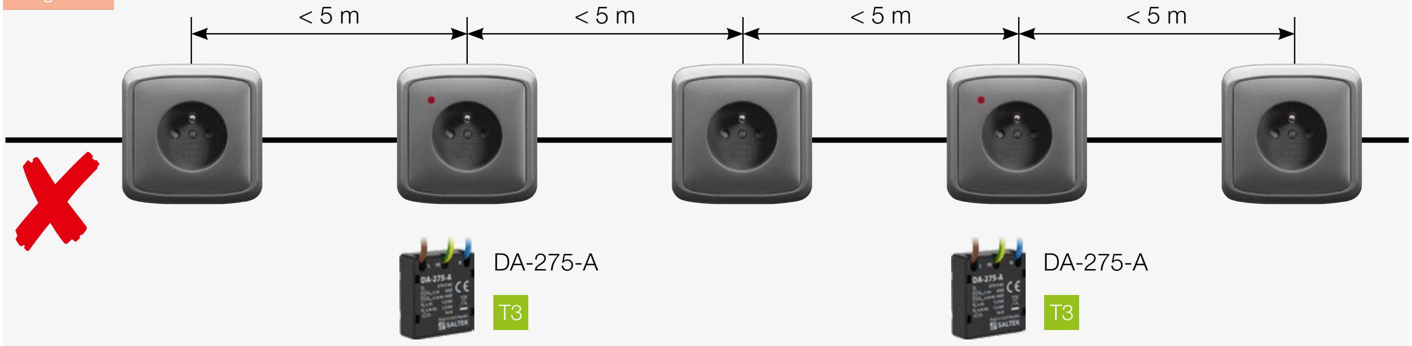


Fig. 33



If this principle is not observed, the problem located at the LV line bar will manifest itself in the socket circuit and will damage the equipment connected to the specific socket. Administrative buildings feature a great number of socket circuits with many sockets. To reduce the number of SPDs in such cases, not only the protective distance for the SPD Type 3 is used, but also so-called installations in groups, as shown in the following examples. If distances between individual groups exceed 5 m, as shown in *Fig. 36*, the passage socket group must be provided with an SPD Type 3 at the first and last socket.

Fig. 34

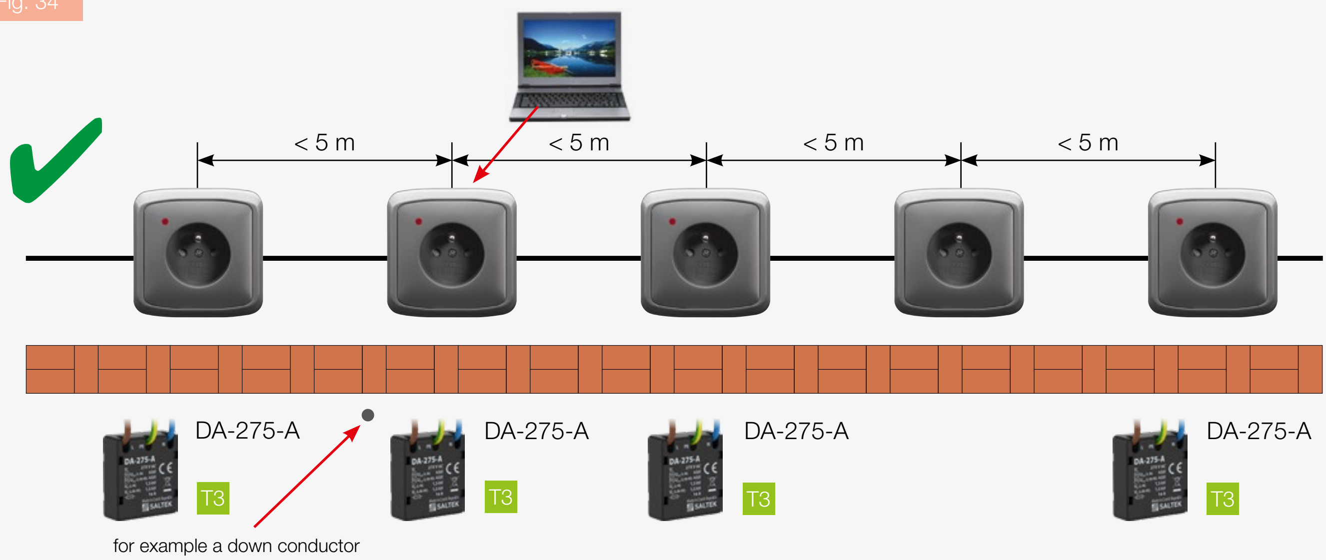


Fig. 35

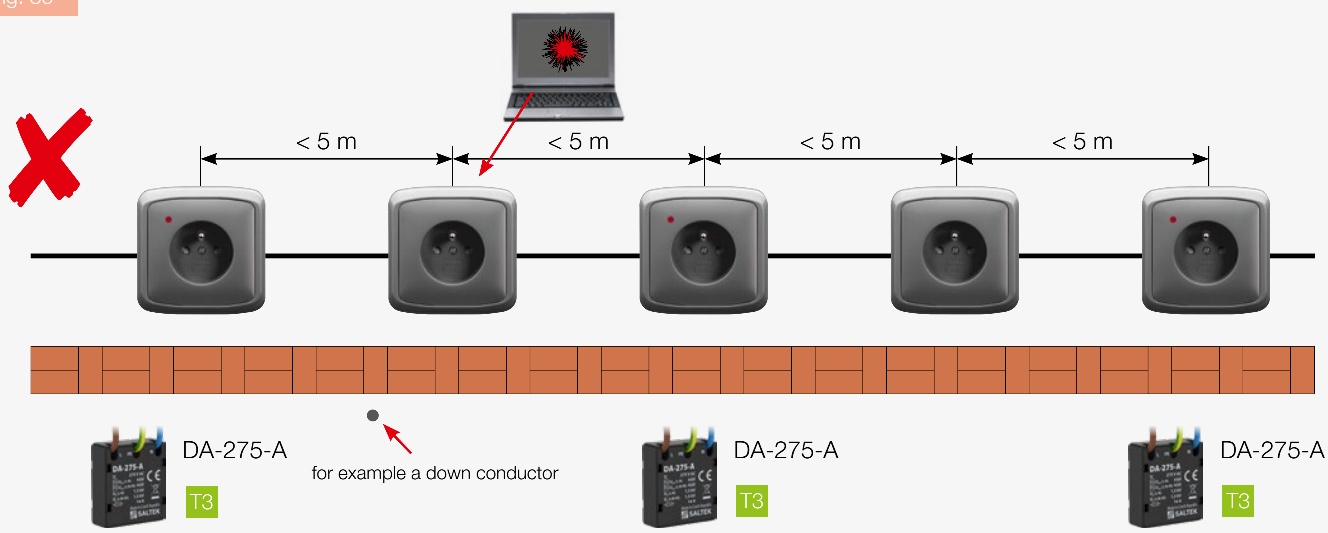


Fig. 36

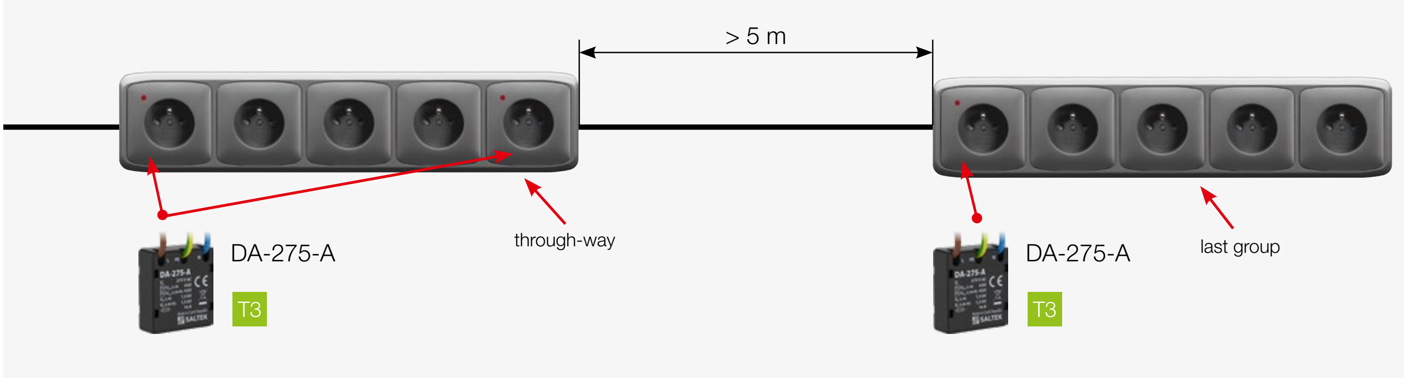


Fig. 37

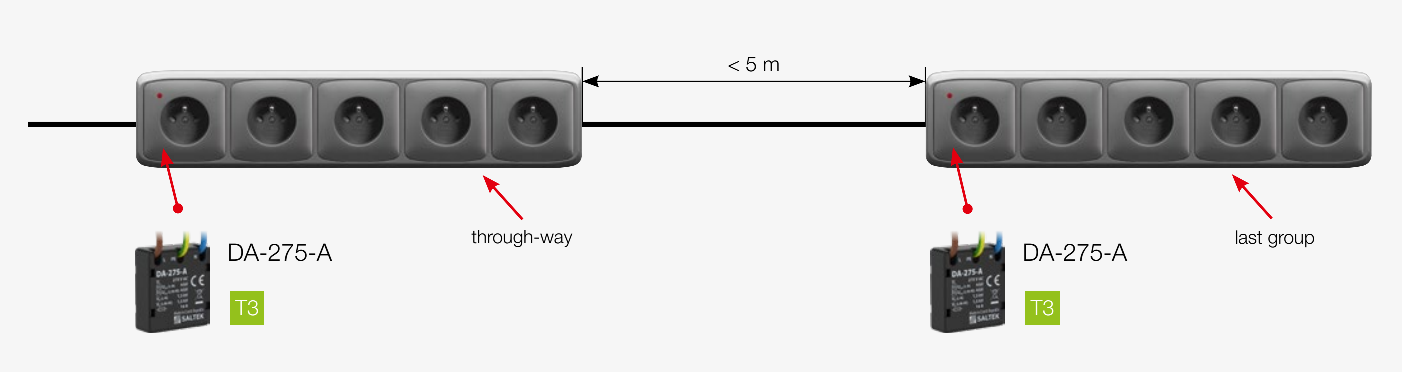
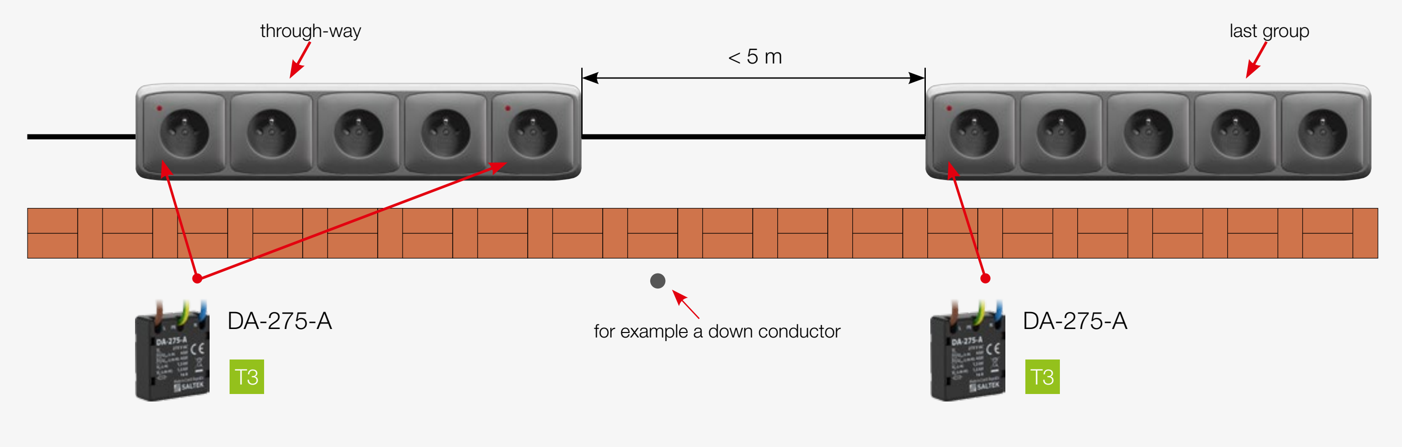


Fig. 38



If the group is not a through-way group, an SPD Type 3 should always be installed at the first socket. Should the distance between individual socket groups be less than 5 m, then the property of the SPD protective distance can be used and the no an SPD Type 3 will be mounted on the through-way group - see *Fig. 37*. The principle of protective distance cannot be applied in situations where the distance between two groups is less than 5 m, and, for example, a down lead or an unprotected LV line is located on the other side of the wall. It is necessary in this case that the last socket of the through-way group be provided with an SPD Type 3. This option is shown in *Fig. 38*.

SALTEK® SPD applications in LV distribution systems

Type of structure	system	main distribution board (in the structure)	sub-distribution board (in the same structure)	end consumer
Family houses, administrative buildings, technological units, industrial structures	3-ph. TN-C	**FLP-B+C MAXI V(S)/3** **FLP-25-T1-V(S)/3** back-up fuse > 250 A **FLP-25-T1-VSF/3**	**SLP-275 V/3 (S)** distance > 50 m **FLP-12,5 V/3 (S)** distance > 100 m **FLP-B+C MAXI V(S)/3**	distance > 5 m surge protection to DIN rail: **DA-275 V/1(S)+1** (up to 63 A) **DA-275 V/3(S)+1** (up to 63 A) **DA-275-DJ25-(S)** (25 A) surge protection to DIN rail with RFi filter: **DA-275-DFx-(S)** (x = 2, 6, 10, 16 A) **DA-275 DF25** for 25 A **DA-275-DFix** (x = 6, 10, 16 A) **RACK-PROTECTOR** multiple sockets for 19" enclosures **DA-275 CZS** **DA-275-A, DA-275-S** for additional assembly to sockets and appliances
		FLP-B+C MAXI V(S)/3 **FLP-25-T1-V(S)/3 + SLP-275 V/3 (S)** (also with terminals to the equipment) back-up fuse > 250 A **FLP-B+C-MAXI-VSF/3**	**SLP-275 V/3 (S)** distance > 50 m **FLP-12,5 V/3 (S)** distance > 100 m **FLP-B+C-MAXI V(S)/3**	
	3-ph. TN-S	**FLP-B+C MAXI V(S)/4** **FLP-25-T1-V(S)/4** back-up fuse > 250 A **FLP-25-T1-VSF/4**	**SLP-275 V/4 (S)** distance > 50 m **FLP-12,5 V/4 (S)** distance > 100 m **FLP-B+C MAXI V(S)/4**	
		FLP-B+C MAXI V(S)/4 **FLP-25-T1-V(S)/4 + SLP-275 V/4 (S)** (also with terminals to the equipment) back-up fuse > 250 A **FLP-B+C-MAXI-VSF/4**	**SLP-275 V/4 (S)** distance > 50 m **FLP-12,5 V/4 (S)** distance > 100 m **FLP-B+C-MAXI V(S)/4**	
	3-ph. TN-C-S	**FLP-B+C MAXI V(S)/3** **FLP-25-T1-V(S)/3** back-up fuse > 250 A **FLP-25-T1-VSF/3**	**SLP-275 V/4 (S)** distance > 50 m **FLP-12,5 V/4 (S)** distance > 100 m **FLP-B+C MAXI V(S)/4**	
		FLP-B+C MAXI V(S)/3 **FLP-25-T1-V(S)/3 + SLP-275 V/3 (S)** (also with terminals to the equipment) back-up fuse > 250 A **FLP-B+C-MAXI-VSF/3**	**SLP-275 V/4 (S)** distance > 50 m **FLP-12,5 V/4 (S)** distance > 100 m **FLP-B+C-MAXI V(S)/4**	
Blocks of flats with 12 or more apartments (SPD located in the apartment distribution boards)	3-ph. TN-C	division in the apartment distr. board	**FLP-12,5 V/3 (S)**	
	3-ph. TN-S		**FLP-12,5 V/4 (S)**	
	3-ph. TN-C-S		**FLP-12,5 V/3 (S)**	
	1-ph. TN-C		**FLP-B+C MAXI V(S)/1**	
	1-ph. TN-S		**FLP-12,5 V/2 (S)**	
Demanding applications (structures – operations classified at the risk of explosion, chemical plants…, structures of a very high importance)	3-ph. TN-C	**3× FLP-SG50 V(S)/1** with terminals to the equipment **3× FLP-SG50 V(S)/1 + 1× SLP-275 V/3 (S)**	**SLP-275 V/3 (S)** distance > 50 m **FLP-12,5 V/3 (S)** distance > 100 m **FLP-B+C MAXI V(S)/3**	distance < 5 m place before the surge protection RTO-xx (xx – rated current 16, 35 or 63 A) number acording to connection 1-phase TN-C **1x RTO-xx** 1-phase TN-S **2x RTO-xx** 3-phase TN-C **3x RTO-xx** 3-phase TN-S **4x RTO-xx**
	3-ph. TN-S	**4× FLP-SG50 V(S)/1** with terminals to the equipment **4× FLP-SG50 V(S)/1 + 1× SLP-275 V/4 (S)**	**SLP-275 V/4 (S)** distance > 50 m **FLP-12,5 V/4 (S)** distance > 100 m **FLP-B+C MAXI V(S)/4**	
	3-ph. TN-C-S	division in the main distribution board **3× FLP-SG50 V(S)/1** with terminals to the equipment **3× FLP-SG50 V(S)/1 + 1× SLP-275 V/4 (S)**	**SLP-275 V/4 (S)** distance > 50 m **FLP-12,5 V/4 (S)** distance > 100 m **FLP-B+C MAXI V(S)/4**	

SALTEK® SPD applications in LV distribution systems

Type of structure	system	main distribution board (in the structure)	sub-distribution board (in the same structure)	end consumer
Structures equipped with ESE (active down conductor)	3-ph. TN-C	**3x FLP-SG50 V(S)/1**	**SLP-275 V/3 (S)**	distance > 5 m surge protection to DIN rail: **DA-275 V/1(S)+1** (up to 63 A) **DA-275 V/3(S)+1** (up to 63 A) **DA-275-DJ-25-(S)** (25 A) surge protection to DIN rail with RFi filter: **DA-275-DFx-(S)** (x = 2, 6, 10, 16 A) **DA-275 DF25** for 25 A **DA-275-DFix** (x = 6, 10, 16 A) **RACK-PROTECTOR** multiple sockets for 19" enclosures **DA-275 CZS** **DA-275-A, DA-275-S** for additional mounting to sockets and appliances
			distance > 50 m **FLP-12,5 V/3 (S)**	
			distance > 100 m **FLP-B+C MAXI V(S)/3**	
		3x FLP-SG50 V(S)/1	**SLP-275 V/3 (S)**	
		i s vývody k zařízení **3x FLP-SG50 V(S)/1** + **SLP-275 V/3 (S)**	**SLP-275 V/3 (S)**	
			distance > 50 m **FLP-12,5 V/3 (S)**	
			distance > 100 m **FLP-B+C MAXI V(S)/3**	
	3-ph. TN-S	**4x FLP-SG50 V(S)/1**	**SLP-275 V/4 (S)**	
			distance > 50 m **FLP-12,5 V/4 (S)**	
			distance > 100 m **FLP-B+C MAXI V(S)/4**	
		4x FLP-SG50 V(S)/1	**SLP-275 V/4 (S)**	
		also with terminals to the equipment **4x FLP-SG50 V(S)/1 + SLP-275 V/4 (S)**	**SLP-275 V/4 (S)**	
			distance > 50 m **FLP-12,5 V/4 (S)**	
			distance > 100 m **FLP-B+C MAXI V(S)/4**	
	3-ph. TN-C-S	**3x FLP-SG50 V(S)/1**	**SLP-275 V/4 (S)**	
			distance > 50 m **FLP-12,5 V/4 (S)**	
			distance > 100 m **FLP-B+C MAXI V(S)/4**	
		3x FLP-SG50 V(S)/1	**SLP-275 V/4 (S)**	
		also with terminals to the equipment **3x FLP-SG50 V(S)/1 + SLP-275 V/3 (S)**	**SLP-275 V/4 (S)**	
			distance > 50 m **FLP-12,5 V/4 (S)**	
			distance > 100 m **FLP-B+C MAXI V(S)/4**	
Technological equipment with 1-phase connection	1-ph. TN-C	**FLP-SG50 V(S)/1** with terminals to the equipment **FLP-SG50 V(S)/1 + SLP-275 V/1 (S)**	**SLP-275 V/1 (S)**	distance < 5 m SPD back-up RTO-xx (xx – rated current 16, 35 or 63 A) number acording to connection 1-phase TN-C **1x RTO-xx** 1-phase TN-S **2x RTO-xx** 3-phase TN-C **3x RTO-xx** 3-phase TN-S **4x RTO-xx**
			distance > 50 m **FLP-12,5 V/1 (S)**	
			distance > 100 m **FLP-B+C MAXI V(S)/1**	
	1-ph. TN-S	**2x FLP-SG50 V(S)/1** with terminals to the equipment **2x FLP-SG50 V(S)/1 + 1x SLP-275 V/2 (S)**	**SLP-275 V/2 (S)**	
			distance > 50 m **FLP-12,5 V/2 (S)**	
			distance > 100 m **FLP-B+C MAXI V(S)/2**	
	1-ph. TN-C-S	division in the main distribution board **FLP-SG50 V(S)/1** with terminals to the equipment **FLP-SG50 V(S)/1 + SLP-275 V/1 (S)**	**SLP-275 V/2 (S)**	
			distance > 50 m **FLP-12,5 V/2 (S)**	
			distance > 100 m **FLP-B+C MAXI V(S)/2**	

SPDs connected to LV power supply systems up to 1 000 V

Lightning current arresters (SPD Type 1), spark-gap based

A high-performance spark gap specified for using in LV installations at the boundary of the LPZ 0 and LPZ 1 zones. Surge protection indirect as well as indirect lightning strikes in the hardest application in heavy, chemical and energy industry. Coordination with SPD Type 2 (SLP-275 V) without coupling impedances.

FLP-SG50 V(S)/1

- Pluggable module
- Visual fault signalling
- Module locking
- Optional remote fault signalling (S)
- $U_p \leq 2.5$ kV

Type	Connection	Suitable networks	U_c	I_{imp} (10/350 µs)	I_{fi}	Remote signalling	Ordering number
FLP-SG50 V/1	1+0	TN, TT	255 V AC	50 kA	50 kA	No	A04054
FLP-SG50 VS/1	1+0	TN, TT	255 V AC	50 kA	50 kA	Yes	A04053

Lightning current arresters (SPD Type 1), spark-gap for N-PE

A spark gap for N-PE with a replaceable module for using in LV installations, at the boundary of the LPZ 0 and LPZ 1 zones. Surge protection in direct as well as indirect lightning strikes. ATTENTION! Only for wiring between N and PE!

FLP-A…N VS/NPE

- Pluggable module
- Pluggable module
- Optional remote fault signalling (S)
- $U_p \leq 1,5$ kV

Type	Connection	Suitable networks	U_c	I_{imp} (10/350 µs)	I_n (8/20 µs)	I_{max} (8/20 µs)	Remote signalling	Ordering number
FLP-A50N VS/NPE	1+1	TT	255 V AC	50 kA	50 kA	100 kA	Yes	A03573
FLP-A100N VS/NPE	3+1	TT	255 V AC	100 kA	100 kA	100 kA	Yes	A03574

SPDs connected to LV power supply systems up to 1 000 V

Lightning current arresters (SPD Type 1), serial combination MOV+GDT

Very high-performance lightning current arresters for LV installations at the boundary of the LPZ 0 and LPZ 1 zones or higher. For protection in direct as well as indirect lightning strikes. For using in a variety of installations, for family houses, office and industrial buildings, or in sub-distribution boards of large buildings. Coordination with SPD Type 2 (SLP-275 V) without coupling impedances. No leakage current. No follow current. Optional **integrated back-up fuse**.

FLP-25-T1-V(S)/…

- Pluggable module
- Visual fault signalling
- Module locking
- Optional remote fault signalling (S)
- $U_p \leq 1.5$ kV

Type	Connection	Suitable networks	U_c	I_{imp} (10/350 µs)	Remote signalling	Ordering number
FLP-25-T1-V/1	1+0	TN-C	260 V AC	25 kA	No	A06263
FLP-25-T1-VS/1	1+0	TN-C	260 V AC	25 kA	Yes	A06264
FLP-25-T1-V/1+1	1+1	TT	260 V AC	25 kA	No	A06257
FLP-25-T1-VS/1+1	1+1	TT	260 V AC	25 kA	Yes	A06258
FLP-25-T1-V/2	2+0	TN-S	260 V AC	25 kA	No	A06259
FLP-25-T1-VS/2	2+0	TN-S	260 V AC	25 kA	Yes	A06260
FLP-25-T1-V/3	3+0	TN-C	260 V AC	25 kA	No	A05300
FLP-25-T1-VS/3	3+0	TN-C	260 V AC	25 kA	Yes	A05301
FLP-25-T1-V/3+1	3+1	TT	260 V AC	25 kA	No	A05304
FLP-25-T1-VS/3+1	3+1	TT	260 V AC	25 kA	Yes	A05305
FLP-25-T1-V/4	4+0	TN-S	260 V AC	25 kA	No	A05302
FLP-25-T1-VS/4	4+0	TN-S	260 V AC	25 kA	Yes	A05303

FLP-25-T1-VSF/...

- **With integrated backup fuse**
- Visual fault signalling
- Module locking
- Remote fault signalling
- $U_p < 1.5$ kV

Type	Connection	Suitable networks	U_c	I_{imp} (10/350 µs)	Remote signalling	Ordering number
FLP-25-T1-VSF/1	1+0	TN-C	260 V AC	25 kA	Yes	A07112
FLP-25-T1-VSF/3	3+0	TN-C	260 V AC	25 kA	Yes	A07113
FLP-25-T1-VSF/3+1	3+1	TT	260 V AC	25 kA	Yes	A07114
FLP-25-T1-VSF/4	4+0	TN-S	260 V AC	25 kA	Yes	A07115

SPDs connected to LV power supply systems up to 1 000 V

Lightning current arresters and surge arresters (SPD Type 1 and 2), serial combination MOV+GDT

Very high-performance lightning current arresters for LV installations at the boundary of the LPZ 0 and LPZ 1 zones or higher. For protection in direct as well as indirect lightning strikes. For using in a variety of installations, for family houses, office and industrial buildings, or in sub-distribution boards of large builings. No leakage current. No follow current. Optional **integrated back-up fuse**.

FLP-B+C MAXI V(S)/...

- Pluggable module
- Visual fault signalling
- Module locking
- Optional remote fault signalling (S)
- $U_p \leq 1.5$ kV

Type	Connection	Suitable networks	U_c	I_{imp} (10/350 µs)	I_n (8/20 µs)	I_{max} (8/20 µs)	Remote signalling	Ordering number
FLP-B+C MAXI V/1	1+0	TN	260 V AC	25 kA	30 kA	60 kA	No	A05091
FLP-B+C MAXI VS/1	1+0	TN	260 V AC	25 kA	30 kA	60 kA	Yes	A03533
FLP-B+C MAXI V/1+1	1+1	TT	260 V AC	25 kA	30 kA	60 kA	No	A05095
FLP-B+C MAXI VS/1+1	1+1	TT	260 V AC	25 kA	30 kA	60 kA	Yes	A03783
FLP-B+C MAXI V/2	2+0	TN-S	260 V AC	25 kA	30 kA	60 kA	No	A05092
FLP-B+C MAXI VS/2	2+0	TN-S	260 V AC	25 kA	30 kA	60 kA	Yes	A03784
FLP-B+C MAXI V/3	3+0	TN-C	260 V AC	25 kA	30 kA	60 kA	No	A05093
FLP-B+C MAXI VS/3	3+0	TN-C	260 V AC	25 kA	30 kA	60 kA	Yes	A03570
FLP-B+C MAXI V/3+1	3+1	TT	260 V AC	25 kA	30 kA	60 kA	No	A05096
FLP-B+C MAXI VS/3+1	3+1	TT	260 V AC	25 kA	30 kA	60 kA	Yes	A03572
FLP-B+C MAXI V/4	4+0	TN-S	260 V AC	25 kA	30 kA	60 kA	No	A05094
FLP-B+C MAXI VS/4	4+0	TN-S	260 V AC	25 kA	30 kA	60 kA	Yes	A03571

FLP-B+C-MAXI-VSF/...

- **With integrated backup fuse**
- Visual fault signalling
- Module locking
- Remote fault signalling
- $U_p < 1.5$ kV

Type	Connection	Suitable networks	U_c	I_{imp} (10/350 µs)	I_n (8/20 µs)	I_{max} (8/20 µs)	Remote signalling	Ordering number
FLP-B+C-MAXI-VSF/1	1+0	TN-C	260 V AC	25 kA	30 kA	60 kA	Yes	A07116
FLP-B+C-MAXI-VSF/3	3+0	TN-C	260 V AC	25 kA	30 kA	60 kA	Yes	A07117
FLP-B+C-MAXI-VSF/3+1	3+1	TT	260 V AC	25 kA	30 kA	60 kA	Yes	A07118
FLP-B+C-MAXI-VSF/4	4+0	TN-S	260 V AC	25 kA	30 kA	60 kA	Yes	A07119

SPDs connected to LV power supply systems up to 1 000 V

Lightning current arresters and surge arresters (SPD Type 1 and 2) in electric vehicle charging stations

Combined lightning arrester and surge arresters designed to protect electric vehicle charging stations located in the LPZ 0 zone. Among other things, it fulfills the requirements of the energy company standard PNE 33 0000-5 for placing the SPD before the measurement (electricity meter). Zero leakage current. No subsequent current is generated.

FLP-EV12,5-VBH/.S+1

- Pluggable module
- Visual fault signalling
- Module locking
- Remote fault signalling
- U_p ≤ 1.5 kV

Type	Connection	Suitable networks	U_c	I_{imp} (10/350 µs)	I_n (8/20 µs)	I_{max} (8/20 µs)	Remote signalling	Ordering number
FLP-EV12,5-VBH/1S+1	1+1	TN-S/TT	275 V AC	12,5 kA	30 kA	60 kA	Yes	A07043
FLP-EV12,5-VBH/3S+1	3+1	TN-S/TT	275 V AC	12,5 kA	30 kA	60 kA	Yes	A07049

Lightning current arresters and surge arresters (SPD Type 1 and 2), MOV based

For LV installations at the boundary of the LPZ 0 and LPZ 1 or higher. Protection against the effects of partial lightning strike currents, induced overvoltage in lightning strikes and against switching overvoltage. It is suitable for lightning protection levels III and IV of buildings, in sub-distribution boards of large buildings or the protection of air conditioners or heating cables.

FLP-12,5 V/…

- Pluggable module
- Visual fault signalling
- Module locking
- Optional remote fault signalling (S)
- U_p ≤ 1.5 kV

Type	Connection	Suitable networks	U_c	I_{imp} (10/350 µs)	I_n (8/20 µs)	I_{max} (8/20 µs)	Remote signalling	Ordering number
FLP-12,5-075-VH/1	1+0	TN	75 V AC/DC	12.5 kA	20 kA	40 kA	No	A04168
FLP-12,5-075-VH/1S	1+0	TN	75 V AC/DC	12.5 kA	20 kA	40 kA	Yes	A04169
FLP-12,5-075-VH/2	1+0	TN	75 V AC/DC	12.5 kA	20 kA	40 kA	No	A04170
FLP-12,5-075-VH/2S	1+0	TN	75 V AC/DC	12.5 kA	20 kA	40 kA	Yes	A04171
FLP-12,5 V/1	1+0	TN	275 V AC	12.5 kA	30 kA	60 kA	No	A03421
FLP-12,5 V/1 S	1+0	TN	275 V AC	12.5 kA	30 kA	60 kA	Yes	A03422
FLP-12,5 V/1+1	1+1	TT	275 V AC	12.5 kA	30 kA	60 kA	No	A03423
FLP-12,5 V/1S+1	1+1	TT	275 V AC	12.5 kA	30 kA	60 kA	Yes	A03424
FLP-12,5 V/2	2+0	TN-S	275 V AC	12.5 kA	30 kA	60 kA	No	A03809
FLP-12,5 V/2 S	2+0	TN-S	275 V AC	12.5 kA	30 kA	60 kA	Yes	A05182
FLP-12,5 V/3	3+0	TN-C	275 V AC	12.5 kA	30 kA	60 kA	No	A03425
FLP-12,5 V/3 S	3+0	TN-C	275 V AC	12.5 kA	30 kA	60 kA	Yes	A03426
FLP-12,5 V/3+1	3+1	TT	275 V AC	12.5 kA	30 kA	60 kA	No	A03427
FLP-12,5 V/3S+1	3+1	TT	275 V AC	12.5 kA	30 kA	60 kA	Yes	A03428
FLP-12,5 V/4	4+0	TN-S	275 V AC	12.5 kA	30 kA	60 kA	No	A03429
FLP-12,5 V/4 S	4+0	TN-S	275 V AC	12.5 kA	30 kA	60 kA	Yes	A03430

SPDs connected to LV power supply systems up to 1 000 V

Surge arresters (SPD Type 2), MOV based

For LV installations, especially to sub-distribution boards. Protection of installation and devices against effects of induced surge during a lightning strike or switching surges.

SLP-… V/… (S)

- Pluggable module
- Visual fault signalling
- Module locking
- Optional remote fault signalling (S)

Type	Connection	Suitable networks	U_c	I_n (8/20 µs)	I_{max} (8/20 µs)	Remote signalling	Ordering number
SLP-275 V/1	1+0	TN	275 V AC	20 kA	40 kA	No	A01617
SLP-275 V/1 S	1+0	TN	275 V AC	20 kA	40 kA	Yes	A01618
SLP-275 V/1+1	1+1	TT	275 V AC	20 kA	40 kA	No	A01948
SLP-275 V/1S+1	1+1	TT	275 V AC	20 kA	40 kA	Yes	A02491
SLP-275 V/2	2+0	TN-S	275 V AC	20 kA	40 kA	No	A01619
SLP-275 V/2 S	2+0	TN-S	275 V AC	20 kA	40 kA	Yes	A05183
SLP-275 V/3	3+0	TN-C	275 V AC	20 kA	40 kA	No	A01760
SLP-275 V/3 S	3+0	TN-C	275 V AC	20 kA	40 kA	Yes	A01761
SLP-275 V/3+1	3+1	TT	275 V AC	20 kA	40 kA	No	A01946
SLP-275 V/3S+1	3+1	TT	275 V AC	20 kA	40 kA	Yes	A02002
SLP-275 V/4	4+0	TN-S	275 V AC	20 kA	40 kA	No	A01722
SLP-275 V/4 S	4+0	TN-S	275 V AC	20 kA	40 kA	Yes	A01763
SLP-075 V/1	1+0	TN	75 V AC	15 kA	40 kA	No	A01815
SLP-075 V/1 S	1+0	TN	75 V AC	15 kA	40 kA	Yes	A01823
SLP-075 V/2	2+0	TN-S	75 V AC/DC	15 kA	40 kA	No	A07022
SLP-075 V/2 S	2+0	TN-S	75 V AC/DC	15 kA	40 kA	No	A07023
SLP-150 V/1	1+0	TN	150 V AC	15 kA	40 kA	No	A05185
SLP-150 V/1 S	1+0	TN	150 V AC	15 kA	40 kA	Yes	A05186
SLP-385 V/1	1+0	TN	385 V AC	20 kA	40 kA	No	A01955
SLP-385 V/1 S	1+0	TN	385 V AC	20 kA	40 kA	Yes	A02771
SLP-440 V/1	1+0	TN	440 V AC	20 kA	40 kA	No	A01817
SLP-440 V/1 S	1+0	TN	440 V AC	20 kA	40 kA	Yes	A01825
SLP-600 V/1	1+0	TN	760 V AC	15 kA	40 kA	No	A03301
SLP-600 V/1 S	1+0	TN	760 V AC	15 kA	40 kA	Yes	A03302
SLP-600 V/3	3+0	TN	760 V AC	15 kA	40 kA	No	A06076
SLP-600 V/3 S	3+0	TN	760 V AC	15 kA	40 kA	Yes	A06305
SLP-600 V/3YS-IT	3+0	IT	760 V AC	20 kA	40 kA	Yes	A04199

SPDs connected to LV power supply systems up to 1 000 V

Surge arresters (SPD Type 2), serial combination MOV+GDT

For protection of installations and devices against the effects of induced overvoltage in lightning strikes in areas with more frequent storms and against switching overvoltage. Suitable for supply by diesel-generator and networks with fluctuating voltages. For protection of measurement circuits as the first level of protection. It is also suitable for Instrumentation and control (I&C) circuits at the boundary of the LPZ 0 and LPZ 1. No leakage current. No follow current.

SLP-…-VB/… (S)

- Pluggable module
- Visual fault signalling
- Module locking
- Optional remote fault signalling (S)

Type	Connection	Suitable networks	U_c	I_n (8/20 µs)	I_{max} (8/20 µs)	Remote signalling	Ordering number
SLP-075-VB/1	1+0	TN	75 V AC/DC	15 kA	25 kA	No	A07051
SLP-075-VB/1 S	1+0	TN	75 V AC/DC	15 kA	25 kA	Yes	A07052
SLP-150-VB/1	1+0	TN	135 V AC/DC	20 kA	25 kA	No	A07053
SLP-150-VB/1 S	1+0	TN	135 V AC/DC	20 kA	25 kA	Yes	A07054
SLP-275-VB/1	1+0	TN	275 V AC/DC	20 kA	25 kA	No	A07055
SLP-275-VB/1+1	1+1	TN-S, TT	275 V AC	20 kA	40 kA	No	A07057
SLP-275-VB/1 S	1+0	TN	275 V AC/DC	20 kA	25 kA	Yes	A07056
SLP-275-VB/1S+1	1+1	TN-S, TT	275 V AC	20 kA	40 kA	Yes	A07058
SLP-275-VB/3+1	3+1	TN-S, TT	275 V AC	20 kA	25 kA	No	A07059
SLP-275-VB/3S+1	3+1	TN-S, TT	275 V AC	20 kA	25 kA	Yes	A07060

Surge protections (SPD Type 3) on the DIN rail, for parallel connection

A combination of varistor surge protection and an encapsulated spark gap connected in the 1+1 (3+1) mode. For LV installations at the boundary of the LPZ 2 and LPZ 3 zones. For protection installations and devices against the effects of induced overvoltage in lightning strikes and against switching overvoltage. Location as close as possible to the protected device.

DA-275 V/… (S)

- Pluggable module
- Visual fault signalling
- Module locking
- Optional remote fault signalling (S)
- $U_p \leq 1.5$ kV

Type	Connection	Suitable networks	U_c	I_n (8/20 µs)	U_{oc}	Remote signalling	Ordering number
DA-275 V/1+1	1+1	TN-S, TT	275 V AC	5 kA	10 kV	No	A01872
DA-275 V/1S+1	1+1	TN-S, TT	275 V AC	5 kA	10 kV	Yes	A01975
DA-275 V/3+1	3+1	TN-S, TT	275 V AC	5 kA	10 kV	No	A01848
DA-275 V/3S+1	3+1	TN-S, TT	275 V AC	5 kA	10 kV	Yes	A01849

SPDs connected to LV power supply systems up to 1 000 V

Surge protections (SPD Type 3) on the DIN rail, for serial connection

A surge protection for universal use to protect all types of LV electrical and electronic devices against transient overvoltage. Location as close as possible to the protected device.

DA-275-DJ25 (S), DA-… DJ

- Symmetrical internal connection
- Visual fault signalling
- Optional remote fault signalling (S)
- $U_p \leq 1.5$ kV

Type	Connection	Suitable networks	U_C	I_L	I_n (L+N-PE) (8/20 μs)	U_{OC} (L+N-PE)	Remote signalling	Ordering number
DA-275-DJ25	Symmetric	TN-S, TT	275 V AC	25 A	5 kA	10 kV	No	A05770
DA-275-DJ25-S	Symmetric	TN-S, TT	275 V AC	25 A	5 kA	10 kV	Yes	A05771
DA-075-DJ25	Symmetric	TN-S, TT	75 V AC	25 A	2 kA	4 kV	No	A06094
DA-150-DJ25	Symmetric	TN-S, TT	150 V AC	25 A	2,5 kA	5 kV	No	A06095

Surge protections (SPD Type 3) for additional mounting

Surge protection for additional mounting to devices, machines, equipment, etc. For protection of all types LV electrical and electronic devices against transient overvoltage. Location as close as possible to the protected device.

DA-275-…

- Acoustic or remote status signalling
- $U_p \leq 1.5$ kV

Type	Connection	Suitable networks	U_c	I_n (L+N-PE) (8/20 μs)	U_{OC} (L+N-PE)	Remote signalling	Ordering number
DA-275 CZS	1+1	TN, TT	275 V AC	3 kA	6 kV	Remote	A01916
DA-275-A	Symmetrical	TN, TT	275 V AC	2 kA	4 kV	Acoustic	A06738
DA-275-S	Symmetrical	TN, TT	275 V AC	2 kA	4 kV	Remote	A06739

SPDs connected to LV power supply systems up to 1 000 V

Surge protections (SPD Type 3) on the DIN rail, with RFi filter

A surge protection with an integrated RFi filter to protect the supply of control systems such as I&C, electronic security and fire alarm systems, etc., against transient overvoltage and RF disturbance. Variants "i" with remote fault signalling by interruption of power supply. Location as close as possible to the protected device.

DA-275-DF…(-S)

- Visual fault signalling
- Optional remote fault signalling (S)
- Filter attenuation range ca. 150 kHz ÷ 30 MHz
- U_p ≤ 1.5 kV

Type	Connection	Suitable networks	U_C	I_L	I_n (L+N-PE) (8/20 μs)	U_{oc} (L+N-PE)	Remote signalling	Ordering number
DA-275-DF2	Symmetric	TN, TT	275 V AC	2 A	5 kA	10 kV	No	A05715
DA-275-DF2-S	Symmetric	TN, TT	275 V AC	2 A	5 kA	10 kV	Yes	A05716
DA-275-DF6	Symmetric	TN, TT	275 V AC	6 A	5 kA	10 kV	No	A05717
DA-275-DF6-S	Symmetric	TN, TT	275 V AC	6 A	5 kA	10 kV	Yes	A05718
DA-275-DF10	Symmetric	TN, TT	275 V AC	10 A	5 kA	10 kV	No	A05719
DA-275-DF10-S	Symmetric	TN, TT	275 V AC	10 A	5 kA	10 kV	Yes	A05720
DA-275-DF16	Symmetric	TN, TT	275 V AC	16 A	5 kA	10 kV	No	A05721
DA-275-DF16-S	Symmetric	TN, TT	275 V AC	16 A	5 kA	10 kV	Yes	A05722
DA-275 DF 25	Symmetric	TN, TT	275 V AC	25 A	5 kA	10 kV	No	A03732
DA-275 DFI 1	Symmetric	TN, TT	275 V AC	1 A	1,5 kA	3 kV	Interruption	A01205
DA-275-DFi6	Symmetric	TN, TT	275 V AC	6 A	5 kA	10 kV	Interruption	A05723
DA-275-DFi10	Symmetric	TN, TT	275 V AC	10 A	5 kA	10 kV	Interruption	A05724
DA-275-DFi16	Symmetric	TN, TT	275 V AC	16 A	5 kA	10 kV	Interruption	A05725
DA-275-BFi2	Symmetric	TN, TT	275 V AC	2 A	5 kA	10 kV	Interruption	A06262

Multiple sockets with surge protection (SPD Type 3) into 19" RACK

Surge protection SPD Type 3 for protection of information technology in 19" RACKs with visual fault signalling. Variants with switch or RFi filter. Earth pin socket version. Location as close as possible to the protected device.

RACK-PROTECTOR-…-1U-...

- Mounting height 1U
- Visual fault signalling
- U_n = 230 V AC, I_L = 16 A

Type	Sockets	Switch	RFi filter	I_n (8/20 μs)	U_{OC}	U_p	Power supply cord	Plug	Ordering number
RACK-PROTECTOR-F6-1U	6	No	Yes	5 kA	10 kV	1.5 kV	3 m	CEE 7/7	A05874
RACK-PROTECTOR-F6-1U-5	6	No	Yes	5 kA	10 kV	1.5 kV	5 m	CEE 7/7	A06751
RACK-PROTECTOR-VF5-1U	5	Yes	Yes	5 kA	10 kV	1.5 kV	3 m	CEE 7/7	A05875
RACK-PROTECTOR-VX7-1U	7	Yes	No	5 kA	10 kV	1.5 kV	3 m	CEE 7/7	A05873
RACK-PROTECTOR-X8-1U	8	No	No	5 kA	10 kV	1.5 kV	3 m	CEE 7/7	A05872
RACK-PROTECTOR-X8-1U-5	8	No	No	5 kA	10 kV	1.5 kV	5 m	CEE 7/7	A07009
RACK-PROTECTOR-X8-1U-PI	8	No	No	5 kA	10 kV	1.5 kV	3 m	Industrial 2P+PE 16 A	A06255
RACK-PROTECTOR-EURO-X12-1U	12 EURO	No	No	5 kA	10 kV	1.5 kV	3 m	CEE 7/7	A05961
RACK-PROTECTOR-EURO-X12-1U-5	12 EURO	No	No	5 kA	10 kV	1.5 kV	5 m	CEE 7/7	A07008
RACK-PROTECTOR-EURO-X12-1U-PI	12 EURO	No	No	5 kA	10 kV	1.5 kV	3 m	Industrial 2P+PE 16 A	A06256

SPDs connected to LV power supply systems up to 1 000 V

Coordination impedance RTO-…

Coupling impedance to secure proper coordination of a SPD if the minimum distance between a SPD Type 1 and SPD Type 2, which exceeds 10 m, is not maintained, or a Type 2 and Type 3 SPD, which exceeds 5 m.

- Surge separating inductors

Type	U_C	I_L	Resistance	Inductance	Power loss at I_L	Ordering number
RTO-16	500 V AC	16 A	5 mΩ	10 µH	1.28 W	A01432
RTO-35	500 V AC	35 A	2.5 mΩ	10 µH	3 W	A01433
RTO-63	500 V AC	63 A	2 mΩ	10 µH	8 W	A01434

Surge protection (SPD Type 3 and Type 2 and 3) for LED lights

SPDs mainly for drivers of LED lights. Instalation close to protected equipment into LV power circuits. Also for equipments in external part of structure with low or high exposure level (according IEEE C62.41.2). Fault signalling by supply interruption.

DA-320-LED

- For equipment in external part of building with low exposure level
- $U_p \leq 1.5$ kV

SP-T2+T3-320/Y-…-LED

- For equipment in external part of building with high exposure level
- $U_p \leq 1.5$ kV

Type	SPD Type	Location	U_C	I_L	I_n (8/20 µs)	U_{OC} (L+N-PE)	Fault signalling	Ordering number
DA-320-LED	3	C low	320 V AC	5 A	3 kA	6 kV	Interruption	A06740
SP-T2+T3-320/Y-CLT-LED	2 and 3	C high	320 V AC	10 A	5 kA	10 kV	Interruption	A06044
SP-T2+T3-320/Y-CLC-LED	2 and 3	C high	320 V AC	10 A	5 kA	10 kV	Interruption	A06246
SP-T2+T3-320/Y-TLC-LED	2 and 3	C high	320 V AC	10 A	5 kA	10 kV	Interruption	A06247
SP-T2+T3-320/Y-TLT-LED	2 and 3	C high	320 V AC	10 A	5 kA	10 kV	Interruption	A06244
SP-T2+T3-320/Y-CCC-LED	2 and 3	C high	320 V AC	10 A	5 kA	10 kV	Interruption	A06245
SP-T2+T3-320/Y-CCT-LED	2 and 3	C high	320 V AC	10 A	5 kA	10 kV	Interruption	A06243
SP-T2+T3-320/Y-TTC-LED	2 and 3	C high	320 V AC	10 A	5 kA	10 kV	Interruption	A06248
SP-T2+T3-320/Y-TTT-LED	2 and 3	C high	320 V AC	10 A	5 kA	10 kV	Interruption	A06222

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